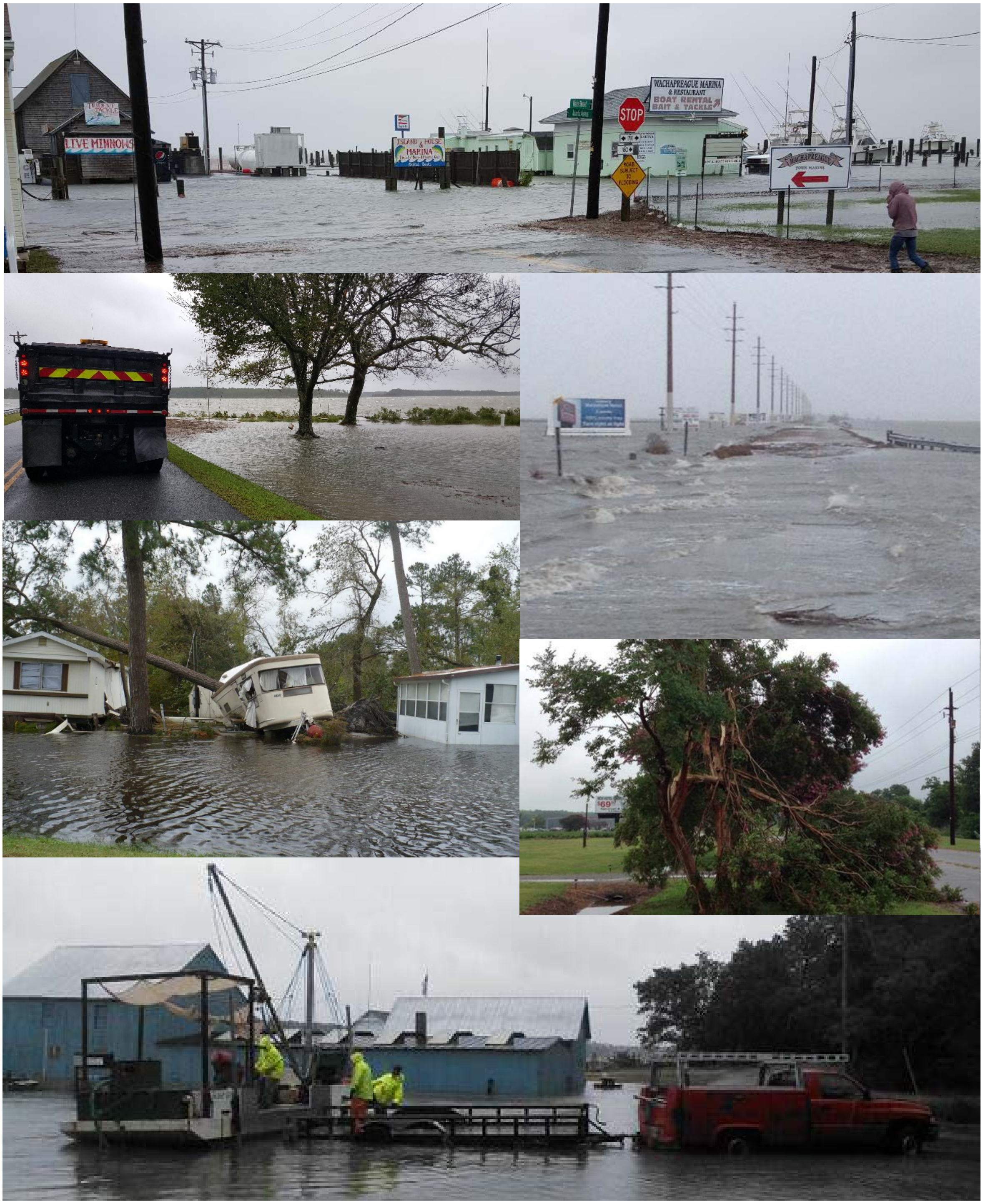

The Eastern Shore of Virginia HAZARD MITIGATION PLAN

2016

Eastern Shore Hazard Mitigation Steering Committee
Accomack-Northampton Planning District Commission

THE EASTERN SHORE OF VIRGINIA
2016
Hazard Mitigation Plan

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Cover photos, clockwise from top: Wachapreague flooding Oct. 2015, Connie Morrison; Chincoteague Causeway closure Jan. 2016, VDOT; Cheriton tornado, Jul. 2014, Connie Morrison; Bayford flooding Apr. 2014, Curt Smith; Chincoteague Sandy damage, VDEM; Quinby bridge Oct. 2015, Connie Morrison

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INTRODUCTION

This section provides a general introduction to the Eastern Shore of Virginia Hazard Mitigation Plan. The section consists of the following subsections:

- *Background*
- *Purpose Plan*
- *Organization*

BACKGROUND

Since the 1960s, Congress and the President have been under increasing pressure to organize resources for the nation during large disasters. The government has increasingly turned its attention to the federal response to these types of disasters. In the 1960s, the government created the National Flood Insurance Program to shift some of the costs to those who choose to live in the areas of most risk. In the 1970s, the Federal Emergency Management Agency (FEMA) was created to centralize a great deal of the assistance the federal government offers to states in emergency situations. In the 1980s, the Stafford Act was passed to standardize the federal response and to institute programs to decrease the United States' vulnerability to disasters. In the early '90s, the National Flood Insurance Program was reformed to increase the participation of those most at risk to flooding. Still, disaster assistance costs mounted and the late '80s and early '90s saw some of the largest disasters the country has ever experienced. This included multiple billion dollar events such as Hurricane Hugo, the Loma Prieta Earthquake, the Northridge Earthquake, Oakland wildfire, the Midwest Floods of 1993, Hurricane Andrew and Hurricane Iniki (*Planning for Post-Disaster Recovery and Reconstruction*, 1998).

In October 2000, the United States Congress passed an amendment to the Stafford Act called the Disaster Mitigation Act of 2000. This act seeks to protect lives and property and to reduce disaster assistance costs by mitigation, sustained actions to reduce long-term risk. FEMA has since written regulations based on this act.

Local governments are required to complete a Hazard Mitigation Plan to continue to receive certain types of disaster assistance.

In spring of 2003, the Virginia Department of Emergency Management asked the counties of the Eastern Shore and the Accomack-Northampton Planning District Commission (ANPDC) to undertake this work and directed the A-NPDC to apply for a Pre-disaster mitigation grant to finance the planning process. The Eastern Shore's plan was originally completed and adopted in 2006 According to 44 CFR Part 78, flood mitigation assistance, and the Disaster Mitigation Act of 2000. The current update to the plan occurred in 2010 and 2011 with the updated plan being adopted in 2011.

As these plans continue to evolve across the country, the understanding of different hazards and hazard planning has expanded to include a broad range of potential disasters and a concept of community resiliency.

The counties and towns of the Eastern Shore of Virginia have worked diligently to complete the following revised Hazard Mitigation Plan, which is presented to address the requirements of the Disaster Mitigation Act of 2000.

PURPOSE

The purpose of the Eastern Shore of Virginia Hazard Mitigation Plan is to:

- Ensure the protection of life, safety, and property by reducing the potential for future damages and economic losses that result from hazards;
- Make local communities safer places to live, work, and play;
- Assist localities in meet the criteria for grant funding prior to and following disasters;
- Expedite the recovery and redevelopment process following disasters;
- Exhibit a commitment from localities to hazard mitigation in the region; and
- Comply with federal and state legislative requirements for hazard mitigation plans.

PLAN ORGANIZATION

The chapters comprising this document follow the process spelled out in the Disaster Mitigation Act of 2000 and are organized to be both functional and reader-friendly as possible. The organization and intended flow of this document is described in the following sections.

Chapter 1, Hazards on the Shore, provides an overview of the hazards that have historically impacted the region and provides insight into the geographic and geologic setting of the region. A chronology of hazard events documents both pre-historic and historic hazard events that have impacted the Shore.

Chapter 2, Planning Process, narrates a complete description of the process used to prepare the Plan including how the public and other stakeholders were involved and who participated on the Hazard Mitigation Steering Committee.

Chapter 3, Risk Assessment, identifies and analyzes the hazards, assesses the risks associated with each hazard that threatens the region, and gauges the capability of available and cost-effective mitigation options for each hazard. This process builds on available historical data, defines detailed profiles for each hazard, and ranks each hazard for associated risk based on occurrence frequency, affected structures, primary and secondary impacts, and mitigation options. The outcome of this process is a priority ranking of hazards that impact the region.

Chapters 4 through 7 profile the four hazards that were given the highest hazard priority ranking: high wind, coastal erosion, coastal flooding, and storm water flooding. Each chapter provides background information, historical accounts, explanations of potential damages, and vulnerability overviews regarding each of the four high priority hazards.

Chapters 8 provides insight to the potential impacts of hazards on the regional level. As rural, low-population, and isolated Virginia counties, many entities must operate at a regional level to be successful and efficient with resources. This is a new chapter for the 2016 Plan and provides a significant level of detailed information.

Chapters 9 and 10 are profiles for each of the two Counties on the Eastern Shore of Virginia. The profiles are ordered alphabetically and provide a general description of the community including geographic, physical, demographic, and economic characteristics. In addition; land-use patterns, general historical disaster data, and building characteristics are discussed. These profiles assist County officials and residents by providing baseline information on concerning environmental and economic character that is plays a role in determining hazard vulnerability.

Chapters 11 through 26 are profiles of each Town locality that took part in the planning process. The profiles are ordered alphabetically and provide a general description of the community including geographic, physical, demographic, and economic characteristics. In addition; land-use patterns, general historical disaster data, and building characteristics are discussed. These profiles assist local officials and residents by providing baseline information on each community's social, environmental, and economic character that is plays a role in determining community vulnerability to hazards. Maps illustrating areas expected to be impacted by the highest priority hazards are included in the profile chapters for Accomack and Northampton Counties.

Chapters 27 through 31 consist of broad vision and regional goal statements that guide the identification and prioritization of specific mitigation projects for the region and for each local government jurisdiction participating in the planning process and funding options for implementation. Descriptions for how the plan is to be maintained by government officials are included in the mitigation strategy chapters for Accomack County, Northampton County, and the Town of Chincoteague (Chapters 28, 29, and 30 respectively). Each specific project is assigned a start timeline and a responsible department/person to ensure action is taken to make localities less vulnerable to the damaging forces of hazards, while improving the economic, social, and environmental health of the community. Chapter 31 describes federal mitigation funding options available to localities prior to and following natural disasters. Together, these chapters are designed to make the Plan both strategic through identification of long-term goals and functional through the identification of short-term and immediate actions that will guide daily decision making and project implementation.

LIST OF ACRONYMS USED IN THE PLAN

A-NPDC – Accomack-Northampton Planning District Commission

BFE – Base Flood Elevation

CBBT – Chesapeake Bay Bridge Tunnel

CBPA – Chesapeake Bay Preservation Area

CRS – Community Rating System

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FIS – Flood Insurance Study

GIS – Geographical Information System

HAZMAT – Hazardous Materials

HIRA – Hazard Identification and Risk Assessment

HMGP – Hazard Mitigation Grant Program

MSC - Marine Science Consortium

NASA – National Aeronautics and Space Administration

NFIP – National Flood Insurance Program

NHC – National Hurricane Center

NOAA – National Oceanic Atmospheric Administration

NOAA CSC – National Oceanic Atmospheric Administration Coastal Services Center

NWS – National Weather Service

RMA – Resource Management Area

RPA – Resource Protection Area

SFHA – Special Flood Hazard Area

USGS – United States Geological Survey

UVA LTER – University of Virginia Long Term Ecological Research

VDEM – Virginia Department of Emergency Management

VDEQ – Virginia Department of Environmental Quality

VDOF – Virginia Department of Forestry

VIMS – Virginia Institute of Marine Science

WFF – Wallops Flight Facility

DEFINITIONS OF FREQUENTLY USED MITIGATION TERMS IN THE PLAN

Mitigation Term	Definition
Acquisition of HazardProne Structures	Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.
Adaptation	The process of developing traits or habits suitable for sustainment of a given activity
Base Flood Elevation (BFE)	The elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as a standard for the National Flood Insurance Program.
Capability Assessment	An assessment that provides a description and analysis of a community or state's capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.
Community Rating System (CRS)	CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of these policyholders in communities are reduced.
Critical Facilities	Facilities vital to the health, safety, and welfare of the population that are especially important following disasters. These include, but are not limited to, shelters, police and fire stations, and hospitals.
Debris	The scattered remains of assets broken or destroyed in a hazard event. Debris transported by a wind or water hazard event can cause additional damage to other assets.
Disability	In ACS: Covers 6 disability types: Hearing, Vision, Cognitive, Ambulatory (serious difficulty walking or climbing stairs), Self-care (difficulty bathing or dressing), and/or Independent Living.
Disaster Mitigation Act of 2000	The latest legislation to improve the planning process. Signed into federal law on October 30, 2000, this legislation reinforces the importance of mitigation planning and emphasizes planning for disasters prior to their occurrence.
Displacement Time	The average time which the building's occupants typically must operate from a temporary location while repairs are made to the original building due to damages resulting from a hazard event.

Elevation of Structures	Raising structures above the base flood elevation to protect structures located in areas prone to flooding.
Erosion	Wearing away of the land surface by detachment and movement of sediments during a flood or storm through the action of wind, water, or other geologic processes.
Federal Emergency Management Agency (FEMA)	Federal agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery. FEMA is currently part of the U.S. Department of Homeland Security.
Flood	A general and temporary condition of partial or complete inundation of normally dry areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation of runoff or surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.
Flood Depth	Height of the flood water surface above ground surface.
Flood Elevation	Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.
Flood Insurance Rate Map (FIRM)	Map of a community prepared by FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.
Flood Insurance Study (FIS)	A study that provides an examination, evaluation, and determination of flood hazards and if appropriate, corresponding water surface elevations in a community or communities.

LAND USE CATEGORY DESCRIPTIONS

Land Use Category	Description
Developed	Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g. asphalt, concrete, buildings, etc).
High	Includes infrastructure (e.g. roads, railroads, etc.) and all highly developed areas.
Medium	Includes highly developed areas where people reside in high numbers. Examples include apartment complexes and row houses. Vegetation accounts for less than 20 percent of the cover. Constructed materials account for 80 to 100 percent of the cover.
Low	Includes areas with a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas.
Open	Includes areas that have approximately 100 percent vegetative cover. These areas could be large grass yards, recreational fields, golf courses, etc.
Planted/Cultivated	Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in

	developed settings for specific purposes. Herbaceous vegetation accounts for 75-100 percent of the cover.
Cultivated Crops	Areas used for the production of crops, such as corn, soybeans, vegetables, rice, etc.
Hay/Pasture	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
Natural	
Forested Uplands	Areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover.
Deciduous Forest	Areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	Areas dominated by trees where 75 percent or more of the tree species `maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest	Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present.
Low Vegetation	
Herbaceous	Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.
Shrub/Scrub	Areas dominated by shrubs; shrub canopy accounts for 25-100 percent of the cover. Shrub cover is generally greater than 25 percent when tree cover is less than 25 percent. Shrub cover may be less than 25 percent in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25 percent and shrubs cover exceeds the cover of the other life forms.
Wetlands	Areas where the soil or substrate is periodically saturated with or covered with water as defined by Cowardin et al.
Woody Wetlands	Areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herb-aceous Wetlands	Areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

Source: Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe, 1979. Classification of Wetlands and Deepwater Habitat of the United States, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.

CHAPTER 1: HAZARDS ON THE SHORE

INTRODUCTION

It is believed that the worst disaster the Shore ever experienced in recorded history was the Great September Gust of 1821. This hurricane caused an ocean recession in the vicinity of the Chincoteague Island. Although not completely understood, it is believed that the hurricane may have triggered a landslide on the continental slope causing a tsunami in tandem with the force of the hurricane. Its destruction was so complete that it is unlikely that any of the homes standing today predate this event. In fact, two of the oldest homes on the island were probably erected to replace destroyed houses (*Once Upon an Island*, Kirk Mariner). Flooding caused by hurricanes, northeasters, and tropical storms has proven to be the greatest natural hazard to people and property on the Eastern Shore of Virginia.

Coastal erosion, high coastal winds, storm water flooding, fires, ice storms, and drought have also caused substantial damage to the communities and environments on the Shore. These events have destroyed property, caused extended isolation of communities where provisions such as fuel and food have grown thin, and at several times whole industries have been wiped out or dealt such a heavy blow that months or years were necessary to recover. In modern times, investments in real estate, infrastructure, and industry have increased the potential for significant damage and the need for advance planning.

DESCRIPTION OF CONDITIONS

GEOGRAPHIC AND GEOLOGIC SETTING

The Eastern Shore is a low-lying peninsula separating two great bodies of water, the Chesapeake Bay and the Atlantic Ocean (Figure 1). The highest elevation on the Shore is near the Town of Melfa in Accomack County at 60 feet above mean sea level. The Eastern Shore of Virginia formed as a southward prograding peninsula that consists of unconsolidated sediments deposited predominantly in marine conditions during approximately the last 200,000 years. Sea level fluctuations during this time have created the landforms seen on the Eastern Shore today.

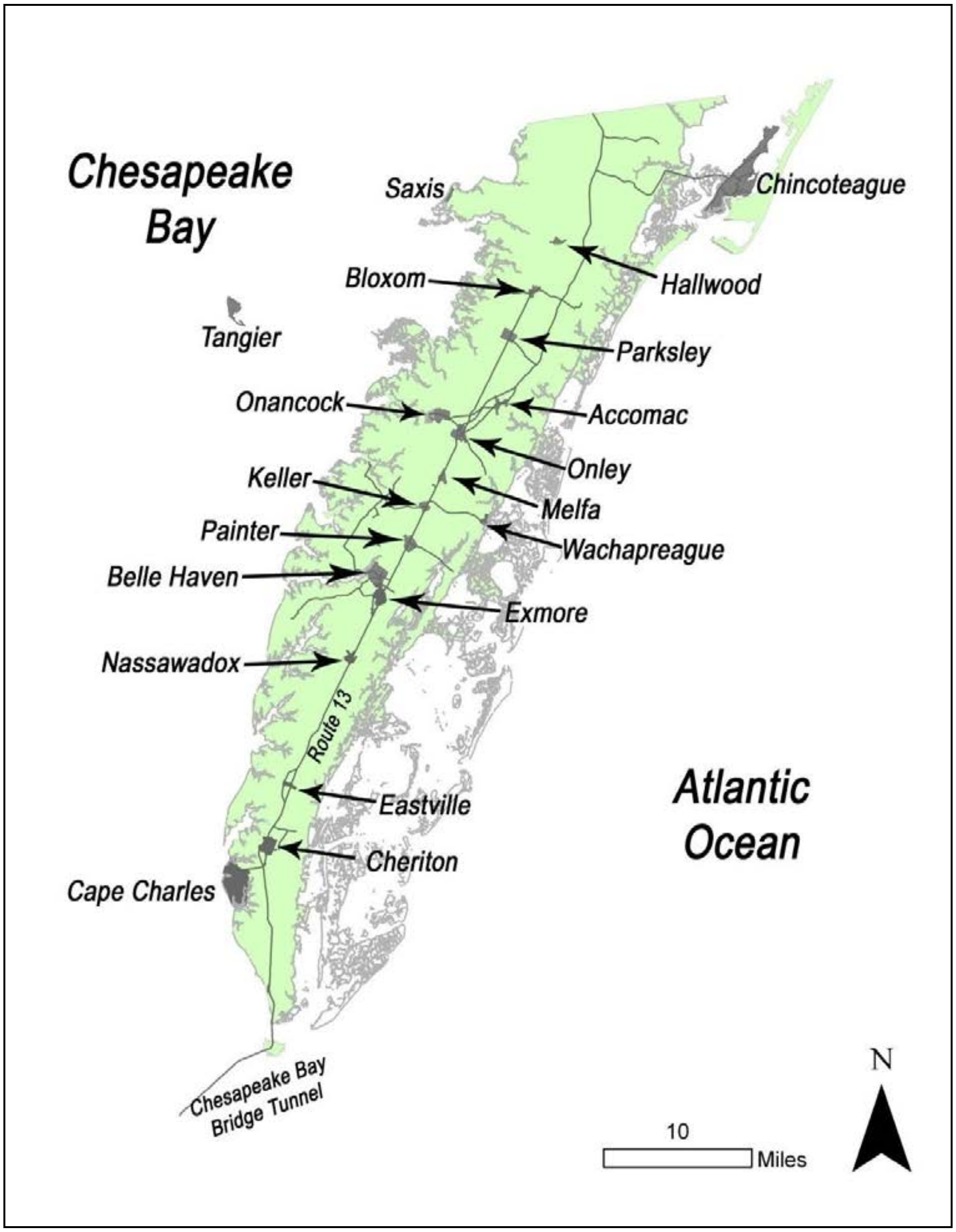


Figure 1: Vicinity Map of the Eastern Shore of Virginia

In addition to marine influences on the creation of the peninsula, there were two other phenomena that had a great influence on the geologic framework of the region: a bolide impact that occurred nearly 35.5 million years ago and the melting and retreat of a massive continental ice sheet.

Geologists have determined that a nearly 2-mile wide bolide, or object from space, struck near the area of what is now Cape Charles nearly 35.5 million years ago towards the end of the Eocene epoch. During this time, sea levels were much higher than today. The coastline existed above the Fall Line and west of the City of Richmond and what is now eastern Virginia lay beneath a shallow sea approximately 100 feet in depth. The impact created a crater twice the size of Rhode Island and generated an enormous tsunami that engulfed the continent, possibly overtopping the Blue Ridge Mountains. The crater, now underlying all of Northampton County and portions of southern Accomack County, and the sediments that have buried it, have continuously settled over time, creating increased subsidence of landforms in the region. It is speculated that the subsidence associated with the crater has influenced the geologic evolution of the southern Delmarva Peninsula and southern Chesapeake Bay region (USGS Fact Sheet 049-98).

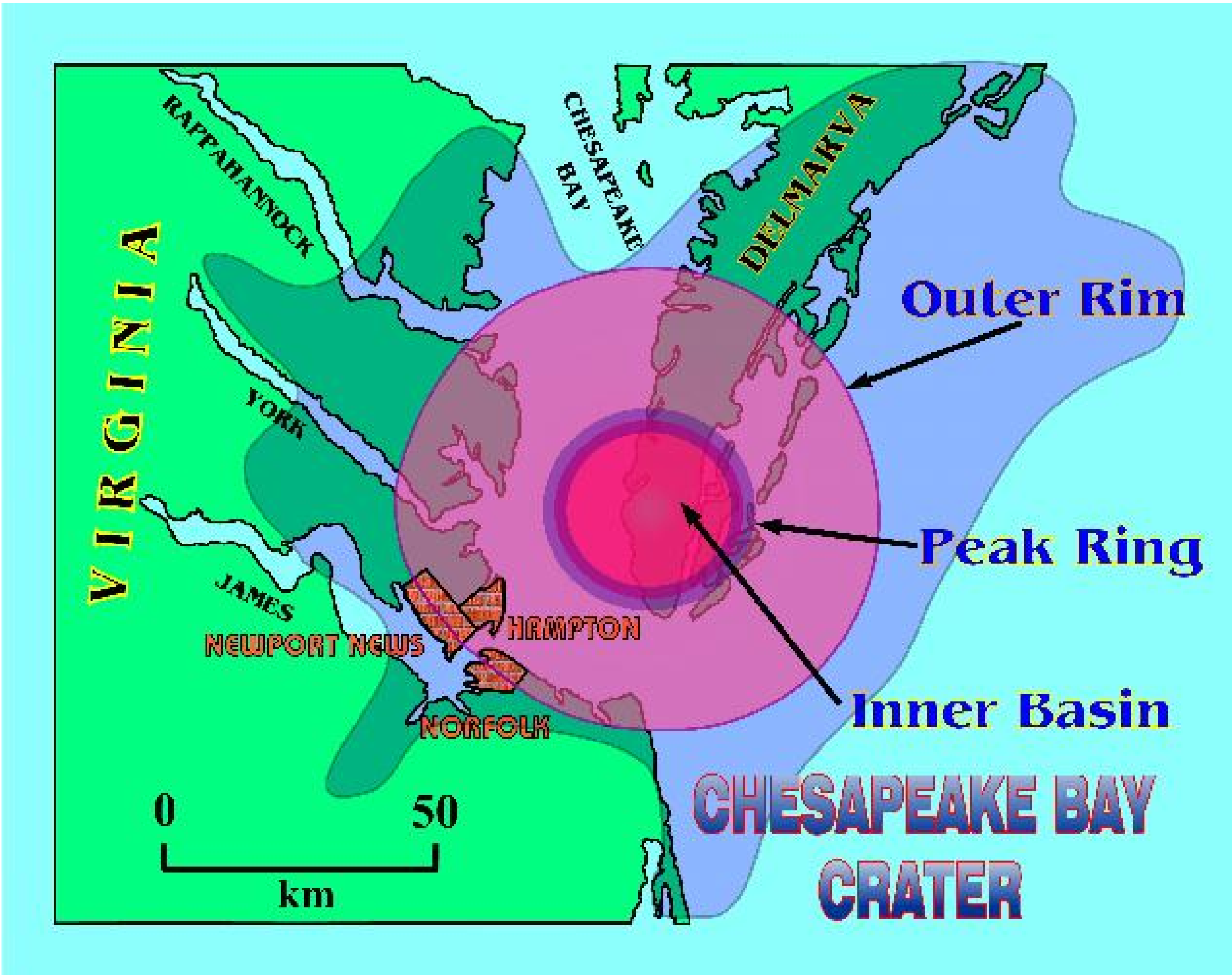


Figure 2: The Chesapeake Bay Impact Crater underlies approximately the southern half of the Eastern Shore. Source: USGS

The enormous weight of the three to four kilometer thick Laurentide ice sheet that covered most of Canada and a large portion of the northern United States existed from approximately 95,000 to 20,000 years ago created an extensive forebulge to the south of the ice sheet, causing the unconfined sediments of the coastal plain in Virginia to uplift. As global climate warmed, the ice sheet melted and retreated further northward. The sediments comprising the Eastern Shore responded elastically to this phenomenon causing subsidence in the region. The Eastern Shore is still subsiding today in response to the elastic rebound from the removal of the ice sheet, which is in part causing rates of relative sea level rise to be above average for the Atlantic coast.

Sea level during the last ice age approximately 20,000 years ago receded to a maximum of over 400 feet lower than present and the coastline was approximately 65 miles eastward of the modern shoreline at the edge of the continental shelf (NASA Science Briefs: *Sea Level Rise, After the Ice Melted and Today*, 2007). It is estimated that the oldest portions of the barrier island chain along the seaside of the Eastern Shore formed in response to sea level rise and other coastal processes approximately 3,500 years ago.

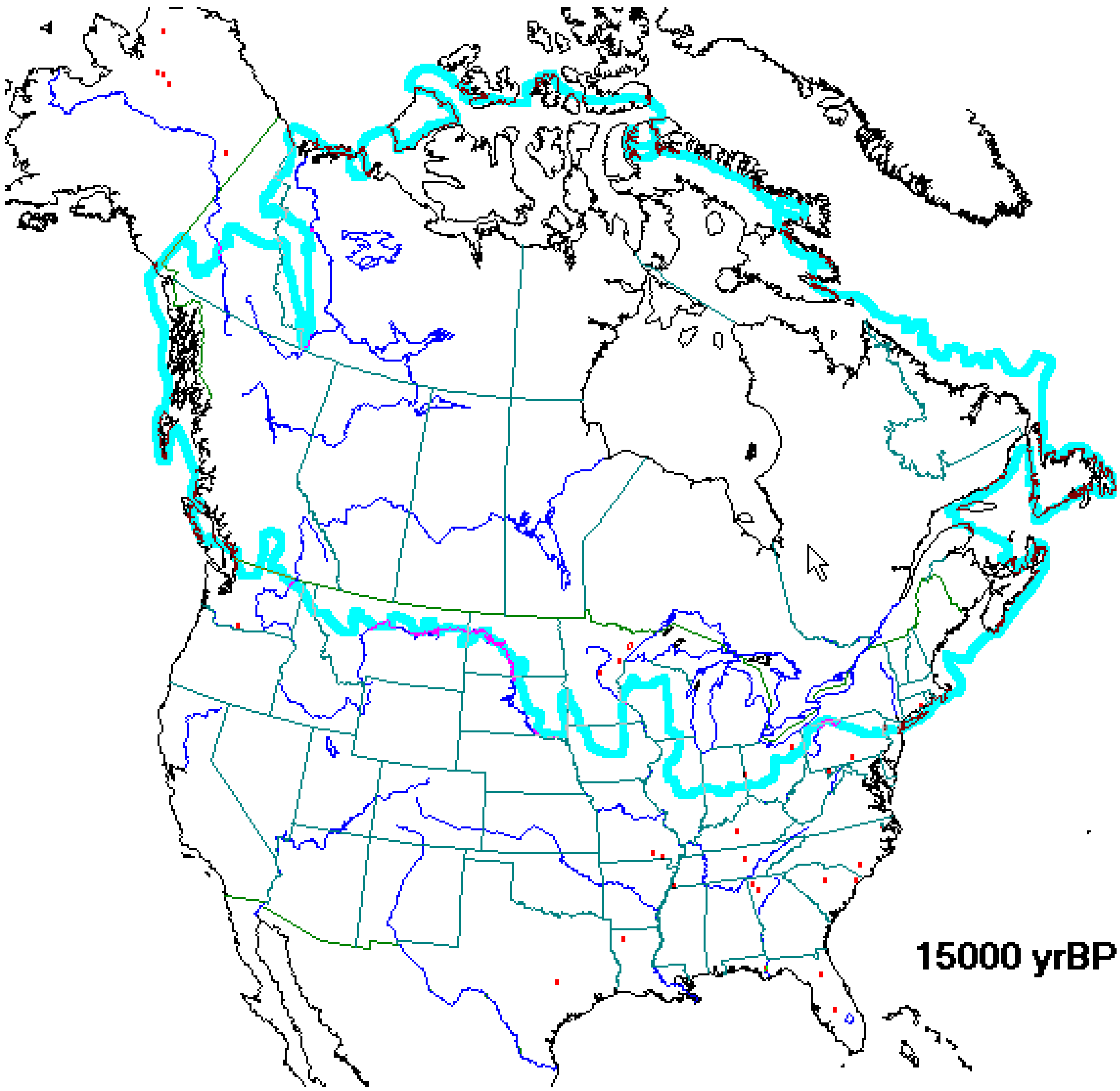


Figure 3: Extent of the massive Laurentide Ice Sheet (outlined in blue). Source: NOAA, National Climatic Data Center

The Chesapeake Bay consists of a series of drowned river valleys that were carved from layers of unconsolidated Coastal Plain sediments during a succession of sea-level fluctuations during the past 200,000 years. Three main paleochannels (Exmore, Eastville, and Cape Charles) are known to be buried beneath the Eastern Shore that still impact groundwater quality and control the locations of some creek basins, coastal inlets, and beach ridges. The modern Chesapeake Bay began to attain its modern resemblance sometime around 4,000 years ago as sea level had risen to levels where the Susquehanna River valley and its tributaries became partially and completely submerged (Sea Level Rise meeting with the EPA, February 2004).

In addition to the peninsula, uninhabited barrier islands protect the Atlantic coastline. Many of these are part of the Nature Conservancy's Virginia Coastal Reserve. Some islands also exist in the Chesapeake Bay. Many of these islands once held communities, but in recent years many have been abandoned in the face of hazards from the sea. Nine of the islands still have development in some manner. Assateague, Chincoteague, Wallops, Cedar, Hog, Smith, and Fisherman's Islands in the Atlantic and Tangier and Saxis Islands in the Chesapeake Bay.

CHRONOLOGY OF HAZARD EVENTS ON THE SHORE

It is no surprise that four risks consistently rise to the top during the risk assessment process for the Eastern Shore: high winds, coastal flooding, coastal erosion, and storm water flooding. All four of these risks are typically embodied in the fierce, frequent, and familiar coastal storms known to area residents: hurricanes, tropical storms, tropical depressions, and nor'easters. This section recaps their histories from the earliest evidence through the most recent documentation.

PRE-1564

Inhabitants of the Eastern Shore have historically needed to adapt to the natural hazards that commonly occur in the area. Coastal storms have shaped the shorelines and both created and destroyed landforms on a regular basis. It was not until these natural events began to impact inhabitants' properties and affect local economies, especially during the 20th and 21st centuries that they were deemed "hazardous."

1564-1799

Virginia was affected by great storms throughout the 16th, 17th and 18th Centuries. Some 16th century storms were recorded because of the shipwrecks. The earliest of these records is believed to have occurred in 1564. Others followed in June 1566, June 1586, August 1587 and August 1591. The June 1586 storm dropped hail and caused waterspouts that threatened Sir Francis Drake's crew. Most information on hurricanes during this time is found in period correspondence, as American newspapers were scarce until the middle of the 18th Century.

Captain John Smith noted in his journal in 1608 that he encountered a fierce storm that he described as "such an extreame gust of wind, rayne, thunder, and lightening happened, that with great danger we escaped the unmercifull raging of that Ocean-like water". Newspaper accounts suggest that major coastal storms impacted the Mid-Atlantic region in August 1635, September 1675, and November 1706, though scarce information is available (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007).

The September 1667 hurricane, called the Dreadful Hurricane of 1667, was a great storm that destroyed at least 10,000 homes in Virginia and demolished the colony of Jamestown (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007). Historic records show that this hurricane and a July 1788 hurricane may have followed a similar track to the 1933 hurricane, which caused massive devastation on the Eastern Shore. Twelve days of rain accompanied the storm, potentially indicating a second storm skirting the coast. A storm that struck in October 1693 is named the Accomack Storm in reference to the only surviving account of the storm by a Mr. Scarburgh who was a resident of the Eastern Shore. Mr. Scarburgh wrote:

> "There happened a most violent storme in Virginia, which stopped the course of the ancient channels, and made some where there never were any: So that betwixt the bounds of Virginia and Newcastle in Pennsylvania, on the seaboard side, are many navigable rivers for sloops and small vessels." – Letter by a "Mr. Scarburgh"
>
> (Transactions of the Royal Society, 1694)

There is little other information available from the Accomack Storm, but it can be inferred from this account that a considerable amount of erosion occurred in the region (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007).

In October 1703, an early snowstorm heralded the arrival of a hurricane just days later. The Great Gust of August 1724 actually refers to a pair of hurricanes that struck just days apart in the Chesapeake Bay region. The October 1749 storm was a great disaster for Virginians. Besides creating Willoughby Spit in Norfolk, the storm flooded the City of Hampton with four feet of water and bodies from shipwrecks washed up for days after the storm (*Virginia Hurricanes*, VDEM). Accounts estimate the storm surge from this powerful storm to be approximately 15 feet in the Chesapeake Bay (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007). A storm of this magnitude today would be catastrophic to the Eastern Shore.

The Great Chesapeake Bay Hurricane of September 1769, the Great Coastal Hurricane of 1785, George Washington's Hurricane of July 1788, and a pair of hurricanes that occurred within 10 days in August 1795 all terrorized the Chesapeake Bay region and rank among the strongest storms during the 18th Century (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007).

THE 19TH CENTURY

As newspapers became more widespread throughout the Mid-Atlantic, accounts of storm events became increasingly accurate, recording a series of powerful storms that wreaked havoc on the Virginia coast during the 19th Century.

THE GREAT SEPTEMBER GUST OF 1821

This storm was also known as the Norfolk and Long Island Hurricane and passed over the Eastern Shore likely as an equivalent Category 2 strength hurricane. Accounts from Eastern Shore residents indicated that the storm covered Tangier Island with at least three feet of water; destroyed houses, trees, and crops at Bradfords Neck near Quinby; and potentially unleashed a tsunami that destroyed Assateague and Chincoteague, killing five residents in the process (*Hurricanes and the MidAtlantic States*, R. Schwartz, 2007).

Other notable hurricanes and other storms swept up the Virginia coast later that century.

- The residents of Smith Island reported to Second Lieutenant Robert E. Lee that the April Gale in 1831 nearly covered all of Smith Island with seawater (*Seashore Chronicles*, Brooks Miles Barnes & Barry R. Truitt).
- The Great October Gale of 1878 completely inundated Smith and Cobb Islands located in Northampton County (*Seashore Chronicles*, Brooks Miles Barnes & Barry R. Truitt).
- The April 1889 storm came from the east and inundated the Island of Tangier for 48 hours (*Seashore Chronicles*, Brooks Miles Barnes & Barry R. Truitt).

- In October 1891, the proximity of two tropical storms and a hurricane created treacherous coastal currents and surf that sank the presidential yacht of President Benjamin Harrison off of the coast of Assateague Island (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007).
- During January 1893, the Eastern Shore suffered extreme cold, the Town of Accomac had 14 inches of snow and men could walk from Chesconessex to Watts Island (*Seashore Chronicles*, Brooks Miles Barnes & Barry R. Truitt).
- In October 1897, a tropical storm that lingered off Virginia for three days submerged Chincoteague, Cobb, Cedar, and other islands along the Seaside. The storm surge from this storm equaled that of the Great October Gale of 1878 (*Hurricanes and the Mid-Atlantic States*, R. Schwartz, 2007).

THE 20TH CENTURY

Major storms continued to pose hazards to life and property throughout the 20th century. The century started with three relatively quiet decades after the tremendous damages that occurred during the 1890s. The 1930s would change that trend.

Table 1 outline the major storms of the 20th century, and their lasting impacts on the Eastern Shore.

Figure 4: Flooding on Randolph Avenue, 3 ½ blocks from the Chesapeake Bay, in Cape Charles from one of the 1930s hurricanes. Photo Credit: U.S. Army Corps of Engineers Flood Plain Cape Charles Report

Table 1: Major 20th Century Storms affecting the Eastern Shore of Virginia

20th Century Storms						
County	**Date**	**System Name**	**Property Damage (in 2015 $$)**	**Crop Damage (in 2015 $$)**	**Description**	**Source**
ACCOMACK/ NORTHAMPTON	8/23/1933	Chesapeake-Potomac Hurricane			The deadly Chesapeake-Potomac Hurricane of 1933, also called the August Storm, was a Category 1 storm that claimed the lives of six Eastern Shore residents. On Chincoteague, Main Street was flooded, and 25' waves broke over Assateague Island. The Towns of Cape Charles, Chincoteague, and Wachapreague, and the Villages of Willis Wharf and Kiptopeke all experienced flooding. Much of Tangier Island was inundated, and children jumped from second floor windows to swim. When the water receded parts of the island were gone.	*The Great Hurricane of 1933* , Assateague Naturalist, www.assateague.com; *God's Island : The History of Tangier* , Kirk Mariner
ACCOMACK/ NORTHAMPTON	9/18/1936				This seaside hurricane was transitioning from Category 2 to Category 1 when it crossed from North Carolina to Virginia, causing heavy damage to agriculture and aquaculture. Late crops were destroyed and some 60,000 broiler chickens were killed. Eel grass, which is a critical habitat for clams, oysters, and bay scallops in the coastal bays along the seaside of the Eastern Shore, had already been decimated by widespread disease, and the succession of storms in the 1930s was likely the main factor in wiping out the remaining eel grass population, and crippling the industries associated with hard-shellfish varieties.	God's Island: The History of Tangier, Kirk Mariner; NOAA Historical Hurricane Tracks, https://coast.noaa.gov/hurricanes
ACCOMACK/ NORTHAMPTON	8/14/1953				Category 1 hurricane that produced record rain on Tangier Island, 10.62" in Onley, and 10.43" in Accomack County.	NOAA Historical Hurricane Tracks, https://coast.noaa.gov/hurricanes
ACCOMACK/ NORTHAMPTON	10/15/1954	Hazel			Hurricane Hazel's eye tracked through the center of Virginia bringing damaging winds and a storm surge of 3 to 7.5 feet that caused extensive erosion. Electric lines were damaged and many were without power.	*Wednesday Storm* , USACE); NOAA Historical Hurricane Tracks, https://coast.noaa.gov/hurricanes
ACCOMACK/ NORTHAMPTON	10/1/1957				The nor'easter caused tides in the Town of Wachapreague four feet above normal, and sinking many boats. The storm also caused wind gusts of 70 mph and brought a great deal of rain	(*Flood Reports of the 1962 Ash Wednesday Storm* , USACE)
ACCOMACK/ NORTHAMPTON	9/12/1960	Donna			Donna was a Category 2 with 105 MPH gusts as it swept past the Eastern Shore, but much of the damage was concentrated on the bayside. Flooding occurred in Cape Charles, Bayford, Onancock and other areas on the Chesapeake Bay. Donna was considered the most destructive storm since accurate weather records began in 1840.	(*Flood Reports of the 1962 Ash Wednesday Storm* , USACE)
ACCOMACK CO.	3/6/1962	Ash Wednesday Storm	$7,885,166		The islands of Chincoteague and Assateague were completely underwater. Hundreds of thousands of chickens died, along with Chincoteague's poultry industry. Dead chickens posted an extreme health hazard causing Health Dept. to ask all women, children and elderly to evacuate. A million dollars in damage was done to NASA's Wallops Island Launch facility. One hundred Assateague ponies were killed, five homes destroyed, and 1,000 were inundated by storm water. Ninety percent of Chincoteague's automobiles were flooded.	Flood reports of the 1962 Ash Wednesday Storm, USACE, http://www.erh.noaa.gov/lwx/Historic_Events/va-winters.htm

Table 2 (cont.): Major 20th Century Storms affecting the Eastern Shore of Virginia

County	Date	System Name	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO.	3/28/1984				Nor'Easter of March, 1984 took a track over the lower Chesapeake Bay. Storm hit Accomack County especially hard, with worst tidal flooding since Ash Wed. Storm of 1962. Saxis and Onancock up to 5' of water; Tangier had water over 75% of the island. East Point, Chesconnessex, Mears, and Sanford were all flooded.	Accomack Community Rating System Application.
ACCOMACK CO.	9/27/1985	Gloria			Hurricane Gloria brushed past the Eastern Shore casuing $2 million in damage to Accomack County. The storm was a Category 2 that caused wind gusts and rain, but did not directly strike the area.	Accomack County Community Rating System application
ACCOMACK/ NORTHAMPTON	10/31/1991	Halloween Nor'Easter			Halloween Northeaster hit unexpectedly, stranding residents, damaging barrier islands, and destroying piers and a motel.	Accomack County Community Rating System application
NORTHAMPTON CO.	8/28/1992	Andrew			Winds associated with Hurricane Andrew remnants blew down trees. No wind speed estimate available.	NOAA, National Climatic Data Center
ACCOMACK/ NORTHAMPTON	9/6/1996	Fran			Hurricane Fran was downgraded to tropical storm status as it arrived in Virginia, but it still brought damaging winds.	Accomack County Community Rating System application
ACCOMACK/ NORTHAMPTON	1/27/1998	Twin Nor'Easter #1			Nor'easter Jan. 27th, 28th. Slow storm movement combined with high astronomical tides created moderated coastal flooding. Two-4" of rain caused widespread flooding on streets and in poorly drained areas in both counties.	NOAA, National Climatic Data Center
ACCOMACK/ NORTHAMPTON	2/3/1998	Twin Nor'Easter #2			Nor'easter Feb. 3-5. Slow movement with extended period of gale-force winds resulted in moderate to severe coastal flooding, Rainfall totals of 5-7" also brought widespread storm water flooding in both counties.	NOAA, National Climatic Data Center
ACCOMACK/ NORTHAMPTON	9/1/1999	Dennis	$8,536		Hurricane and Tropical Storm Dennis, Aug. 30 - Sept. 5. One of most prolonged periods of tropical cyclone conditions across eastern Virginia on record. Moderate coastal flooding and 46 mph winds	NOAA, National Climatic Data Center
ACCOMACK CO.	9/15/1999	Floyd	$4,339,147	$16,547,741	Hurricane Floyd was a Category 1 Hurricane when it impacted the Eastern Shore. Ten to 20" of rain brought flash floods along with 7' storm surge, which damaged 300 buildings (both counties)	Accomack Community Rating System Application.
ACCOMACK/ NORTHAMPTON	10/17/1999	Irene	$1,271,556	$3,055,714	Hurricane Irene brushed by the Eastern Shore bringing gusty winds, locally heavy rainfall, and widespread flooding and road closures. Highest sustained wind of 45 mph, with a peak gust of 66 mph, was recorded at Wachapreague; sustained wind of 49 mph with gusts to 63 mph recorded at Kiptopeke. Rainfall totals: 8.23" at Wallops; 7.13" at Onancock; 9.38" at Cashville; elsewhere generally 5"-8". Storm tides generally 4'-5' above astronomical tides in Accomack; 3'-4' in Northampton. The tide level at Wachapreague reached 9.30' MLLW; 6.48' MLLW at Kiptopeke. Irene spawed a torndado near Chincoteague.	NOAA, National Climatic Data Center

Figure 5: Flooding during the Ash Wednesday Storm of 1962. Photo printed in the Army Corp of Engineers Flood Plain Report for Wachapreague

THE 21ST CENTURY

Despite advancements in modern technology and understanding of coastal storms, the residents of the Eastern Shore still face the same hazards in the 21st Century that have plagued residents throughout history.

Table 2 summarizes the major storms affecting the Eastern Shore of Virginia since year 2000. The eight storms detailed in the table wrung $73 million in damages from Eastern Shore residents, businesses, and farmers (damages have been converted to 2015 dollars).

Table 3: Major 21st Century Storms affecting the Eastern Shore of Virginia

County	Date	System Name	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
21st Century Storms						
ACCOMACK CO./ NORTHAMPTON CO.	4/10/2003		$25,763	$0	A spring nor'easter produced strong gusts up to 55 mph. The winds also downed some trees and utility poles, as well as produced minor structural damage.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	9/18/2003	Isabel		$12,881,359	Hurricane Isabel made landfall over Ocracoke, NC, and continued overland toward Richmond. ESVA communities of Wachapreague, Oyster, Tangier, and Saxis all had significant coastal flooding. Farmers reported crop loss due to salt spray. Storm surge inundated communities on seaside and bayside. Wachapreague, Tangier, & Saxis all experienced significant coastal flooding. Wachapreague' s tide monitor was swept away. Salt spray coated power lines causing outages until precipitation washed lines clean. One-2" of rainfall. Northampton farmers reported $10M of agricultural damages, mostly losses of tomato and green bean crops. Winds reached 74 mph.	NOAA, National Climatic Data Center, local oral accounts of the storm, NOAA Isabella Pos-Storm Summary
NORTHAMPTON CO.	8/14/2004	Charley			Tropical Storm Charley. Sustained winds of 45 mph at CBBT, 51 estimated gust. Rain measured 3.17" at Wallops.	http://www.nhc.noaa.gov/data/tcr/AL032004_Charley.pdf
ACCOMACK CO./ NORTHAMPTON CO.	9/1/2006	Ernesto	$37,621,745	$0	Tropical Depression Ernesto interacted with a strong weather front to produce a tight pressure gradient resulting in high winds that caused numerous downed trees and power outages, along with significant structural damage. Tides were 4-5' above normal, and 6' to 8' waves caused significant damage to homes, piers, bulkheads, boats, and marinas. Sustained winds of 34 MPH and gusts to 51 MPH at Kiptopeke; 38 kts/44mph at Wallops. Delmarva Power reported 49,000 residents without power in MD and ESVA.	NOAA, National Climatic Data Center; Tropical Storm Ernesto Post-Storm Report, NWS, 2006
ACCOMACK CO./ NORTHAMPTON CO.	9/6/2008	Hanna	$561,436	$0	Tropical Storm Hanna. Heavy rain and gusty winds. 1.16" rain recorded in Onancock; 1.27" in Eastville. Minor beach erosion. Gusts to 50 mph at Wachapreague; sustained winds 39 mph.	NOAA, National Climatic Data Center

Table 4 (cont.): Major 21st Century Storms affecting the Eastern Shore of Virginia

County	Date	System Name	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO./ NORTHAMPTON CO.	11/12/2009	Nor'Ida	$4,430,260	$0	Intense Nor'easter formed from the remnants of Hurricane Ida and produced moderate to severe coastal flooding. Peak tide height at Kiptopeke was 7.04 feet above MLLW, which was higher than Isabel's peak tide. Numerous homes and businesses were flooded with between 3-12" of water in the Chincoteague area. The boat ramp, dock and parking area were flooded during high tide in Onancock; Chesconessex area roads were flooded. A 4-5' storm surge battered Assateague and Chincoteague, and overtopped the Chincoteague causeway, which was closed 3 times. The Assateague beach was closed so workers could clear the parking lot of sand make repairs to a road, and there was severe beach erosion. The flooding in Chincoteague was comparable to the storm surge flooding experienced with Hurricane Gloria in 1985. At Wachapreague, flooding was comparable to Hurricane Isabel in 2003, although no major damage was reported. Winds gusted 50-70 mph, toppling trees and causing power outages in both counties. In Northampton County, peak tide at Kiptopeke was 7.04' above MLLW, higher than Isabel's peak tide. Generally 4-8" of rain fell across the counties, flooding roadways and poorly drained areas. Onley recorded 6.25"; 13" fell in Chincoteague.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	8/27/2011	Irene	$1,422,487	$3,055,714	Hurricane Irene, Aug. 27-28. The highest sustained winds were 45 mph with a peak gust of 66 mph at Wachapreague, and 49 mph sustained with 63 mph gust at Kiptopeke. Coastal storm tides of 4-5' above astronomical tide levels were common in Accomack Co., 3-4' above astronomical tides in Northampton Co. The tide level at Wachapreague reached 9.30 feet MLLW; at Kiptopeke it reached 6.48' MLLW. Rainfall totals: Wallops 8.23"; Onancock 7.13"; Cashville 9.38"; elsewhere across both counties generally ranged 5"-8". Widespread low-land flooding was reported across mucharea, including roadways which were washed out or closed. Tornado spawned from Irene downed trees and casued minor roof damage.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	10/28/2012	Sandy	$13,334,997	$0	Hurricane Sandy/Superstorm Sandy caused widespread coastal flooding and erosion, storm water flooding, and brought very strong winds (68 mph) that downed numerous trees and power lines and produced minor structural damage. Water levels were 3-5' above normal in Accomack Co.; 3'-4' above normal in Northampton Co. Wachapreague reached a tide of 8.40 feet MLLW; Kiptopeke reached a tide height of 6.82' MLLW. Chincoteague, Saxis, and Sanford received the most damage; estimated damage near $2M in Chincoteague alone. Rainfall totals of 6"-10" were reported across the area, with nurmerous road closings.	NOAA, National Climatic Data Center

Figure 6: Storm water flooding on U.S. Route 13 during Tropical Depression Ernesto in 2006. Photo Credit: Jay Diem, Eastern Shore News

MODERN STORM TRACKING

Advances in modern technology have allowed for improved weather forecasting and storm tracking. Residents of the Eastern Shore are provided more information on approaching weather events from multiple media outlets including television, internet, and radio with the end result being increased hazard preparedness.

In addition, the Wallops Flight Facility in northern Accomack County is home to the NOAA Wallops Command and Data Acquisition Station, which is one of only two facilities of this type in the world (the other is in Alaska) (Figure 7). This facility provides accurate weather data to the entire nation and also has a global reach, monitoring natural phenomena such as sea surface temperatures, forest fires, icebergs in shipping lanes, hurricanes, tsunamis, and earthquakes, among others around the world.

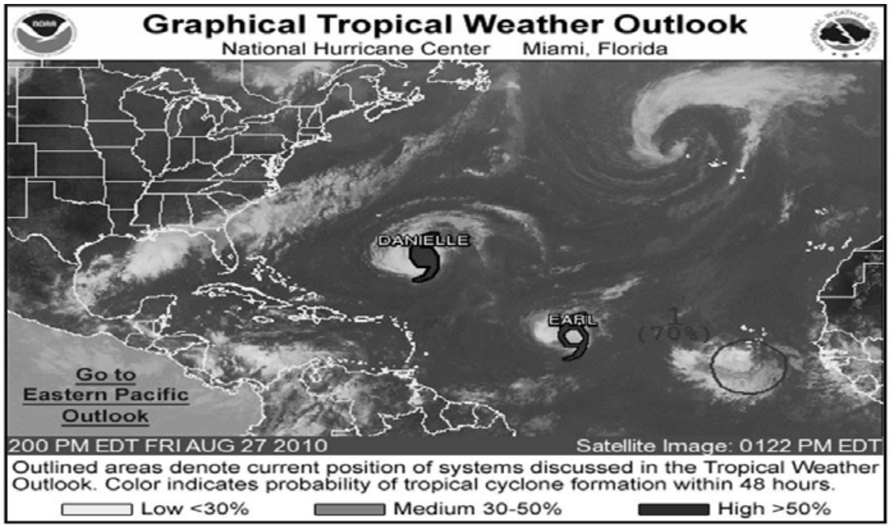


Figure 7: An example of modern storm tracking data from the NOAA Wallops Command and Data Acquisition Station at the Wallops Flight Facility in northern Accomack County. Courtesy of NOAA

CHAPTER 2: PLANNING PROCESS

PLAN DEVELOPMENT PROCESS OVERVIEW

Like most of the mid-Atlantic, the Eastern Shore of Virginia did not escape the wrath of Sandy. The "super storm" was still a hurricane as it pushed past most of Virginia, leaving $7 million in combined damages in Accomack and Northampton Counties. Funding for this hazard mitigation plan is the result of Hurricane Sandy relief funding provided by FEMA, through the VDEM.

The Eastern Shore's first Hazard Mitigation Plan was completed in 2006, a hallmark in Shore-wide planning for the protection of citizens, businesses, and visitors alike. The 2011 update built off those initial success, bringing in additional towns and new technology.

Changes in resources and technology since 2011, however, have been even more dramatic than between 2006 and 2011. With the availability of new data, tools, and online resources, a complete rewrite was determined to be the best course of action for the 2016 plan.

A-NPDC endeavored to engage all of the 19 towns, along with both counties, in the new plan. Even though that goal was not quite reached, three additional towns signed on: Melfa, Cheriton, and Nassawadox, raising to 16 the number of participating incorporated Towns, for a total of 18 participating jurisdictions.

Participating Community	2006	2011	2016
A-NPDC	X	X	X
Accomack County	X	X	X
Chincoteague	X	X	X
Saxis	X	X	X
Hallwood	-	X	X
Bloxom	-	X	X
Parksley	-	X	X
Tangier	X	X	X
Accomac	-	-	-
Onley	-	X	X
Onancock	X	X	X
Melfa	-	-	X
Wachapreague	X	X	X
Keller	-	X	X
Painter	-	-	-
Belle Haven	-	-	-
Northampton County	X	X	X
Exmore	-	X	X

Nassawadox	-	-	X
Eastville	-	X	X
Cheriton	-	-	X
Cape Charles	X	X	X

Participating towns and counties were invited to join the plan's Steering Committee, and to designate their own representatives. Additional stakeholders were identified and invited to join the Planning Council. The distinction between the two committees was only distinguishable for key content issues: if differences on those decisions could not be resolved, the final decision rested with steering committee members since they were expected to adopt the plan at its completion. Both groups were invited to participate in all meetings and receive all agendas and other meeting materials.

More than 30 agencies and organizations were invited to join the Planning Council, ranging from local historical and cultural non-profits, to social services, to neighboring county governments across the state line in Maryland. All received the same agenda and packet materials at the same time as the Steering Committee members, and were invited to attend all meetings, but not all were regular participants. Some that were not regular participants were called upon by A-NPDC staff when their expertise was needed, whether for a particular meeting, or while drafting materials to take before the committees.

The Eastern Shore Community College, a Planning Council member, provided monthly meeting space and a conference telephone. These meetings, which were open to the public, were held on the first Monday of each month from November, 2015 to August, 2016 at 10:00am. Email invitations were distributed to the Planning Council and Steering Committee and meeting dates and location were posted on the A-NPDC web site.

An iterative process was used, with A-NPDC staff assembling information, and presenting the information to the combined committees at regular meetings. Many small towns do not have staff and were unable to participate in daytime meetings that were best for most members. Special meetings were scheduled with those towns to review materials and to prepare town chapters of the plan. Those towns were: Tangier, Saxis, Cheriton[1], Hallwood, Melfa, Keller, Eastville, Onley, and Bloxom.

In addition, two Community Rating System workshops on February 11, 2015 drew a total of 22 individuals including two A-NPDC staff; two members of the planning department from Somerset County, Maryland; nine Steering Committee members; four Planning Council members (representing a university research facility, health services, and environmental organizations); four members of the general public; and a staff member from the Virginia Department of Conservation and Recreation.

On February 11 and 12, 2016 The Nature Conservancy (TNC) and partners offered two seminars to train interested parties in the use of the newly released Coastal Resilience tool, which was developed by TNC as a way for local decision makers and the public to view the effects of sea-level rise and storm surge under various scenarios. Eight members of the Steering Committee and Planning Council, and another five partner agencies attended one of two training sessions to learn how to use the tool.

[1] Councilman Greg Hardesty attended the half-day hazard identification and prioritization workshop on November 6, 2014.

2016 HAZARD MITIGATION PLAN STEERING COMMITTEE MEMBERS

First	Last Name	Jurisdiction	Position
James	Eichelberger, Chairman	Parksley	Mayor
Peter	Stith, Vice Chairman	Northampton County	Long Range Planner
Denise	Bendick	Melfa	Mayor
Mark	Bowden	Accomack County	Acting Code Official
Jeb	Brady	Cape Charles	Code Official
Tom	Brockenbrough	Accomack County	GIS Coordinator
R. Scott	Callander	Bloxom	Mayor
Denise	Drewer	Saxis	Mayor
Robert	Duer	Exmore	Town Manager
Taylor	Dukes	Exmore	Public Works
David	Eder	Eastville	Town Police Sergeant
James	Eskridge	Tangier	Mayor
Ed	Gibb	Nassawadox	Mayor
Greg	Hardesty	Cheriton	Town Council Member
Robert	Hodgson	Wachapreague	Town Council Member
John	Joeckel	Wachapreague	Town Council Member
Doug	Jones	Accomack County	Deputy Director of Public Safety
Russell	Jones	Onancock	Mayor
Rob	Marney	Chincoteague	Town Planner
Mariann	Miller	Saxis	Town Clerk
Greg	Nottingham	Keller	Mayor
John	Outten	Northampton County	Building Official
J. Jackie	Poulson	Hallwood	Mayor
Bryan	Rush	Chincoteague	EMS Supervisor
Don	Strautz	Onley	Council Member

OTHER PARTICIPANTS

First	Last Name	Jurisdiction	Position
Shannon	Alexander	A-NPDC	Coastal Resources Program Manager
Connie	Morrison	A-NPDC	Transportation Program Manager
Curtis	Smith	A-NPDC	Planning Director
Amy	Howard	VDEM	Hazard Mitigation Coordinator

PLANNING COUNCIL MEMBERS

Planning Council members were invited to participate in all meetings, and received the same meeting materials as Steering Committee members. Some were not heard from throughout the process, others came periodically to meetings, and still others served as resources to A-NPDC staff, and readily answered questions and provided information as needed. Their involvement is outlined in the public planning process section.

PUBLIC PLANNING PROCESS AND OUTREACH EFFORTS

A combination of strategies was used to generate interest and participation both in the plan and issues addressed in the plan. The 30+ organizations and agencies represented in the stakeholders group were selected both for their expertise and the individuals and interests they represent, so that our reach would be broad and deep.

The following section documents the efforts made to generate interest, opinion and comments about the Eastern Shore Hazard Identification and Risk Assessment and Hazard Mitigation Plan.

THE PUBLIC

The public were invited to attend all meetings of the Hazard Mitigation Steering Committee which were publicly posted and held in an ADA-accessible building, on the main public transportation line.

The A-NPDC used invited the press to include articles about hazard mitigation-related issues, and tied those to the plan as a way to interest the public in the plan. An article appeared on page B1 of the Eastern Shore News on February 4, 2015 to inform the public about the Hazard Mitigation Plan and the Community Rating System, prior to a workshop that took place on February 11. That article also explained how the workshop related to the development of the hazard mitigation plan and invited the public to get involved with both the workshop and the plan. Another article on May 11, 2016 followed the release of the Coastal Resilience tool, and explained the use of the tool in hazard mitigation planning.

The public was provided an opportunity to review the hazard identification, risk assessment, and findings, and to provide comment at a public meeting held on December 1, 2016. It was advertised on social media, with local radio stations (online and on air), email blasts were distributed through the Eastern Shore Chamber of Commerce, and press release flyers were issued both in English and in Spanish in the Eastern Shore Post. The flyers for the event were also distributed at most of the region's post offices and various businesses and organization buildings. The meeting was held at The Hermitage in Onancock, an ADA-accessible building.

The Committee then began incorporating public and agency comments into an updated draft of the Plan, and once finalized, the draft of the updated plan was submitted to the Virginia Department of Emergency Management and the Federal Emergency Management Agency.

BUSINESS

The Eastern Shore of Virginia Chamber of Commerce, the Northampton County Chamber of Commerce, and the Chincoteague Chamber of Commerce were invited to appoint a representative to the Planning Committee. Evelyn Shotwell of the Chincoteague Chamber of Commerce participated in some meetings, including hazard identification and prioritization at the half-day workshop on November 6, 2014, and George Bryan of the Hampton Roads Small Business Development Center, was a regular Planning Council meeting participant.

ACADEMIA

David Rogers, Eastern Shore Community College Chief of Police, participated in hazard identification and risk assessment, and the June 1, 2016 meeting to discuss mitigation actions. Bobby Mears, Facilities Supervisor, also attended the June 1 meeting. The community college also provided ADA-accessible meeting space for all Steering Committee meetings, except one which was held at the A-NPDC office, which is also a barrier-free facility.

Art Schwarzchild, a researcher from University of Virginia's Long Term Ecological Research Laboratory, participated as a Planning Council member in several of the meetings. Ursula Tankard and Theresa Long of Virginia's Cooperative Extension Service (Northampton and Accomack Counties, respectively) participated in hazard identification and prioritization at the half-day workshop on November 6, 2014, and provided agricultural storm damage data.

Schools in both Counties were invited to participate. Chris Truckner and Coleen Charlton of Northampton County Public Schools and Tange Francis of Eastern Shore Project Head Start participated in hazard identification and prioritization.

GOVERNMENT AGENCIES

Representatives of the NASA Wallops Flight Facility, the U.S. Coast Guard, U.S. Fish and Wildlife Service, National Weather Service, and U.S. Department of Agriculture participated and provided expertise when called upon. The U.S. Army Corps of Engineers and the FEMA worked together with Steering Committee members from both counties and A-NPDC staff to provide the depth grids and database inputs for the Hazus® model. These products were handed off to A-NPDC staff so that they could run the flood and hurricane modules at the county and local levels as needed in the risk assessments.

At the state level, Amy Howard, Hazard Mitigation Coordinator for VDEM, provided guidance throughout the process and participated in several meetings by teleconference, with on-site visits interspersed. The Eastern Shore Health District of the Virginia Department of Health was limited in its ability to attend meetings because of scheduling conflicts, but nonetheless provided valuable input. Dr. David Matson, Jennifer Justis, Kimberly Wright, Jon Richardson, and Joni White supplied information about secondary flooding impacts, and biological hazards, including secondary hazards that could occur in sheltering conditions.

The Virginia Departments of Historic Resources, Forestry, and Conservation and Recreation were members of the Planning Council. Although unable to attend most meetings, they did provide information for the risk analysis. The Department of Social Services in both counties, the Virginia Department of Game and Inland Fisheries, and the Eastern Shore Soil and Water Conservation District (ESSWCD) were unable to attend meetings, but were sent all meeting packets. The ESSWCD participated in hazard identification and prioritization.

In addition to the Hazard Mitigation committees, the Eastern Shore Disaster Preparedness Coalition (ESDPC) meets quarterly. This regional body is made up of federal, state, regional, and local government officials with any type of role in preparing for, or responding to, disasters, so there is some overlap between the two groups. The coalition also includes representatives of businesses, physical and mental health services, communication providers, education, and private environmental providers. A-NPDC staff participates in the coalition, updated it regularly on the status of the plan, and presented materials for its review.

NON-PROFIT INTERESTS

A concerted effort was made to engage a wide range of stakeholders in the development of the Plan. The following non-profits participated in hazard identification and prioritization: Riverside Shore Memorial Hospital, Eastern Shore Area Agency on Aging, Eastern Shore Coalition Against Domestic Violence, TNC, the Watermen's Museum, and Eastern Shore Amateur Radio Club.

Others that were invited to participate, but did not attend meetings, include: NAACP; Eastern Shore Center for Independent Living, Food Bank of Southeast Virginia, Eastern Shore; Eastern Shore Community Services Board; the Chincoteague Museum; Eastern Shore Historical Society; the Barrier Islands Center; and Saxis Island Museum.

Wetlands Watch, a non-profit with an interest in preserving wetlands, was engaged to provide two Community Rating System workshops on February 11, 2015.

TNC provided support in several ways. In addition to participating in the identification and prioritization of hazards at the half-day workshop on November 6, 2014, TNC provided technical support to A-NPDC staff and the committees in the area of storm surge modeling and sea level rise, through its Coastal Resilience tool.

Seventeen hypothetical storms were modeled in building the Coastal Resilience tool, along with Nor'Ida, a nor'easter that formed from the remnants of Hurricane Ida in 2009. The model was calibrated using measured water depths from that storm. The depth grids, paths, and data from these hypothetical storms (before sea level rise factors were applied) were shared with A-NPDC staff, for use in the storm surge analysis.

INFRASTRUCTURE

Virginia Department of Transportation (VDOT), the Chesapeake Bay Bridge Tunnel (CBBT), A & N Electric Cooperative (ANEC), and Bay Coast Railroad were invited to be members of the Planning Council. CBBT and ANEC participated in hazard identification and prioritization, and VDOT participated through the ESDPC. ANEC was contacted for information regarding electrical facilities and first-priority service restoration customers (due to medical needs), but the agency was limited in what it could provide by security and privacy concerns.

NEIGHBORING JURISDICTIONS

Somerset County, Maryland and Worcester County, Maryland, are the only two Maryland Counties that border Accomack County. Both were added to the Planning Council so that they would receive all development material, and could participate in any discussions. Neither chose to participate in the plan development phase, however, Gary Pusey and Kim Kudla, for the Somerset County Planning Department, attended the CRS workshop.

CONTINUED PLAN MAINTENANCE

During the interim time before the next Plan update (2021), the participating Towns and both Counties will use the Plan when they are updating their respective Comprehensive Plans. Each Town will keep a copy of their respective Chapter in their Town Hall and each County a copy of the entire plan in their respective planning offices for convenient reference. With these copies, there will also be a comment areas provided for written comments and the contact information for A-NPDC staff in order to provide comment by email or phone.

In addition, the plan will be referenced in the event of funding availability and/or a disaster event. Mitigation actions will be revisited at least annually in an effort to track completions and add newly discovered potential mitigation actions. A-NPDC staff will attend quarterly meetings of the Disaster Preparedness Coalition in order to maintain a running knowledge of the status of emergency services in the region and track status of the regional and county mitigation actions, updating the project status section of the Hazard Mitigation Strategies tables during these meetings.

New this year, all of the mitigation actions for each jurisdiction were compiled into a master spreadsheet. This allows mitigation actions to be easily compared and contrasted. The format also allows for easy updating and reference within the 5-year cycle.

The entire plan will remain indefinitely available on the A-NPDC web site and in the office in Accomac for stakeholder reference and use and for public comment.

PLAN EVALUATION

In addition to the Emergency Management Coordinator (EMC) evaluating the Plan annually according to Local Capability Readiness Assessment (LCAR) criteria, the A-NPDC staff will work together with the EMC to address the following concerns to evaluate if:

- The Plan offers mitigation actions that: protect property, promote public awareness, aid emergency services, suggest preventative land use, structural controls, and protect natural mitigation features?
- Goals and objectives address current and expected conditions.
- The magnitude or nature of the risks have changed.
- Current resources are appropriate for implementing the Plan.
- Additional or different resources are now available.
- Implemented actions were cost effective.
- There were any implementation challenges.
- Changes in county/town resources impacted Plan implementation.
- Changes in programming or government structure have created a need to change the Plan.
- New agencies/departments/staff/organizations should be included.

DOCUMENTS AND RESOURCES

The Committee and A-NPDC staff drew on many written resources throughout all phases of plan development, referenced in Appendix B, and accessible through direct links embedded in the document where available online. Among the resources are local historical books and articles, U.S. Army Corps of Engineer Flood Reports of storms that struck the Eastern Shore, the FEMA's Coastal Construction Manual, the NOAA and the USGS data, historical information and technical information available through various government websites such as the Chincoteague National Wildlife Refuge on Assateague Island and the VDEM, and local town and county plans. Staff also listened to local accounts of various hazard events.

Since the 2011 plan, a number of tools and databases have been placed online, and several of these were used extensively in this report.

Historic severe weather events data were extracted from the NOAA's National Climatic Data Center Severe Weather Events database and compiled as the basis for weather-related hazard information. Data from January 1996 through December 2015 are reflected in the Plan.

The Virginia Department of Environmental Quality tracks potential violations of environmental laws through its Pollution Response Program (PREP). A database of calls by county can be found at http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/PREPDatabaseFiles.aspx.

The FEMA's multi-hazard Hazus® model was downloaded and employed to estimate flood losses for the one percent annual chance flood and hurricane wind losses. The database for the Hazus® model was compiled for the A-NPDC by Cynthia McCoy, formerly of the FEMA Region III (now with FEMA Region X), and Michelle Hamor of the USACE. Complete documentation of the Hazus® modeling process can be found in Appendix C.

TNC's Coastal Resilience tool allows users to view storm surge under various sea level rise scenarios. The storm modeling that underlies that tool, was used to model storm surge for the coastal flood risk assessment.

CHAPTER 3: RISK ASSESSMENT

RISK ASSESSMENT PROCESS

The process of risk assessment began with a half-day workshop on November 4, 2016 at the Eastern Shore Community College. Local, state, and federal government; cultural and environmental resource non-profits; and health care, transportation, utilities, law enforcement, business, and education interests were all represented. Together, they learned about historic hazards that have affected the Shore, the expected effect of sea-level rise on the frequency and intensity of tropical storms, and the role of hazard mitigation planning in protecting lives and property.

Participants were given worksheets with the hazards that were identified in the last two hazard mitigation plans, and asked to work in groups to prioritize those hazards, calling on their own knowledge, as well as new knowledge they had acquired from workshop presentations. They were instructed to add to the list if they judged there were items missing.

The starting set of hazards evaluated included:

- Coastal Flooding
- Coastal Erosion
- Drought
- Heat Wave
- Storm Water Flooding
- Ice and Snow
- Wildfire
- Biohazards
- High Wind
- Sewage Spills
- Hazmat Incidences
- Well Contamination

During the workshop, participants added invasive environmental diseases, fish kills, blast zone, thermonuclear disasters, and earthquakes.

Participants were asked to score hazards across several criteria using a set of guidelines provided, and shared below.

PROBABILITY

Frequency of occurrence based on historical data plus projected future climate and meteorological conditions.

1 Unlikely (fewer than one event likely to occur within 100 years, past or future)
2 Likely (between one and ten events likely to occur in a 100-year period, past or future)
3 Highly Likely (11 or more events likely to occur in a 100-year period, past or future)

AFFECTED STRUCTURES

Number of structures likely to be affected

1 Negligible (likely will affect zero or 1 building)
2 Few (likely will affect 2-10 buildings)
3 Large (likely will affect more than 10 buildings)

PRIMARY IMPACTS

Based on the percentage of damage to typical structure or industry in the community

1 Negligible (less than 3 % damage)

2 Limited (between 3% and 49% damage)
3 Critical (more than 49% damage)

SECONDARY IMPACTS

Based on impacts to the community at large

1 Negligible (no loss of function, no displacement time, no evacuations)
2 Limited (some loss of function, displacement time or evacuations)
3 Critical (major loss of function, displacement time or evacuations)

MITIGATION OPTIONS

Based on the number of cost-effective mitigation options

1 Few (0-1 cost effective mitigation options)
2 Several (2-3 cost effective mitigation options)
3 Many (more than 3 cost effective mitigation options)

The scores were compiled and averaged by A-NPDC staff and shared with all Steering Committee members and Planning Council members (all that attended the half-day workshop were members of one or the other). Hazards were divided into three priorities: high, medium, and low.

The resulting prioritization was presented at the first official meeting of the Steering Committee and Planning Council on December 3, 2014. At that meeting, the prioritization was slightly revised, combining some similar categories (such as hazmat, thermonuclear and blastzone). The high priority hazards – coastal flooding, wind, coastal erosion, and storm water flooding – did not change, and remained consistent with the previous two hazard mitigation plans (Table 3.1)

Table 1 Eastern Shore of Virginia Hazard Prioritization

Hazard Type	2016 Plan Ranking	2011 Plan Ranking	2006 Plan Ranking	Probability	Impacts: Affected Structures	Impacts: Primary Impact	Impacts: Secondary Impact	Mitigation Options	Total Score
High Wind	High	High	High	2.96	2.92	2.58	2.67	1.79	12.92
Coastal Erosion	High	High	High	2.96	2.83	2.46	2.58	1.83	12.67
Coastal Flooding	High	High	High	2.96	2.96	2.46	2.63	1.67	12.67
Storm Water Flooding	High	High	High	2.92	2.63	2.38	2.38	2.17	12.46
Well Contamination	Medium	Unranked	Unranked	2.00	2.17	1.96	1.75	2.04	9.92
Ice-Snow	Medium	Medium	Medium	2.46	2.13	1.50	2.13	1.67	9.88
Biological Hazards**	Medium	Unranked	Unranked	2.35	1.63	1.71	1.83	1.88	9.39
Drought	Medium	Medium	Medium	2.13	1.63	2.13	1.88	1.46	9.21
Sewage Spills	Medium	Medium	Unranked	2.00	1.79	1.58	1.79	1.83	9.00
Wildfire	Low	Medium	Low	1.75	1.96	1.71	1.67	1.71	8.79
Hazardous Materials Incidents*	Low	Low	Low	2.04	1.42	1.38	1.71	1.92	8.46
Heat Wave	Low	Low	Medium	2.42	1.38	1.46	1.50	1.38	8.13
Fish Kills	Low	Unranked	Low	2.04	1.38	1.58	1.67	1.29	7.96
Invasive Envirnonmental Disease***	Low	Unranked	Unranked	2.00	1.00	1.00	1.00	2.00	7.00
Earthquake	Low	Unranked	Unranked	1.00	1.50	1.50	1.50	1.00	6.50

*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

With the hazards identified, the groups began the risk analysis for the four priority hazards: coastal flooding, wind, coastal erosion, and storm water flooding. The first step was to thoroughly document their histories, to understand the causes, and look at the human systems that have been put in place to attempt to mitigate their effects. This work can be found in Chapter 4: Wind; Chapter 5: Coastal Erosion; Chapter 6: Coastal Flooding; and Chapter 7: Storm Water Flooding.

The extent and vulnerability of each of the high priority hazards, as well as those hazards that did not rank as high, are documented in each of locality chapters, beginning with Chapter 8: Eastern Shore Region. Structures insured by the National Flood Insurance Program (NFIP) that have been repetitively damaged by floods are addressed in the appropriate local chapters.

DEFINITIONS OF EASTERN SHORE HAZARDS

HIGH PRIORITY HAZARDS

The four high priority hazards scored virtually evenly in the prioritization. All other hazards placed well behind these four. Hazards ranked as medium or low priority are not considered in substantial detail across the region since mitigation options either do not exist or the mitigation options are not as cost effective as the high priority mitigation options. On the Eastern Shore, mitigating damages from ice/snow events, sewage spills, drought, wildfire, hazmat incidents, heat waves, or biohazards are not as cost effective as mitigating damages from coastal flooding, storm water flooding, coastal erosion, and high wind events, which cause extensive disruption and damage.

However, individual towns may have prioritized some of the other hazards and provided more detail on extent and vulnerability due to local conditions or experience.

HIGH WIND

High wind events are highly likely, affecting large numbers of buildings. These events can result from the same tropical and nor'easter systems as coastal flooding. Primary impacts are seen in the form of direct property damage (building, contents, and inventory) and secondary impacts from business interruption losses (income, relocation, rental, wages). Damage to buildings in such storms is widespread and can be critical, with some suffering more than 49 percent damage from these events.

Damage from thunderstorm wind tends to be more localized, as are those from tornadoes, but tornadoes can be far more destructive, with some buildings suffering more than 49 percent damage. Thunderstorm winds and tornados are not typically destructive across the entire region, although tornadoes can draw emergency services from across the region.

COASTAL EROSION

Coastal erosion is considered to be highly likely, affecting large numbers of buildings. Damages can be critical with buildings suffering more than 49 percent damage from these events. Primary impacts to buildings and property are commonly connected to other secondary impacts such as shoaling of navigable waterways and degradation of water quality. These events are not typically disruptive to the entire region.

COASTAL FLOODING

These events are highly likely, affecting large numbers of buildings, infrastructure, and people. Primary impacts are seen in the form of direct property damage (building, contents, and inventory) and secondary impacts from business interruption losses (income, relocation, rental, wages). Damage to buildings can be critical, with some suffering more than 49 percent damage from these events.

STORM WATER FLOODING

These events are highly likely, affecting large numbers of buildings, infrastructure, and people. Damages can be critical with buildings suffering more than 49 percent damage from these events. These events can be disruptive to the region, causing some displacement and evacuations.

MEDIUM PRIORITY HAZARDS

WELL CONTAMINATION

This hazard was not ranked in either of the last two plans, but rose to the top of the medium priority list for this plan. It was seen as a medium likelihood of occurrence, affecting a moderate number of structures, but with few feasible mitigation opportunities.

ICE/SNOW

The probability of ice and snow events is deemed moderately likely for the current plan. These hazards affect small numbers of structures, and are considered to cause limited damage to the structures on the Eastern Shore. However, they can affect large numbers of people, and tie up large amounts of local resources for towns located along major travel routes, particularly U.S. Route 13. Ice and snow can be disruptive to the region, causing loss of function to the area's commercial businesses, schools, shellfish harvesting industry, and aquaculture industry.

BIOHAZARDS

Biohazards are considered low likelihood events, with little impact on buildings, but high impact on the population. Pandemic pathogens, and tick and mosquito-borne illnesses fall into biohazards. This category also includes secondary impacts to primary events, such as illnesses that develop in confined spaces, such as shelters, or from injury or food spoilage following extended power outages.

DROUGHT

Droughts are seen as moderately likely, a decrease in emphasis from the 2011plan. Droughts cause critical damages to the water supply for farmers and residents, so while primary (building) impacts are low, secondary impacts from crop loss can be quite high. These events are typically disruptive to the region causing some loss of individual water supply wells and regional income loss.

SEWAGE SPILLS

This hazard is considered moderately likely, with low primary and secondary impacts. This marks a decrease from the 2011 plan, which viewed sewage spills as highly likely, with a small number of structures affected by an event. These events cause limited damages to structures and cause limited disruption to the region. The committee considers there to be limited cost effective options for mitigating these events.

LOW PRIORITY HAZARDS

WILDFIRES

The Eastern Shore is not an area where wildfires are of a scale that damage the entire region. These events are considered highly likely but affect small numbers of structures, and generally cause negligible damage to the larger wood product industry.

HAZMAT INCIDENTS

These events are reprioritized to unlikely for the current plan. Formerly the category was defined as incidents such as those that might occur with the transport of hazardous materials, are at an industrial location with hazardous materials, which cause negligible damage to the structures on the Eastern Shore, but could have implications for nearby residents, and are moderately disruptive to the region. With the new plan, hazmat incidents are re-defined to also include larger-scale incidents such as oil spills, blast zones, and thermo-nuclear incidents.

HEAT WAVES

These events are very likely but generally do not affect the built environment, although they can be harmful to people and animals. Heat waves cause negligible damages to structures and industries in the community. These incidents are not typically disruptive to the region.

FISH KILLS

Fish kills are considered highly likely, but with low impact on structures and human lives, although they do cause short-term disruption to the fishing industry, and can have secondary impacts on income.

INVASIVE ENVIRONMENTAL DISEASE

Invasive environmental disease was seen as moderately likely, and includes invasive land and water species and diseases. Local examples include plants like purple loosestrife, phragmites, nutria (a large marsh-dwelling rodent), and diseases that caused the devastating die-off of oyster beds.

EARTHQUAKE

These are considered by the Steering Committee to be very low likelihood events that would have medium impacts on structures, income, and industry.

CHAPTER 4: HIGH WIND

INTRODUCTION

The Eastern Shore's location between two coastal bodies, the Chesapeake Bay and the Atlantic Ocean, makes it vulnerable towards high wind events. Hurricanes, coastal spouts, tornadoes, tropical storms, and nor'easters are some of the high wind events that cause the shore to be designated as within the 110 to 120 mph zone.

NATURAL FORCES AND CONDITIONS

CAUSES OF HIGH WIND

High winds on the Eastern Shore of Virginia primarily stem from tropical cyclones like hurricanes, tropical storms, and nor'easters; rotating cells within thunderstorms like tornadoes and waterspouts; and straight-line winds associated with fast-moving thunderstorms. Waterspouts can also occur without thunderstorms. These tend to arise from the water surface and move upward, forming along the base of a developing line of cumulus clouds. Fair weather water spouts tend to move little and dissipate quickly (http://oceanservice.noaa.gov/facts/waterspout.html).

Sources of high wind are tornadoes, waterspouts and various coastal storms. The entire Eastern Shore is located in the 110 to 120 mph design wind zone. This means that structures built should be able to withstand 110 mph (Building Code). This is consistent with a strong Category 1 hurricane whose 3 second gusts could be anywhere from 93 to 119 mph.

HURRICANES, TROPICAL STORMS, AND TROPICAL DEPRESSIONS

Tropical cyclone storms were reviewed in detail in Chapter 6 – Coastal Flooding, but that discussion centered on coastal flooding, not wind speed, which is the key measure of hurricane intensity, as shown in the Saffir-Simpson Wind Scale. However, wind speed is also used to differentiate tropical depressions, tropical storms, and post-tropical depressions.

In tropical depressions, sustained surface wind is 38 mph or less, but these storms are capable of producing high amounts of rainfall. Once surface winds reach 39 mph, the storms are considered trapical storms until they reach the 74 mph hurricane wind threshold.

Hurricanes weaken from being deprived of the conditions that led to their formation: namely by moving over land or into cold water, depriving them of warm, moist air from the sea; or by encounters with strong winds at high levels, which can tear them apart. As they weaken, hurricanes re-trace, in reverse, the steps they made while forming, becoming tropical storms, then tropical or post-tropical depressions, before dissipating entirely (University Corportation for Atmospheric Research, http://www.ucar.edu/news/features/hurricanes/htc_t3.htm).

> *"Tropical cyclone: a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has a closed low-level circulation."*
>
> *-NOAA, National Hurricane Center*

Table 1 Hurricane Category Descriptions

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

NOR'EASTERS

Nor'easters, or Northeasters, usually occur in the mid-latitudes over the winter months from September to April. Because these storms are generally very large and slow moving, they can cause severe and widespread damage at the same level as their stronger summer counterpart, the hurricane (USGS, St. Petersburg Coastal and Marine Science Center).

In the early 1990's the Dolan-Davis Scale was created for the classification of winter storms or Nor'aasters, however, this system is infrequently used by the general public or the media (Zielinski 2002; Schwartz 2005).

Table 2: The Dolan - Davis Scale for Nor'easter Classification. Source: Schwartz, 2005.

Dolan – Davis Scale				
Storm Class	Significant Wave Height (m)	Duration (h)	Power (m^2h)	Effects
1 Weak	2.0	8	32	Minor beach erosion. No property damage.

2 Moderate	2.5	19	107	Moderate beach & dune erosion. No property damage.
3 Significant	3.2	35	384	Significant beach & dune erosion. Moderate property damage.
4 Severe	5	62	1420	Severe beach & dune erosion. Overwash damage. Community-wide structure loss.
5 Extreme	6.8	97	4332	Extreme beach & dune erosion. Massive overwash in sheets & channels. Extensive regional-scale property losses in millions of dollars.

TORNADOS

"We got an emergency message on a cellphone and within 30 seconds, the thing hit and it blew down 40, 50 trees in the park..” That’s how one man described the early morning EF1 tornado that struck Cherrystone Campground on July 24, 2014, killing three and injuring 36. The popular summertime destination on the Chesapeake Bay near Cheriton, Virginia, was packed with 1,328 adults and children and 40 staff members at the time. A New Jersey couple was killed instantly when a tree fell on their tent. Their son, who was in a neighboring tent, died days later from a head injury, also from a fallen tree.

The tragedy brought into sharp focus the dangers posed by tornadoes. The July 24 twister was one of Virginia’s deadliest, and although the National Weather Service Office issued a tornado warning 20 minutes before it hit, campers were caught off guard, forcing early risers to scramble for cover, and catching others completely unaware.

The catastrophe made national news, and since then the Eastern Shore Disaster Preparedness Coalition has been working cooperatively with campgrounds on preparing materials to be provided to campers at check-in about where to seek shelter during storms and other camper safety information.

Tornadoes have traditionally occurred on the Eastern Shore during the spring and summer months with the largest one reaching F3 status in 1967. This tornado caused 5 injuries and about $25,000 in damage. An F3 tornado has wind speeds ranging from 158 to 206 mph, as you can see in Table 3. Tornados are ranked using the Fujita or F-Scale or some version thus based, the Enhanced Fujita Scale or EF-Scale was implemented in the U.S. in 2007. The most common tornado to strike on the Eastern Shore is the F1 with wind speeds of 73 to 112 mph (Weather Bureau online data).

Table 3: Fujita and Enhanced Fujita Scales

Fujita & Enhanced Fujita Scales				
F Number	EF Number	Description	Wind Range (F)	3 Second Gust (EF)
F0	EF0	Gale	40-73 mph	65-85 mph
F1	EF1	Weak	73-113 mph	86-110 mph
F2	EF2	Strong	113-158 mph	111-135 mph
F3	EF3	Severe	158-207 mph	136-165 mph
F4	EF4	Devastating	207-261 mph	166-200 mph
F5	EF5	Incredible	261-319 mph	Over 200 mph

Source: NOAA Storm Prediction Center

Table 4 High Wind Events Recorded in NOAA Storm Events Database, 1996-2015 Excluding Tropical Cyclones and Nor'Easters

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
NORTHAMPTON CO.	1/19/1996	**HIGH WIND**			Several power lines down between Cape Charles and Eastville. (No wind speed estimate.)	NOAA, National Climatic Data Center
ACCOMACK CO.	5/11/1996	**HIGH WIND**	$0	$0	Measured thunderstorm gust of 70 mph.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	5/15/1997	**HIGH WIND**	$4,430	$2,953	Few trees down between Cedar Grove and Cape Charles. Also hail (.88") caused crop damage.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/26/1997	**HIGH WIND**	$22,151	$0	Thunderstorm wind blew off back part of a wood frame building	NOAA, National Climatic Data Center
NORTHAMPTON CO.	6/13/1998	**HIGH WIND**	$7,270	$0	Thunderstorm winds downed trees across both counties. No wind speed estimates given.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	6/16/1998	**HIGH WIND**	$14,541	$0	Thunderstorm winds blew roof off a gas station; several trees down. (Cape Charles)	NOAA, National Climatic Data Center
ACCOMACK CO.	6/26/1998	**HIGH WIND**	$7,270	$0	Thunderstorm wind downed trees and light poles; window blown out of car (Wallops Islands)	NOAA, National Climatic Data Center
ACCOMACK CO.	4/9/1999	**HIGH WIND**	$14,227	$0	Thunderstorm wind: Farm damaged, car moved, dump truck overturned. Debris evident 1/4 MI from damage site. Impact area Onley to Painter.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	1/25/2000	**HIGH WIND**	$0	$0	A significant winter storm affected ESVA with several inches of snow, high winds, and some minor beach erosion. Accomack county had 1 to 2 inches. Precipitation began as rain, which changed to a mixture of snow, sleet, and freezing rain during the afternoon. Winds gusted over 50 mph which created some blowing snow during the late afternoon and evening hours.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/30/2000	**HIGH WIND**	$0	$0	Three waterspouts reported by on-duty Coast Guard, just off-shore.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/11/2001	**HIGH WIND**	$0		Thunderstorm wind: 57 mph wind in Melfa; 67 mph recorded in Painter	NOAA, National Climatic Data Center
CO.	5/2/2002	**HIGH WIND**	$2,635	$0	Thunderstorm wind: Trees down.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	5/18/2002	**HIGH WIND**	$3,952	$0	Thunderstorm wind: Twelve trees and a power pole down around Cape Charles.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/22/2003	**HIGH WIND**	$2,576	$0	Thunderstorm wind: trees down. Wind speed 64 mph in Onancock and 57 mph in Accomac.	NOAA, National Climatic Data Center
ACCOMACK CO.	8/16/2003	**HIGH WIND**	$5,153	$0	Thunderstorm wind: trees down over roads. Wind speeds 57 mph near Sanford, Parksley.	NOAA, National Climatic Data Center
ACCOMACK CO.	8/26/2003	**HIGH WIND**	$2,576	$0	Thunderstorm wind 57 mph. Numerous trees down near Wallops Island.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	8/16/2005	**HIGH WIND**	$2,427	$0	Thunderstorm wind 60 mph: Several large tree limbs down on roads. (Cape Charles)	NOAA, National Climatic Data Center
NORTHAMPTON CO.	4/15/2006	**HIGH WIND**	$9,405	$0	Thunderstorm winds 69 mph: Several large pine trees blown over. Minor structural damage to several cottages with shutters and doors blown off. Dime size hail also fell. (Silver Beach)	NOAA, National Climatic Data Center

Table 4 (Cont.) High Wind Events Recorded in NOAA Storm Events Database, 1996-2015 Excluding Tropical Cyclones and Nor'Easters

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
NORTHAMPTON CO.	6/27/2006	**HIGH WIND**	$4,703	$0	Thunderstorm wind 57 mph. Several trees blown down (Parksley, Exmore)	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	7/22/2006	**HIGH WIND**	$4,703	$0	Thunderstorm wind (57 mph): trees down on power lines. (Wachapreague, Exmore, Eastville).	NOAA, National Climatic Data Center
ACCOMACK CO.	7/28/2006	**HIGH WIND**	$2,351	$0	Thunderstorm wind: trees down on power lines and blocking roads near Onancock and Accomac (60 mph)	NOAA, National Climatic Data Center
ACCOMACK CO.	4/16/2007	**HIGH WIND**	$1,143	$0	Low pressure moved off the Delmarva peninsula and intensified rapidly as it moved northeast of the area. Winds on the backside of the departing low produced isolated wind damage. Numerous trees and power lines were downed by winds across Accomack County (58 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	5/6/2007	**HIGH WIND**	$2,286	$0	Intense low pressure off the Mid Atlantic Coast produced very strong winds (53 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	6/8/2007	**HIGH WIND**	$0	$0	Scattered thunderstorms produced widespread wind damage and large hail near Atlantic. Winds at 57 mph.	NOAA, National Climatic Data Center
NORTHAMPTON	11/3/2007	**HIGH WIND**	$1,143	$0	Combination of Extratropical Storm Noel tracking up off the Mid Atlantic Coast and High Pressure building into the region from the northwest produced strong northeast winds at 46 mph.	NOAA, National Climatic Data Center
ACCOMACK CO.	3/5/2008	**HIGH WIND**	$1,101	$0	Scattered sever thunderstorms produced damaging winds and large hail; trees were downed in Hallwood (57 mph)	NOAA, National Climatic Data Center
ACCOMACK CO.	5/11/2008	**HIGH WIND**	$14,819	$0	Low pressure produced very strong winds (67 mph) and wind damage. Trees and powerlines were downed. Some structural damage and power outages also occurred.	NOAA, National Climatic Data Center
ACCOMACK CO.	5/31/2008	**HIGH WIND**	$3,318		Scattered severe thunderstorms in advance of a cold front produced damaging winds (57 mph); trees downed on Atlantic Rd. between Atlantic and Assawoman.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/4/2008	**HIGH WIND**	$1,101	$0	Thunderstorm in advance of cold front; large tree downed in Accomac (57 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	6/16/2008	**HIGH WIND**	$1,101	$0	Thunderstorm wind in advance of cold front (57 mph). Power lines downed (Belle Haven)	NOAA, National Climatic Data Center
NORTHAMPTON CO.	6/29/2008	**HIGH WIND**	$3,303	$0	Scattered severe thunderstorms in advance of a cold front produced damaging winds (57 mph) and large hail. 2 MI NNW Eastville to 1 mi E of Exmore.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/27/2008	**HIGH WIND**	$1,101	$0	Thunderstorm n advance of cold front. Trees downed near Route 13 near Tasley. (57 mph).	NOAA, National Climatic Data Center

Table 4 (Cont.) High Wind Events Recorded in NOAA Storm Events Database, 1996-2015 Excluding Tropical Cyclones and Nor'Easters

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO./ NORTHAMPTON CO.	8/10/2008	**HIGH WIND**	$4,403	$0	Scattered severe thunderstorms in advance of cold front produced damaging winds (57 mph) and large hail. Several trees and power lines downed just west of Townsend, and between Route 13 and Wallops trees and power lines downed; power outages	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	12/31/2008	**HIGH WIND**	$3,303	$0	Intense low pressure departing to the northeast and cold high pressure building in from the west, produced very strong wind gusts of 51 knots (59 mph) was measured at Wallops; 53 mph at Capt Charles; 46 mph at Exmore. Several trees were downed.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	6/9/2009	**HIGH WIND**	$1,105	$0	Scattered severe thunderstorms in advance of a cold front produced large hail and damaging winds (57 mph). Trees were downed on Plum Street and also Robin Road in Cheriton area.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/26/2009	**HIGH WIND**	$3,315	$0	Severe thunderstorm winds downed large tree and power lines on Waterfield Road and other locations in Accomack County (57 mph).	NOAA, National Climatic Data Center
NORTHAMPTON CO.	5/12/2010	**HIGH WIND**	$2,174	$0	Scattered severe thunderstorms in advance of a cold front produced large hail and damaging winds. A large tree and power lines were downed.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/25/2010	**HIGH WIND**	$1,087	$0	Thunderstorm wind (57 mph): Tree was downed on power lines on Horntown Road.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	7/29/2010	**HIGH WIND**	$1,087	$0	Scattered severe thunderstorms in advance of a cold front produced large hail and damaging winds (57 mph). A large tree was downed.	NOAA, National Climatic Data Center
ACCOMACK CO.	8/5/2010	**HIGH WIND**	$2,174	$0	Numerous trees downed in thunderstorm winds (57 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	2/25/2011	**HIGH WIND**	$2,107	$0	Very strong gradient winds produced wind gusts to around 60 mph over portions of eastern Virginia.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	4/16/2011	**HIGH WIND**	$6,322	$0	Scattered severe thunderstorms in advance of a cold front produced damaging winds (57 mph). Numerous trees were reported down around Weirwood, Simpkins, Exmore, and Accomac.	NOAA, National Climatic Data Center
ACCOMACK CO.	5/24/2011	**HIGH WIND**	$4,215	$0	Thunderstorm winds knocked down silos (57 mph) in Assawoman.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/28/2011	**HIGH WIND**	$2,107	$0	Thunderstorm winds downed several large limbs near Mears and New Church (57 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	7/20/2011	**HIGH WIND**	$1,054	$0	Thunderstorm winds downed power lines near Davis Wharf (57 mph).	NOAA, National Climatic Data Center
ACCOMACK CO.	2/24/2012	**HIGH WIND**	$2,065	$0	Scattered severe thunderstorms in advance of a cold front produced damaging winds (57 mph) and downed trees.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	6/29/2012	**HIGH WIND**	$5,162	$0	A derecho produced a widespread path of damaging winds across much of central and eastern Virginia. Numerous trees and power lines were downed. A gust of 57 MPH was recorded at Kiptopeke.	NOAA, National Climatic Data Center

Table 4 (Cont.) High Wind Events Recorded in NOAA Storm Events Database, 1996-2015 Excluding Tropical Cyclones and Nor'Easters

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO.	8/25/2012	**HIGH WIND**	$10,323	$0	Scattered thunderstorms associated with low pressure along the Mid Atlantic Coast produced heavy rain which caused flash flooding. Many roads were closed due to flooding. Cars were disabled and filing with water in the Keller-Painter area. Trailer home was damaged by straight line winds (57 MPH). One minor injury was reported.	NOAA, National Climatic Data Center
ACCOMACK CO.	8/3/2013	**HIGH WIND**	$0	$0	A squall line produced widespread wind damage and embedded large hail across much of central and eastern Virginia. Numerous trees downed across the northern part of the county.	NOAA, National Climatic Data Center
ACCOMACK CO.	1/11/2014	**HIGH WIND**	$2,002	$0	Thunderstorm winds (57 mph) downed trees.	NOAA, National Climatic Data Center
ACCOMACK CO.	5/27/2014	HIGH WIND	$2,002	$0	Scattered severe thunderstorms knocked down trees, blocking a road between Melfa and Keller (57 mph)	NOAA, National Climatic Data Center
NORTHAMPTON CO.	7/24/2014	**HIGH WIND**	$951,127	$1,255,819	Tornado and downburst straightline winds (75 mph) struck Cherrystone Campground with little warning to campers. 7.699 MI long; 150 yards wide. Tornado began in the Chesapeake Bay, a few miles west of the campground, then tracked eastward into Cherrystone Campground, continuing eastward across Old Cherrystone Rd. and Route 13 before lifting near Seaside Rd. close to the Northampton Landfill. Straightline wind damage from just S. of Cherrystone to Cape Charles. Many trees were downed or snapped off, some down across homes. Numerous camping trailers were damaged, and several were destroyed. Several trees were downed on cabins. Golf ball size hail, with a few reports of baseball size hail near Cherrystone Campground. Hail fell in a 0.5 to 0.75-MI-wide swath from Cherrystone Campground eastward to Oyster. Considerable leaf debris from trees was associated with the hail. In addition, hail combined with strong winds damaged the siding on a number of homes. Significant crop damage: 2,284 acres damaged.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/15/2015	**HIGH WIND**	$2,000	$0	Winds of 57 mph struck; several trees were downed.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/18/2015	**HIGH WIND**	$10,000	$0	Scattered severe thunderstorms associated with a trough of low pressure produced damaging winds (57 mph). Boats were capsized and a roof blown off; a pier was damaged at Deep Creek Marina; trees were snapped in Tasley; and several trees were damaged in Onancock and Accomac.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/20/2015	**HIGH WIND**	$4,000	$0	Scattered severe thunderstorms in advance of low pressure and a weak cold front produced damaging winds and large hail. Numerous trees were downed and blocking roads. (Winds 57 mph)	NOAA, National Climatic Data Center

Table 5: Tornadoes Recorded in NOAA Storm Events Database, 1996-2015

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO.	7/30/2000	**TORNADO**	$2,890	$0	An F0 tornado touched down in a trailer park. The tornado briefly kicked up dust and debris before dissipating, but no damage occurred. .2 MI long and 20 yards wide.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	9/14/2007	**TORNADO**	$34,294	$0	Waterspout came onshore near Whittington Rd. Produced some structural damage and downed numerous trees in about a six mile path from Silver Beach northeast to Wardtown. 50 yards wide. Rated EF0	NOAA, National Climatic Data Center
NORTHAMPTON CO.	9/27/2010	**TORNADO**	$21,739	$0	Blew over a shed, downed trees, and severely damaged a mobile home. There was also one minor injury. .45 MI long; 30 yards wide. Rated EF0	NOAA, National Climatic Data Center
ACCOMACK CO.	8/27/2011	**TORNADO**	$26,342	$0	EF0-rated tornado spawned from Irene downed trees and caused minor roof damage.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	6/1/2012	**TORNADO**	$3,097	$0	EF0 tornado near Savage Neck Dunes. 75 yards wide, .73 MI long.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/14/2012	**TORNADO**	$15,485	$0	Isolated severe thunderstorm along a weak frontal boundary produced a tornado across portions of the Virginia Eastern Shore. A slow moving tornado made a short narrow path through rural portions of Accomack county just east of Onley. The tornado first touched down in a small residential development just southwest of the intersection of Custis Neck Road and Drummondtown Road. Numerous trees were damaged or brought down by the tornado with one tree falling on an unoccupied vehicle. The tornado then continued slowly southwest through a wooded area with the last visible tree damage seen just southwest of Accomack Elementary School.	NOAA, National Climatic Data Center
ACCOMACK CO.	6/18/2013	**FUNNEL CLOUD**	$0	$0	Funnel cloud reported over Tasley.	NOAA, National Climatic Data Center

NORTHAMPTON CO.	7/24/2014	**TORNADO**	$951,127	$1,255,819	Tornado and downburst straightline winds (75 mph) struck Cherrystone Campground with little warning to campers. Began in the Chesapeake Bay, west of the campground, then tracked eas into the campground, continuing east across Old Cherrystone Rd. and Route 13 before lifting near Seaside Rd. close to the Northampton Landfill. Straightline wind damage from just S. of Cherrystone to Cape Charles. Many trees were downed or snapped off, some down across homes. Numerous camping trailers were damaged, and several were destroyed. Several trees were downed on cabins. Golf ball size hail, with a few reports of baseball size hail near Cherrystone Campground. Hail fell in a 0.5 to 0.75-MI-wide swath from Cherrystone Campground eastward to Oyster. Considerable leaf debris from trees was associated with the hail. In addition, hail combined with strong winds damaged the siding on a number of homes. Significant crop damage: 2,284 acres damaged. Three deaths and 36 injuries from event; 5 of the injuries were from the tornado. The rest of the injuries and deaths were determined by the National Weather Service to have been from straightline winds.	NOAA, National Climatic Data Center
ACCOMACK CO.	8/4/2015	**TORNADO**	$2,000	$0	Scattered severe thunderstorms in advance of a cold front produced damaging winds, large hail, and one weak tornado. A weak tornado was reported by several people near and east southeast of Saxis. Large limbs were downed in the road. Other debris was blown around and quarter-size hail was reported near Jenkins Bridge.	NOAA, National Climatic Data Center

TYPE, LOCATION, AND EXTENT

DAMAGES

High wind events cause progressive failure of structures. Once a building's envelope has been breached wind will start to enter the building and either pull or push at other parts of the structure. Partially enclosed buildings experience a 30% higher wind pressure than enclosed buildings. Once a building becomes partially enclosed due to wind damage, higher wind pressures cause further damage (*FEMA Coastal Construction Manual*, 2011).

A building fails in high winds because the wind speed exceeds the capacity of the structure to hold up. This can happen in two ways, wind speed exceeds the design or construction standards used or windborne debris damages the structure and as a result of increased wind pressure the design or construction standards are surpassed. Wind damage commonly assumes a couple of forms. Roofs can fail, lightweight structures can overturn at the foundation, siding and shingles can be pulled off the building and openings can be blown in. Once a structure's envelope has been penetrated by wind, wind-driven rain and debris causes additional damages (*FEMA Coastal Construction Manual*, 2011).

Storms that occur when the trees are in full leaf also cause tremendous tree damage. Hurricane Isabel was such a storm. Thousands of trees were blown over due to the winds from Isabel and saturated soils. Many of these trees and their limbs damaged houses, auxiliary structures, power lines, and vehicles.

EXPOSURE AND POTENTIAL LOSS

The Eastern Shore is in wind Zone II (ASCE7-98). This means that a community shelter in this area would have to be built to withstand 160 mph winds. This shelter could withstand a F2 tornado and a Category 4 hurricane. The building code requires all structures to withstand 110 mph winds, the equivalent of a Category 1 hurricane.

This wind speed is based on the 100-year return frequency. That means that over 70 years a structure would have a 50% chance that the 110 mph wind speed would be met or exceeded. However, wind speed design builds in a 1.5 safety factor. So a structure should withstand a higher wind speed (*FEMA Coastal Construction Manual*, 2011).

Siting decisions affect the types of wind speed seen at a building. Ocean promontories generally receive high wind speed due to the topography of the area. A more exposed condition because of lack of vegetation around the structure will open the building up to greater wind speeds. Those structures near open water are exposed to higher winds than structures located more landward. In addition, the height of a structure above the ground affects the wind speeds. The higher a house is located above ground the higher the wind speed will be around the structure. This can be an issue in flood zones since elevation of the building is the primary means of mitigating flood damage (*FEMA Coastal Construction Manual*, 2011).

In addition, a structure is only as wind resistant as its smallest component. If a window, door, roof covering, siding or chimney fails, the rest of the structure will be subjected to wind pressures that can cause other components to fail even though they perform to their design guidelines (*FEMA Coastal Construction Manual*, 2011).

SECONDARY HAZARDS

Auxiliary hazards of high wind are salt spray and soil erosion. High winds that pick up salt from the ocean blow this over the Eastern Shore causing crops to be destroyed and power lines to fail. Hurricane Isabel caused both types of damage. Additionally, strong winds from the northwest are common during the winter months on the Eastern

Shore. These winds can cause significant soil erosion to fields in the winter stripping critical nutrients from fields and depositing them in local waterways (Local oral accounts).

HUMAN SYSTEMS

There are various ways that property damage and personal injury can be minimized. Preparation is one of the most important of these, and resilient construction is key to this, as discussed previously in the Exposure and Potential Loss section above. Similarly, early warnings are vital to insuring people are able to move to shelter prior to the onset of a high wind event.

WARNING ANNOUNCEMENTS

The National Weather Service provides warnings for high winds through their Land-based Wind Hazard Announcements and Water-based Wind Hazard Announcements.

Land-Based Wind Hazard Announcements
Hurricane Wind Watch: Issued for inland areas that sustained winds of 74 mph or greater associated with a hurricane are anticipated beyond the coastal areas. The actual occurrence, timing and location are still uncertain.
Hurricane Wind Warning: Issued for inland areas that sustained winds of 74 mph or greater associated with a hurricane are anticipated beyond the coastal areas in the next 6 to 24 hours.
Tropical Storm Wind Watch: Issued for inland areas that sustained winds of 39-73 mph or greater associated with a tropical storm are anticipated beyond the coastal areas. The actual occurrence, timing and location are still uncertain.
Tropical Storm Wind Warning: Issued for inland areas that sustained winds of 39-73 mph or greater associated with a tropical storm are anticipated beyond the coastal areas in the next 6 to 24 hours.
Severe Thunderstorm Watch: Issued when severe thunderstorms are possible in and near the watch area. Severe thunderstorms contain winds of 58 mph or higher and/or hail 1 inch in diameter or larger.
Severe Thunderstorm Warning: Issued when severe thunderstorms are occurring or imminent in the warning area. Severe thunderstorms contain winds of 58 mph or higher and/or hail 1 inch in diameter or larger.
Wind Advisory: Issued when the following conditions are expected for 3 hours or longer under the following conditions: sustained winds of 31 to 39 mph and/or wind gusts of 46 to 57 mph.
High Wind Watch: Issued when the following conditions are possible: Sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph or higher for one hour or more.

High Wind Warning: Issued when the following conditions are occurring or imminent: Sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph or higher for one hour or more.
Extreme Wind Warning: Issued for surface winds of 100 knots (115 MPH) or greater associated with non-convective, downslope, derecho (NOT associated with a tornado), or sustained hurricane winds are expected to occur within one hour.
Tornado Watch: Issued when severe thunderstorms and tornadoes are possible in and near the watch area.
Tornado Warning: Issued when a tornado is imminent. When a tornado warning is issued, seek safe shelter immediately.

Water-Based Wind Hazard Announcements
Gale Warning: Issued for the Tidal Potomac River and the Chesapeake Bay when one or both of the following conditions is expected to begin within 36 hours and not directly associated with a tropical cyclone: Sustained winds of 34 knots to 47 knots, or frequent gusts (duration of two or more hours) between 34 knots and 47 knots.
Storm Warning: Storm Warnings are issued for the Tidal Potomac River and the Chesapeake Bay when one or both of the following conditions is expected to begin within 36 hours and not directly associated with a tropical cyclone: Sustained winds of 48 knots to 63 knots, or frequent gusts (duration of two or more hours) of 48 knots to 63 knots.
Hurricane Force Wind Warning: Hurricane Force Wind Warnings are issued for the Tidal Potomac River and the Chesapeake Bay when one or both of the following conditions is expected to begin within 36 hours and not directly associated with a tropical cyclone: Sustained winds of 64 knots or greater, or frequent gusts (duration of two or more hours) of 64 knots or greater.
Special Marine Warning: A warning of potentially hazardous weather conditions of short duration (up to 2 hours) affecting areas included in a forecast area that are not adequately covered by existing marine warnings and producing one or more of the following: Sustained marine convective winds (showers/thunderstorms) or associated gusts of 34 knots or greater; and/or hail three quarters of an inch or more in diameter, and/or waterspouts.

CONSTRUCTION STANDARDS

The 2011 Coastal Construction Manual, Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas (Fourth Edition). V. 1-2 lays out very specific design standards for not only wind, but flooding, fire, and more. Design for wind loads is essentially the same whether the winds are due to hurricanes, thunderstorms, or tornadoes, and both Counties (and subsequently their respective incorporated Towns), go by these standards for building and zoning codes.

The Eastern Shore is in wind Zone II (ASCE7-98). This means that a community shelter in this area would have to be built to withstand 160 mph winds. This shelter could withstand a F2 tornado and a Category 4 hurricane. The building code requires all structures to withstand 110 mph winds, the equivalent of a Category 1 hurricane.

PERSONAL RESPONSIBILITY

Even if structures are built to the proper standard, regular maintenance to ensure their stability and resilience are important. There is a FEMA fact sheet for protected shingled roofs from high winds that could be useful to many Eastern Shore residents.

During high wind events, families and businesses should have a designated 'safe room' in which to stay until the event subsides. These rooms should be located outside known flood prone areas, including the 0.2%-annual-chance event, and away from any potential large debris sources.

CHAPTER 5: COASTAL EROSION

INTRODUCTION

Standing on the pristine beach of Cobb Island in Northampton County, one would never know that the now-tranquil barrier island was a bustling recreational center in its prime where a harpist once entertained guests in the island's grand resort hotel (Figure 4.1: Advertisement for Cobb's Island Hotel).

Figure 1: Advertisement for Cobb Island Hotel

The Cobb's Island Hotel might have been lost in a single storm, but the setup came over the course of a couple of decades as the hotel went from being 500 yards from the surf to within 50', according to authors of "A Short History of the Virginia Barrier Islands" (Barnes and Truitt, 1997). Erosion from a series of late century storms had made the hotel easy pickings for a nor'easter-hurricane double-punch in 1897.

Over the course of the subsequent 100 years, Tangier Island would see more than half of its land mass recede into the Chesapeake Bay, but officials are working to make sure that Cobb Island's history is not Tangier Island's future. The Town received a commitment from the Commonwealth and the Corps of Engineers in 2012 to build a seawall and jetty to protect the Town harbor.

There are other factors that differentiate Cobb and Tangier Islands. For example, the conditions and energy to which they are subjected are vastly different. Cobb Island is part of a long chain of barrier islands subjected to a constant barrage of plunging ocean waves breaking onto the beach, while Tangier Island is within the Chesapeake Bay where wave energy is less intense and erosion is augmented primarily by sea-level rise and subsidence.

Erosion itself can be described in simplistic terms as energy moving sediment. It can happen so incrementally that it goes almost unnoticed in the short-term, and is best measured in years, or so dramatically that what was there one day is gone the next. Although erosion is a natural coastal process, it becomes problematic when it threatens lives or property, and with sea-level rise, it is doing so with greater frequency.

On a peninsula, water and waves come to mind as primary drivers of erosion, but wind is also a powerful sculptor of land. The rate of erosion is also greatly influenced by underlying geology, and sometimes by man-made interventions in those natural processes - like the seawall and jetty proposed for Tangier. Those interventions can also have negative effects, like accelerating erosion in other locations, or destruction of natural bottom in front of the structure from reflected wave energy.

FEMA's Coastal Construction Manual describes these ways in which erosion can threaten coastal buildings:

- Destroying dunes or other natural protective features,
- Destroying erosion control devices,
- Lowering ground elevations,

- Undermining shallow foundations, and reducing penetration depth of pile foundations,
- Transporting beach and dune sediments landward, where they can bury roads, buildings and marshes,
- Breaching low-lying coastal barrier islands exposing structures on the mainland to increased flood and wave effects, and
- Eroding coastal bluffs that provide support to buildings outside the floodplain itself.

This chapter succinctly reviews the forces at work that cause erosion, how erosion changes the coastline and adjacent landforms over time, and erosion control measures that have attempted to redirect - at least temporarily - water's capacity to reshape land.

While the section does look at changes to portions of the Eastern Shore landscape over time, risk assessment is not found in this chapter, but can be found in each of the locality chapters, beginning with Chapter 8.

NATURAL FORCES AND CONDITIONS

CAUSES OF EROSION

Large tropical and extratropical storms are associated with three of the major causes of erosion: Water, wind, and waves. A list of major storms affecting the region can be found the Chapter 1: Hazards on the Shore.

WATER

Water moving over land surfaces picks up and transports sediment. Surface erosion by water will depend on the volume of water, the speed at which it is moving, the surface characteristics (vegetative cover, permeability, sediment grain size), and its slope (EPA, water.epa.gov). Coastal floods identified in the previous chapter can be sources of coastal erosion as they pick up and move large quantities of water-borne sediment to be deposited elsewhere. Erosion from water can degrade coastal bluffs and tidal marshes, causing them to slump into adjacent water bodies.

Localized scour - the removal of sediment from around a fixed structure - can result from water moving at high velocity. Scour can undermine slabs or other at-grade foundations, causing them to fail, or expose other structural elements (FEMA Coastal Construction Manual, 2011).

Regardless of the source, sediment transported by water is left somewhere, and even experienced boaters have been caught in spring on shoals that were not there the previous fall. Shoaling in some stretches of the Virginia Inside Passage, once a continuous seaside water passage buffered from the sea by the mainland to the west and the barrier islands to the east, has now rendered sections impassable, and others passable only at high tide.

WIND

Anyone who has been stung by sand carried in a gust on the beach has felt directly the effects of sediment being transported by wind. Exposed soil is susceptible to wind erosion, and in coastal areas, sandy areas are prevalent. The same wind that shifts sand on the beach can lower ground elevations around coastal buildings, exposing those built in velocity zones to higher-than-anticipated forces, and exposing buildings that were not built to withstand velocity flows to those hazards. Like water, wind can also scour sand from around structural supports (FEMA Coastal Construction Manual, 2011).

Wind also contributes to wave height – another erosional force - through the interaction of three factors: wind speed, duration, and fetch - the distance over water that wind blows in a single direction. Slow wind speed will produce small waves, regardless of duration and fetch. Strong winds lasting only a few minutes will not produce large waves, and strong winds over a long period, but over a short fetch, will not result in large waves. All three factors must be present (NOAA, oceanservice.noaa.gov).

WAVES

Away from shore, waves do not have much forward motion, but as they approach the shore, friction with the ocean bottom gives the top of the waves forward momentum, causing the waves to break. The mass of forward-moving water breaking into the shore gives waves their erosive power (Hyndman and Hyndman, 2011).

With perpendicular or near-perpendicular waves, sand is pushed onto the beach by breaking waves, and pulled back as the wave washed back into the ocean. Sometimes waves break at angles, pushing sand on shore at an angle, but as the water is pulled back into the ocean, it is pulled back in perpendicularly, which nudges sand along the coastline through a process known as longshore drift, and this drift generally moves sand southward along the Atlantic coast of the Eastern Shore (Hyndman and Hyndman, 2011).

This pattern moves sediment grain-by-grain to build long stretches of beach, a pattern that is repeated, within zones, along the entire Atlantic coastline, taking from one area of the zone through erosion, and depositing in another through accretion.

The general pattern of transport in the Eastern Shore area is southward along the Atlantic Coastline into the Chesapeake, and southward within the bay to the lower Chesapeake where it is deposited either in the bay or tributaries of lower bay rivers (USACE, 2015) (Figure 2).

Figure 2: Net sediment transport pathways for Chesapeake Bay and Atlantic area off the Virginia Coast. Source: "North Atlantic Coast Comprehensive Study Report" USACE, 2015

EROSION AND UNDERLYING GEOLOGY

The rate of erosion of a given area is largely dependent on its underlying geology. Figure 3 is taken from the USACE North Atlantic Comprehensive Study, mandated to examine coastal risk following Hurricane Sandy. The figure depicts the mid- and northern Atlantic's coastal geology, with the Chesapeake Bay side of the Eastern Shore characterized as "drowned river valley" and the ocean side as "barrier coast."

Drowned river valley coastlines are commonly characterized by low banks, marshes, and beaches fronting the mainland. Bayside dunes are extant in both counties, with 4.9 miles of dune shoreline in Accomack County and 10.2 miles of dune shoreline in Northampton County, including those reaching 20'-50' at Savage Neck Dunes Natural Area Preserve. In addition to the dunes, natural resiliency features include submerged aquatic vegetation beds, oyster reefs, tidal marsh beds, and tidal creeks. Primary drivers of erosion are wave action, wave height, and wind strength and direction, which can direct water into normally dry shore areas.

Atlantic barrier coastlines consist of long and narrow barrier islands, with beach on the seaward side and one or

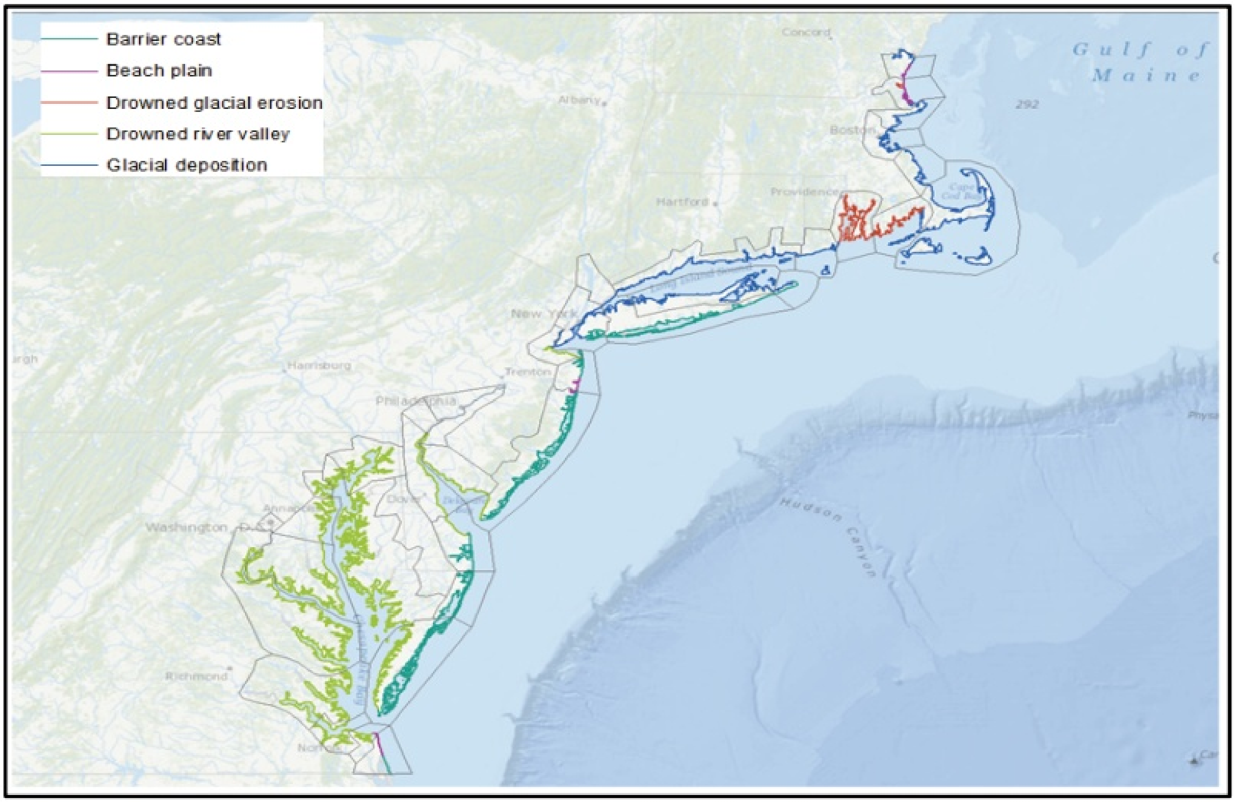


Figure 3: Atlantic Coastal Geology. Source: "North Atlantic Coast Comprehensive Study Report" USACE, 2015.

more bays on the land-facing side that support complex tidal marsh systems. Natural resiliency features include beaches, washover fans, extensive tidal marshes with tidal flats and tidal creeks, mollusk reefs, and submerged aquatic vegetation beds.

The Eastern Shore's seaside includes the longest expanse of coastal wilderness remaining on the Atlantic seaboard and is comprised of thousands of acres of pristine tidal marshes, vast tidal mudflats, shallow lagoons, and navigable tidal channels that support thriving seafood and recreational tourism industries. This unique environment carries the designation of World Biosphere Reserve from United Nations Educational, Scientific and Cultural Organization.

Biodiversity of the barrier island ecosystem may be globally recognized, but it is only one benefit the island chain affords. Barrier islands take the brunt of ocean energy, protecting the habitats and structures behind them. This makes barrier islands important in times of hurricanes, tropical storms and destructive nor'easters. The low wave energy environments allow for thousands of acres of tidal marshes to thrive in the coastal bays behind the islands, increasing their flood mitigation benefits.

Governor, USACE announce funding for Tangier Island jetty

U.S. Army Corps of Engineers Press Release, Norfolk, Nov. 21, 2012

TANGIER ISLAND - Gov. Bob McDonnell and Col. Paul Olsen of the U.S. Army Corps of Engineers traveled today to Tangier Island in the Chesapeake Bay to announce they have signed an agreement to build a long-awaited seawall and jetty to protect the Island's endangered harbor. The project will involve both state and federal funding.

"This is fantastic news," Gov. McDonnell said. "The harbor is the economic heart of Tangier Island, and the center of a significant commercial fishing industry worth millions to Virginia's economy."

The purpose is to protect the channel to the only harbor on the island, and shield the harbor itself from direct wave impact and from damage caused by sheets of ice pushed into the inner channel and harbor. The project also will reduce erosion of the shoreline and sediment flow into the navigation channel.

The cost of the project is currently estimated at $4.2 million, of which the federal government will ultimately pay approximately $3.2 million. The state's share would be $950,000 over the next five years.

Sediment in this environment is moved by both longshore drift, which requires an adequate supply of sediment and "rollover," where high tides erode sand from the ocean side of the island and carry it toward the center or back side of the island (Figures 4 and 5). In addition to wave action, another factor of barrier island erosion is the interruption of the supply of sand by up-stream interventions such as jetties or groins. Storms are unable to remobilize this trapped sediment, and downstream islands become starved for nourishment and erode (USACE, 2015).

Sections of the barrier islands are changing rapidly, with segments of islands disappearing and moving into the back barrier channels and marshes. This is especially true for areas adjacent to active inlets and this phenomenon can be observed in Figure 4. The home that is the subject of the photos no longer exists. The owners saw its fate as inevitable, and burned it rather than have it fall into the sea.

Tidal marshes are also subject to erosion. Some of the worst erosion occurs when winds pick up during mid-tide or from wake generated by motorized vessels. During low tide, the water is not high enough for waves to lap against the land edge, and during high tide, it is buried. However, at mid-tide the water is pushed against the marsh edge and wears away at the edge, (Art Schwarzchild, University of Virginia Long-Term Ecological Research-Anheuser Busch Coastal Research Center, Comments made during March 4, 2015 meeting).

SEA-LEVEL RISE AND EROSION

Sea-level rise threatens both seaside and bayside marshes, which afford the mainland with protection from both floods and erosion. As sea-level rises, barrier islands will respond by migrating landward, disintegrating if sediment supply is insufficient, or drowning in place (Moore, List, et al., 2011).

Changes to vegetation can also occur, as seen on Assateague Island, where a 2012 study concluded that the "ghost forests" - stands of dead and dying loblolly pines - are succumbing to salt water intrusion caused by a combination of sea-level rise and barrier island processes. Vegetation serves as a stabilizing force for shorelines and loss of vegetation increases a shoreline's vulnerability to erosion.

With changes in inundation, habitat types shift, changing, for example, from irregularly-flooded marshes to regularly-flooded marshes, and eventually to mud flats or open water. This change in habitat type is not only detrimental to the wildlife that reside there, but also increases coastal exposure to wind and wave action, most often leading to increases in erosion rates.

Figure 5: Changes to the southern end of Cedar Island, 2006-2014. Source: Gordon Campbell, At Altitude Photograph. Copyright protected, used with permission.

Because the Eastern Shore barrier islands are largely in their natural states and without erosion control mechanisms, the process of rollover is readily observed. In Figure 5, images of a section of Assateague Island, taken before and after Hurricane Sandy, illustrate how waves washing over the island carried sand toward the mainland. This phenomenon provides critical width for islands and establishes a back-barrier platform which the island can continue to roll onto, thereby increasing the long-term viability of the island.

Figure 4: Aerial photographs of a section of Assateague Island before and after Hurricane Sandy. Photo Credit: USGS

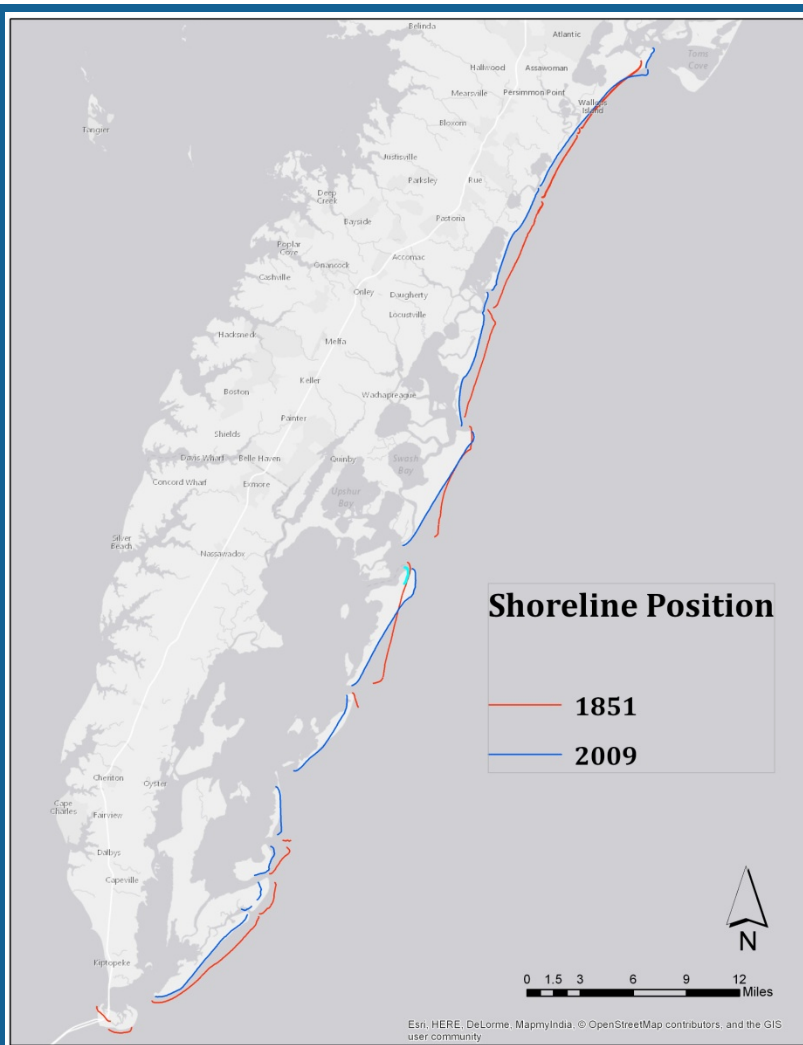


Figure 6: Historically mapped shorelines from Chincoteague Inlet to Fishermans Island as digitized by Dr. Michael Fenster and students at Randolph-Macon College.

HUMAN SYSTEMS

When natural processes threaten lives and investments, it is commonplace to look for ways to redirect nature's course or lessen its impacts. To slow coastal erosion and stabilize shorelines, structural interventions such as groins, jetties, and seawalls, are often employed, or soft interventions may be used, such as living shorelines or beach nourishment. These erosion control responses must be considered and selected based on conditions of the particular location and surrounding environs. Measures that are employed on the Eastern Shore are described in the following sections. A complete listing, along with benefits, impacts, and costs, can be found in Appendix C of the North Atlantic Coast Comprehensive Study.

HUMAN INTERVENTIONS

GROINS AND JETTIES

Groins and jetties are engineered structures placed perpendicular to the shoreline to interrupt longshore drift. Both kinds of structures extend out into the water, but jetties are generally used to protect inlets and harbor entrances (Figure 7), while groins can be used to protect any stretch of shoreline.

Because groins and jetties interrupt the natural drift of sand, sediment tends to build, or accrete, on the up-drift side of the structures, but they accelerate erosion on the immediate down-drift side because the area is robbed of the natural sediment it would have received from longshore drift. (Barnard, Thomas, VIMS Self-Taught Education Unit, Coastal Shoreline Defense Structures).

Figure 7: Jetty at Cape Charles Harbor. Photo Credit: Jay Diem, Eastern Shore News. Used with permission.

PARALLEL STRUCTURES – SEAWALLS, BULKHEADS, AND REVETMENTS

Seawalls are built parallel to shorelines to inhibit erosion by intercepting waves. They are designed with sufficient height and heft to prevent being overrun by storm surge or undermined by powerful waves.

The down-side to seawalls is up-front costs – they average $36 million per mile - and they can be undermined by scour, causing wall failure. (Reuters, "Water's Edge: The Crisis of Rising Sea Levels, September 4, 2014) Seawalls can also obstruct scenic views and negatively impact wildlife (USACE, 2015).

Bulkheads, also built parallel to shorelines, are meant to keep land from eroding into the sea. They can be anchored or cantilevered sheet piles, or gravity structures; but they, too, can be undermined by scour.

Both seawalls and bulkheads can have detrimental effects on neighboring shorelines and nearshore environments. When these structures work as designed, they protect the property where they are installed, but the deflected wave energy has to go somewhere. Neighboring properties and the near-shore environment in front of parallel shoreline protection structure usually receive the brunt of that energy, which creates not only scour conditions for the structure, but scours the ocean bottom of marine life (Barnard, Thomas, VIMS Self-Taught Education Unit, Coastal Shoreline Defense Structures).

Figure 9 shows the locations of all type of shoreline erosion control structures for the northern two-thirds of Northampton County, including bulkheads. As increasing numbers of property owners install these structures, and with lifespans of 20-25 years, long-term financial commitments will be needed to maintain them (Barnard, Thomas, VIMS Self-Taught Education Unit, Coastal Shoreline Defense Structures).

Figure 8: Revetment at the beach of Wallops Flight Facility. Photo Credit: NASA

REVETMENTS

Revetments are hardening or reinforcement of a surface exposed to waves or strong currents to prevent erosion. Typical construction consists of a filter layer overlain with stone or concrete (Figure 8). Revetments can be used alone or in combination with other structures. For example, a seawall can be capped with a revetment.

Revetments tend to reflect less wave energy because they are more sloped, but are still subject to the same erosion impacts as other parallel structures. Accessibility to the shoreline can be a drawback of using revetments (USACE, 2015).

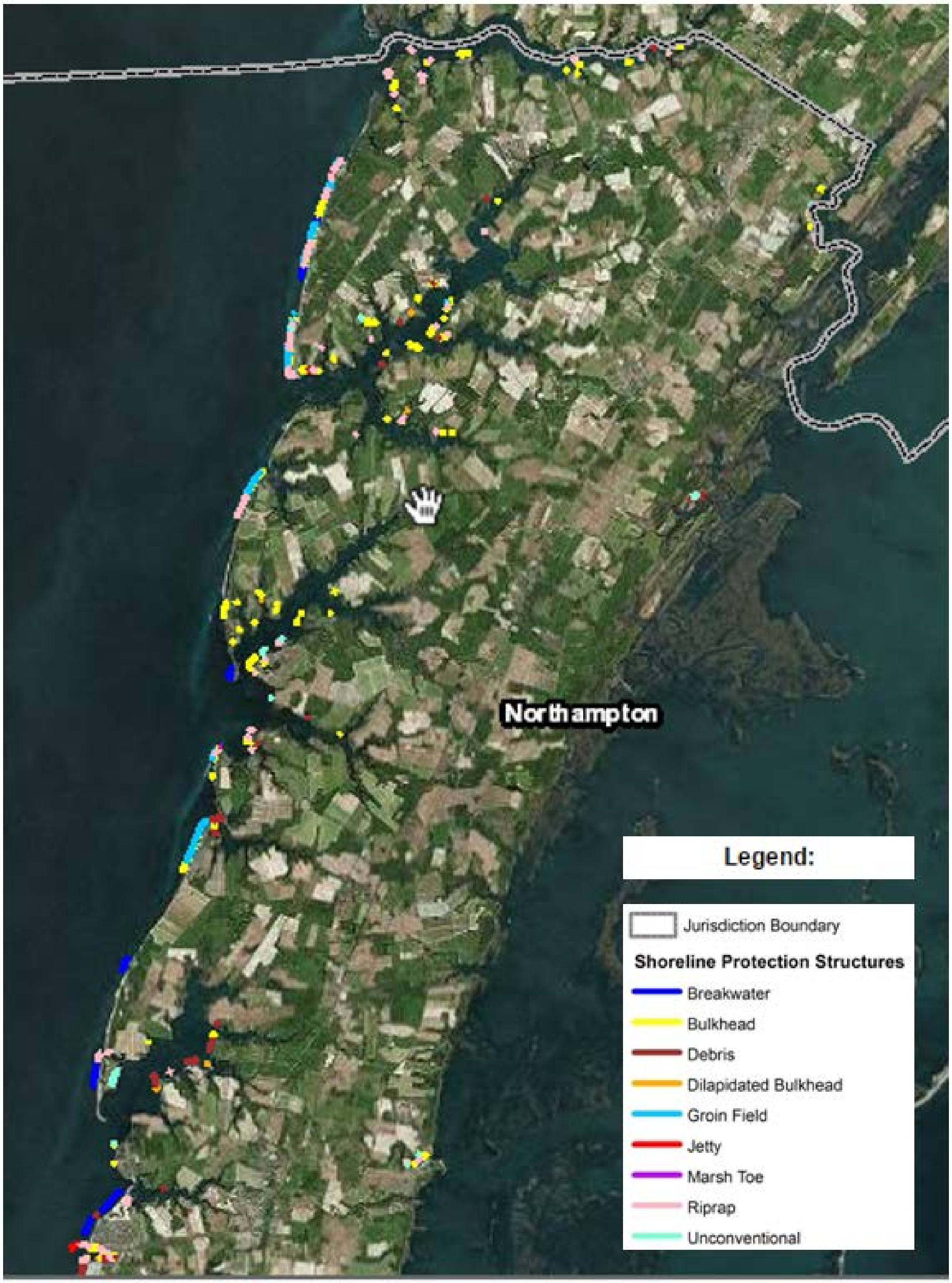


Figure 9: Northampton County Shoreline Protection Structures. Source: VIMS Center for Coastal Resource Management

BEACH NOURISHMENT

The placement of sand on an eroded beach is known as beach nourishment. It can be used alone as a beach restoration tool or in combination with other tactics, such as breakwaters. Beach nourishment does not change the rate at which erosion is occurring, and in fact, can accelerate erosion under certain conditions (USACE, 2015).

Beach nourishment is not a long-term fix; once it is selected as a solution, it requires periodic renourishment, typically every four to five years on average, or following major storms. NASA found it had good news and bad news to report about its recently completed beach protection project at the Wallops Flight Facility in the aftermath of Hurricane Sandy in 2012. The $43 million investment in a revetment and beach nourishment – completed three months before the storm - had worked to protect $1.2 billion in state and federal space program-related assets and launch infrastructure. The bad news was that another $11 million would be needed to replace 650,000 cubic yards of sand taken from the beach by the storm (Figure 10).

Figure 10: Beach Erosion at Wallops Flight Facility. Left: The completed beach nourishment project at WFF in August 2012. Right: The same stretch of beach is extensively eroded less than three months later, following Hurricane Sandy. Photo Credit: NASA

INTERVENTIONS ON BARRIER ISLANDS

In their natural states, conventional wisdom holds that barrier islands are best left to manage themselves. Such conventional wisdom may offer little consolation to communities like Wachapreague and Chincoteague, which are closely watching the year-by-year changes to Cedar Island and Assateague Island – barrier islands that have long afforded storm protection to their communities.

The USACE North Atlantic Coast Comprehensive Study acknowledges that some barrier islands may require management and intervention if the islands are to continue to provide such protections, and in fact, the USACE did intervene at the Assateague Island National Seashore.

The USACE has begun a sediment management plan, but communities like Wachapreague would like to do more to engage state and federal agencies to develop management plans where erosion threatens the island system that protects lives or natural resources.

Figure 12: Locations of Manually-Constructed Oyster Reefs in Waters off Virginia's Eastern Shore. Source: VCZMP

Figure 11: Oyster Reef under Construction Photo Credit: © Bowdoin Lusk/ The Nature Conservancy. Used with permission.

BREAKWATERS

Offshore structures placed parallel to the shoreline to soften the impact of waves are called breakwaters. Because wave energy is slowed by the structures, sand and sediment may settle in the area behind the breakwater, which can form an inviting environment for the growth of marsh grasses, an added protection against future erosion. The downside of breakwaters is that they can disrupt supply of sand to down-drift beaches (USACE, 2015).

Oyster reefs can serve as natural breakwaters and, once established, continue to grow vertically over time with sea-level rise, improving their ability to resist storms and mitigate erosion. Figure 11 shows the locations of oyster reefs that have been installed for long-term water quality and coastal resilience benefits, and Figure 12 is a photograph of an oyster reef under construction. Since oyster reefs are limited in elevation by the depth of the water column at a normal high tide, they provide excellent protection from relatively smaller waves and storm surge events; however, they can only provide minimal protection from wave action riding atop that is above average high tides or storm surge.

LIVING SHORELINES

One approach that is being employed in low wave-energy areas on the Eastern Shore is the construction of living shorelines. These shorelines re-establish the natural vegetative, nutrient, and slope characteristics of healthy shorelines so that they naturally dissipate wave energy. Figure 13 provides a cross-section of a typical living shoreline.

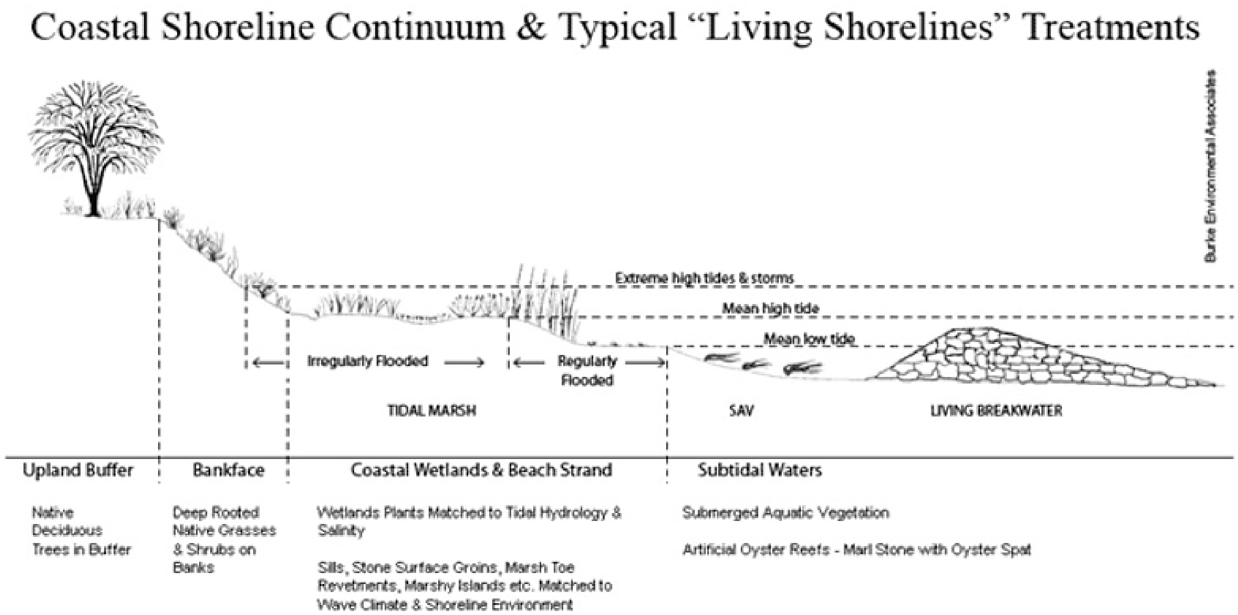


Figure 13: Typical Living Shoreline Cross-Section. Source: Burke Environmental Associates, http://www.habitat.noaa.gov/restoration/techniques/lsimplementation.html/

Large-scale living shorelines have been established in Oyster and at Camp Occohannock. In both locations, large granite rocks were brought in and piled parallel to the shore. Sand was added between the rock barriers and the shoreline to create salt marshes sloping upward to meet the previous shore edges. Marsh grasses were planted to stabilize the newly created areas between the open waters and the uplands.

Figure 14 shows the construction of the living shoreline in Oyster in 2009, and in July 2012 with marsh grasses fully established.

Figure 14: Living Shoreline in Oyster, Virginia. Left: October, 2009 - Construction. Right: July, 2012 - Fully Established. Photo Credit: Jay Diem, Eastern Shore News.

EROSION PREVENTION LAWS AND PROGRAMS

COASTAL ZONE MANAGEMENT ACT

The federal Coastal Zone Management Act (CZMA) of 1972 put into statute the recognition of the "national interest in the effective management, beneficial use, protection, and development of the coastal zone."

The CZMA established three national programs, the National Coastal Zone Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program (CELCP). The National Coastal Zone Management Program aims to balance competing land and water issues through state and territorial coastal management programs, the reserves serve as field laboratories that provide a greater understanding of estuaries and how humans impact them, and the CELCP provides matching funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements.

The CZMA connects with coastal erosion prevention through its many programs, including Coastal Zone Enhancement Grants, technical assistance grants, and research.

VIRGINIA COASTAL ZONE MANAGEMENT PROGRAM

The Coastal Zone Management Program, established through Executive Order, administers enforceable laws, regulations and policies that protect coastal resources and foster sustainable development. Those that are relevant to protecting against coastal erosion are shown below.

WETLANDS MANAGEMENT

The tidal wetlands program is administered by the Marine Resources Commission under Code of Virginia § 28.2-1301 thru § 28.2-1320. It is intended to preserve and protect tidal, and accommodate economic development in a manner consistent with wetlands preservation. Oversight is provided by the Virginia Marine Resources Commission and local wetlands boards.

The Virginia Water Protection Permit Program is administered by the Department of Environmental Quality (DEQ) and includes protection of tidal and non-tidal wetlands. This program is authorized by the Code of Virginia § 62.1-44.15.5 and the Water Quality Certification requirements of Section 401 of the Clean Water Act of 1972.

DUNES AND BEACHES MANAGEMENT

Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Code of Virginia § 28.2-1400 thru 28.2-1420).

COASTAL LANDS MANAGEMENT

*Coast*al Lands Management is a state-local cooperative program administered by DEQ's Water Division and 84 localities that regulates activities in Chesapeake Bay Resource Management Areas and Resource Protection Areas in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §§ 62.1-44.15:67 through 62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 VAC 25-830-10 et seq.).

EROSION AND SEDIMENT CONTROL

Three state laws apply to land disturbance activities in Virginia: the Stormwater Management Act, Erosion and Sediment Control Law, and the Chesapeake Bay Preservation Act. For more information on these three laws, see "Storm Water Flooding Prevention Laws and Programs" in the Storm Water chapter.

CHAPTER 6: COASTAL FLOODING

INTRODUCTION

On October 28, 2012, Hurricane Sandy – it was still a hurricane as it raked the Eastern Shore of Virginia – had not yet reached its full strength, and yet it left an estimated $6.3 million in property damage (National Climatic Data Center Storm Events Database) and displaced more than 25 families (A-NPDC 2013 Annual Report].

Sandy went on to be the second largest Atlantic storm on record, making landfall in southern New Jersey on October 29 (FEMA, Hurricane Sandy FEMA After-Action Report, 2013), with catastrophic results. Despite the damage to the Eastern Shore, area residents were fortunate. Had Sandy followed a slightly different course and moved up the Chesapeake Bay or stalled off the coast as originally forecast, the results for the bay, and the economy and residents that rely on its bounty, could have been tragically different ("Ecological impacts of Hurricane Sandy on Chesapeake & Delmarva Coastal Bays, Dennison," W.C. et. al.). A nine-foot storm surge would have been calamitous for land, and the sediment washed into the Chesapeake Bay would have been equally cataclysmic for aquaculture and other water-based economic sectors (ibid).

Flooding accounts for more than 70 percent of federally-declared disasters (Government Accountability Office), but hurricanes are not the only source of flooding for the Eastern Shore. Different types of storms and the paths they take, often exacerbated by tide cycles and low-lying elevations, can all affect the extent of coastal flooding. Add to this global and relative sea level rise, and the causes of coastal flooding become still more complex and interwoven.

Chapter 1 provided a review of major storms in the Eastern Shore's history – all tropical cyclones and nor'easters. However, other storms and events can cause coastal flooding, and the causes are not always easily sorted out. Strong onshore winds, offshore low pressure systems, changes to ocean currents, and high astronomical tides, or any combination of these, can also cause coastal floods that disrupt schools, local businesses, and transportation routes, as was the case on October 2, 2015.

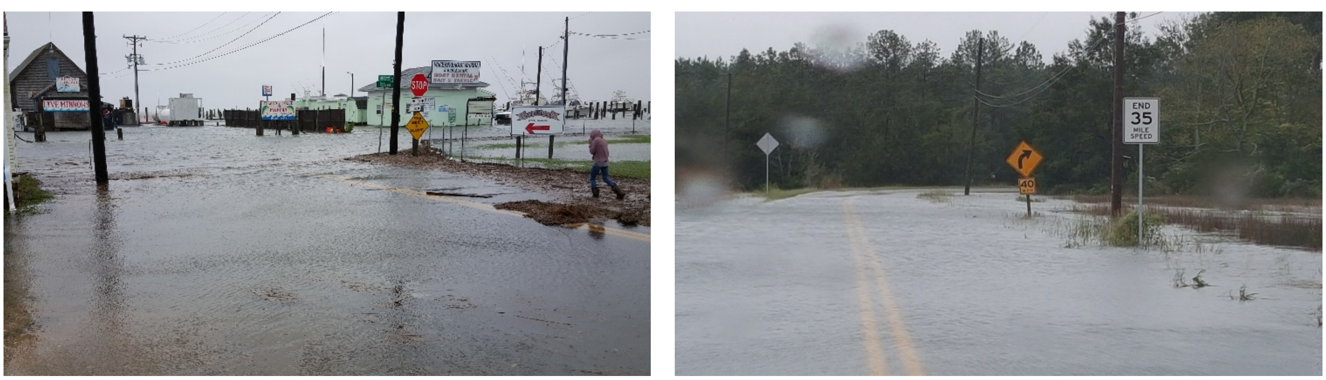


Figure 1: Flooding on Drummondtown Rd. (right), Atlantic Ave. (left), Oct. 2, 2015. Photo Credit: A-NPDC staff

On that day, Hurricane Joaquin's center was still in the vicinity of the Bahamas. A "cut-off low aloft" had developed over the southern U.S. and was fed by a steady stream of moisture from Joaquin. Complicating matters were gales blowing in from New England associated with a strong pressure gradient that only accelerated as Joaquin moved northward, and the already-occurring perigean spring tide (the extra-high tide that occurs when spring tide coincides with the point where the sun, moon, and earth are in nearly full alignment, maximizing their gravitational pull). It was the combination of the astronomical high point in the tide cycles, gales from the pressure gradient, and some swell from Joaquin as it moved northward, even though the storm remained well offshore, that contributed to the flooding seen in Figure 1. ("Hurricane Joaquin, 28 September – 7 October, 2015 (AL112015);" www.nhc.noaa.gov/data/tcr/AL112015_Joaquin.pdf) Recorded storm surge on Oct. 2 at Wachapreague was 3.9 feet; Kiptopeke recorded a storm surge of 3.2 feet.

Table 1 provides a recent history of coastal flooding events that were not included in the Chapter 1 list. The events were taken from the NOAA's National Climatic Data Center storm events database. Data reinforce that while hurricanes other tropical cyclones (tropical storms and tropical depressions) are predominant storm types causing coastal flooding, other conditions, such as coastal low pressure systems, tides cycles, and a rapidly-moving cold front also brought coastal flooding.

This chapter examines in detail the natural forces and conditions that cause flooding, and the human systems used to gauge their impacts and protect against harm to lives and property. The quantitative assessment of risks posed by flooding will be found in the local chapters, beginning with Chapter 8.

Table 1: Coastal Flooding Events from NOAA National Climatic Data Center Storm Events Database 1996-2015

Coastal Flooding Events Affecting the Eastern Shore of Virginia 1996-2015
Excluding Hurricanes, Tropical Storms, and Nor'Easters

Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
4/17/2003	COASTAL FLOODING	$0	$0	Flooding at high tide in some streets and yards of the town of Oyster. The water on Broadwater Circle was over a foot deep.	NOAA, National Climatic Data Center
10/6/2006	COASTAL FLOODING	$76,419	$0	Strong onshore winds resulted in major coastal flooding during high tide. Tidal departures were 4 to 5' above normal. The Chincoteague causeway was closed due to high water.	NOAA, National Climatic Data Center
11/22/2006	COASTAL FLOODING	$117,568	$0	An intense low pressure system off the North Carolina coast combined with an upper level cutoff low to provide very strong winds, heavy rains, and moderate coastal flooding. Strong onshore winds caused moderate coastal flooding during high tide. Tidal departures were about 3' above normal.	NOAA, National Climatic Data Center
12/19/2009	COASTAL FLOODING	$11,048	$0	Coastal low pressure produce moderate to severe coastal flooding. The peak tide height at Kiptopeke was 6.04'above MLLW. Several streets, homes and businesses were flooded in low lying areas close to or directly exposed to the Chesapeake Bay and Atlantic Ocean. Ice accumulations reached 1" in some places, causing widespread power outages that lasted up to 10 days in some places.	NOAA, National Climatic Data Center
12/21/2012	COASTAL FLOODING	$154,850	$0	A rapidly moving cold front produced an abrupt shift in very strong winds pushing water into inlets and causing moderate to severe coastal flooding across portions of Accomack County.	NOAA, National Climatic Data Center
3/6/2013	COASTAL FLOODING	$13,226	$0	Intense low pressure moving off the mid-Atlantic coast produced very strong northeast winds and contirubted to coastal flooding on the seaside side of Accomack County. Chincoteague causeway was impassable with 2' of water over the roadway; numerous other roads in Chincoteague impassable. Winds downed trees, produced minor structural damage, and caused scattered power outages.	NOAA, National Climatic Data Center
10/2/2015	COASTAL FLOODING	$0	$0	Strong high pressure over New England produced strong onshore winds over the Mid-Atlantic. The strength and duration of the onshore winds, together with high astronomical tides, and swells from Hurricane Joaquin near the Bahamas, produced moderate coastal flooding along the Atlantic Coast and Chesapeake Bay. A tidal departure of 3'-4' resulted in moderate flooding.	NOAA, National Climatic Data Center (data from tidal guages)

NATURAL FORCES AND CONDITIONS

TROPICAL CYCLONES: HURRICANES, TROPICAL STORMS, AND TROPICAL DEPRESSIONS

Hurricanes occupy a place in legend and lore to those whose lives and ancestry are tied to the Eastern Shore of Virginia. Accounts of the tempests date back to the mid-1600s, recording sinking ships, scattered cargo, demolished settlements, and re-carved landscapes. Shipwrecks themselves testify to of some of these “dreadful” and “tremendous” storms, as they were colorfully named.

Hurricanes are but one type of tropical cyclone: Organized, rotating systems of clouds and thunderstorms originating in tropical or subtropical waters. They typically form during the months of June through November and feed off of the warm tropical waters present in the ocean during this period (National Hurricane Center).

Categories of tropical cyclone are distinguished by wind speed.

- **Tropical depressions** have a maximum wind speed of 38 mph.
- **Tropical storms** have a wind speed between 39 – 74 mph.
- **Hurricanes** have a wind speed 75 mph or higher.

Hurricanes are further rated by the Saffir-Simpson Wind Scale from 1 to 5 based on the hurricane’s sustained wind speed (Table 2). This tool helps to estimate potential property damage and threat to human life from winds.

Table 2: Saffir-Simpson Hurricane Wind Scale

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center

The scale is not an indicator of the extent of flood damage that can be expected, but winds do affect flooding in two ways. First, they drive wave action and push waters onshore. Secondly, with larger tropical storms, the storm's low pressure elevate the water and then push it ahead creating an elevated storm surge at the leading edge of the storm.

> "THERE HAPPENED A MOST VIOLENT STORM IN VIRGINIA WHICH STOPPED THE COURSE OF ANCIENT CHANNELS AND MADE SOME WHERE THERE NEVER WERE ANY."
>
> LETTER BY A "MR. SCARBURGH", TRANSACTIONS OF ROYAL SOCIETY OF LONDON, 1694, REGARDING THE ACCOMACK STORM OF 1693

Figure 2 is a compilation of the tropical cyclones that have tracked within 75 miles statute miles of Painter, Virginia, more or less the center point of the Eastern Shore, from 1842 to 2013 as catalogued by NOAA, and identified by category.

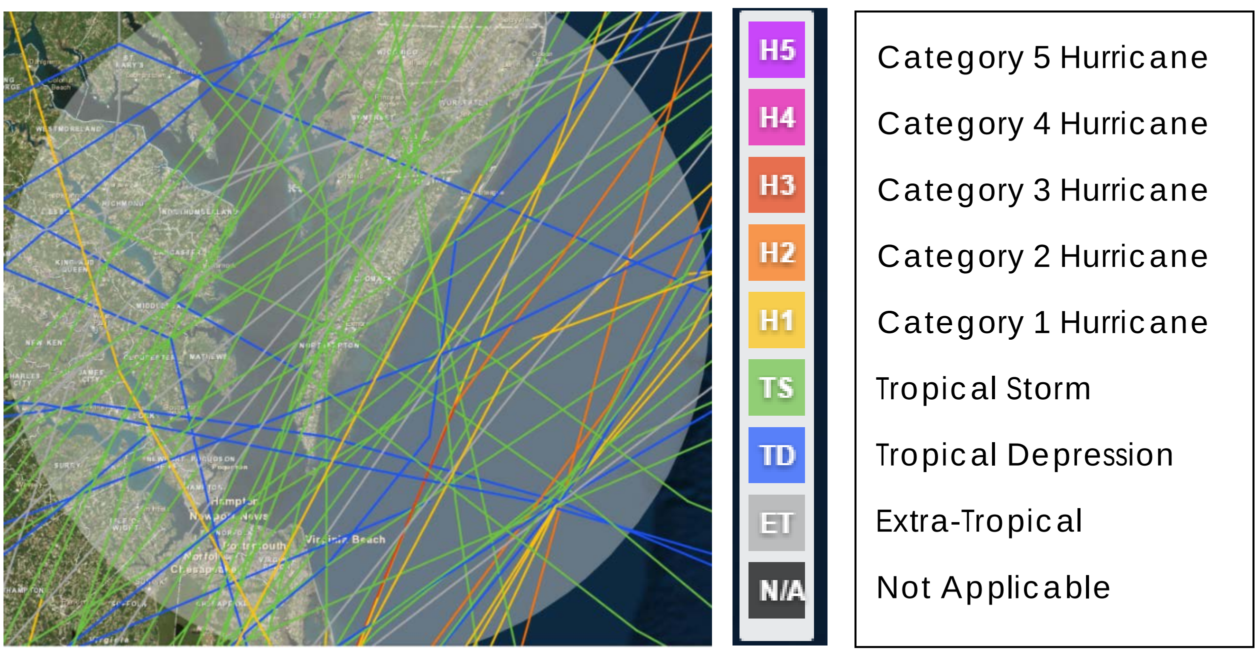


Figure 2: Paths of tropical and extra-tropical systems with 75 statute miles of Painter, Virginia, 1842-2013. Source: NOAA Digital Coast, Historical Hurricane Tracks

One disadvantage of using a mileage buffer to look at storm threats is that it ignores the massive scale of tropical cyclones. One glaring absence from Figure 2 is Hurricane Sandy; its storm-force winds extended over 1,000 miles in diameter, yet it did not register in Figure 2, as it only depicts tropical cyclones that passed within 75 miles of Painter. Figure 3 traces the path of Sandy from its formation in the Caribbean until it dissipated entirely east of Cleveland. At its nearest point, the eye was more than 100 miles away- and that was near Chincoteague after Sandy had begun to turn west and was no longer a hurricane.

Yet Sandy managed to cause more than $6 million in damage across the Eastern Shore, including significant damage in Cape Charles, Saxis, Sanford, Tangier, and other bayside locations, in addition to losses on

Figure 3: Track of Hurricane/Post-Tropical Cyclone Sandy

Chincoteague. Although sustained winds did not reach a tropical storm strength on the Eastern Shore, the flow of the existing wind and impact on tides, similar to a severe nor'easter, is responsible for the damage from Sandy.

Likelihood of Recurrence: The long time frame of Figure 2 does not provide a sense of the frequency of tropical cyclones over the short term. In its study of recurrent flooding in Tidewater Virginia, the Virginia Institute for Marine Science (VIMS), citing a NOAA report, asserts that a tropical storm, or its remnants can be expected to affect Virginia every year, with hurricanes every 2.3 years.

NOR'EASTERS

Nor'easters are cyclonic storms that form along the Atlantic Coast of North America when the polar jet stream reaches the Atlantic and meets warmer air pushed up from the Gulf of Mexico and southern Atlantic. They typically develop within 100 miles of the coastline between Georgia and New Jersey and are strongest and most frequent between September and April (NOAA).

Some of the most damaging floods the Eastern Shore has experienced have been from nor'easters, which tend to move more slowly than hurricanes, lasting through multiple tide cycles. Further exacerbating the flooding, the storms sometimes occur in pairs, with one flood not fully receding before the next nor'easter flooding begins.

Some nor'easters are seared in the memories of Eastern Shore residents as much as or more so than hurricanes: storms like the devastating Ash Wednesday storm of 1962 and the nor'easters of November and December 2009. With the exception of "The Perfect Storm," nor'easters do not tend to receive the same public excitement as hurricanes, but they can pack the same winds, catastrophic flooding, and severe coastal erosion.

Notorious Nor'easters

Ash Wednesday Storm March 6-8, 1962
The Ash Wednesday storm moved north over the Eastern Shore and then reversed course moving south, bringing several days of coastal flooding. Waves from Chincoteague Bay broke on the high school, splashing the roof. Main Street flooded. Five homes were destroyed, and almost 1,000 homes were inundated by floodwaters. One hundred of the famous Assateague ponies were killed. The island's seafood industry, while damaged, survived, but the poultry industry did not. Other coastal communities also were flooded during this storm. (Flood Reports of the 1962 Ash Wednesday Storm, USACE)

Northeaster of March 28-29, 1984 The storm's track over the lower Chesapeake Bay caused the worst tidal flooding in Accomack County since the 1962 Ash Wednesday storm. Gusts of 50 mph were recorded and towns on the bayside were inundated with water. Saxis and Onancock were inundated with as much as five feet of water. Tangier Island saw a foot of water over 75 percent of the island. East Point, Chesconessex, Mears and Sanford were all flooded. (Accomack County Community Rating System application)

Other notorious nor'easters, including the so-called "Nor-Ida" nor'easter of November 2009, which formed from the remnants of Hurricane Ida, and during which tides exceeded levels experienced during Hurricane Isabel.

Likelihood of Recurrence: Nor'easters occur with sufficient frequency to provide a high level of confidence they will continue to be a significant coastal flooding threat.

ASTRONOMICAL TIDES

Note: Information in this section sourced from NOAA Ocean Service

Astronomical tides on their own rarely cause more than nuisance flooding, but high astronomical tides combined with storms can worsen coastal flooding. To understand how this happens, it is helpful to understand astronomical tides.

Astronomical tides result from the gravitational pull of the sun and the moon on the earth's oceans, causing the oceans to bulge. Because the moon is closer to the earth than the sun, its effect on tides is greater.

As the moon makes its monthly orbit around the earth, and the earth makes its yearly orbit around the sun, the oceans are pulled back and forth as the bodies' positions relative to one another change, causing tides go in and out.

Table 3: Tidal Ranges at Eastern Shore Tidal Stations

Tidal Ranges

	Mean Tidal Range	Great Diurnal Change*
Seaside		
Chincoteague Bay Inlet**	n/a	n/a
Wachapreague	4.02	4.51
Bayside		
Chesapeake Bay Bridge Tunnel	2.55	2.90
Kiptopeke	2.60	2.94
Nassawadox Creek**	n/a	n/a
Saxis**	n/a	n/a

*difference between highest and lowest tides of the day
**Tidal gauges deployed by USGS in 2015
Source: NOAA Tides and Currents and waterdata.USGS.gov

NOTORIOUS NOR'EASTERS

Halloween Nor'easter – Oct. 1991 Before going on to ravage New England as told in the movie "The Perfect Storm," this nor'easter unexpectedly hit the Eastern Shore causing extensive damage to the barrier islands. Many piers and a motel were damaged, and many residents did not react in time to keep themselves from being stranded. (Accomack County Community Rating System application)

Twin Nor'easters – Feb. 1998 Half of Chincoteague was submerged, and many Tangier residents could not remember a storm with higher tides. Roof damage was reported due to high winds. (Accomack County Community Rating System application)

Nor'easters of Nov. & Dec. 2009 The storms produced high winds, heavy rains, power outages, tree damage, flooded roadways, and persisting over several tidal cycles, causing extensive coastal flooding. The Town of Chincoteague declared a local emergency with 13 inches of rain and 4 to 5 foot storm surges that battered the island and overtopped the causeway. Overwash on Assateague Island caused $450,000 in parking lot damage. A December nor'easter brought up to an inch of ice in places, leaving some without power for up to 10 days.

In the normal course of a day, the NOAA official tide stations record tidal differences between high and low tide of about three feet on the bayside and four and a half feet on the seaside (Table 3).

During new and full moons, the earth, moon, and sun are nearly in full alignment, and the gravitational pull of the moon and sun are working together to cause the oceans to bulge more than usual. New and full moons cause high tides to be slightly higher and low tides to be slightly lower than average. These are known as spring tides.

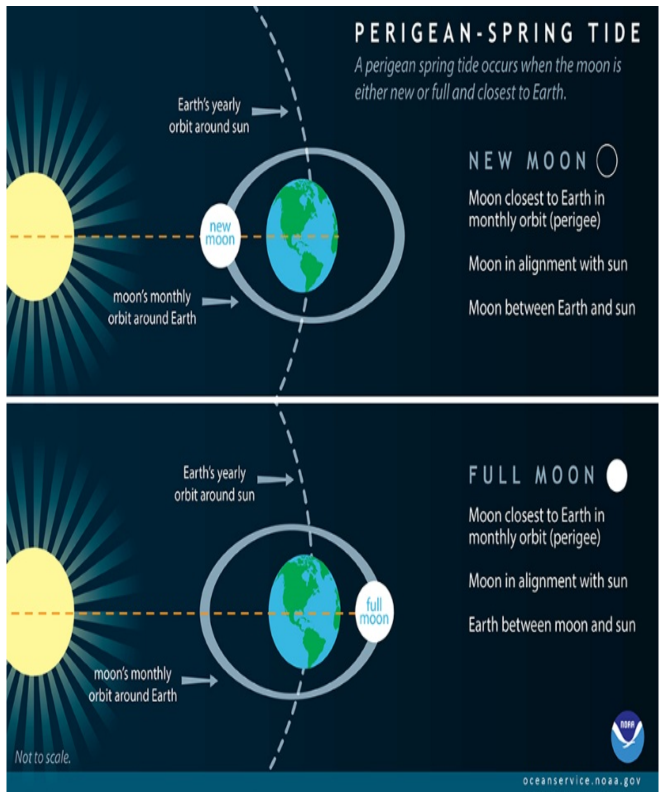


Figure 4: Perigean Spring Tide. Source: NOAA Ocean Service

Every 28 days, the moon reaches its closest point to the earth, known as a perigee, which also causes a larger tide. When perigee coincides with a spring tide, three or four times each year, it is referred to as a perigean spring tide (Figure 4), and the effect is to expand the tidal range, as illustrated in Figure 5. Notice how the length of line representing the difference between low tide and high tide at the Kiptopeke tidal gauge is elongated approaching the perigean spring tide on February 18.

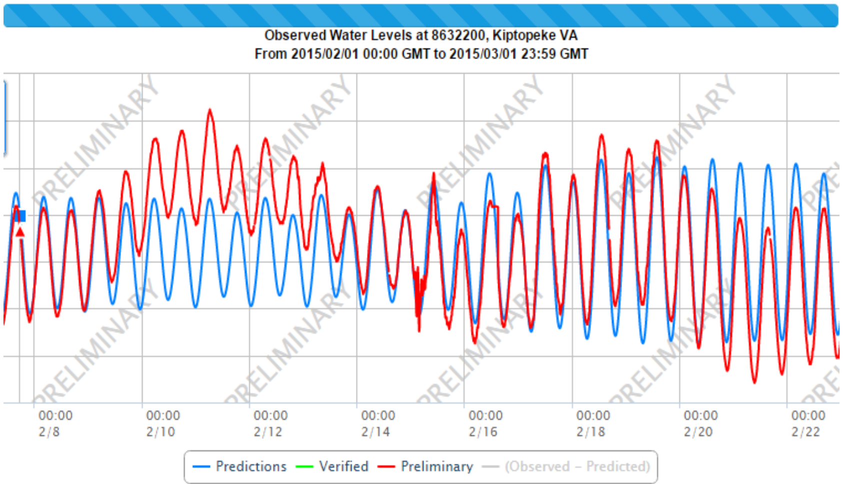


Figure 5: Perigean Spring Tide at Kiptopeke Tide Gauge. Source: NOAA Tides and Currents

The converse of the perigee is the apogee – the point in the earth's elliptical orbit where the earth is farthest from the sun and the sun's gravitational pull on the earth is the weakest.

Table 4 demonstrates some of these effects with the moon and tide phases on the landfall approach for some of the Eastern Shore's historic storms.

Table 4: Moon/Tide Phases Coinciding with Historic Eastern Shore Storms

Storm	Phase of the Moon	Perigee/Apogee
September 3, 1821 (The Great September Gust)	First Quarter (Neap Tide)	Apogee
August 23rd, 1933 (The Chesapeake-Potomac Hurricane)	Waxing Crescent – 3 Days from the New Moon (Spring Tide)	In between
October 15, 1954 (Hurricane Hazel)	Waning Gibbous – 3 Days from the Full Moon (Spring Tide)	2 Days after the Perigee
March 6th-8th, 1962 (The Ash Wednesday Storm)	New Moon (Spring Tide)	Perigee
September 15th-16th, 1999 (Hurricane Floyd)	Waxing Crescent – 6 Days from the New Moon and 2 Days to the First Quarter (Neap Tide)	Apogee
September 18th, 2003 (Hurricane Isabel)	Waning Gibbous – 8 Days from the Full Moon and 1 Day to the Third Quarter (Neap Tide)	Apogee
NOTE: The Ash Wednesday storm occurred during a perigean spring tide. Both the new moon and the perigee occurred on March 6th, 1962 the first day of the storm.		

STORM SURGE

Note: information in this section is sourced from the National Hurricane Center.

The high tide generated by a storm that is above the predicted astronomical tide is known as storm surge. The surge is produced by the force of the cyclone winds pushing the water ahead, along with the lesser force of the low pressure. Figure 6 illustrates this effect.

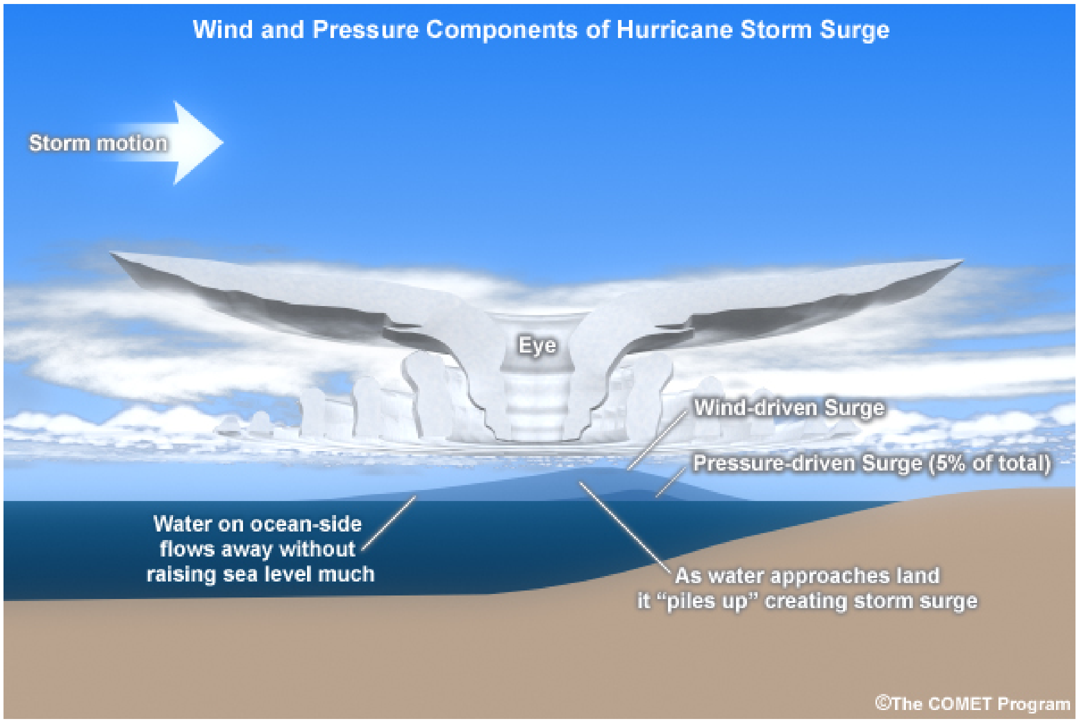


Figure 6: Wind and Pressure Components of Hurricane Storm Surge. Source: The Comet Program. ©1997-2015 University Corporation for Atmospheric Research. All Rights Reserved.

The bathymetry of the ocean and bay floors also greatly influence storm surge. Shallower gradients, such as those along the bayside and seaside of the Eastern Shore, allow for greater storm surge. For example, a Category 1 hurricane may cause four to five feet of surge. However, the shape of the Chesapeake Bay "pinches" the water and thereby make the surge grow in height on the bayside.

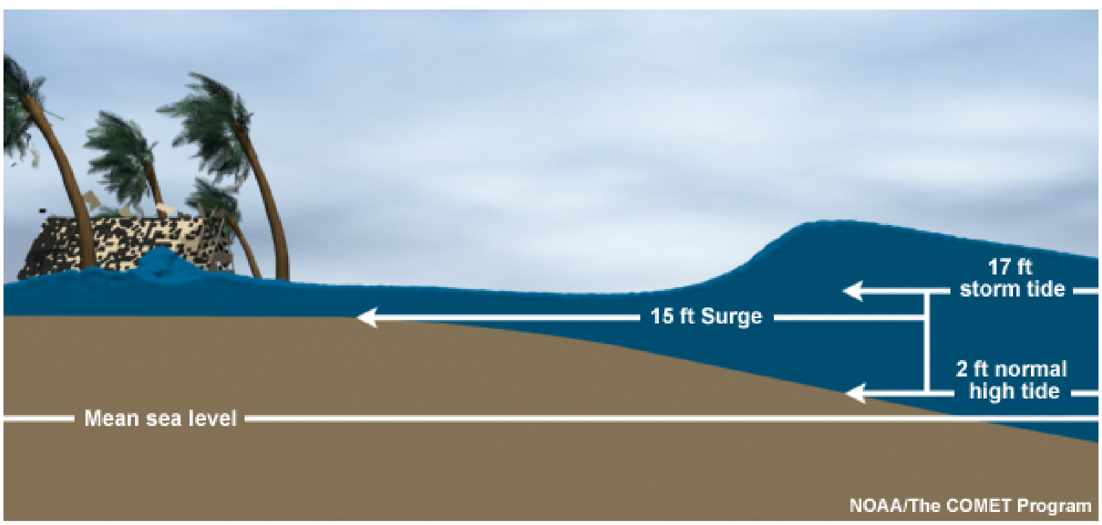


Figure 7: Storm Surge vs. Storm Tide. Source: NOAA/The COMET Program. ©1997-2015 University Corporation for Atmospheric Research. All Rights Reserved.

Storm surge is not the same as storm tide. Storm tide refers the water level rise attributable to the astronomical tide plus the effects of the storm surge, as illustrated in Figure 7.

SEA LEVEL RISE AND COASTAL FLOODING

The consensus of scientists reporting to the Virginia General Assembly in January 2013 on recurrent coastal flooding in southeast Virginia was that:

- sea level rise is an established fact;
- water levels in Hampton Roads (including the Eastern Shore) have risen 1 foot over the last 80 years; and
- Hampton Roads should anticipate sea level rise of 1.5 feet over the next 20 to 50 years.

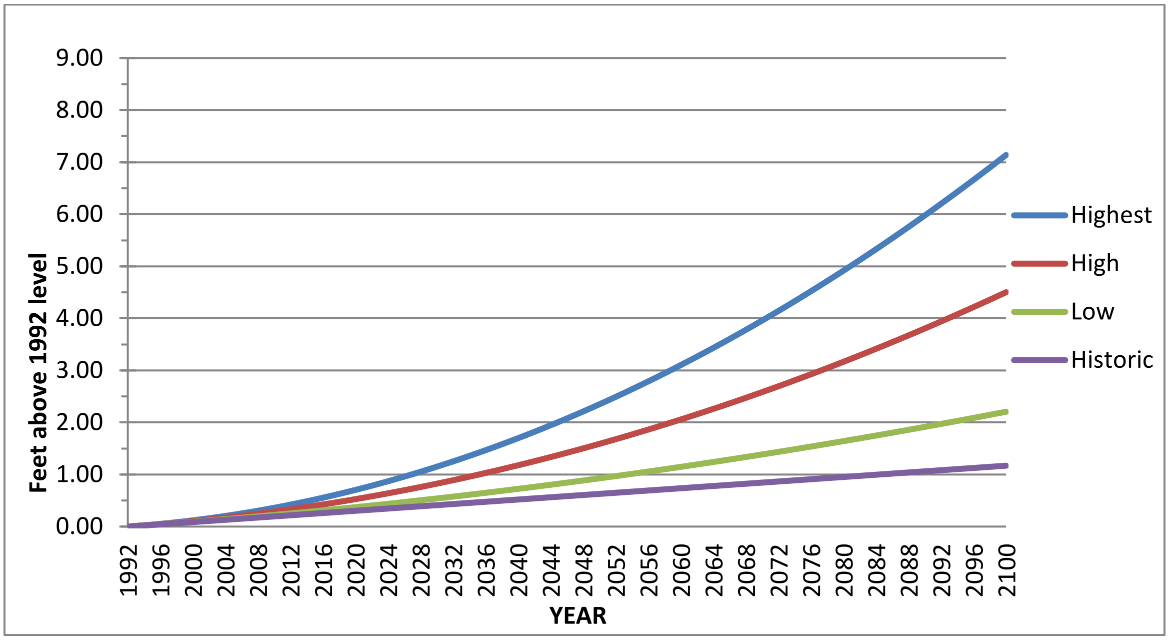


Figure 8: Sea Level Rise Scenarios. Source: Adapted from 2013 VIMS Recurrent Flooding Study to reflect local rates of land subsidence.

There is ample scientific evidence linking sea level rise to increasing global levels of greenhouse gases. Four sea level rise scenarios were developed for the National Climate Assessment, based on a range of greenhouse gas emissions. These scenarios were modified to account for land subsidence – the slow sinking of landforms - and used by the Virginia Institute of Marine Science (VIMS) as the basis for estimates of sea level rise in southeast Virginia. VIMS scientists later adapted these scenarios to reflect rates of land subsidence on the Eastern Shore. The results of these scenarios are found in Figure 8.

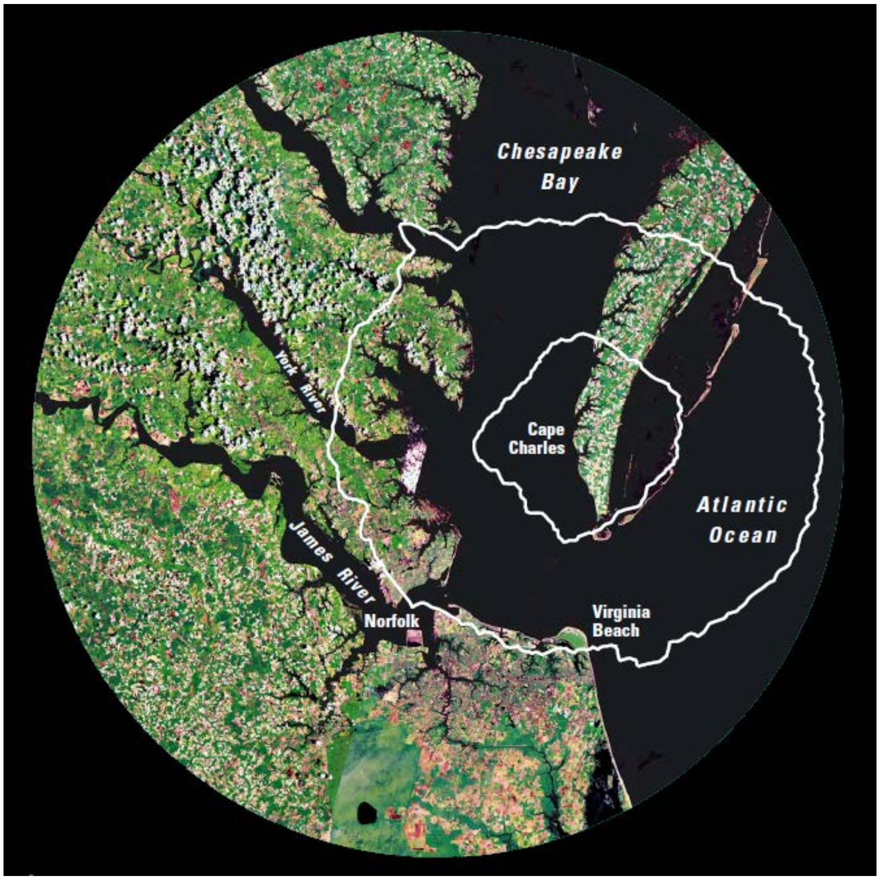


Figure 9: A Bolide Bulls-Eye. Source: USGS

There are a number of factors contributing to sea level rise, and one way to examine them is by looking at eustatic, or global causes, and isostatic, or relative sea level rise from changes in the land elevation.

RELATIVE SEA LEVEL RISE

Relative sea level is the perceived water level as it relates to the level of land. The discussion of relative sea level rise in the lower Chesapeake region begins approximately 35.5 million years ago when a bolide, or object from space, two to three miles in diameter, struck near the area that is now Cape Charles, creating an impact crater roughly twice the size of Rhode Island (Figure 9). The crater, now underlying all of Northampton County and portions of southern Accomack County, and the sediments that have buried it, have continuously settled over time, creating increased subsidence of landforms in the region (USGS Fact Sheet 049-98).

A second cause of subsidence is rebound of the earth's crust from glaciers. Even though the Laurentide ice sheet did not reach the lower Delmarva Peninsula, the weight of the ice as it pressed down caused the earth's crust to bulge in adjacent areas. As the ice retreated, and the pressure it exerted was relieved, the earth's crust began to rebound, the bulging areas began gradually sinking, and in fact are still trying to achieve a state of equilibrium (USGS Circular 1392).

Two other factors that affect relative sea level rise to a lesser degree on the Eastern Shore are groundwater withdrawal and tectonic changes. Subsidence from all sources range from 1.2 millimeters of subsidence per year at Kiptopeke to 2 millimeters per year at southern Assateague (Holdahl and Morrison, 1974).

GLOBAL SEA LEVEL RISE

The increasing volume of water in the ocean is a global cause of sea level rise. As water trapped in glaciers and ice sheets melts into the earth's oceans, and water already in the ocean expands as the temperature increases, the volume of water in the ocean increases, causing sea level to rise (VIMS).

Scientists posit that another contributor to sea level rise could be changes to the Gulf Stream brought on by warmer polar regions. A smaller difference in temperature between the Atlantic coast and the polar region slows the cycle in which waters sink and move south as they are cooled, which in turn slows the rate at which they are replaced by warmer waters drawn north (VIMS). The result of the sluggish cycle is higher tides in the mid-Atlantic, as illustrated in Figure 10.

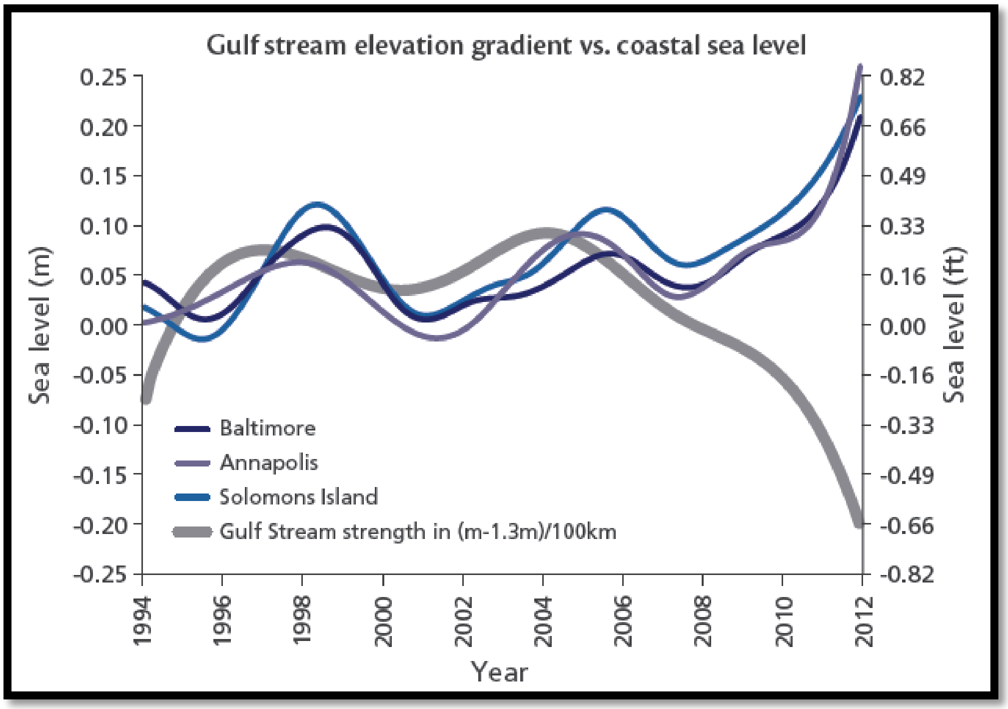


Figure 10: Sea level at elevation vs. Gulf Stream strength. Source: Ezer et al., 2013

The result of sea level rise is that it essentially raises the base flood elevation. The same VIMS study estimates 208 square miles of land in Accomack County is vulnerable to sea level rise over the next century, and another 186 square miles is vulnerable in Northampton County, along with increased threats from erosion and infrastructure flooding.

A study conducted by the A-NPDC during 2015 examined the implications of future sea level rise upon roads within the region and the communities they serve. The study found that at just one foot of inundation – a threshold that could be reached in the next 10 years – could put the majority of Tangier's roads completely under water, disrupt access to eight more communities, and limit access to two more. More about the study results can be found in local chapters, beginning with Chapter 8.

Vulnerability of Virginia's Eastern Shore to Sea Level Rise

"Several communities in Accomack are considered vulnerable to sea level rise. The natural resource-based agriculture and seafood industries of the region are being impacted as farmlands are experiencing increased inundation and salt contamination and local seafood industries are experiencing problems created by stormwater runoff and changing coastal dynamics. Accomack has three developed islands, Tangier, Saxis and Chincoteague. In Tangier, approximately 90% of structures are in the 100-year flood plain, the entire island is below the 5-ft contour, and severe shoreline erosion threatens the island. Saxis Island also has severe erosion problems, and the northern portion of the island is very low-lying land. The evacuation route, a causeway through the marsh, is at risk from both potential compaction of the road bed and erosion of the surrounding marshes as well as recurrent flooding and sea level rise. Chincoteague is somewhat less vulnerable to erosion, because it is located in the wave attenuated Chincoteague Bay, but is vulnerable to recurrent flooding and sea level rise.

"Overall the risk to communities in Northampton County is lower than those in Accomack County. This is due in a large part to topography; even the lowest lying town (Town of Cape Charles) is mostly above the 5-ft elevation. However, it is still vulnerable to storm surges and stormwater flooding as drainage ditches become tidal, reducing their capacity to handle stormwater. The lowest lying lands (the barrier islands) are largely undeveloped. The primary impact from sea level rise is expected to be increased shoreline erosion."

"Recurrent Flooding Study for Tidewater Virginia," Virginia Institute of Marine Science, 2013.

ELEVATION

The elevation of land in relation to water levels must also be considered as a contributing factor in flooding. Northampton and Accomack Counties are low-lying areas with the highest elevation in the town of Melfa at 60 feet above mean sea level.

In 2011, LiDAR (Light Detection and Ranging) elevation data was acquired for all of the Eastern Shore. LiDAR data is collected by flying aircraft using light pulses to measure distance to earth. The data is the most accurate comprehensive elevation data collected for the Eastern Shore of Virginia, accurate to within about six inches. In 2015, a second set of LiDAR elevation data was collected and further enhanced the region's planning capacity.

The 2013 VIMS study considered anything under 4.5 feet to be potential recurrent flood zones (Figure 11).

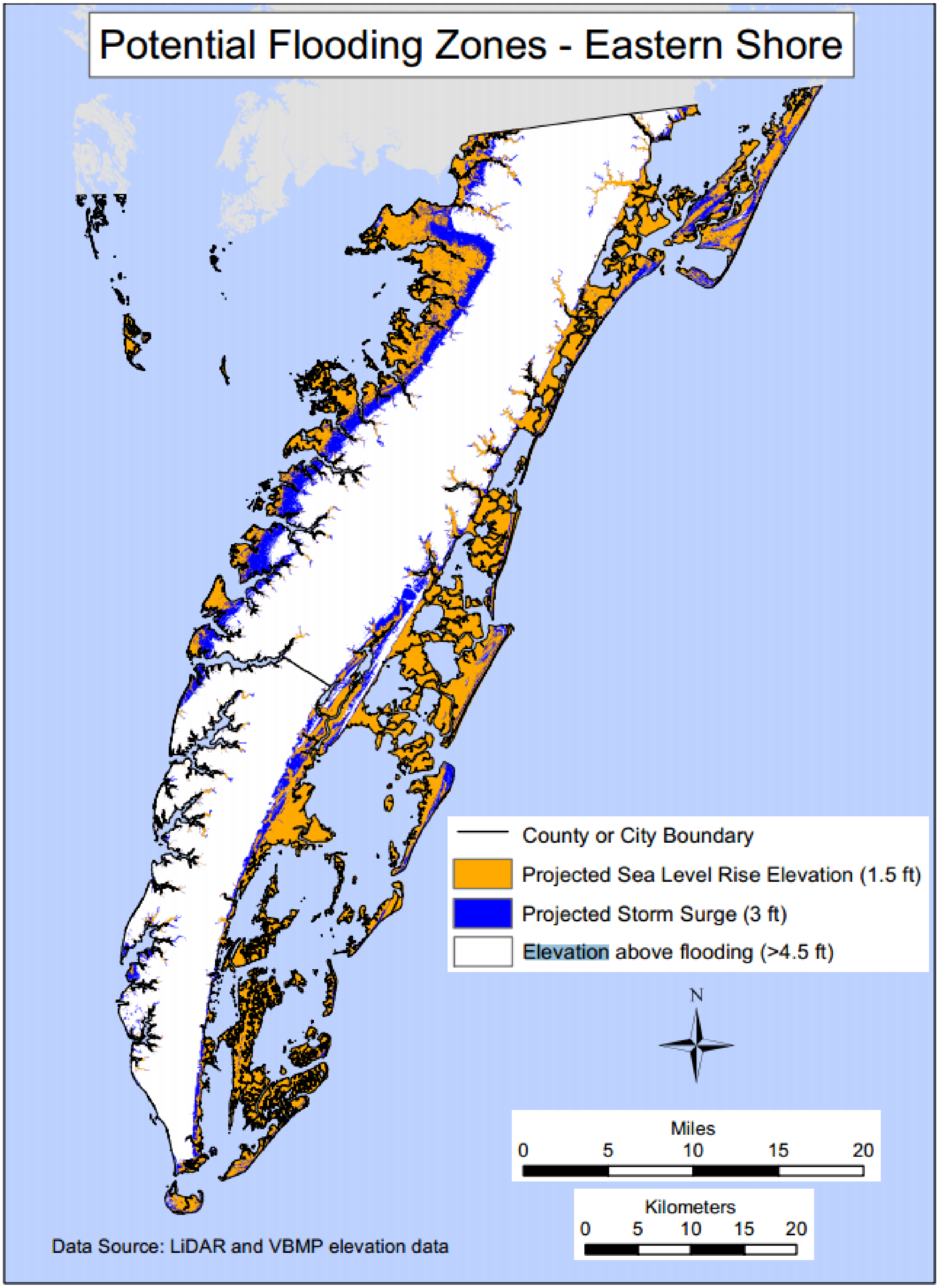


Figure 11: Potential Recurrent Flood Zones

TYPE, LOCATION, AND EXTENT

FLOOD ZONES

A flood is a general and temporary condition where two or more acres of normally dry land or two or more properties are inundated by water or mudflow. To identify a community's risk, FEMA conducts a flood insurance study, which is then used as the basis for maps that identify flood risk areas, called Special Flood Hazard Areas (SFHA). The maps are known as Flood Insurance Rate Maps or FIRMs.

It should be pointed out that FIRMs and flood zones are regulatory tools used to set construction standards and flood insurance rates, and are based on a flood that has a one percent chance of occurring in any given year. Although storm surge is a factor in determining the extent of the flood zones depicted on FIRMs, a storm surge map issued for a given storm is not the same, and a FIRM should not be counted on to determine potential storm surge from a storm event.

V ZONES

V zones are the portion of the Special Flood Hazard Area (SFHA) that extends from offshore to the inland limit of a primary frontal dune along an open coast, and any other area subject to high-velocity wave action. Within these zones, damage from coastal flooding is from hydrodynamic force called velocity flow. This type of flow is known to scour around buildings and to destroy structures in its path. In addition, velocity flow picks up debris and smashes that debris into anything in its way. FEMA has identified areas where velocity flow from the 100-year flood event would occur as V zones. These flows commonly damage or destroy any wall that is struck by this moving water.

Current floodplain management ordinances require that in V zones any new structure be built with its lowest horizontal structural element to be elevated above the Base Flood Elevation. Further, no living space is to be put below the Base Flood Elevation and any enclosures must have breakaway walls.

The debris carried by velocity flow can destroy a structure that is built to flood regulations. This debris commonly includes parts of houses, decks, vehicles, propane or oil tanks, and any other objects that the floodwater picks up. During Hurricane Isabel in 2003, six-ton riprap was swept-up from beaches and came to rest in front of houses. Smaller riprap actually was swept through broken walls and came to rest inside of structures. If flood-borne debris strikes or gets caught against the foundation of a post-FIRM structure, that structure could sustain severe damage or destruction despite it being built to floodplain regulations.

Waves are another source of damage to structures in velocity flow areas. When waves break against a structure the tremendous force can damage the walls. Waves commonly destroy decks as waves advance up a vertical wall further than they would on a sloped surface.

(Source for this section: Coastal Construction Manual, 2011; local oral accounts from Hurricane Isabel)

A ZONES

A zones are areas where the one-percent-annual-chance flood would inundate, but waves would not exceed three feet.

A-zone construction must have the lowest floor positioned at or above the base flood elevation, and foundation walls must be equipped with openings that allow floodwaters to enter and exit to equalize hydrostatic pressure (Figure 12).

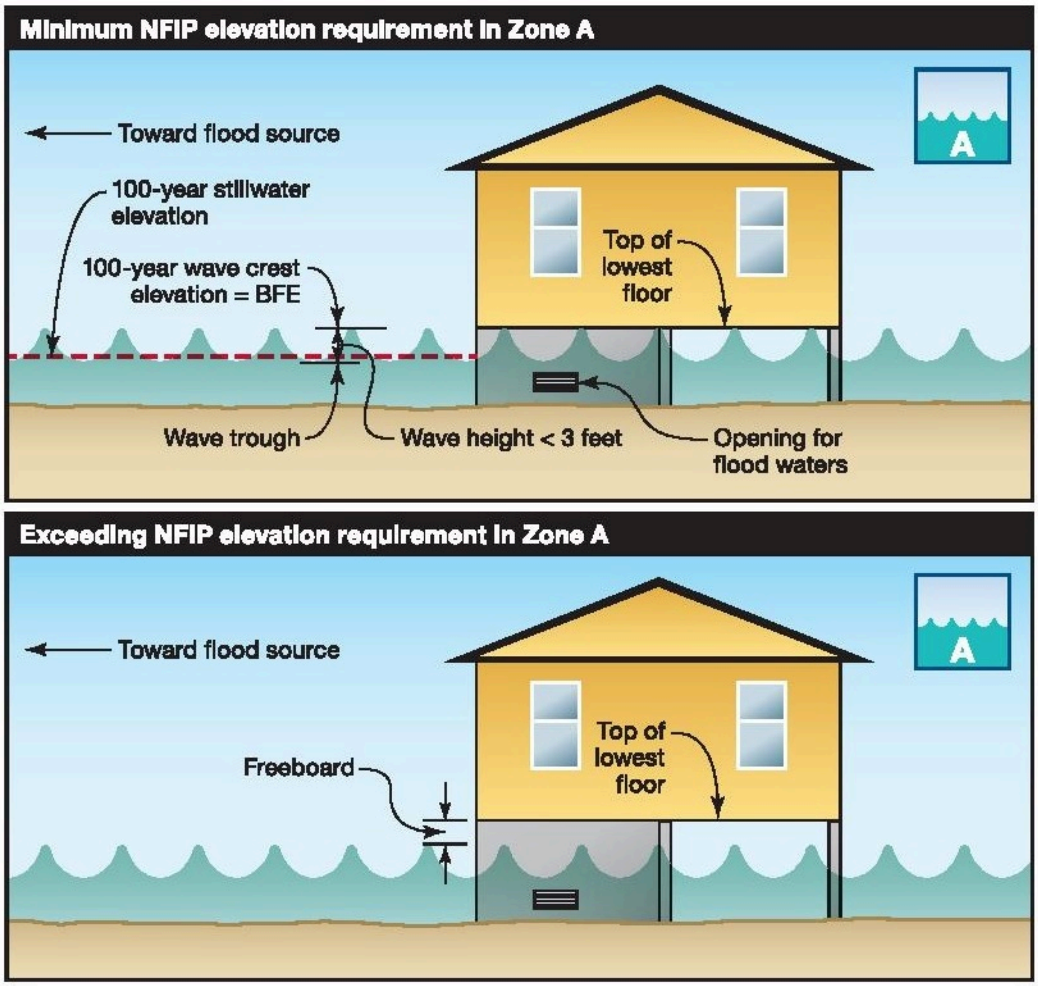


Figure 12: Recommended Elevation for Buildings in Zone A Compared to Minimum Requirements Source: FEMA Coastal Construction Manual, 2011

FEMA post-storm inspections have shown that coastal A zones are areas of increased damages. The A zone regulation does not take into account the hazards of waves, hydrodynamic flow and erosion. Yet coastal A zones can be subject to all of these hazards during a 100 year flood event.

Some of the coastal A zones may not experience these types of hazards but will suffer from damage from standing water. Common types of direct damage include waterlogged and corroded building elements, waterlogged furniture, damaged electronic appliances and equipment, damaged tanks from buoyancy forces, and contaminated exteriors and interiors from black water. In addition, building materials may wick up floodwater to higher areas not directly inundated (FEMA Coastal Construction Manual, 2011). All new construction must address these issues and meet the Virginia Uniform Statewide Building Code.

Damages from flooding increase rapidly with water depth. The National Flood Insurance Program provides an online interactive flood damage estimation tool at floodsmart.gov. Based on estimates from this tool, just 1 inch of water in a 1,000-square-foot home built on a slab with average furnishings would cause an estimated $10,600 of damage – most of it in finished floors and carpet. At 6 inches of water, the damage estimate roughly double.

Former flood zone maps used still water to establish base flood elevations, not taking into account wave height associated with storm surge. New FIRM maps effective in early 2015 incorporated this information, along with the line of moderate wave action (LIMWA) – a line that delineates the approximate edge of 1.5-foot wave height, which although not in a velocity zone, can still pose a significant hazard to properties constructed to AE-zone standards (Accomack County Flood Insurance Study, 2015).

SECONDARY FLOOD HAZARDS

Secondary hazards associated with coastal flooding include water that contaminates wells. Floodwater commonly becomes contaminated with pollutants. When this water level is above the elevation of a well's air vent, the contaminated water can flow into the well and render it unusable until the water is treated and in agreement with state and federal health standards. Wells for public use are required to be tested regularly per state and federal health regulations, but private wells are not held to the same standards. Therefore, private well owners are responsible for tracking the water quality of their wells. In economically disadvantaged communities, private well owners may not be able to afford the sampling needed to ensure adequate water quality.

On the Eastern Shore, several types of older wells are in use. The rarest type is the hand dug well. This well is usually 10 to 12 feet deep and would have initially been used with a bucket. There are also shallow wells, less than 100 feet deep, that have a static water level near the top of the well and a non-submersible pump that pulls water into a tank.

Deeper wells, greater than 100 feet, that were drilled prior to the 1970s, were designed in much the same way but instead of just a pump located in the top of the well there is a second pipe running down to the static water level capped by a packer with a venturi. The packers were most useful with metal pipes but in the 1970s most well pipes were replaced with PVC and the packers could not easily maintain a seal against this material. These wells also have low pumping rates and are hard to prime if power is lost (Written communication, Jon Richardson, Eastern Shore Health District, May 10, 2016).

In most cases, since the 1970s, submersible pumps have been used. The well with this setup needs an air vent. During a flood, water can enter the well through the air vent. Elevating this air vent above the Base Flood Elevation is one of the best ways to avoid contaminated floodwater entering the well. (Written communication, Jon Richardson, Accomack and Northampton Health Department, May 10, 2016). An NFIP flood policy will not cover wells damaged by floods (NFIP Standard Flood Policy).

Septic tanks and septic systems are also not covered under an NFIP flood policy. When a flood is in the area of a septic tank, the water will backflow from the drainfield into the tank causing the cushion of air at the top of the tank to disappear. This means the tank can no longer handle flow from the structure and drainage will fail inside. After the floodwater recedes a small cushion of air will redevelop and it is during this time that sewage can escape the septic tank through the drainfield. This small cushion of air will allow the tank to accept wastewater from the structure, but at the level of drainage inside the tank the water is poorer than it usually is. This poor quality water containing sewage can escape into the drainfield (Written communication, Jon Richardson, Eastern Shore Health District, May 10, 2016).

Alternative sewage systems are much more susceptible to flood waters than conventional septic tank and drain field (STE) systems because they, in most instances, rely on an above grade mound to dispose of wastewater. All of the mound, or portions, could erode away during a flood event. Alternative systems also produce a higher quality (cleaner) effluent than STE systems. In addition, they include electrical components to operate pumps and pre-treatment tanks which can malfunction if exposed to flood waters. A pump malfunction would render the system incapable of receiving wastewater from the home once that tank filled with wastewater. A failure of the pre-treatment tank operation would result in wastewater of lesser quality to be dispersed to the mound which would foul the distribution piping in the mound and could lead to premature mound failure. Pre-treatment tanks are also susceptible to flooding (Written communication, Jon Richardson, Eastern Shore Health District, May 10, 2016).

HUMAN SYSTEMS

NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

While NFIP flood insurance covers some losses associated with flood events, several types of property have no available coverage under this program.

Although NFIP flood insurance has many exclusions and types of property not covered, some of the more important ones to remember are wells, septic systems, land, seawalls, bulkheads, piers, wharves, containers, decks, driveways, and walks. In addition to these, FEMA's 38 General Property Form, Standard Flood Policy lists several other types of property that will not be covered. Finally, NFIP flood insurance only covers flood damage, not coastal erosion, rain damage, wind damage, or water spray. Past disasters have shown that many policyholders while carrying flood insurance for the structure do not purchase flood contents insurance. In Hurricane Floyd, several homes were not structurally damaged to a great degree, yet the contents were totally destroyed (local oral accounts).

The federal government requires that all improved property in a SFHA with a federally backed mortgage be covered with flood insurance. Contents coverage is not required unless it is part of the security of the mortgage. Many buyers who are confronted with this requirement will obtain flood insurance for the structure but will opt not to buy contents insurance to reduce the cost of closing on the property. After an event occurs, these policyholders learn the costly consequences of this decision.

Although the 100-year base flood is a 1% chance in each year that it will occur, over 30-years (the standard mortgage) a structure in an A or V zone will have a 26% chance of experiencing a 100-year flood. If that same house lasts 70 years, the useful life of most buildings, it has a 51% chance of experiencing a 100-year base flood. The 50-year flood event has a 45% probability of occurring within its floodplain over the course of a 30-year mortgage and a 76% chance of occurring in 70 years. It is important to understand that a smaller flood such as the 50-year event could damage a structure, especially those built below the Base Flood Elevation. The 50-year still water elevation for V zones ranges from 7.5 – 8.5' on the seaside and 3.8 – 7.4' on the bayside. In addition, the 50-year still water depth in Chincoteague Bay ranges from 4.8 – 6.0'.

Over time, buildings become more susceptible to hazards, so it is important to maintain coastal structures. The predominant hazards in coastal areas are corrosion from salty air and wind driven salt spray, termites, moisture, and sun-caused weathering. Regular maintenance lowers the risk of flood damage during a storm event. The 2011 FEMA Coastal Construction Manual recommends an annual inspection of foundation, exterior walls, porches, walls, floors, windows and doors, roof, and attic using a checklist provided in the manual.

COMMUNITY RATING SYSTEM

Localities volunteering to participate in the NFIP Community Rating System (CRS) have chosen to recognize and encourage floodplain management activities that exceed the minimum NFIP requirements. The CRS is a voluntary incentive program that rewards residents with reduced flood insurance premium rates as result of the participating community's actions pertaining to the three goals of the CRS: reducing flood losses, facilitating accurate insurance rating, and promoting the awareness of flood insurance. Flood insurance premium rates are discounted in increments of 5% for the ten different class ratings.

Accomack County, plus the towns of Cape Charles, Chincoteague, and Wachapreague participate in the Community Ratings System. Information about savings through their participation in the program can be found in Table 5.

Table 5: Eastern Shore participation in Community Rating System
Source: FEMA, as reported by Wetlands Watch on Feb. 11, 2015

Community Rating System Participation			
	Number of Policies	Total NFIP Premium	Total CRS Discount
Accomack County	2,789	$2,346,251	$240,330
Cape Charles	337	$374,411	$17,891
Chincoteague	954	$980,532	$104,810
Wachapreague	109	$107,257	$5,329
Eastern Shore	4,189	$3,808,451	$368,360

Communities participating in CRS are rated A, B, or C based on the number of repetitive losses. Each category carries specific steps that must be taken, with C requiring a plan or repetitive loss analysis. Accomack County is the only community currently participating in CRS that must take this step. As a Category A, Cape Charles is required only to submit information as needed to update the repetitive loss list. Chincoteague and Wachapreague are Category B communities, and must take steps to identify the repetitive loss areas and properties, but not in the level of detail required for Category C communities. Several other localities in the region have expressed interest in joining the program but have not done so to date due to staff limitations.

REPETITIVE LOSS PROPERTIES

An insured property with two or more NFIP losses (occurring more than 10 days apart) of at least $1,000 each during any 10-year period since 1978 is known as a repetitive loss property. A 2004 report of the U.S. Government Accountability Office found 38 percent of NFIP claim costs were the result of repetitive loss properties. 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. These repetitive loss properties are addressed within the local chapters, beginning in Chapter 8.

CHAPTER 7: STORMWATER

INTRODUCTION

While the section does look at changes to portions of the Eastern Shore landscape over time, risk assessment is not found in in this chapter, but can be found in Chapter 3: Risk Assessment.

On September 3, 2003, a massive thunderstorm produced heavy rains, dropping 6 to 8 inches of rain in a very short period across northern Accomack County (NOAA Climate Data Center Severe Weather Events Database). In Bloxom, floodwaters reached a depth of at least 2 feet; in some areas the flooding was greater. Railroad tracks blocked drainage in some directions in town, contributing to extensive stormwater flooding that impacted several homes. An afternoon rainstorm that had saturated the soils earlier in the day, a common contributor to stormwater flooding on the Shore. The drainage ditches were inundated from high tides that accompanied the storm, and deferred maintenance leading up to the storm event meant the ditches could not accommodate the large amounts of water the storm produced.

Compounding the problem in Bloxom was that many acres of tomato fields in the area were covered in plastic, greatly increasing the amount of impervious surfaces and increasing stormwater runoff. This practice is still in use across the Shore, exacerbating runoff where it is employed.

Although there were no estimates of the probability of this storm event, the entire 12-hour period including the initial storms in the afternoon would put this at the 100-year storm event level, which on the Eastern Shore is 7 to 8 inches in 12 hours. Residents who remember the Bloxom storm recall that the larger storm’s rainfall occurred over approximately 2 hours, making this storm above the 100-year storm event. The 2-hour 100-year storm on the Eastern Shore is between 4.5 and 5 inches of rain. Recurrence intervals of rainfall intensity are presented in Table 1 below.

Table 1: Recurrence Intervals of 24 hour Rainfall Totals

Recurrence Interval	Rainfall (inches)
1-year 24 hour	3.0 - 3.5*
2-year 24 hour	3.5 - 4.0
5-year 24 hour	4.5 - 5.0**
10-year 24 hour	5.0 - 6.0
25-year 24 hour	6.0 - 7.0
50-year 24 hour	7.0 - 8.0
100-year 24 hour	8.0 - 9.0

* All of the Eastern Shore has this recurrence interval except for the immediate environs around the Town of Saxis. Recurrence

Interval: 2.5 – 3.0

** All of the Eastern Shore has this recurrence interval except for the Southeast corner of Northampton County. Recurrence Interval: 5.0 – 5.5

Source: The National Weather Service established that the worst case scenario for the Eastern Shore would be 28 to 30 inches of rainfall during a 6-hour precipitation event for a 10 square mile area.

NATURAL FORCES AND CONDITIONS

STORMWATER AND UNDERLYING GEOLOGY

Surface features characteristic of the Coastal Plain of the Eastern Shore include terraces, stream channels, drowned valleys, Carolina bays, swamps and marshes, remnant dunes, and bar-like features formed during the Pleistocene time. The central portion of the Eastern Shore peninsula forms a broad, low ridge which trends northeast-southwest and stands at an elevation ranging from about +25 to +50 feet mean sea level. This central highland area is the principal fresh ground water recharge area for the peninsula and is referred to as the "recharge spine" of the Eastern Shore. The terrace has maintained the same strand line for almost the entire length of the Atlantic Coastal Plain and is divided into a lower and upper terrace which directs the drainage of the Eastern Shore.

The lower terrace, generally located west of Route 13, consists of broad flats broken by large meandering tidal creeks and bordered by tidal marshes. The topography of the upper terrace, typically thought of as more complex than the lower terrace, is characterized by shallow sand-rimmed depressions known as Carolina bays. Prior to the advent of LiDAR (Light Detection and Ranging, remote sensing method), there were fewer than 100 Carolina bays inventoried for the Eastern Shore. Now there have been 700 identified, not only along the spine, but also at lower elevations (Davias, 2016). These bays, predominantly oval in shape, exert an influence on the infiltration, retardation of runoff, and movement of surface and ground water, often due to the associated Nimmo series soil types. Between the mainland and the barrier islands are extensive tidal marshes flooded regularly by saltwater and drained by an extensive system of creeks (Hulme, 1955). These systems accept ground and surface water discharge.

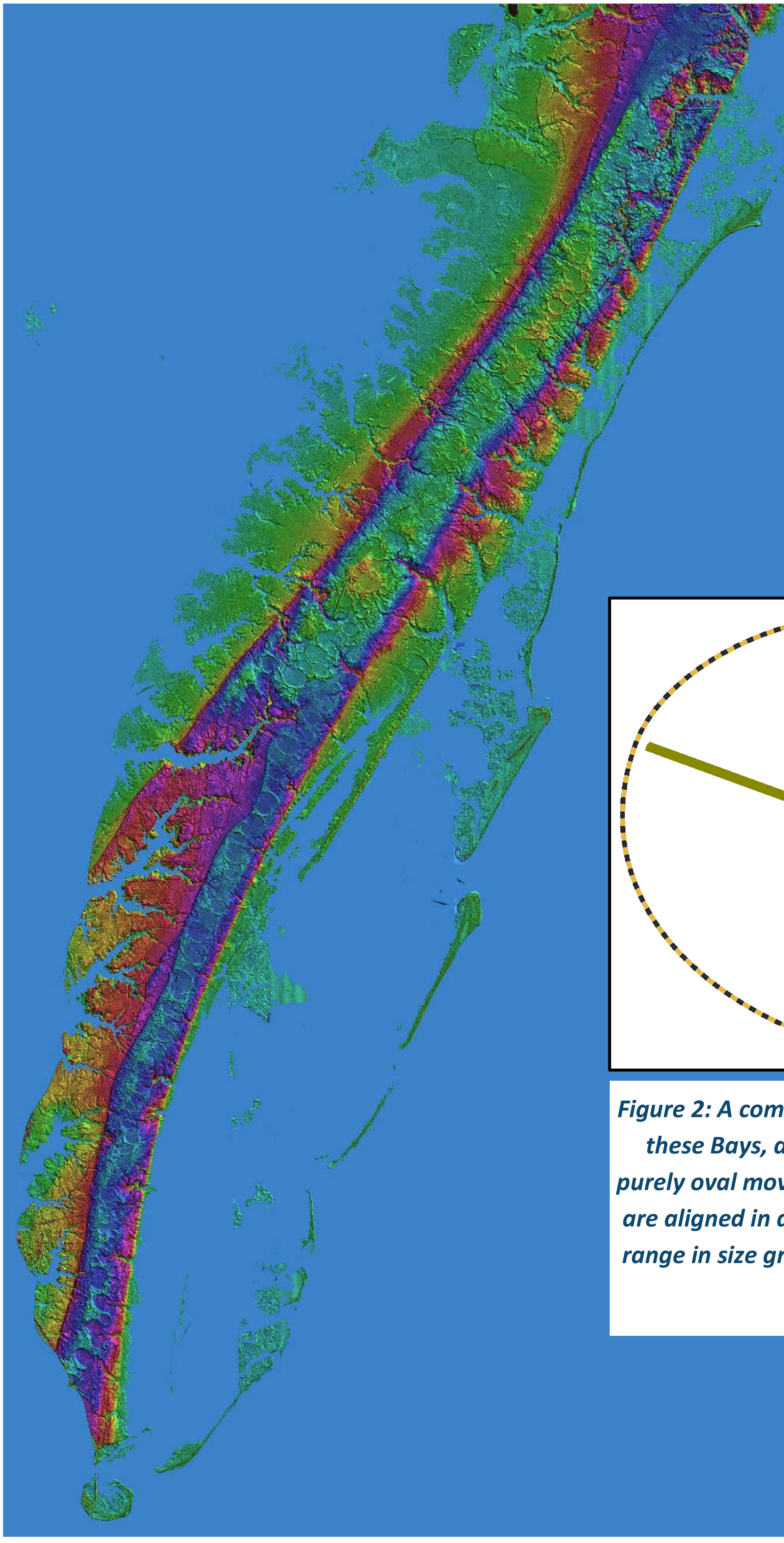


Figure 1: Created with LiDAR data, this "bayShore" overlay reveals the hundreds of ellipsoidal Carolina Bays. Prior to the advent of LiDAR, using aerial imagery only about 100 bays were identified, but now there are 700. Source: Michael Davias http://cintos.org/

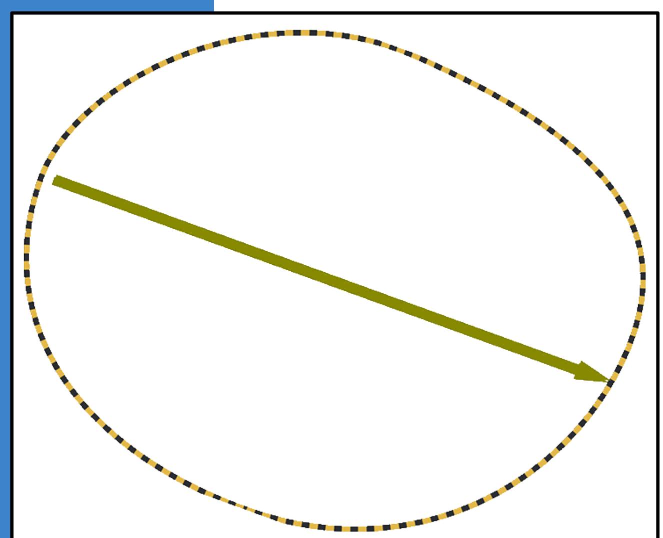


Figure 2: A common representation for the shape of these Bays, although the shape becomes more purely oval moving north from North Carolina. They are aligned in a northwest-southeast direction and range in size greatly, from one to several thousand acres.

Numerous drainage basins exist on the Shore ranging in size from approximately four to six square miles. These basins consist of several small creeks and interconnected ditches. Primary drainage basins of the Eastern Shore of Virginia are Gargathy Creek, Folly Creek, Finney Creek, Occohannock Creek, and Pungoteague Creek basins in Accomack County; and Mattawoman Creek and Nassawadox Creek basins in Northampton County. The Pocomoke River basin borders Worcester County, Maryland and Accomack County, Virginia and serves as a major drainage divide for this area.

STORMWATER AND SOIL COMPOSITION

The Eastern Shore exists entirely within the Atlantic Coastal Plain Physiographic Province, which consists of unconsolidated sediments deposited by marine and fluvial processes. The three most abundant soil types on the mainland of Accomack and Northampton Counties are the Bojac, Munden, and Nimmo series (Table 2, Figures 3 and 4). These soil types have distinct characteristics that affect the way that they either contribute towards or help alleviate stormwater impacts (ESVA Land Use & Ground Water Resources Report, 2010).

Table 2: Predominant Soil Types, Eastern Shore of Virginia

Soil Series	**Description**	**Drainage**	**Suitability for Septic**	**Water Table**
Bojac	Primarily loamy sands found on undulating surfaces and rims of Carolina bays	Moderately to excessively well drained	Considered most suited for septic drainage	Water table more than 4’ below surface
Munden	Sandy loam found in nearly level surfaces of coastal plain uplands and stream terraces	Not well drained	Not as well suited for septic drainage	Water table 18”-30” below surface
Nimmo	Sandy loam found in flats, depressions, and drainageways of coastal plain uplands and stream terraces	Poorly drained	Not suited for septic drainage	Water table 0-12” below surface

Source: USDA Natural Resource Conservation Service Soil Survey, 1994

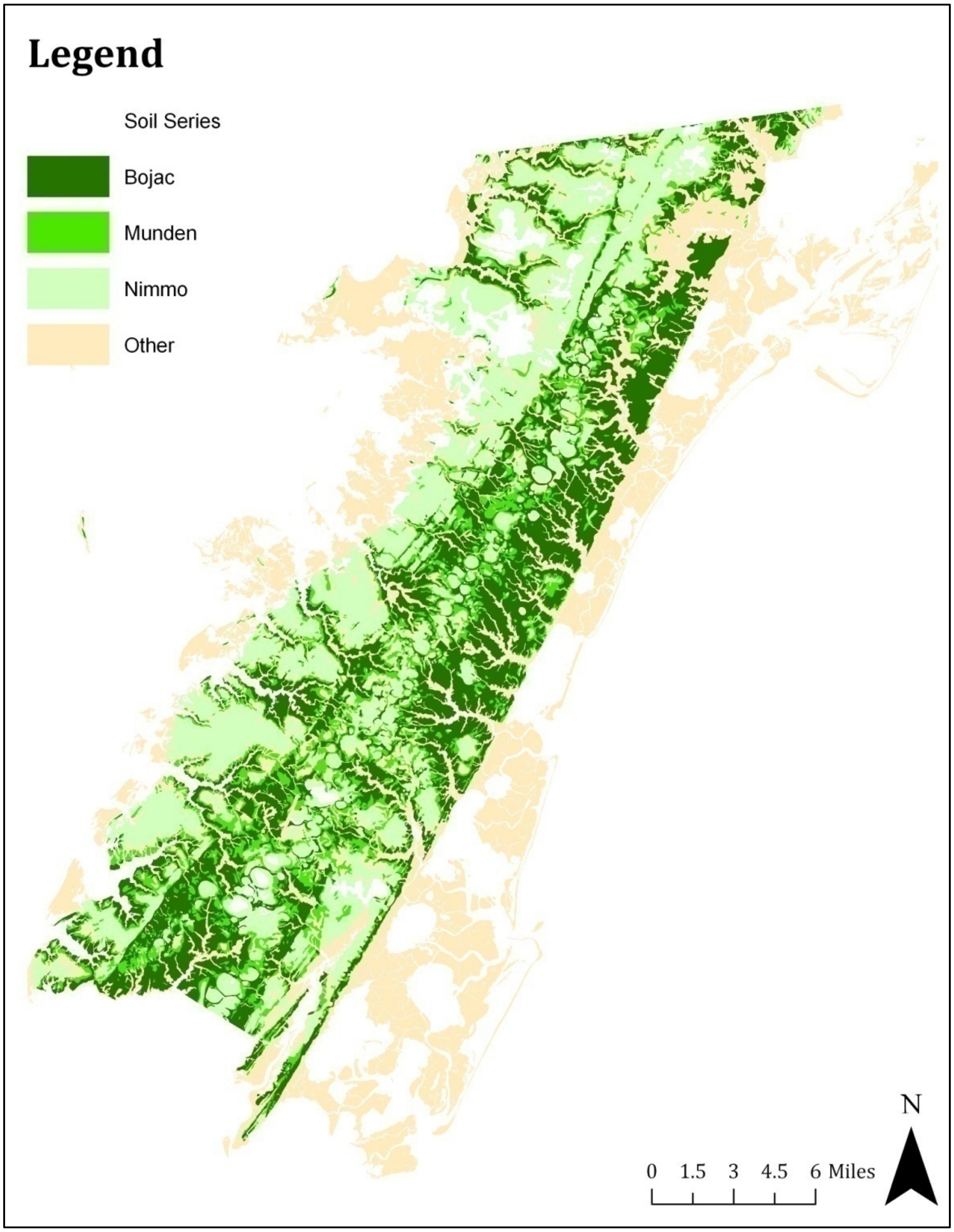


Figure 3: Accomack County Soils Map showing the distribution of the three predominant soil types in the county

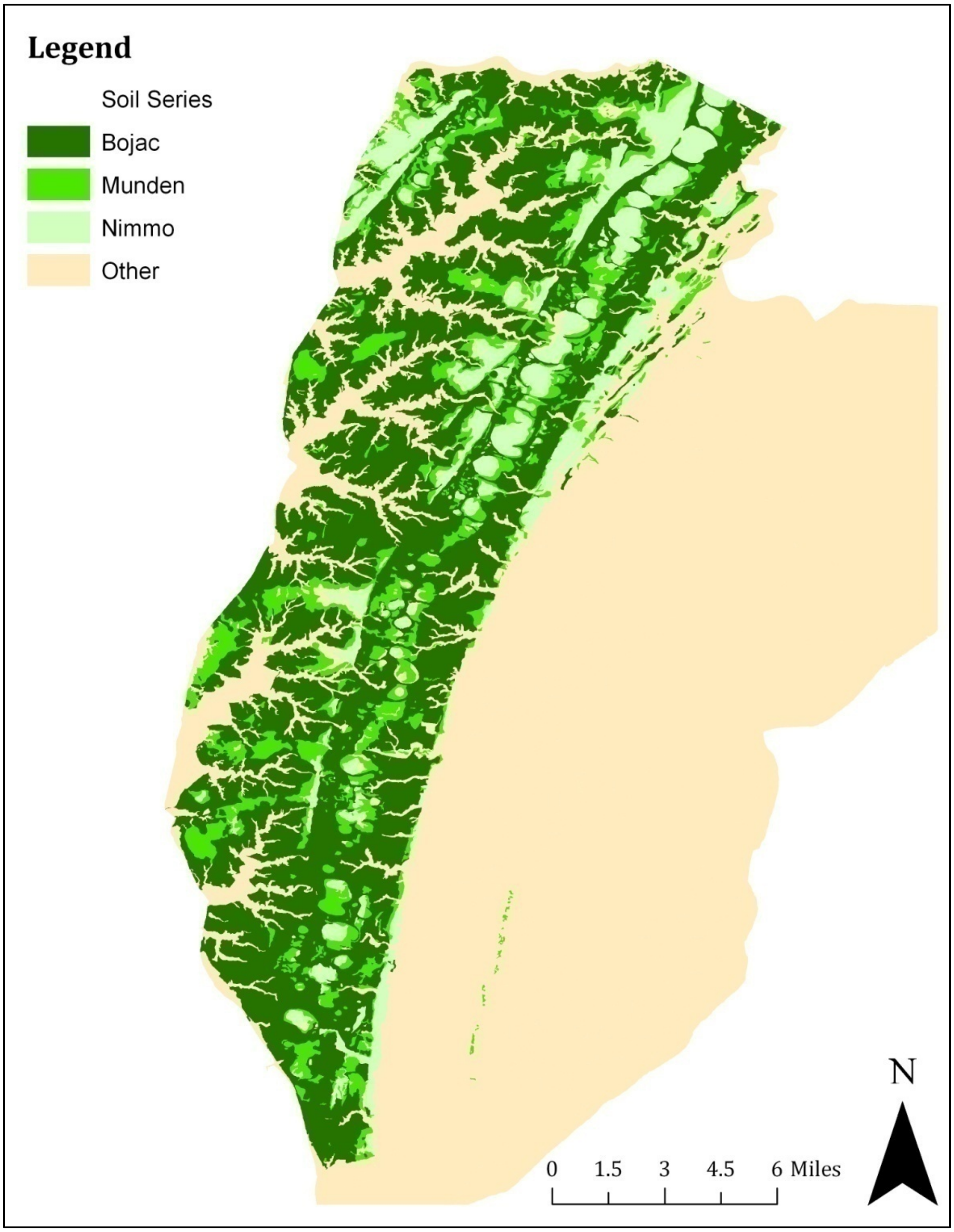


Figure 4: Northampton County Soils Map showing the distribution of the three predominant soil types in the county

CAUSES OF STORMWATER

Stormwater flooding is unlike coastal flooding in that it is caused by intense downbursts of rain or from rainwater accumulation in low-lying or poorly drained areas, or where debris blocks drainage paths. Once rainwater falls on the land surface, it drains into the soil and enters the ground water system, re-enters the atmosphere through evaporation, is taken up by vegetation via transpiration, or enters streams or creeks as surface runoff and eventually enters the tidal waters draining towards the Atlantic Ocean or Chesapeake Bay.

The greatest amount of flow in the creeks and streams lags after the peak rainfall. This is due to the various factors that cause the rain to slow down as it flows over the land including land cover, slope, extent of soil saturation, and capability of drainage in ditches and culverts.

STORM POTENTIAL

Extratropical storms including hurricanes and nor'easters represent the greatest threat of catastrophic stormwater flooding that can occur on the Eastern Shore. The 2009 storm known as Nor'Ida is one such example. When tropical storm Ida traveled northeast from Alabama, eventually moving into offshore Atlantic Ocean, it re-grouped into a major nor'easter, producing moderate to severe coastal flooding. Peak tide at Kiptopeke was 7.04 feet above MLLW, which was a higher reading than during Hurricane Isabel, which was a storm of record for much of the larger Chesapeake Bay region. Chincoteague recorded 13" of rain, and rainfall across the rest of the Eastern Shore averaged 4"-8". The National Weather Service recorded stormwater flooding in both counties on roadways and in poorly drained areas.

Figure 5: Common scene of flooded roadways following intense rainfall on the Eastern Shore. Photo by Jay Diem, Eastern Shore News.

The chapter of this report on Coastal Flooding details tropical storms and nor'easters, most of which were also stormwater events for the region. Downbursts of rain from thunderstorms also have the potential to create stormwater flooding. The worst downburst in Virginia's history was in Guinea across the Bay from Northampton County. On August 24, 1906, 9.25 inches fell in 40 minutes.

Table 3 below lists storm events that have caused stormwater flooding on the Eastern Shore, not including tropical cyclones and nor'easters, which were covered in Chapter 1.

Table 3: Storms that have generated intense rainfall on the Eastern Shore, 1996 - 2015

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO.	8/4/2000	STORM WATER FLOODING	$0	$0	Heavy rain caused flooding on Route 13 near Mappsville and Nelsonia	NOAA, National Climatic Data Center
NORTHAMPTON CO.	7/30/2003	STORM WATER FLOODING	$0	$0	Extensive flooding to secondary roads, as well as Route 13	NOAA, National Climatic Data Center
ACCOMACK CO.	9/3/2003	STORM WATER FLOODING	$0	$0	Several inches of water on Route 13 in the areas of Nelsonia and Mappsville. Many roads reported cloased under 6-8" of water.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/28/2004	STORM WATER FLOODING	$0	$0	Thunderstorms produced 1' of water across Route 175 in town of Chincoteague; 6" of water to 1.5' of water across northbound and southbound lanes of Route 13. Southbound lanes of Route 13 were closed for a time. Standing water of 1.5'alongside northbound Route 13 was threatening houses along the road.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	10/24/2007	STORM WATER FLOODING	$0	$0	Low pressure over the SE U.S. and a near-stationary front across the Mid-Atlantic Region helped to produce heavy rain across portions of Central and Eastern Virginia. The storm system brought an average of two to four inches of rainfall across the county	NOAA, National Climatic Data Center
ACCOMACK CO.	12/10/2008	STORM WATER FLOODING	$0	$0	2" -5" of rain fell across the county. Rainfall amount of 4.98 inches was measured at Wallops.	NOAA, National Climatic Data Center
ACCOMACK CO.	7/27/2009	STORM WATER FLOODING	$0	$0	Scattered thunderstorms in advance of a cold front produced heavy rain: 4.5" reported. Atlantic road was flooded near Wallops Island; Chincoteague and Fisher Rds. also reported flooded.	NOAA, National Climatic Data Center
ACCOMACK CO.	3/13/2010	STORM WATER FLOODING	$0	$0	Water was ponding on roads in Accomack county due to heavy rains. A portion of Route 13 north of Accomac was partially covered by water. Rainfall amount in the area was estimated to be 1.20 inches.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	3/28/2010	STORM WATER FLOODING	$0	$0	Showers and thunderstorms associated with low pressure and a cold front produced one to three inches of rain across portions of central and eastern Virginia from Sunday night, March 28th, through Monday afternoon March 29th. Eastville reported 3.28" rainfall	NOAA, National Climatic Data Center
ACCOMACK CO.	6/19/2011	STORM WATER FLOODING	$0	$0	Isolated thunderstorms associated with low pressure produced heavy rains which caused flash flooding across portions of the Virginia Eastern shore. High water was covering Routes 316 (Greenbush Rd) and 182.	NOAA, National Climatic Data Center

Source: NOAA, National Climatic Data Center, Storm Events Database: http://www.ncdc.noaa.gov/stormevents/

Table 4 (Cont.): Storms that have generated intense rainfall on the Eastern Shore, 1996 – 2015

County	Date	Event Category	Property Damage (in 2015 $$)	Crop Damage (in 2015 $$)	Description	Source
ACCOMACK CO.	7/14/2012	**STORM WATER FLOODING**	$0	$0	Isolated thunderstorm along a frontal boundary caused heavy rain which produced flash flooding across portions of the Virginia Eastern Shore. Bobtown Road was flooded. Pungoteague Elementary School was flooded. Portion of Hollies Church Road was washed out. 6.68" rain reported at Accomack Co. Airport	NOAA, National Climatic Data Center
ACCOMACK CO.	8/25/2012	**STORM WATER FLOODING**	$10,323	$0	Scattered thunderstorms associated with low pressure along the Mid Atlantic Coast produced heavy rain which caused flash flooding. Many roads were closed due to flooding. Cars were disabled and filing with water in the Keller-Painter area. Trailer home was damaged by straight line winds (57 MPH). One	NOAA, National Climatic Data Center
ACCOMACK CO.	6/7/2013	**STORM WATER FLOODING**	$0	$0	The combination of the remnants from Tropical Storm Andrea and a frontal boundary draped over the region caused heavy rain which produced flash flooding across portions of central and eastern Virginia. Heavy rainfall resulted in flash flooding over the southeast portions of the county. Several roads were impassable due to high water.	NOAA, National Climatic Data Center
NORTHAMPTON CO.	9/8/2013	**WATER FLOODING**	$0	$0	Showers associated with low pressure produced 3-7" rain	NOAA, National Climatic Data Center
NORTHAMPTON CO.	8/12/2014	**STORM WATER FLOODING**	$0	$0	Slow moving storms produced 3-5" of rain around Cape Charles. Flooding reported on many streets; some cars were flooded by 2-3 feet of water.	NOAA, National Climatic Data Center
ACCOMACK CO./ NORTHAMPTON CO.	11/9/2015	**STORM WATER FLOODING**	$0	$0	Low pressure moving up along the East Coast produced rainfall amounts between 1.5 inches and 3.5 inches across the area. New Church reported 2.93"; Onancock reported 2.50".	NOAA, National Climatic Data Center

Source: NOAA, National Climatic Data Center, Storm Events Database: http://www.ncdc.noaa.gov/stormevents/

SEA-LEVEL RISE AND STORMWATER

Since 1933, the relative sea-level rise measured at Sewell's Point has risen by 14.5 inches, and the rate of rise is shown to be steadily increasing. Because of the Chesapeake Bay impact crater, the Eastern Shore is also subsiding. The combination of the sinking and the sea-level rise is considered the relative sea-level rise and is an even greater threat.

With issues associated with climate change, recurrent flooding, and or increased storm frequency, the frequency of heavy precipitation events (or proportion of total rainfall from heavy storms) is expected to increase in the Eastern United States. Although the average total annual precipitation isn't predicted to change significantly in our region, the timing and intensity of storm events is expected to change (ICPP, 2007), with increased precipitation extremes leading to increases in stormwater flooding.

Changes to vegetation can also occur, and depending on the ecosystems' ability to migrate and their ability to retain flood waters, the impacts on stormwater flooding will vary greatly. Overall, it is predicted that there will be a decrease in dry land (developed and undeveloped), irregularly flooded salt marsh, and other nontidal wetlands, but an increase in the expanse of regularly flooded and transitional salt marshes. Figure 5 reveals these changes, as shown by the Future Habitat application of the Coastal Resilience mapping tool. Vegetation serves as a stabilizing force for shorelines and a water retention resource on the shoreline and inland, and thus a loss of vegetation increases inland areas' susceptibility to flooding.

Figure 6: One of the ecosystem services of fresh water wetlands is flood mitigation. Shifting habitats can alter the ability of an area to help absorb flood waters. Photo By: Shannon Alexander

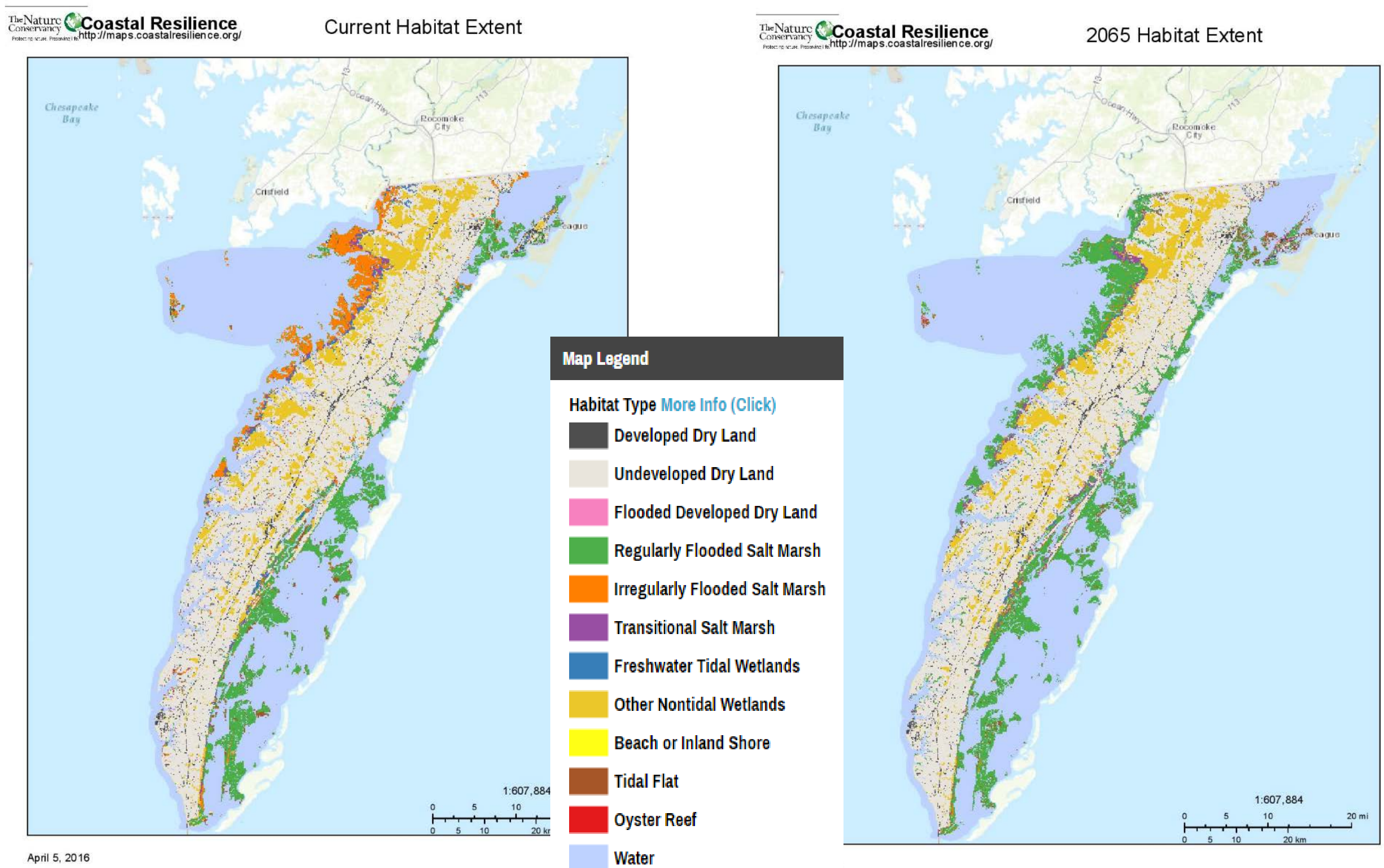
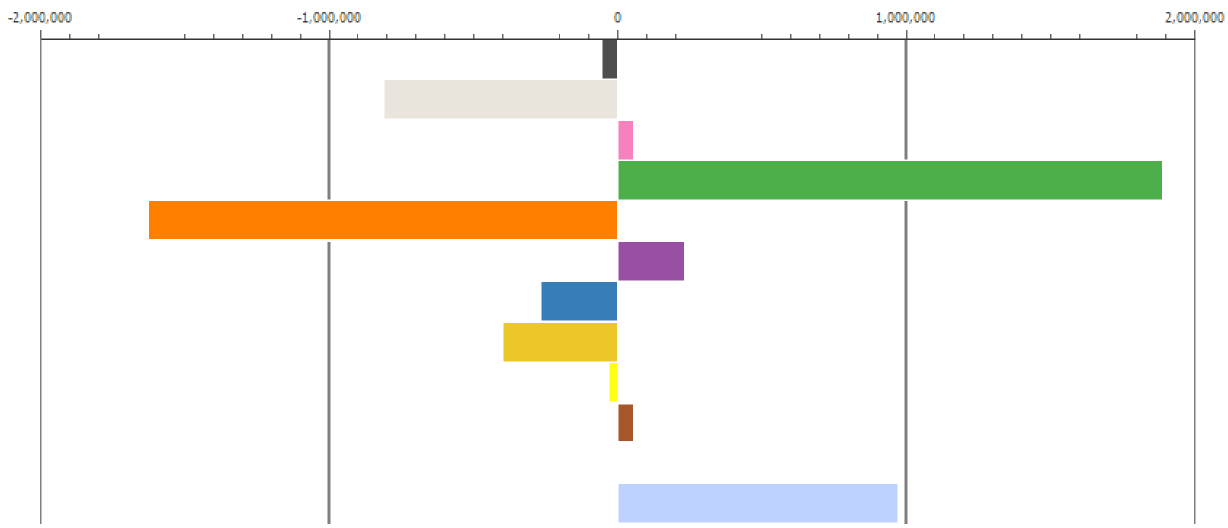


Figure 7: Coastal Resilience Tool Habitat Mapping Application. Source: http://maps.coastalresilience.org/virginia/

Habitat Change from Current Condition (Acres)



Code	Name	Total (Acres)	Change (Acres)	Change (%)
1	Developed Dry Land	782,370	-57,509	-6
2	Undeveloped Dry Land	15,189,164	-811,377	-5
3	Flooded Developed Dry Land	57,508	57,508	NaN
4	Regularly Flooded Salt Marsh	5,795,452	1,889,253	48
5	Irregularly Flooded Salt Marsh	235,928	-1,629,778	-87
6	Transitional Salt Marsh	619,368	232,417	60
7	Freshwater Tidal Wetlands	184,504	-266,523	-59
8	Other Nontidal Wetlands	3,636,670	-400,878	-9
9	Beach or Inland Shore	29,391	-33,096	-52
10	Tidal Flat	497,880	55,801	12
11	Oyster Reef	649	-8,538	-92
12	Water	20,804,538	972,720	4
	Totals	47,833,422	6,415,398	13

Figure 8: Histogram and table showing the change in acreage data associated with Figure 7. Source: http://maps.coastalresilience.org/virginia/

TYPE, LOCATION, AND EXTENT

DAMAGES

Flash flooding from stormwater can be quite hazardous to humans. Since conditions develop rapidly, people can become trapped before even realizing they are in danger. During the Great Bloxom Flood of 2003, two people had to be rescued. There were several inches of water even on Routh 13 in the areas of Nelsonia and Mappsville, several parts impassable. Many secondary roads were closed as they were under 6 to 8 or more inches of water. Floodwater commonly blocks roads in the area. This is quite a dangerous problem since motorists commonly believe that they can ford these areas without knowing whether the water has damaged the road below.

Figure 9: Stormwater flooding in Bloxom, VA in 2003. Photo Credit: Franklin Kreisl

Buildings are in danger from hydrostatic loads, which occur when flood waters come into contact with a building, its foundation, or a building element. The hydrostatic load can be lateral or vertical. In order for lateral forces to cause displacement of a building or element, there must be a substantial difference in water elevation on opposite sides of the wall. The purpose of flood vents is to allow water to flow freely through a crawl space area to equalize hydrostatic pressure on either side of the foundation wall (Coastal Construction Manual, 2011).

Inadequately elevated buildings on shallow foundations are those most in danger from vertical hydrostatic forces (buoyancy or flotation). Such buildings are vulnerable to uplift from flood and wind forces because the weight of a foundation or building element is much less when submerged than when not submerged. (Coastal Construction Manual, 2011).

Stormwater floods that move faster than 10 feet per second are generating hydrodynamic loads in addition to the hydrostatic loads (Figure 10). Hydrodynamic loads are a function of flow velocity and structural geometry, including frontal impact on the upstream face, drag along the sides, and suction on the downstream side. These loads can destroy walls, push structures off of foundations, and carry sediment and debris (*FEMA Coastal Construction Manual*, 2011).

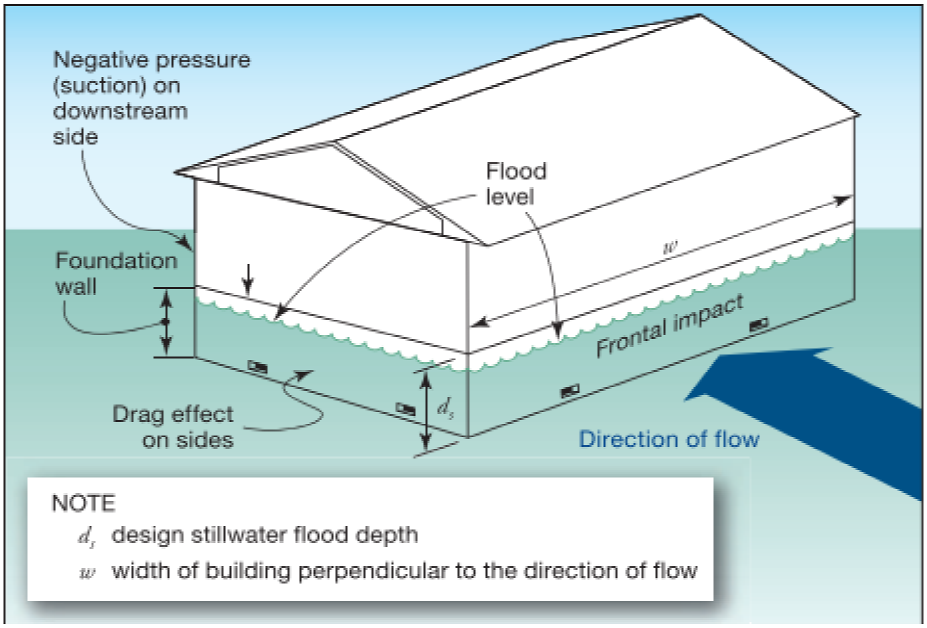


Figure 10: Hydrodynamic building loads

Source: FEMA Coastal Construction Manual, 2011

Table 5: Locations identified as flooded following rain events. Source: See local Chapter personal communication reference.

County	Town	Intersection / Road	Intensity/Effect
Accomack	Bloxom	Between Bull St & Bayside Dr	No homes, recreational area for the Town
Northampton	Cape Charles	Historic district; Intersection of Plum St & Madison Ave	Residential and commercial; primarily road flooding, hindering travel
Northampton	Cheriton	Mill St, Cherrystone Rd; Drainage an issue Town-wide	Residential, saturated soils, higher risk of wind damage to trees
Northampton	Eastville	Courthouse Rd, Willow Oak Rd east of Rt 13, northwestern side of the Rt 13 & Willow Oak Rd intersection. Willow Oak Rd receives water from the Holland Court area.	Residential, commercial, and access to County seat buildings and jail

Northampton	Exmore	Town-wide except along the railroad tracks and New Road's housing area (west of Rt 13 & south of Occohannock Neck Rd)	Damage to buildings and other personal property, affects mobility of non-automobile travelers, erosion cutting away parking lots, can impact public water/sewer
Accomack	Hallwood	Town-wide; particularly adjacent to the railroad past Bethel Church Rd, Main St	Hinders travel, saturated soils, damage to personal property
Accomack	Keller	Central & northern part of Town, intersection of Center Ave w/ West St & Lee St, northern end of West St	Town Office & PO susceptible
Accomack	Melfa	Woodland Ave – entire street (culvert pipe needed)	Residential and Shore Engineering
Northampton	Nassawadox	Woodstock residential area, Hospital Ave (even next to Rayfield 's Pharmacy)	Hinders travel, residential, commercial, medical
Accomack	Onancock	Lilliston Ave, North St area including the Police Station/Town Office	Residential, Town facilities
Accomack	Onley	Town-wide, particularly east of Rt 13 (hydric soils)	Primarily commercial
Accomack	Parksley	Intersection of Dunn Ave & Adelaide St, in front of Jaxon's, perennial ditch on south side	Some residential, but primarily the downtown business district

Bloxom and Melfa had some success mitigating stormwater flooding through aggressive ditch maintenance programs.

EXPOSURE AND POTENTIAL LOSS

In some interior areas of the Shore, the Base Flood Elevation (BFE) is 4 feet. However, the AE Zones identified are associated with creeks, the ocean or a bay. For example, there is no identified Special Flood Hazard Area in Bloxom. Flood Insurance Rate Maps (FIRMs) were updated in 2015, but some still miss many areas with recurring stormwater flooding.

There are two main hazards to residential construction associated with falling rain itself. One is the penetration of the building envelope during high-wind events and the other is the vertical weight load due to rainfall ponding on a roof (*FEMA Coastal Construction Manual*, 2011).

To look at potential losses it is necessary to observe what a flood would do to a structure. The average 2,000 ft^2 home, built on a slab, and with typical household items would suffer from $52,220 in total losses with a foot flood and $74,580 in total losses under a four-foot flood (NFIP The Cost of Flooding App).

Since so many areas of stormwater flooding are unstudied and unmapped, probabilities of the occurrence of certain flood elevations are not really known. High resolution LiDAR elevation data has been produced for the entire Eastern Shore making the region one of the few regions in the state to have access to such excellent data. There are current efforts to recapture the LiDAR data to create an even more accurate data set. This will provide the resolution needed to map and analyze stormwater flooding issues on the Eastern Shore. The data have already been used in the Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment and subsequently in the Coastal Resilience 2016 mapping portal for the Eastern Shore.

Just because a rain event is within a certain probability also does not necessarily correspond to the same flood probability. Since floods are dependent on both rain and other conditions, such as soil moisture, a small isolated low probability rain event might not cause a low probability flood.

In 2011, there were 246 and 173 non-Special Flood Hazard Area (SFHA) NFIP flood insurance policies in the unincorporated portions of Accomack County and Northampton County, respectively. These numbers represent the percent of all policies in Accomack County and 11.9 percent in Northampton County. There was an increase in the total number of policies, both SFHA and non-SFHA policies, and in the percentage of non-SFHA policies in both Counties from 2003 to 2011, but then a decline from 2011 to 2016, although the number of policies remains higher than in 2003 (FEMA NFIP Insurance Reports, July 2003, May 2011, and January 2016). Table 5 summarizes these trends. This is an indication that there are areas in both Counties where property owners feel the need to buy flood insurance although their structure is not in an identified flood zone, but that perhaps the new FEMA flood zone maps has prompted some home owners to discontinue their policies.

Table 6: Summary of flood insurance policies for the unincorporated areas of Accomack and Northampton Counties.

Flood Insurance Policy Summary – Unincorporated Areas of Accomack and Northampton Counties				
	Year	SFHA Policies (% of Total)	Non-SFHA Policies (% of Total)	Total Policies
Accomack County	2016	2060 (88.1%)	246 (11.9%)	2306
	2011	2724 (93.7%)	184 (6.3%)	2908
	2003	2457 (95.8%)	107 (4.2%)	2564
Northampton County	2016	161 (48.2%)	173 (51.8%)	334
	2011	252 (59.9%)	169 (40.1%)	421
	2003	213 (73.2%)	78 (26.8%)	291

***Sources: FEMA NFIP Insurance Reports, May 2011, July 2003, and January 2016**

Take these Steps to Minimize Damage from Major Storms

Harrison Jackson, Column, DelmarvaNow, Feb. 27, 2016

As we have seen with Hurricane Joaquin and Winter Storm Jonas, one of the biggest problems major storms pose to our coastal bays watershed is flooding. Due to a variety of factors – including tides, a high water table and porous soils – we often experience flooding during major rainstorm events, which can cause serious damage to houses, businesses and other infrastructure.

While it may seem daunting, there are simple solutions most homeowners or families can do to help reduce local flooding in their area and improve water quality:

- Rain Barrels
- Rain Gardens
- Lawn Tips
  - Let it grow a bit
  - Use little fertilizer & pesticides
- Storm Drains
  - Keep clear of trash
- Pet Waste
  - Pick it up
  - Avoid human and environmental health impacts

"Homeowners can help keep the coastal bays watershed clean and reduce flood damage, too."

SECONDARY HAZARDS

There are secondary hazards from stormwater flow. Generally, intense rainfalls will not only affect the immediate area but will affect other places downstream. On the Eastern Shore, this is less of a problem than other areas in Virginia that have much larger watersheds. Unlike most places in Virginia and the nation, Accomack and Northampton are not coping with stormwater coming from other jurisdictions.

Intense rainfalls increase the amount of contaminants in the water. When the water flows over agricultural land, residential yards, roads and commercial parking lots, contaminates are picked up and carried into the streams. Larger overland flows also erode streams and if this erosion is severe, property damage can ensue. The excess nutrients that are introduced into our coastal creeks and bays following heavy rain events can cause algal blooms followed by eutrophication, depleting the dissolved oxygen levels to a level that kills aquatic animals. Additional steps need to be made to ensure that areas storing materials with high levels of nutrients are not built in the flood plain or too near tidal tributaries.

Often the saturated soils and standing water cause septic system and drain field failures. In some flooding instances alternative system tanks have become dislodged and actually floated out of the ground (see Chapter 14: Town of Chincoteague, page 22). When this occurs, additionally contaminants that pose immediate risk to human health, are introduced into the flood waters. Without proper education about these dangers, residents often wade through and children often play in the remaining waters once the storm system has passed.

HUMAN SYSTEMS

FRESH WATER IMPOUNDMENTS

An important source of water for agricultural and other irrigation supply is from dug farm ponds and, to a much lesser extent impounded creeks and streams. Most of the impounded creeks and streams are historical, many created before 1980 and most of the dug ponds post-date 1980. These impoundments often serve as a sort of holding tank for stormwater, however, the source of water is a combination of both stormwater and groundwater recharge from the Columbia aquifer. (Eastern Shore Ground Water Management Plan, 2013)

STORMWATER FLOODING PREVENTION LAWS AND PROGRAMS

The lead agency for developing and implementing statewide Stormwater management and nonpoint source pollution control programs in the Commonwealth is the Virginia Department of Environmental Quality (DEQ). As a result of precipitation events, stormwater runoff from streets, lawns, parking lots, construction sites, industrial facilities and other impervious surfaces occurs. Stormwater can cause erosion and flooding and carry excess nutrients, sediment and other contaminants into our creeks, particularly when not managed appropriately. When managed well, stormwater can recharge groundwater and protect land and streams from erosion, flooding, and pollutants.

A new EPA study released in December of 2015 supports long-term benefits of green infrastructure and low impact development. This modeling study used the FEMA Hazus model and national-scale datasets to estimates the flood loss avoidance benefits from application of small storm retention practices for new development and redevelopment nationwide. According to the study, the use of green stormwater infrastructure can save hundreds of millions of dollars in flood losses when applied to new development and redevelopment, and if retrofitting were to occur, the avoided losses would be even more significant (Atkins, 2015).

The Clean Water Act (CWA), properly titled the Federal Water Pollution Act, was essentially established in 1972, and is managed by the U.S. Environmental Protection Agency (EPA). This is the origin of Virginia’s Total Maximum Daily Loads (TMDLs). These are important values developed by DEQ to assess state waters and causes of impairment. The development process of the TMDL and the Implementation Plan (IP), often result in a need to reduce the amount of runoff. On the Eastern Shore this is frequently due to nutrients associated with the runoff, and the resulting eutrophication, elevated bacteria levels, and reduced dissolved oxygen (DO).

At this point in time, there are three Commonwealth of Virginia laws that apply to land disturbance activity in Virginia, however, the Stormwater Stakeholder Advisory Group (SAG) is currently brainstorming ways to streamline these programs. These laws include the Stormwater Management Act (§ 62.1-44.15:24 et seq.), Erosion and Sediment Control Law (§ 62.1-44.15:51 et seq.), and Chesapeake Bay Preservation Act (§ 62.1-44.15:67 et seq.), all three of which were incorporated into the State Water Control Law (§62.1-44.2 ET SEQ.) in 2013. For counties and towns, these laws are important in the creation of zoning and subdivision ordinances, in setting out the way in which these laws are followed. From the restricting of where new development can occur, to the frequency of septic pump-outs, these regulations affect the local municipalities and residents, with the intent to improve water quality.

In rural areas, the volume of water that is discharged following a storm event has an increased flow rate due to the combined effects of subdivisions, roads, and buildings. Historically the aim of stormwater management was to quickly drain water away, in our case to the seaside and bayside creeks and bays. Not only can this lead to erosion and nutrient loading, but it is also eliminating the opportunity for that rainwater to recharge aquifers or be retained for irrigation and agricultural use.

Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries and other rivers and waters of the Commonwealth. This program is administered by DEQ (Virginia Code §62.1-44.15:51 *et seq.*).

Coastal Lands Management is a state-local cooperative program administered by the Department of Environmental Quality (DEQ) Water Division and 84 localities that regulates activities in the Chesapeake Bay Resource Management Areas and Resource Protection Areas in Tidewater, Virginia. It was established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §§62.1-44.15:67 through 62.1-44.15:79) and the Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Code 9 VAC 25-830-10 *et seq.*).

The Department of Conservation and Recreation (DCR) has 47 Soil and Water Conservation Districts (SWCDs), who work closely with districts, land owners, and other land managers to control and decrease harmful runoff. The Eastern Shore Soil and Water Conservation District offers technical assistance in shoreline erosion control, soil surveys, and animal waste management and more information can be found on their web site at http://esswcd.org/.

The United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) also provides technical and financial assistance to farmers, private landowners, conservation districts, tribes, and other types of organizations through the Farm Bill.

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.

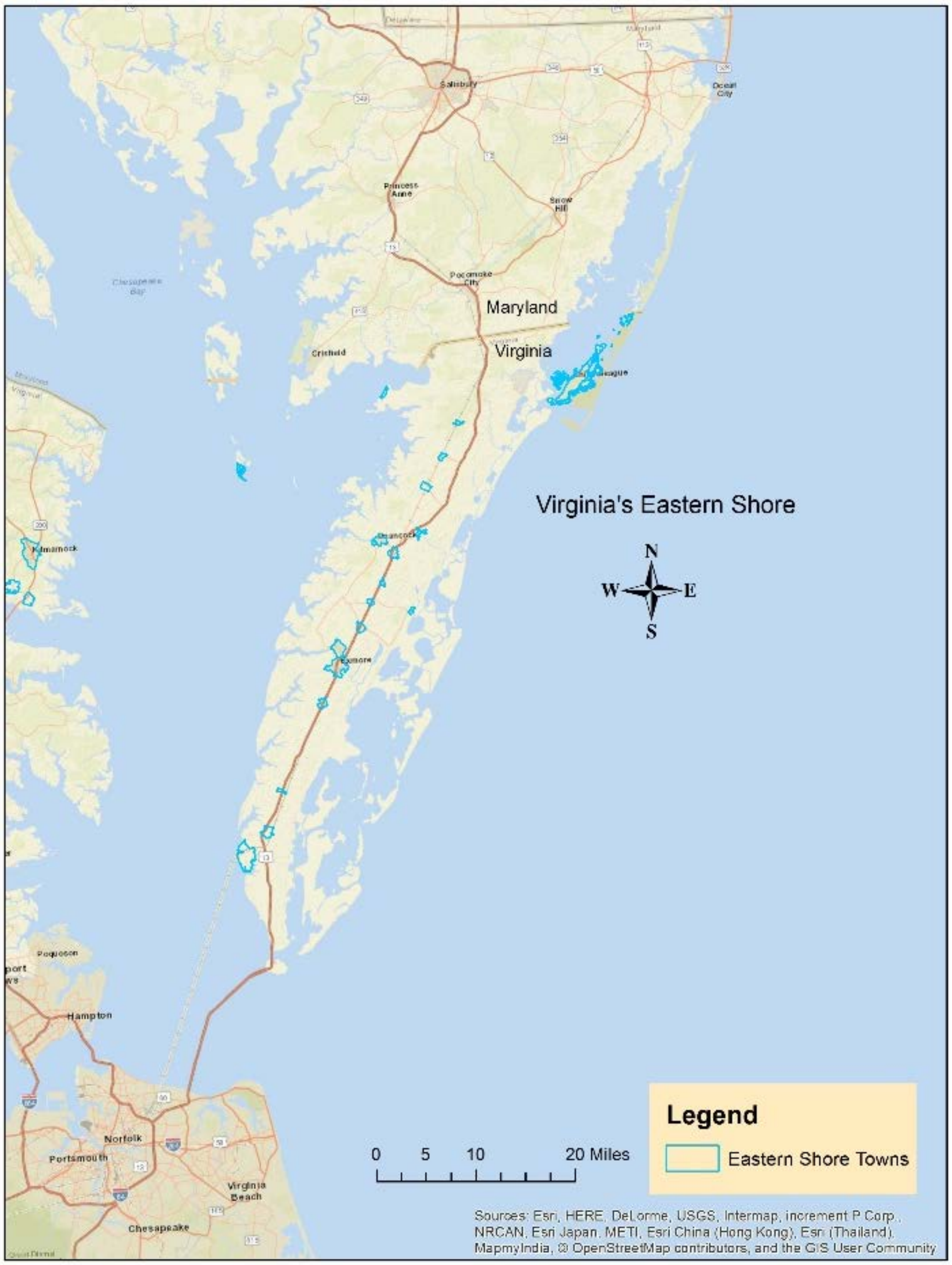


Figure 1: Eastern Shore Location Map

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 waterfowls, 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 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.

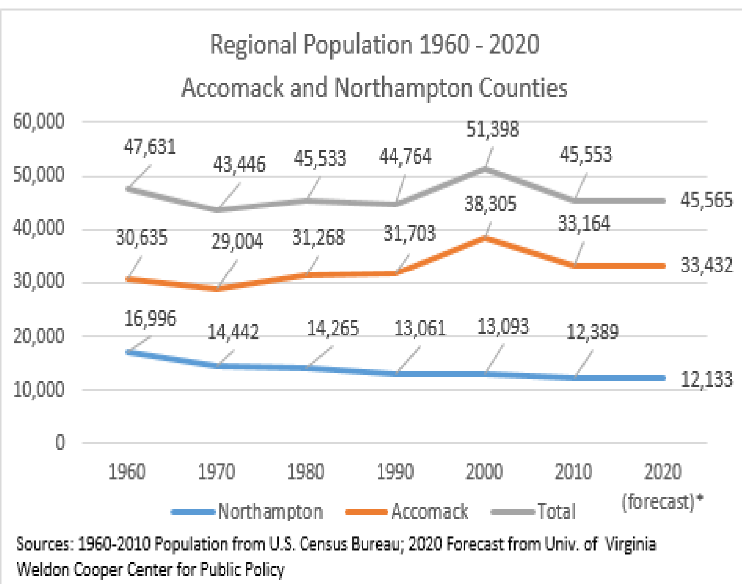


Figure 2: Regional population 1960-2020

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 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

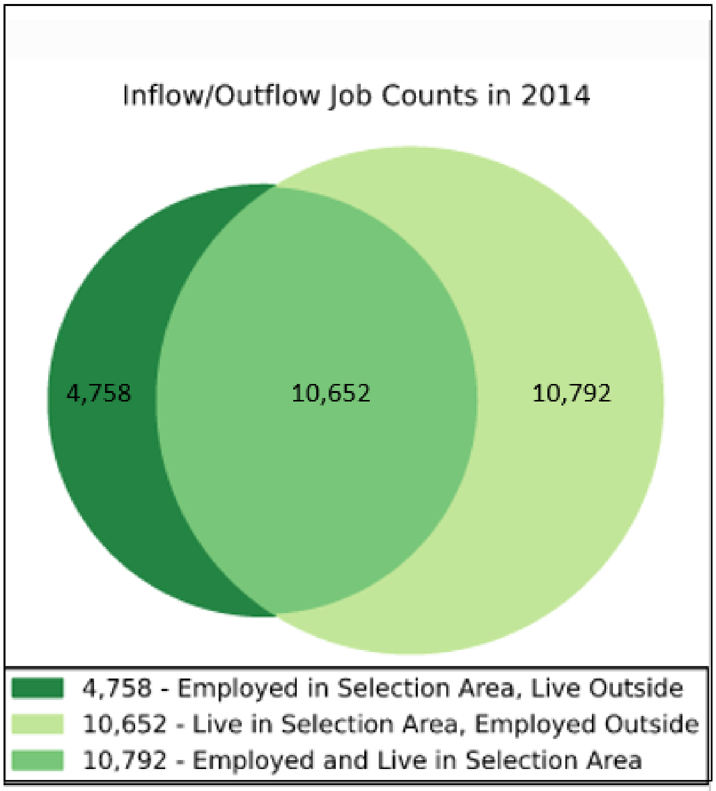
	2014***			2013**			2010*			2000****		
	Accomack	Northampton	Region	Accomack	Northampton	Region	Accomack	Northampton	Region	Accomack	Northampton	Region
Population	33,165	12,254	45,419	33,289	12,339	45,628	33,164	12,369	45,533	38,305	13,093	51,398
Median Age	44.9	48		44.8	47.2		44.7	47.8		39.4	42.4	
Income												
Median Household Income	39,389	34,656	n/a[+]	39,328	33,635	n/a[+]	41,372	35,760	n/a[+]	30,250	28,276	n/a[+]
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
Disability	3,959	1,538	5,497	3,668	1,584	5,252	4,408	n/a[+]	n/a[+]	n/a[+]	n/a[+]	n/a[+]
Language at Home												
Only English	89.60%	91.80%	90.10%	89.90%	92.20%	90.60%	91.30%	93.60%	92.00%	93.30%	n/a[+]	n/a[+]
Spanish	8.30%	6.80%	7.90%	8.30%	6.70%	7.90%	6.90%	5.20%	6.40%	5.70%	n/a[+]	n/a[+]
Indo-Euro	1.90%	0.80%	1.60%	1.50%	0.50%	1.20%	1.40%	0.70%	1.20%	0.70%	n/a[+]	n/a[+]
Asian	0.20%	0.50%	0.30%	0.20%	0.50%	0.30%	0.30%	0.40%	0.30%	0.20%	n/a[+]	n/a[+]
Other	0.00%	0.10%	0.10%	0.10%	0.10%	0.00%	0.10%	0.00%	0.10%	0.00%	n/a[+]	n/a[+]

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000, [+]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.

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



Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The size of the workforce in the two-county region has declined by about 5.8% from 2010 to 2014, according to estimates from the U.S. Census Bureau's American Community Survey. Two primary contributors to the dwindling workforce are the shrinking population and individuals aging out of the workforce as the population as a whole ages. On the whole, there is a net outflow of jobs, meaning the workforce is larger than the number of jobs available (Figure 3).

The category of educational and health care services dominates the work in which regional employees are engaged, followed by 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

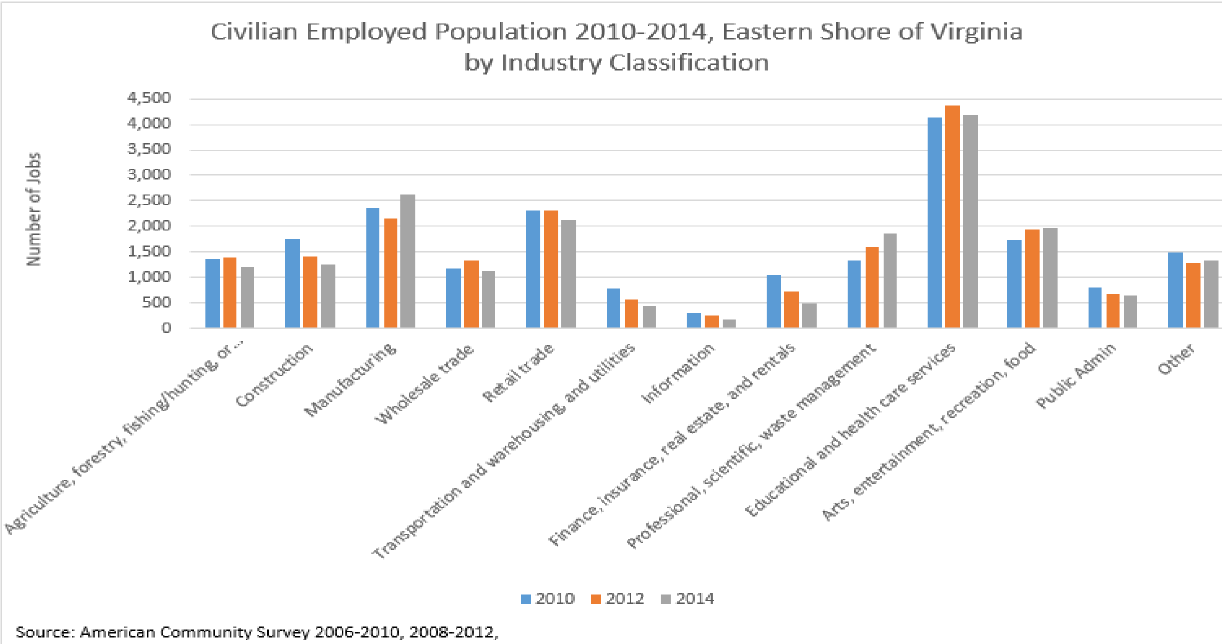


Figure 4: Civilian Employed Population 2010-2014

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

	Civilian Employed Population						
	2014		2012		2010		2010-2014
Industry	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Regional Change**
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%
TOTAL CIVILIAN EMPLOYED POPULATION	19,399	100%	20,034	100%	20,585	100%	

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 show in Figure 5.

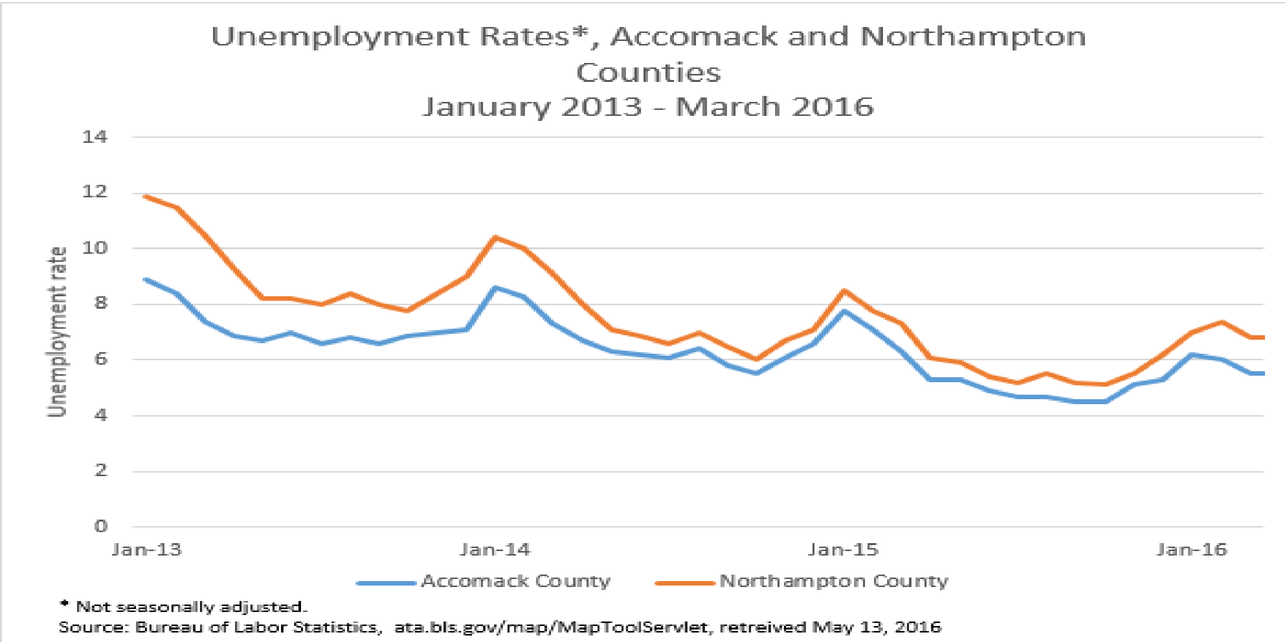


Figure 5: Regional Unemployment Rates, not seasonally adjusted, 2013-2016

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).

Jobs Counts by Counties Where Workers are Employed - All Jobs

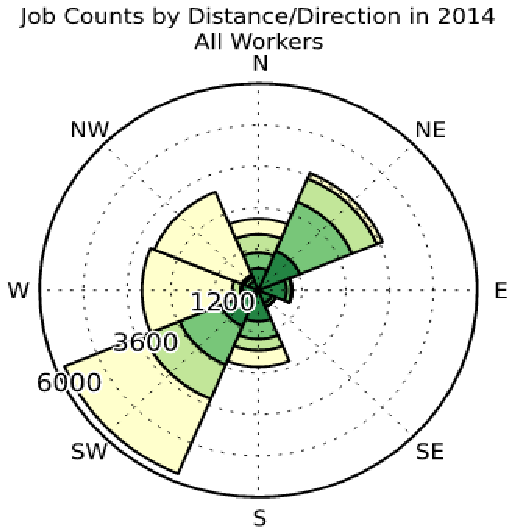
	2014 Count	2014 Share
All Counties	21,444	100.0%
Accomack County, VA	7,942	37.0%
Northampton County, VA	2,850	13.3%
Virginia Beach city, VA	785	3.7%
Newport News city, VA	703	3.3%
Fairfax County, VA	556	2.6%
Norfolk city, VA	516	2.4%
Worcester County, MD	503	2.3%
Wicomico County, MD	493	2.3%
Chesapeake city, VA	448	2.1%
Henrico County, VA	325	1.5%
All Other Locations	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



Jobs by Distance - Home Census Block to Work Census Block

	2014 Count	2014 Share
Total All Jobs	21,444	100.0%
Less than 10 miles	5,822	27.1%
10 to 24 miles	4,124	19.2%
25 to 50 miles	2,998	14.0%
Greater than 50 miles	8,500	39.6%

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.

Table 3: Eastern Shore Establishments by Industry Groups

	2013	2011	2009
Industry Code Description	**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
Total, All Establishments	1,077	1,105	1,156
Total Employees	11,611	12,068	12,635

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

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). 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, in the ‘Coastal Land’ data category.

BUILT INFRASTRUCTURE

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.

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
Total Housing Units	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%
Owner-Occupied	13,716 70.2%*	13,516 70.7%*	14,131 68.5%*
Renter-Occupied	5,900 30.2%*	5,605 29.3%*	5,489 26.6%*
Median Housing Value	$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).

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.

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

	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).

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.

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)

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.

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).

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 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.

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.

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 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 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.

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.

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 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.

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).

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.

SCHOOLS

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.

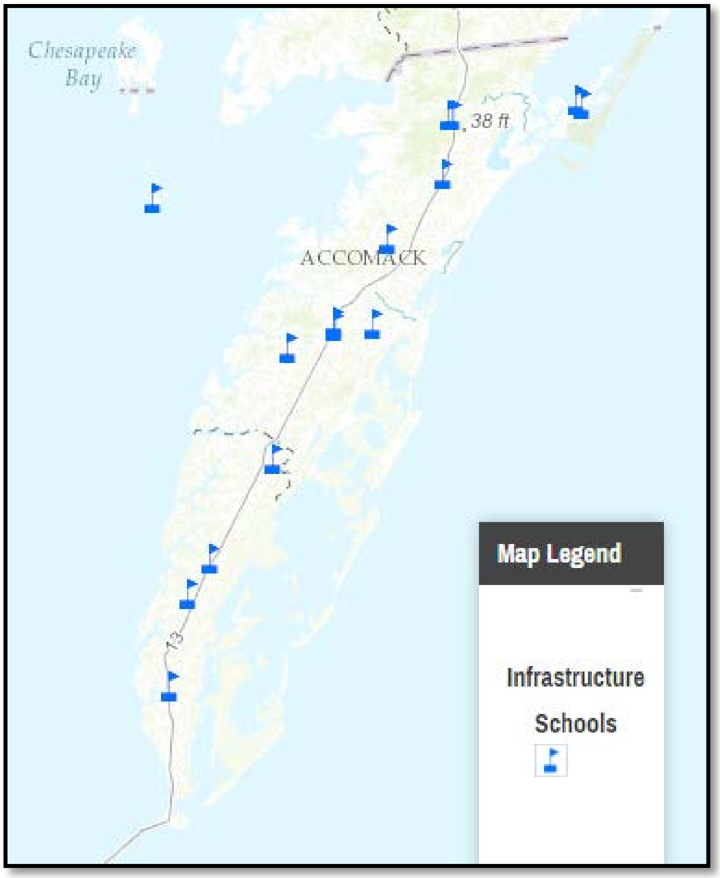


Figure 8: Location of 15 public schools in the region. Source: Accomack County, Northampton County, The Nature Conservancy, as depicted in coastalresilience.org

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), 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.

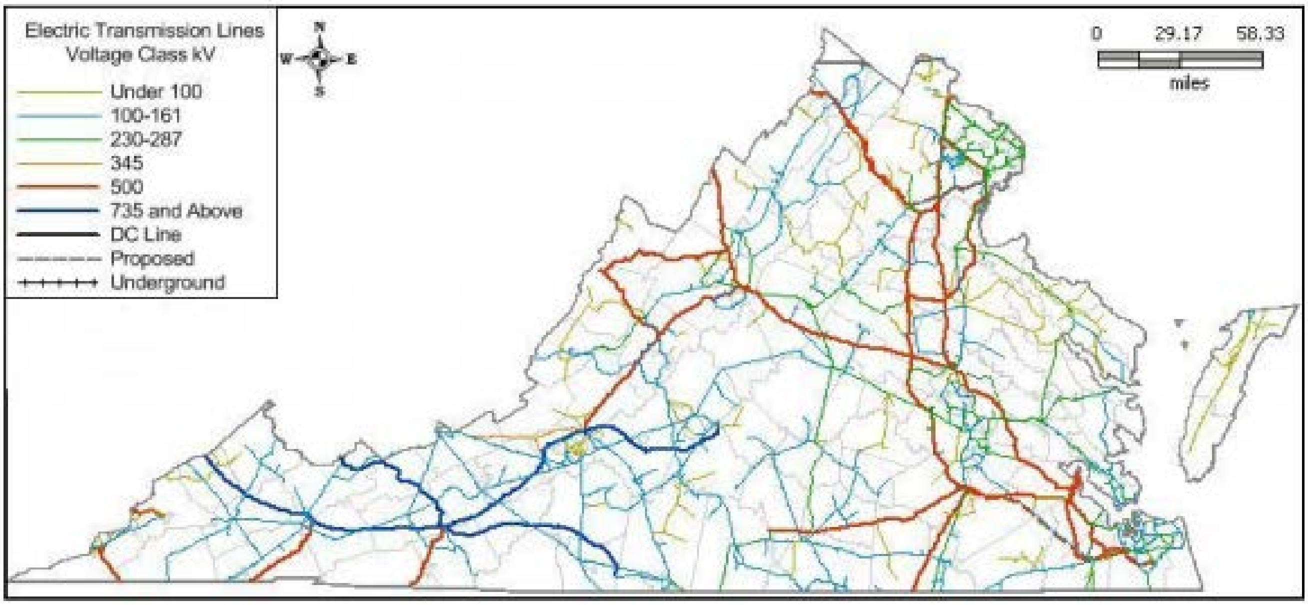
Both the University of Virginia and William and Mary operate coastal research facilities that are built at the water' and located at Wallops Island, has about a dozen member universities, and has been educating students of all ages for almost 50 years. The University of Virginia's Anheuser-Busch Coastal 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.

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).



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

Figure 9: Electric Transmission Lines

NATURAL ENVIRONMENT

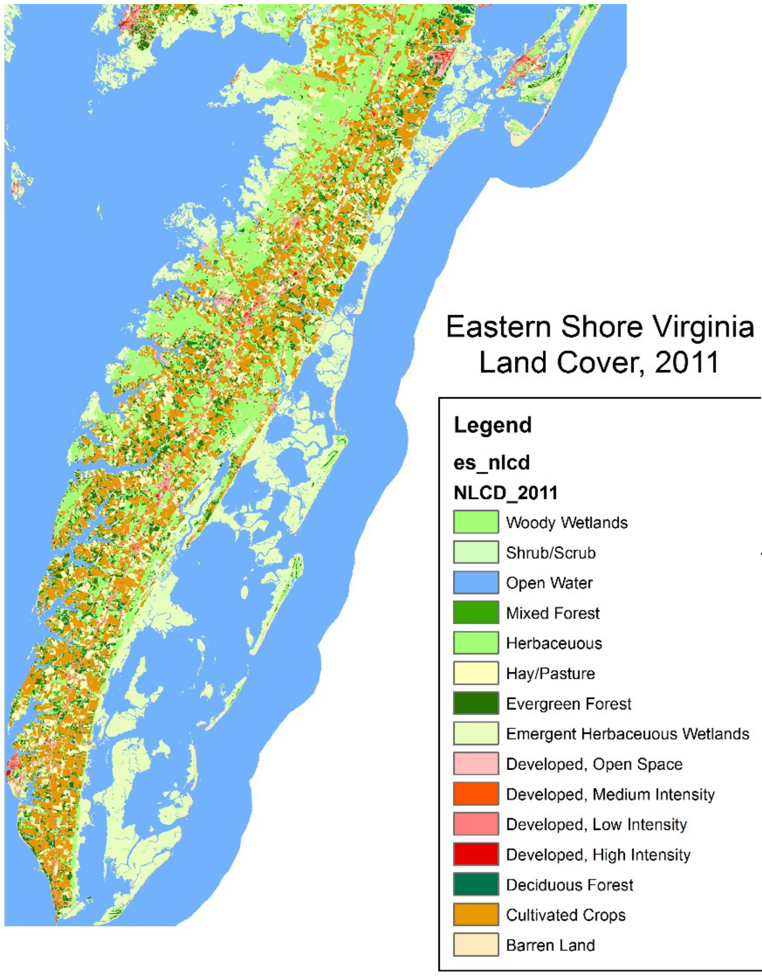
GEOLOGY AND SOILS

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.

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 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, Sherriff'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

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 are 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.

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
TOTALS	4,172	$943,812,200	$3,791,036	1,164	$13,001,738

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.[1] 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.

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.

[1] 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

Table 9: Regional Community Insurance Information

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
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

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
Northampton County	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

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
									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 uses. 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, 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.

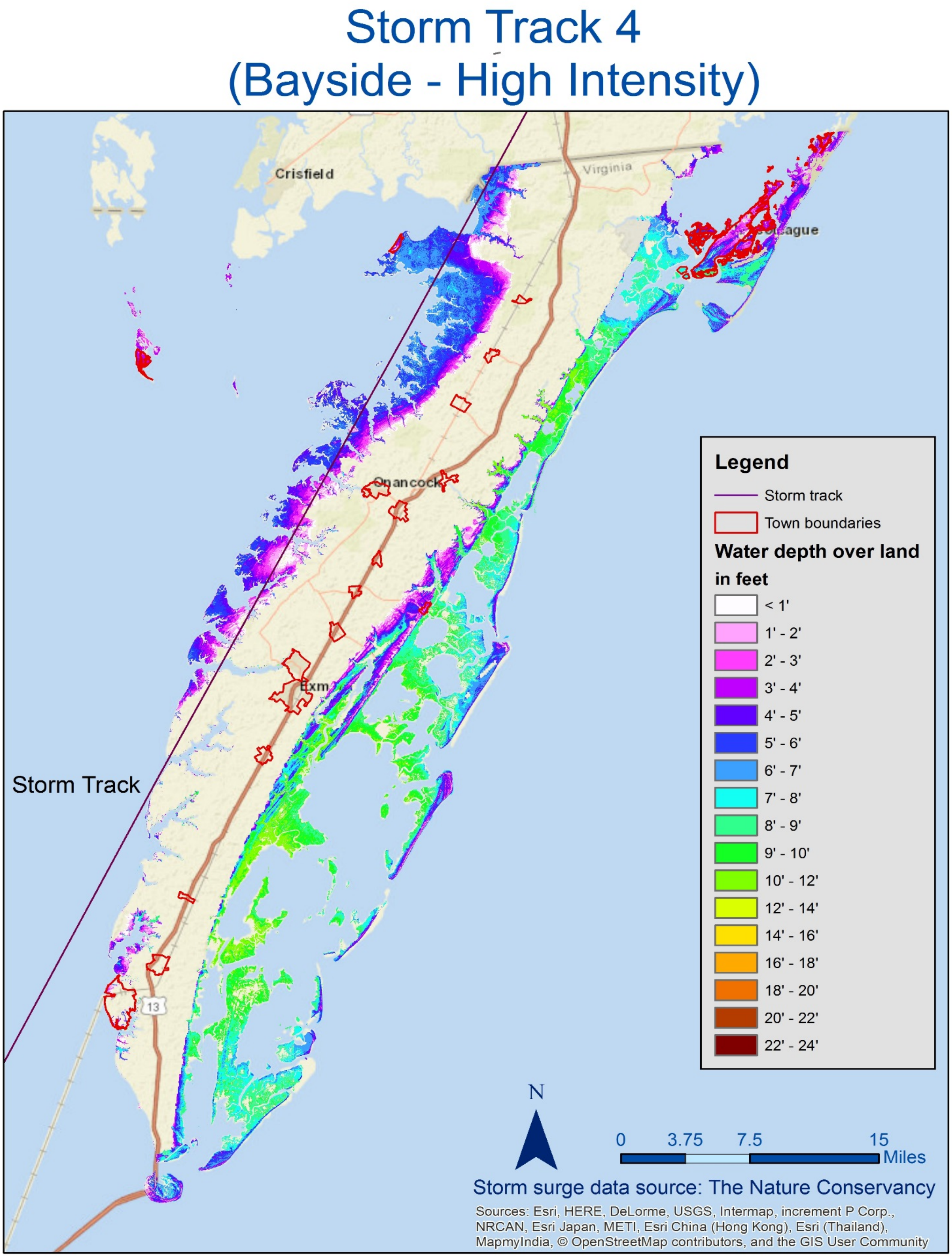


Figure 11: Storm 4: Bayside, High Intensity

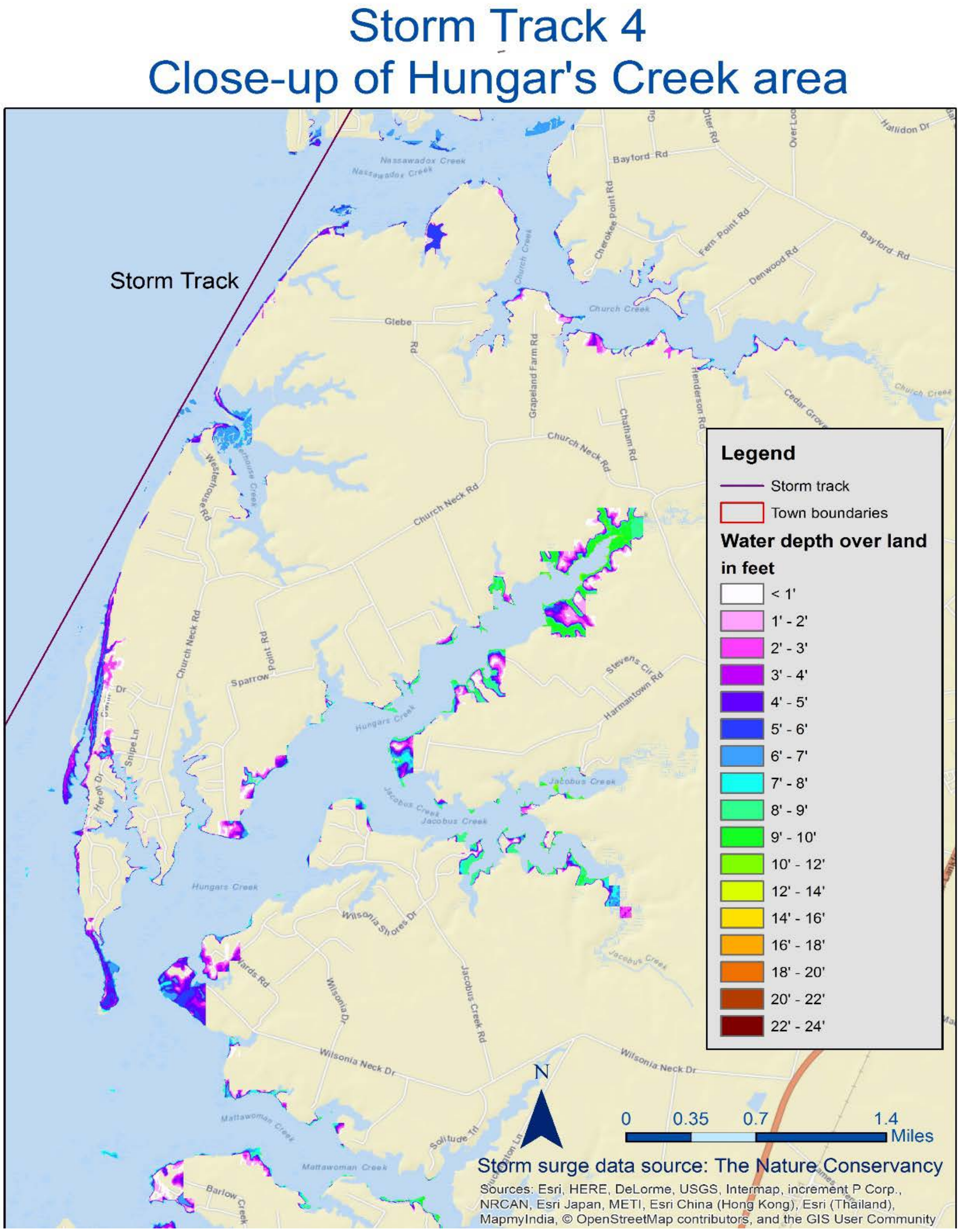


Figure 12: Close up of Hungars Creek under Storm 4 Scenario

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.

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.[2] 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).

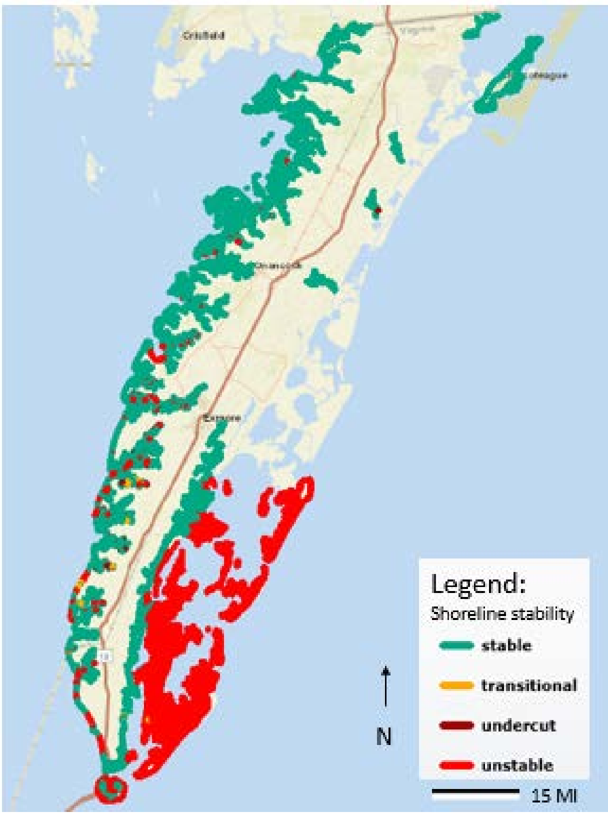
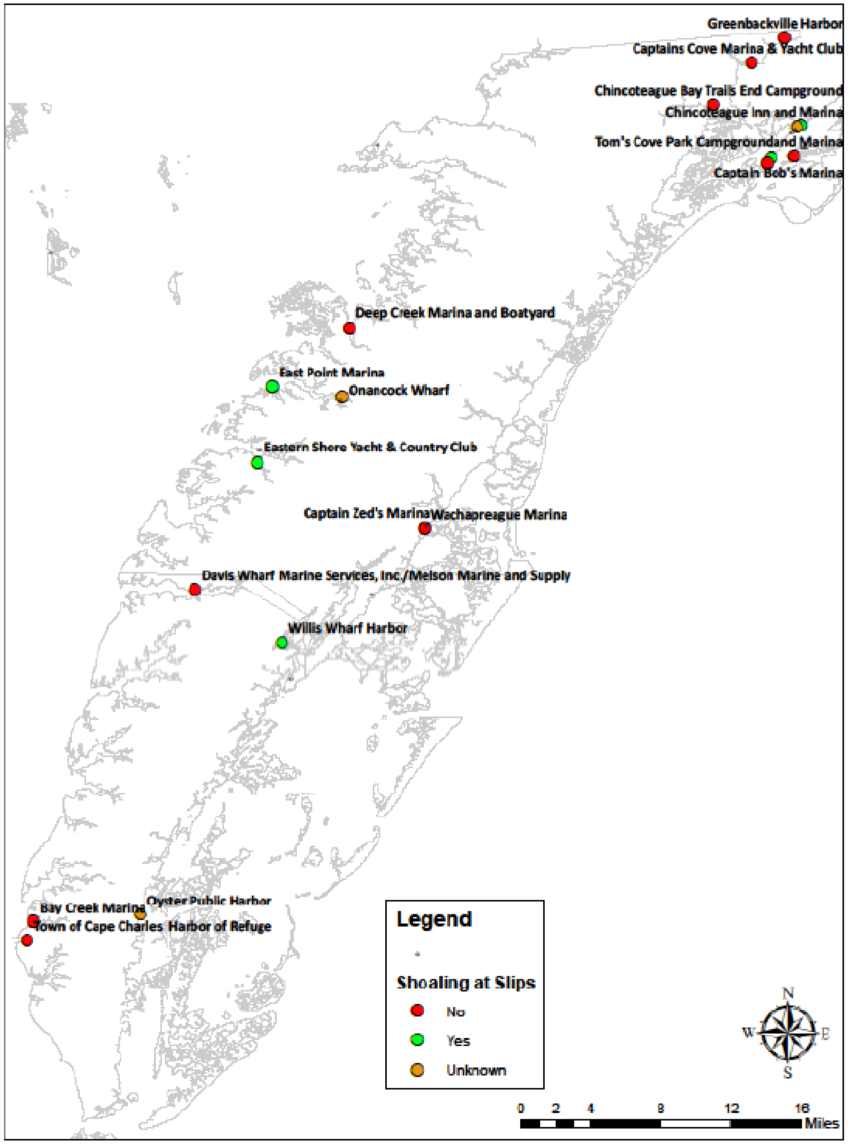


Figure 13: Shoreline stability, Eastern Shore

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.

[2] Data are scarce for early years, but are progressively more complete, especially after 1990.



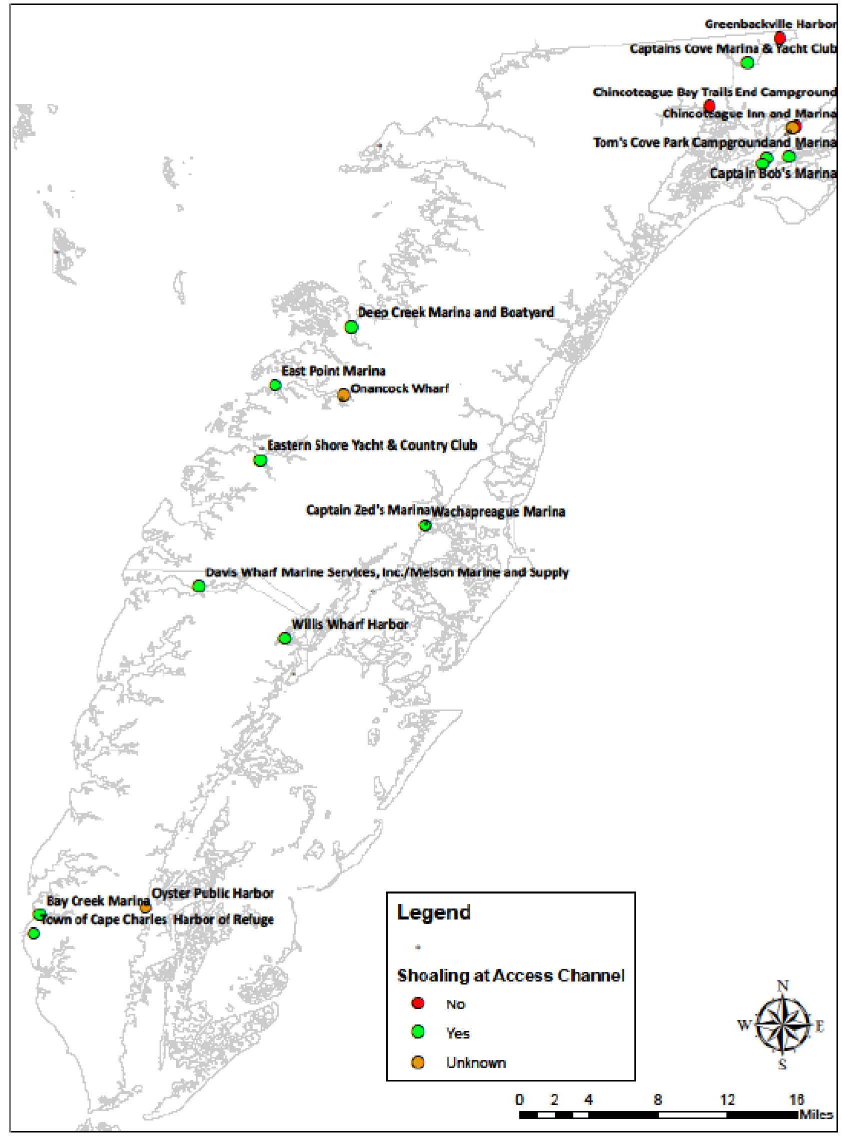


Figure 14: Shoaling at Eastern Shore slips and access channels in 2013. Source: Eastern Shore of Virginia Transient and Working Waterfront Infrastructure Needs Assessment, A-NPDC, 2013

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.[3] 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.

[3] Data are scarce for early years, but are progressively more complete, especially after 1990.

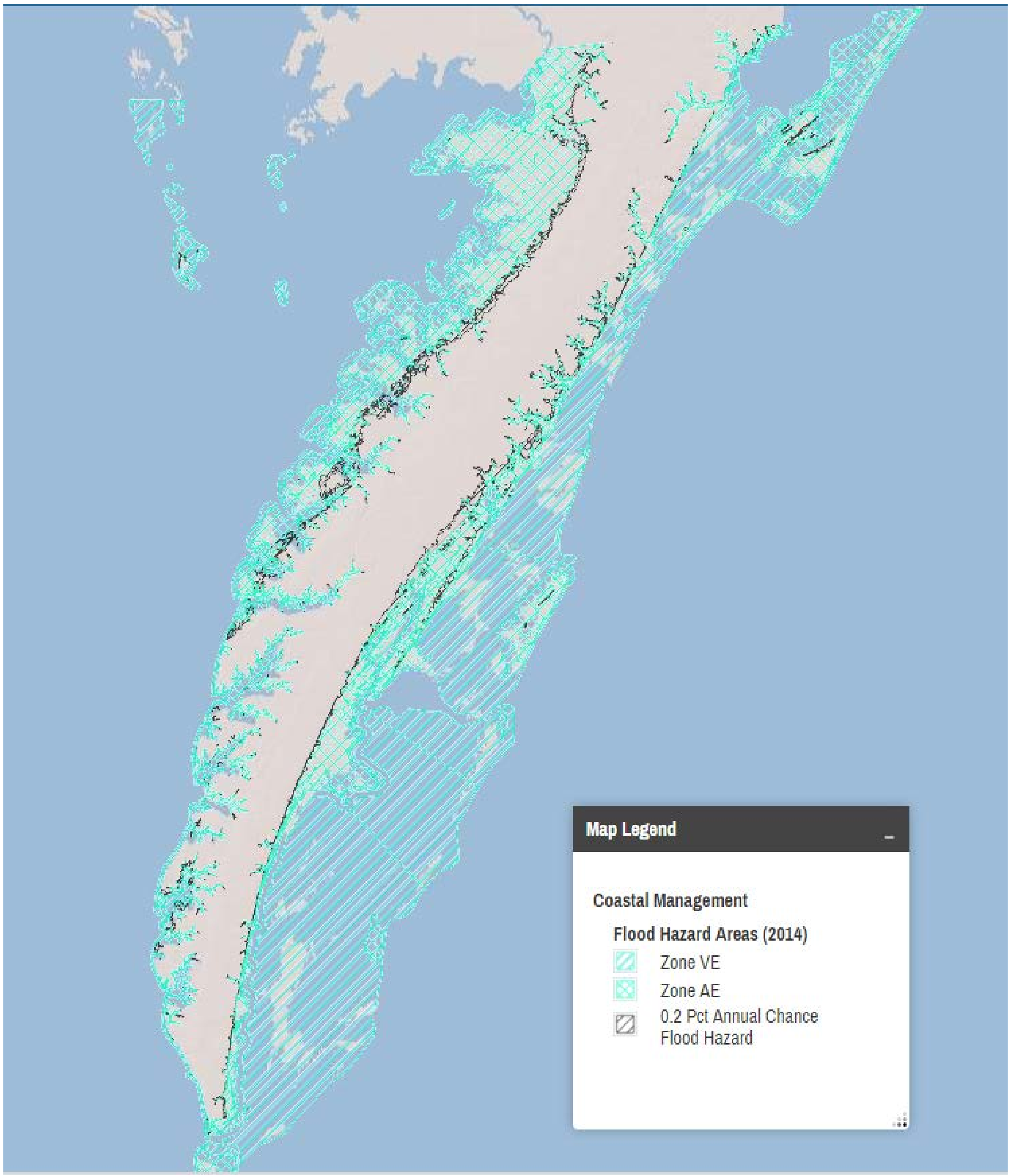


Figure 15: Special Flood Hazard Areas for Accomack and Northampton Counties.
Source: FEMA Flood Hazard Areas as depicted in coastalresilience.org

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.

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)
Accomack	27,422	3,539,966	1,627,855	1,316	287.02	6.45	6	68,727
Northampton	8,529	1,574,820	619,617	78	57.77	0.10	0	4.778
TOTALS	**35,951**	**5,114,786**	**2,247,472**	**1,394**	**344.79**	**6.55**	**5**	**73,505**

*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 A-NPDC 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:

- 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.

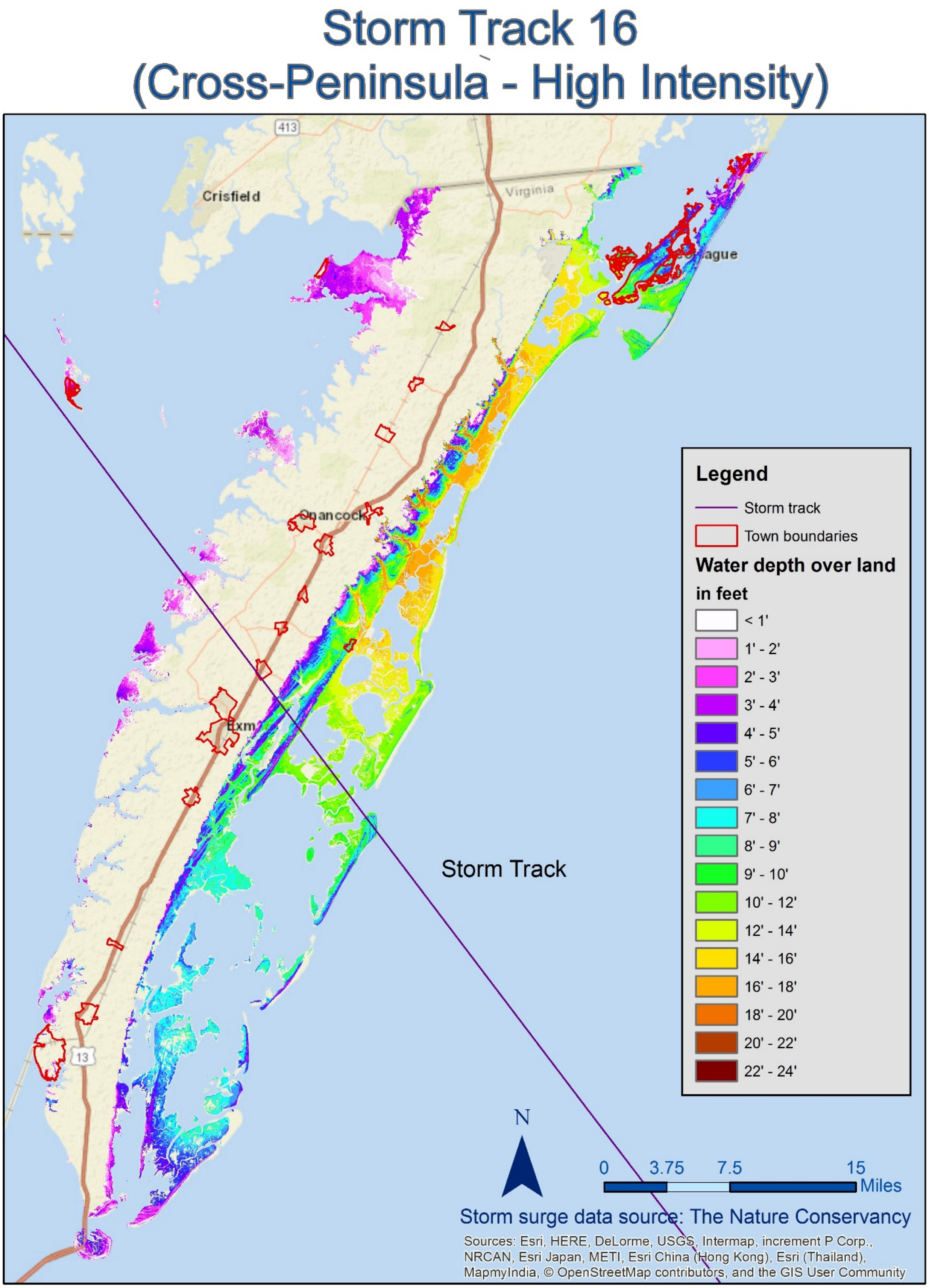


Figure 16: Storm 16: High-Intensity, Cross-Peninsula

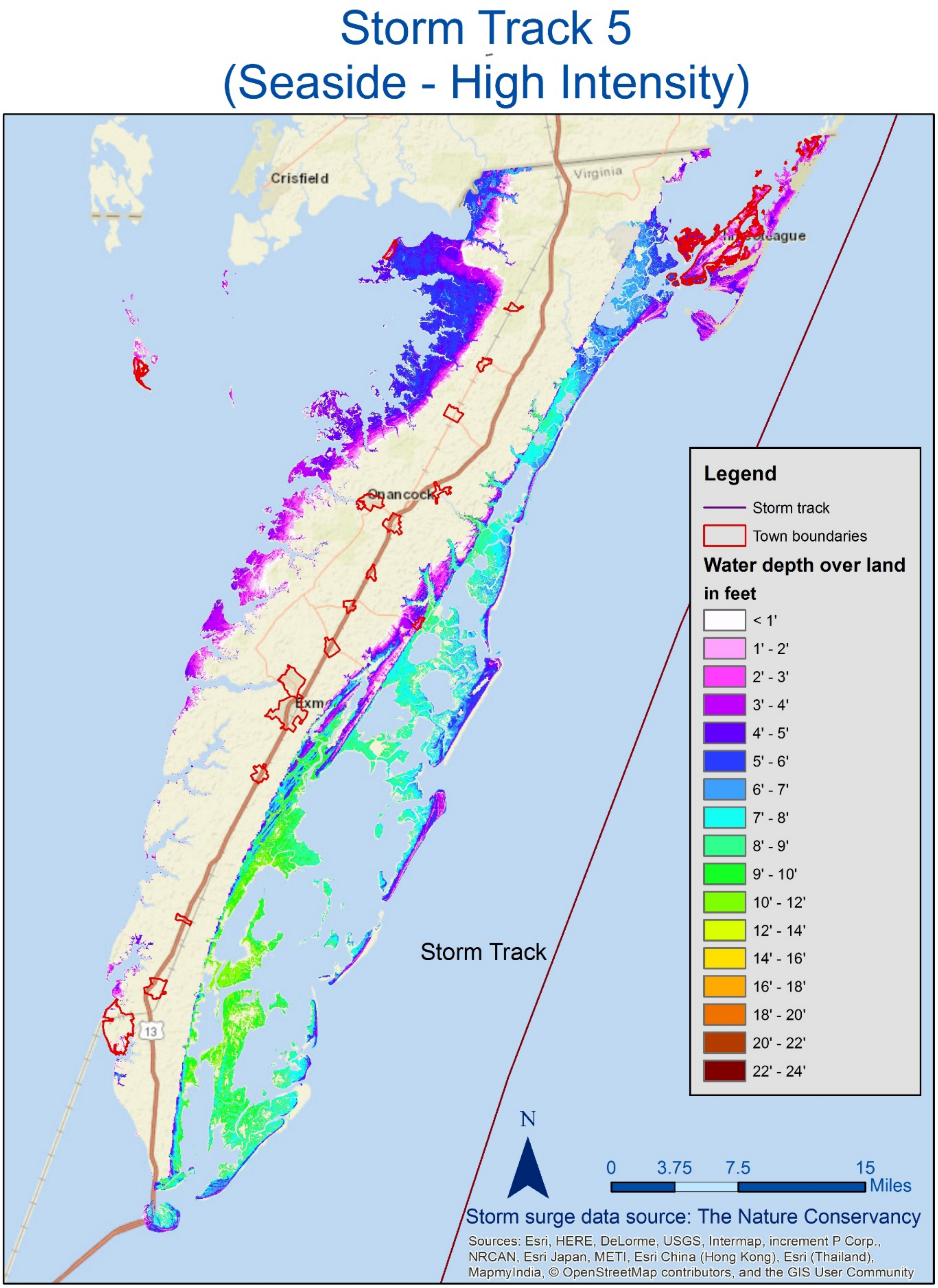


Figure 17: Storm 5, High-intensity, Seaside, with path similar to Hurricane Floyd

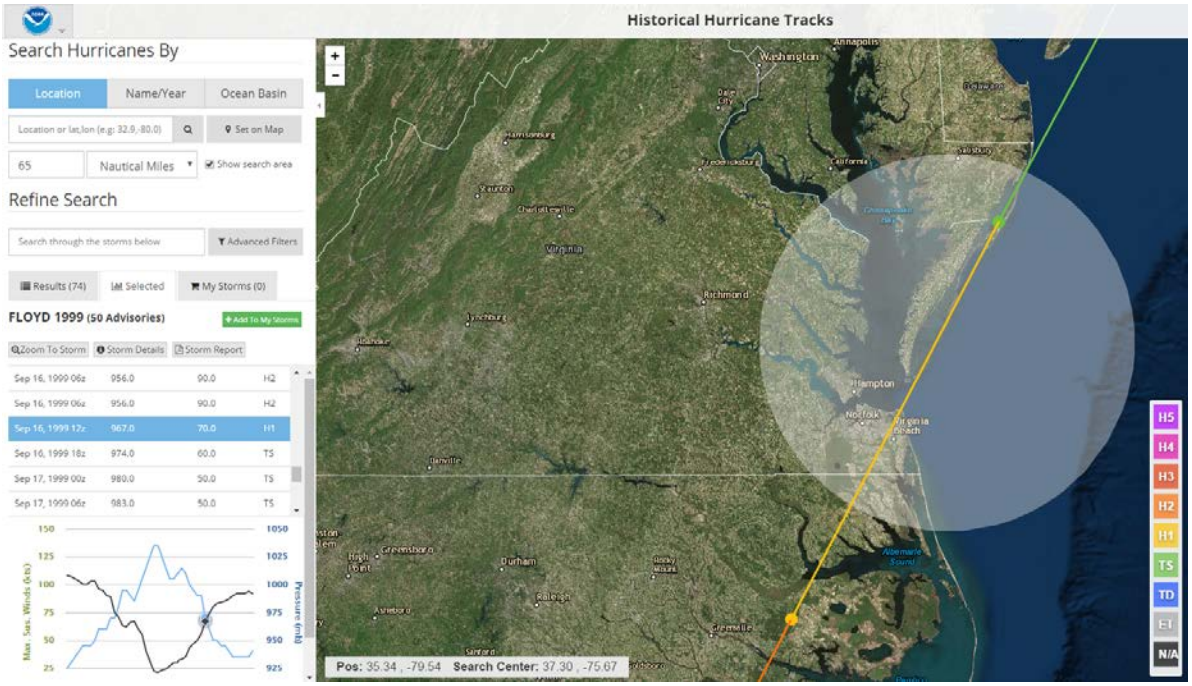


Figure 18: Hurricane Floyd (1999)

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 Sherriff'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.

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

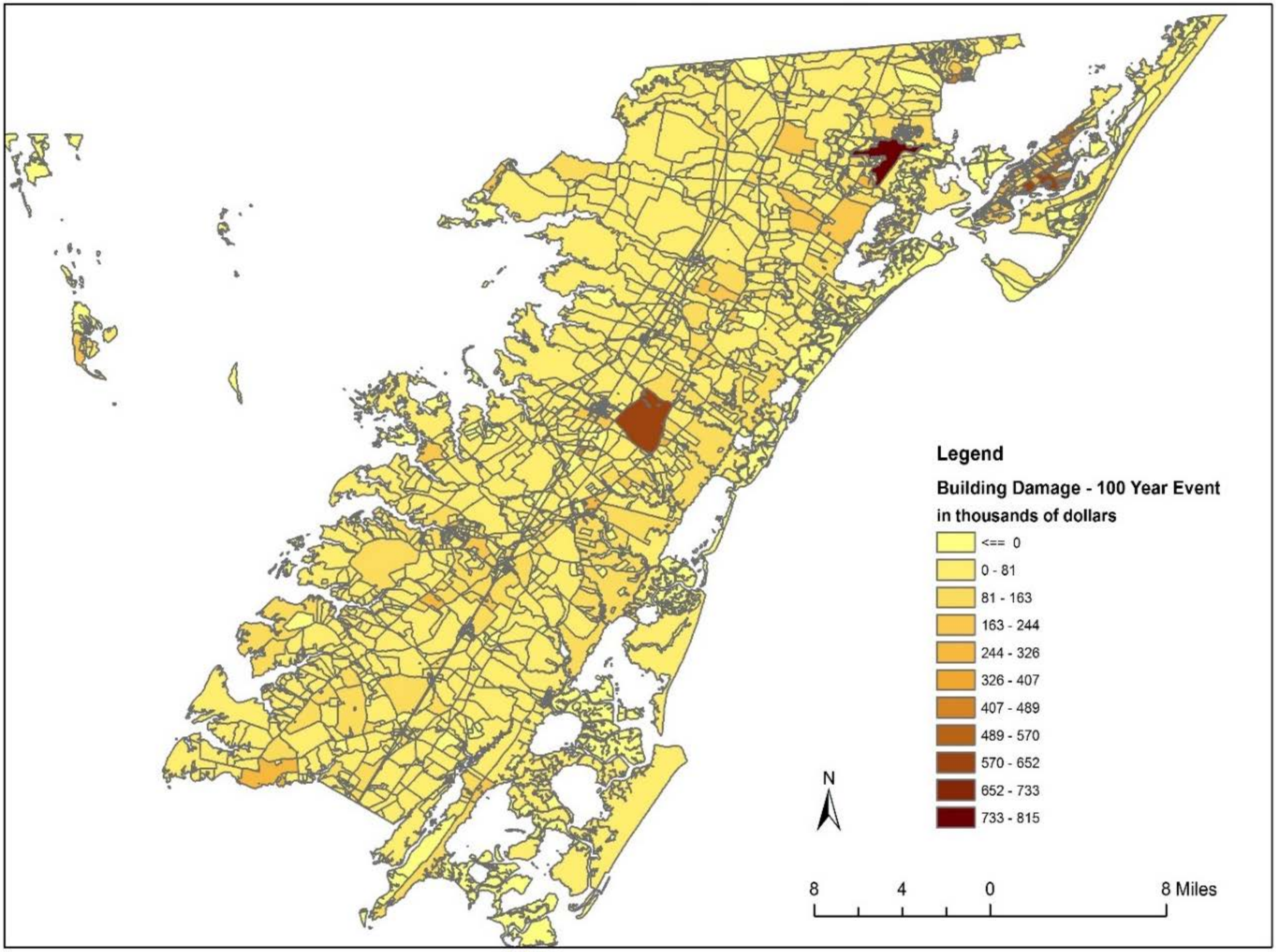


Figure 19: Estimated wind damage from 100-year hurricane, Accomack County

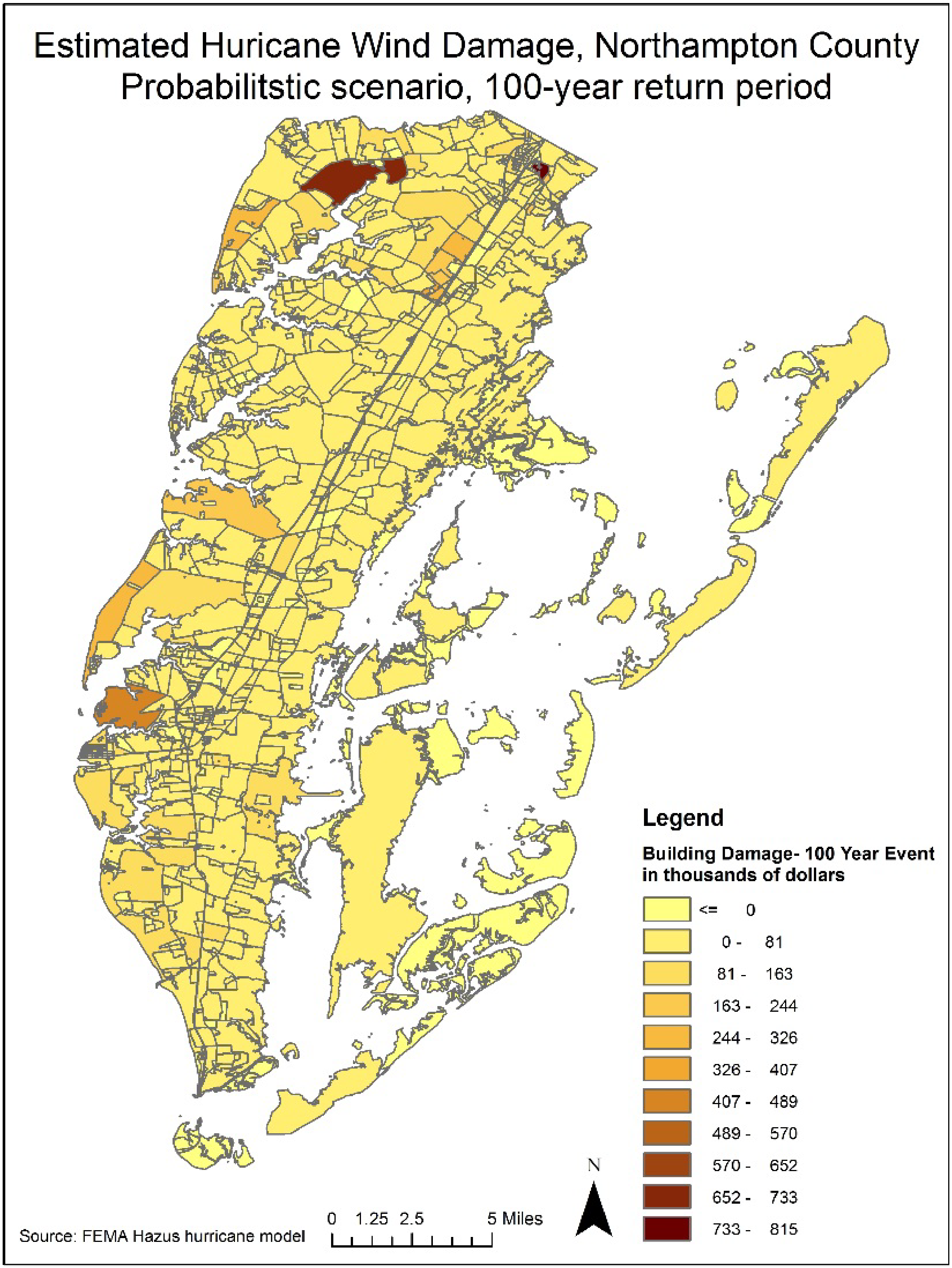


Figure 20: Estimated wind damage from 100-year hurricane, Northampton County

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.

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.

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).

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).

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.

FIRES

Fires that could been 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.

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.

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

FISH KILLS

Large die-off of fish can by 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 instance of broken fishing nets were also recorded in the PREP database.

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

BIOLOGICAL HAZARDS

Accomack and Northampton Counties are both active areas for tick and mosquito-borne illnesses. Tick-borne illnesses include Lyme disease, erhlichiosis, 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)

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.

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 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 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).

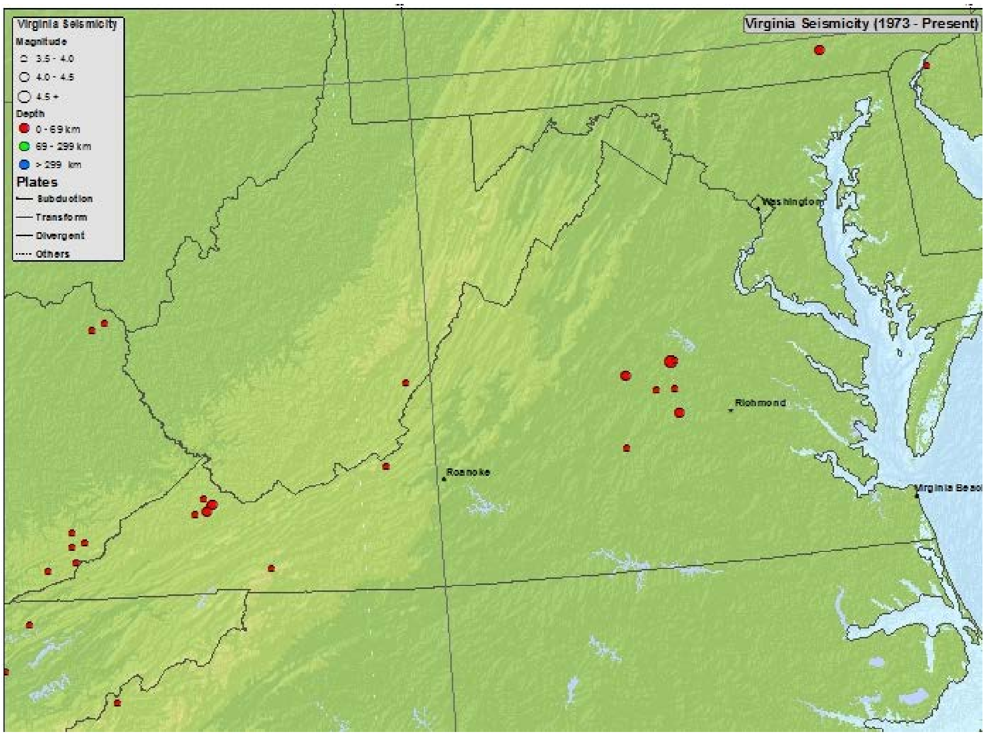


Figure 21: Virginia Seismicity 1973-Present

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

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.

ACCOMACK COUNTY

COUNTY PROFILE

Accomack County is the northern county on Virginia's Eastern Shore. It was formed from Northampton County in 1662. The original settlement of the County was scattered seaside and creek side plantations and farms. In the late 1600s, towns and villages gradually grew around the courthouse, ports and wharfs that the residents used to ship their goods to Europe. In the mid-1800s, the economy boomed as the coming of the railroad opened up the northern markets to seafood products. Trains carried seafood products north and brought tourists south and created many new towns along the spine of the County. (*Hazard Mitigation Plan*, 2011)

Figure 1: Accomack County Aerial Imagery

There are 14 incorporated towns in the County: Accomac, Belle Haven (portion located in Northampton County also), Bloxom, Chincoteague (most populated town), Hallwood, Keller, Melfa, Onancock, Onley, Painter, Parksley, Saxis, Tangier, and Wachapreague. The following information is for the unincorporated areas of Accomack and the incorporated Towns of Accomac, Belle Haven, and Painter. Information for the other incorporated towns in Accomack are located in later chapters. These Towns include Bloxom, Chincoteague, Hallwood, Keller, Onancock, Onley, Parksley, Saxis, Tangier, and Wachapreague

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 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

The 2014 American Community Survey estimate indicated the County had a population of 33,165, which would indicate that the population is remaining more or less steady and has not declined much since 2000. The median age for residents in Accomack County in 2014 was indicated to be 44.9, which is about 8 years higher than that of both the state and nation, and is an increase from 2000. Often individuals in a higher age bracket require additional assistance, particularly in the case of an emergency. County representatives indicated that there has been an increase in the non-English speaking population, particularly Creole and Spanish speaking residents. These residents often require specific attention when reaching out to educate the public about preparations prior to and instruction during and following an emergency.

Table 1 : Accomack County Demographic Information

	2014*	2010**	2000***
Population	33,165	33,164**	~~38,305~~ Figured disputed by County and determined to be 34,488****
Median Age (Years)	44.9	44.7**	39.4
Disability	3.8%	3.2%**	19.9%
Income			
Median Household Income	$39,389	$41,372*	$30,130
Poverty Level	20.5%	34.7%*	18.0%
Language			
Only English	89.6%	91.3%*	93.3%
Other	10.4%	8.7%*	6.7%
Spanish	8.3%	6.9%*	5.7%
Ind-Euro	1.9%	1.4%*	0.7%
Asian	0.2%	0.3%*	0.2%

* ACS 2009-2014, ** U.S. Census 2010, *** U.S. Census 2000, **** 2014 Accomack County Comprehensive Plan

As illustrated in Table 1, there was a significant increase in the poverty level from 2000 to 2010. Hopefully the ACS estimates for 2014, which reveal a decrease in the percentage of the population within the poverty level, is accurate. Values from Table 1 also indicate that the non-English speaking population is increasing. Populations living in poverty, and populations that do not speak English often are at a disadvantage in their ability to receive imperative information for preparing for and recovering from hazards.

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. Additionally, they can identify where disruptions in employment and income might occur in the aftermath of a disaster.

The County is primarily an agricultural community with the largest two employers in the County being The Tyson Farms and Perdue Products poultry processing facilities, these two employ approximately one quarter of the jobs in Accomack County. Other large employers include The County of Accomack, the School Board, NASA, Eastern Shore Community Services, Shore Memorial Hospital, Byrd Food, and more. Although agriculture can take some time to recover following a hazard, the United States Department of Agriculture (USDA) Farm Service Agency provides assistance for natural disaster losses, which enables farmers to rebound more easily following severe weather events. Both Tyson Farms and Perdue have disaster plans, however, a long-term closure of either facility would create a problematic scenario for the County and prevent many of the residents from being able to rebound following the cause of the closure.

Although a respectively smaller group of the employed population work in fishing and aquaculture, it is a culturally invaluable trade. In the year 2000 there were 599 commercial licenses and zero aquaculture permits issued by the Virginia Marine Resources Commission (VMRC). In 2010 VMRC issued 475 commercial licenses, but also 153 oyster aquaculture permits and 116 clam aquaculture permits, revealing an increase in the number of individuals who make their living working on the waterways of the Eastern Shore. There is an observation that many of the individuals who were previously employed as migrant workers are staying on the Eastern Shore year-round and working in the aquaculture industry. Because clam and oyster aquaculture is a long-term investment, with oysters typically taking about three years to reach suitable size for market, and because the equipment can be costly, this important industry could take years to rebound following a damaging storm event.

Table 2 : Accomack County Workforce

Civilian Employed Population						
Industry	**2014***		**2010***		**2000****	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Agriculture, forestry, fishing/hunting, or mining	669	4.6%	740	4.9%	1,050	5.8%
Construction	873	6.0%	1,283	8.6%	1,357	7.5%
Manufacturing	2,276	15.8%	1,960	13.1%	2,945	16.4%
Wholesale trade	785	5.4%	860	5.7%	697	3.9%
Retail trade	1,619	11.2%	1,770	11.8%	2,963	16.5%
Transportation and warehousing, and utilities	310	2.1%	470	3.1%	581	3.2%
Information	137	0.9%	259	1.7%	19	0.1%
Finance, insurance, real estate, and rentals	299	2.1%	729	4.9%	702	3.9%
Professional, scientific, waste management	1,339	9.3%	1,067	7.1%	940	5.2%
Educational and health care services	2,922	20.2%	2,879	19.2%	2,696	15.0%
Arts, entertainment, recreation, food	1,575	10.9%	1,183	7.9%	1,567	8.7%
Public Admin	1,105	7.7%	1,257	8.4%	1,181	6.6%
Other	524	3.6%	512	3.4%	740	4.1%
TOTAL CIVILIAN EMPLOYED POPULATION	14,433	-	14,972	-	17,983	-

Source: * ACS, 2010 – 2014; ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

According to Table 3, the County has seen a steadily declining business presence over the last five years, and the total civilian employed population has also declined respectively.

Table 3 : Accomack County Business Types

Industry Code Description	**Total Establishments**		
	2014	**2012**	**2010**
Agriculture, Forestry, Fishing, and Hunting	**4**	4	3
Utilities	**4**	4	2
Construction	78	81	96
Manufacturing	19	17	21
Wholesale Trade	24	28	31
Retail Trade	168	173	168
Transportation and warehousing	17	23	22
Finance and insurance	31	15	16
Information	13	32	35
Real Estate and Rental and Leasing	37	38	39
Professional, Scientific, and Technical Services	59	64	71
Management of Companies and Enterprises	3	3	3
Administrative, Support, Waste Management	26	25	27
Education Services	3	2	2
Health Care and Social Assistance	55	57	61
Arts, Entertainment, and Recreation	17	15	20
Accommodation and Food Services	97	101	106
Other Services (except Public Administration)	86	92	103
Industries not Classified	1	-	-
Total, All Establishments	742	774	826

Source: Census Zip Code Business Patterns, 2014

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

As Table 4 reveals, there has been very little change in the number of housing units in the County. The table also indicates that over a quarter of the total housing units are vacant. According to County representatives, however, only about 800 homes in the unincorporated areas of the County are unoccupied (County staff, personal communication, July 14, 2016), this large variance could be due to the U.S. Census Bureau's definition of 'vacant' which can be found in the definitions at the beginning of the Plan. Often unoccupied houses are not properly maintained and can cause additional debris hazards during high wind events. Between 1990 and 2005, over half of the new housing units were manufactured units (2014 Comprehensive Plan). These manufactured homes are typically more susceptible to storm damages incurred from winds and flooding.

Table 4: Accomack County Housing

	2014*	2010**	2000***
Total Housing Units	21,054	21,002	19,550
Occupied	14,289	13,798	15,299
Vacant	6,765	7,204	4,251
Owner-Occupied	10,053	9,963	11,482
Renter-Occupied	4,236	3,835	3,817
Median Housing Value	152,500 (owner occupied only)	NA	NA

Source: * American Community Survey, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary. As of 2014, it is estimated that about 10% of the County's occupied residences are without even a single vehicle. This is actually a slight decrease since 2000, although the number of residences without a vehicle is about the same. This can be assumed to be due to the fact that the owners of the estimated 1,504 new residences since 2000 most likely have at least one vehicle.

Table 5: Accomack County Vehicles Available per Households

Vehicles Available	2014*	2010**	2000***
None	1,470	2,574	1,447
One	4,664	8,744	5,570
Two	5,263	11,294	5,686
Three or more	2,892	5,558	2,596

* American Community Survey, 2010-2014, ** American Community Survey, 2006-2010, *** U.S. Census 2000

Star Transit provides substantial, daily services up and down the Eastern Shore. The Greyhound bus line typically offers to travel times from the Eastern Shore across the Chesapeake Bay Bridge Tunnel, however, does not have a stop in Accomack County, but rather right at the County line with Northampton in the Town of Belle Haven. The cost is not very high (about $20 each way to either Norfolk or Salisbury), however, this service would probably not run during an emergency, and doesn't have the capacity to evacuate all residents without a vehicle.

Prior to the construction of the railroad in 1884, water-based transportation dominated the region. Water-transportation is still vital in Accomack County. Used both commercially and recreationally for enjoyment and fishing activities, the waterways are essential to the economy of the County. The Town and Island of Tangier relies upon personal vessels and the ferries to gain access to the mainland and its essential commodities. Dredging of these channels is vital not only for safe transportation, but also for the local economy. The Regional Dredging Needs Assessment was completed in the fall of 2016 and provides detail about the condition of navigable waterways in the region.

The Accomack County Airport (MFV) sits on 410 acres and is the only public airport on the Eastern Shore of Virginia. The runway is lit and is 100' wide and 5,000' long. The airport also has eighteen hangars and jet fueling services. This is also the location of the Automated Weather Observation System AWOS III. Although the train tracks are still active, they have not offered passenger services on the Eastern Shore of Virginia in over 50 years.

COMMUNITY SERVICES AND FACILITIES

Community facilities support the services and functions provided by the County government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the County and its citizens. It is important to note what facilities are available in case of a hazard, and it is important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

Emergency Services in Accomack County are provided by 50 career personnel and over 600 volunteer members. Services are delivered from 14 independent volunteer fire companies and 1 independent volunteer rescue squad. Crews respond to an estimated 7,000 calls annually. In addition to emergency response, the Department of Public Safety personnel provide free smoke detector program, disaster preparedness presentations, Emergency Response Training (CERT), community CPR training, and staff serve on regional committees to advance emergency services within the County and region. (Accomack County Department of Public Safety web page, July, 2016) The Regional Chapter has details on the capabilities of each response facility.

All of the volunteer fire departments in the County are struggling to obtain an adequate amount of funding and number of volunteers. A lack of fire and EMS volunteers create additional demand on County resources. The Onley Fire Rescue is scheduled for potential closure, but the 20-minute response time for the area that it currently serves would still be upheld by the three adjacent volunteer fire departments.

With 26 deputies, the Accomack County Sheriff's Department responded to more than 9,500 calls and 1,450 arrests in 2015. None of the police stations are located within the SFHA.

According to FEMA estimates using Hazus, during a 1-percent-annual-chance flood event, of the 13 total fire stations in the County, 1 would be completely lost and 3 would be at least moderately damaged. According to Hazus, all of the police and fire stations are to be unaffected by a 1-percent-annual-chance wind event, although this statement is not supported by local representatives (County Staff, personal communications, July 14, 2016).

MEDICAL SERVICES

Although there is currently not an operating hospital in the County, the new Shore Memorial Hospital construction between Onley and Onancock will be completed by the end of 2016. The County has just hired 12 EMS personnel, as many of the fire companies also provide EMS services. There is currently a transition under way, in which the Wachapreague station will be discontinuing EMS services and the Painter station will be starting to supply EMS services, this will strengthen the effectiveness and decrease the EMS response time in the southern reaches of the County.

Of the five the Eastern Shore Rural Health System Medical Centers and four Dental Offices, most are located in Accomack County in Onancock, Onley, Atlantic, Parksley, Melfa, and Chincoteague.

PARKS AND RECREATION

The Accomack County Department of Parks and Recreation maintains three parks and a golf driving range at Pungoteague Elementary School (35 acres). Arcadia Park (25 acres), Wachapreague Park (15 acres), and Nandua

Middle Park are used extensively for picnics, reunions, family gatherings and excursions. By fall of 2016, Accomack County's new Central Park is scheduled to open. The new park is located at the former Jones Lumber property adjacent to the Town of Accomac, and will include softball, football, and soccer fields, and a field house for activities such as batting cages, indoor soccer and basketball, as well as a playground and other amenities.

The County maintains twenty-seven water access sites of varying infrastructure, only two of which (Greenbackville and Quinby Harbors) incur any fee for use. A list of these access points with their location and facility types can easily be found on the Accomack County website. There is extremely limited access to beaches in Accomack County. The beaches of Assateague Island in Chincoteague National Wildlife Refuge are accessible for a fee. There are two other water access sites which have a limited amount of sand and even more limited parking, including Guard Shore. Mutton Hunk is the only Natural Area Preserve in the County with public access, and although there are two walking trails and seaside bay views, there is no water access.

WATER SUPPLY AND WASTEWATER

Most residents rely on private wells and septic systems for their water supply and wastewater disposal. The only two public Waste Water Treatment Plants in the County for residential sewage treatment are in the Town of Onancock and Tangier. There are several private sewage treatment plants, including NASA WFF designed to 800,000 GPD and Captain's Cove in Greenbackville designed to serve over 200 residences. The Captain's Cove facility has two lagoons for onsite effluent treatment and in 2016 updated their VDEQ permit to allow for infiltration polishing basins. In the past, poor soils limited development on some vacant parcels of land in the County, but above-ground septic technologies have made some previously undevelopable parcels available for development. However, these systems are much more expensive to build and to maintain than traditional systems.

The largest industries which discharge wastes directly into surface waters are Perdue, Inc., Tyson, NASA Wallops Flight Facility, the Town of Onancock's WWTP, and six seafood facilities. Although surface water in the County is not used for human consumption, it is important for recreation and shellfish harvesting, and thus water quality must be protected, in accordance with the State Water Control Law. According to the 2014 VDEQ Water Quality Assessment Integrated Report, all almost all of the creeks in the County are considered impaired due to various causes such as pH, Enterococcus, Fecal Coliform, benthic-macroinvertebrate bioassessment, E. Coli, dissolved oxygen, etc. There are many causes for the various impairments, including wildlife, however, it is worth noting that there are an estimated 200 to 400 homes Shore-wide lacking any plumbing. This is a source of contamination that could be avoided, while at the same time directly improving the quality of life of individuals living in these conditions.

Due to the sole source aquifer designation of the Eastern Shore's water supply, Accomack County has revised its zoning ordinance to require that groundwater protection be considered in all major site plan review. The primary concern is not quantity of water in the York-Eastover aquifer, but rather quality, as salt water intrusion has already been documented in some coastal areas.

SOLID WASTE

The County operates seven Convenience Centers, all of which are closed one day each week (staggered) and offer recycling, tire, and used oil disposal, some offer disposal of scrap metal including appliances, but none accept commercial waste. There is one landfill and one landfill transfer station, which meet the disposal needs for commercial operations, construction companies, and households.

POWER AND COMMUNICATIONS INFRASTRUCTURE

Recently Old Dominion Electric Cooperative (ODEC) in cooperation with Accomack and Northampton Electric Cooperative (ANEC) replaced the main transmission line between Tasley and Exmore. This project extended the redundant line from the state line to Tasley that was installed several years ago (Janelle Dawkins, ANEC, personal communication, July 28, 2016). There are plans to add more redundant lines, which will help ensure that long-term power outages are not a wide-spread concern on the Eastern Sore. Maintaining and advancing our infrastructure is key to increasing our resiliency in the occasion of a hazard. In the last year there have been three large solar projects initiated, two 80-megawatt projects in Accomack County (one proposed, one approved) and one 20-megawatt project approved in Northampton County. This is a new land use, has required rezoning and additional permits, and decreases acreage available for agriculture, as currently there are currently no designated joint land uses for these operations.

One of the goals of the Accomack County Information Technology Department is to create an IT Disaster Recovery Plan, which has already been drafted, but is not a document for public use. This will aid in the County's ability to maintain efficiency following an IT Disaster.

The Eastern Shore of Virginia Broadband Authority (ESVBA) network of fiber cable stretches from Virginia Beach to the Maryland border and serves as the electronics 'backbone', providing high-speed internet to both Counties. That said, the majority of service is provided along Route 13 and there is still a high percentage of underserved households in Accomack County. Wide-spread high speed internet provides residents with the capability to take advantage of educational opportunities, work from home, etc.

DRAINAGE DITCHES

The County relies on VDOT for the maintenance of ditches along state maintained roadways, but is responsible for maintenance of all ditches along county roads and between properties that drain state ditches. There are approximately 1,516 miles of primary and secondary roads in Accomack and Northampton Counties (Virginia Base Mapping Program Road Centerline Data, 2014).

SCHOOLS

Schools are important to consider for disaster readiness and during an actual emergency. Schools offer an opportunity to teach children and adults how to effectively and efficiently respond to many emergency situations. However, they are also areas of concentrated high risk individuals, particularly primary schools with the youngest students. The Accomack County Public School Division is responsible for such planning. Each school has a Crisis Response Team, an emergency radio to receive updates on weather situations, two-way radios, a Crisis Management Plan for all bus drivers, and a pre-recorded warning message system.

There are six elementary and five secondary schools in the Accomack County school system, the location of these ten schools can be seen in Figure 2. In addition, there are four private schools in the County. According to FEMA estimates using Hazus, during a 1-percent-annual-chance flood event, of the fourteen total schools, Chincoteague Elementary would require more than a year to restore while the Tangier Combined School would only suffer minor damages. There are also an estimated 26 daycare facilities in the County, some are located in Accomac, Horntown, Hallwood, Tasley, Onley, Parksley, and Atlantic. Arcadia Middle School and Nandua Middle School are the emergency shelters for the County. The County has previously expressed willingness to open their shelters, and even additional schools if necessary, to Northampton County residents as well, since their neighbor to the south currently have no shelter. Six of the County's schools are designated emergency shelters and can be easily found on their website.

The Eastern Shore Community College in Melfa provides opportunities for residents to continue their education. The facility has also been used as a base of operations during times of declared emergency and will be building a new, generator-equipped building in the near future.

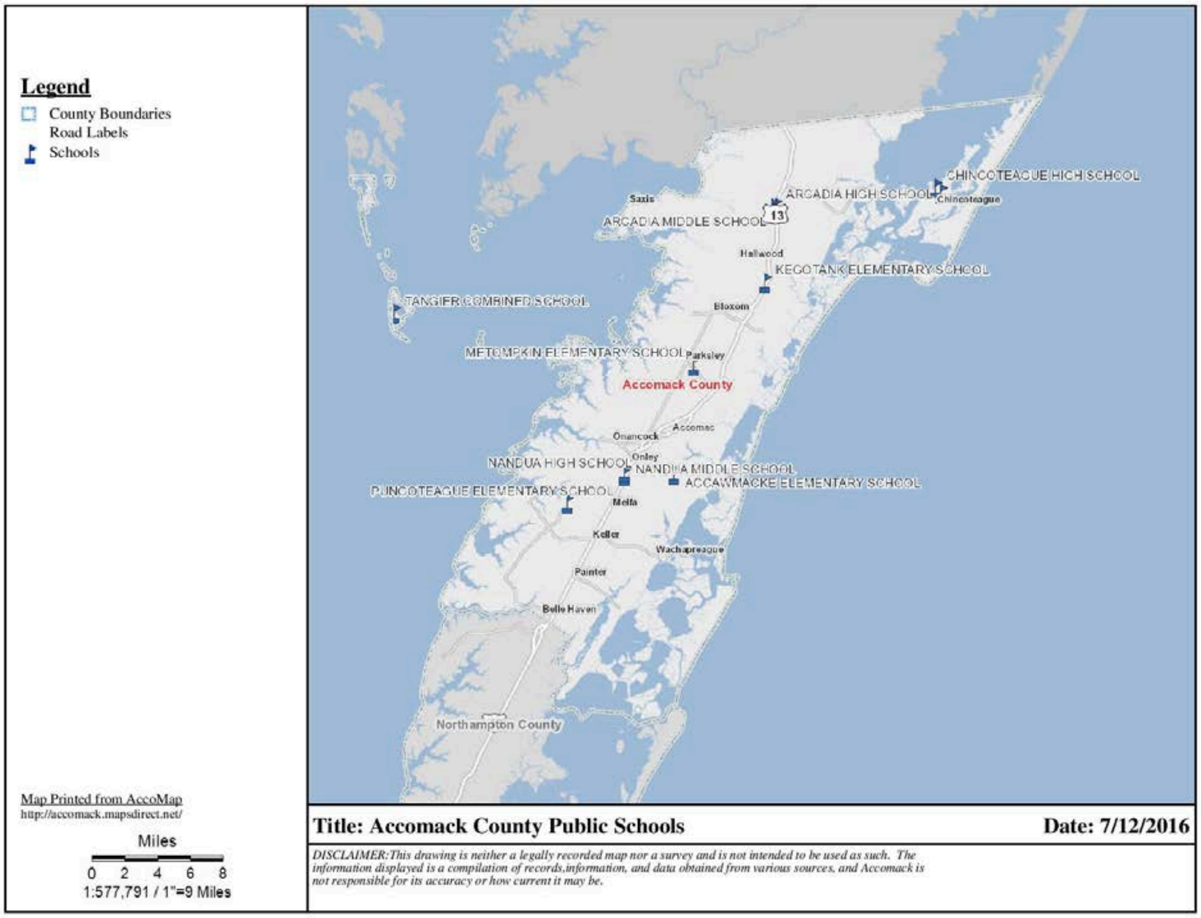


Figure 2: Accomack County Public Schools

CULTURAL RESOURCES

Although the County has several building museums, Kerr Place, Locustville Academy, the Debtors Prison, the Railway Museum, Tangier Island Museum, etc., there is no interpretive center or readily available materials that comprehensively teach the history of the Eastern Shore culture. The Historical Society of the Eastern Shore is based in Onancock, maintains three properties there, and offers a range of educational programs.

Accomack County is steeped in history, and would ideally have a designated Virginia Heritage Trail. There have been past efforts to do so, but no progress has been made to date. Only 25 buildings in Accomack County are registered with the Virginia Department of Historic Resources (VDHR) as official Historic Places. In 2001 the VDHR completed the archaeological survey of the Chesapeake Bay shorelines and in 2003 the Atlantic coast shorelines associated with both Eastern Shore Counties. The latter was updated in April of 2016.

NATURAL ENVIRONMENT

Accomack County, entirely within the Atlantic Coastal Plain, is relatively flat with the elevation ranging from sea level to about 50 feet above mean sea level. The majority of slopes are under 1%, but in a few sections, the slope reaches up to 15%. The average depth of the water table is about 18 inches. Flat areas are typically more prone to flooding problems, particularly where the water table is high and the hydric soils dominate.

There are approximately eighteen major tidal creeks on the seaside and twelve on the bayside, according to the FEMA reports. The Regional Dredging Needs Assessment (Appendix A) inventoried 34 seaside creeks and 24 bayside creeks in Accomack County.

LAND USE LAND COVER

The total land and water area of Accomack County is approximately 602 square miles, 476 of which is comprised of uplands and the adjacent wetland areas. The majority of land use consists of farms, forests, and marshlands, dotted with towns, villages, and hamlets.

According to the 2012 Census of Agriculture, there were 226 farms in 2012. This is a decline of 22 farms and 16,375 acres since 2007 and 53 farms since 1992. There has been a downward trend in the number of farms, the total acreage of farms, and the acreage of land in the agricultural and forestal districts dating back to at least 1992. Although there was a boom in subdivision activity which peaked between 2004 and 2006, many of those areas were never developed after the downturn in the economy. The larger decrease in farm acreage cannot be largely attributed to these subdivisions, but rather the result of various causes. A 2009 publication indicated that 47 acres of wetlands are created annually from the inundation of low-lying farms (Titus, 2009), which could be part of the cause in the continuing decrease of farm lands. Around the time of the 2012 Census, one of the major vegetable growers was going through bankruptcy. They owned and leased a large quantity of land. In 2013 another company bought the majority of their operations at auction, and now most of the land is back in production. It is estimated that the 2017 Census may show somewhat of a rebound, however, that depends on unforeseen circumstances and the expansion rate of operations such as solar energy production areas.

Figure 3 has open water and wetlands excluded, as they originally made up approximately 65% collectively, and the terrestrial, upland land cover is more relevant for management purposes. According to the NOAA C-CAP Land Cover Atlas, between 1996 and 2010 there was a net increase of 4.75% and 8.27% in developed area and in impervious surfaces respectively. Still, Accomack County only has a total of 4% of its upland areas classified as developed and the percent of the County that is wetland has remained fairly constant for the past two decades. (NOAA, C-CAP, accessed July, 2016)

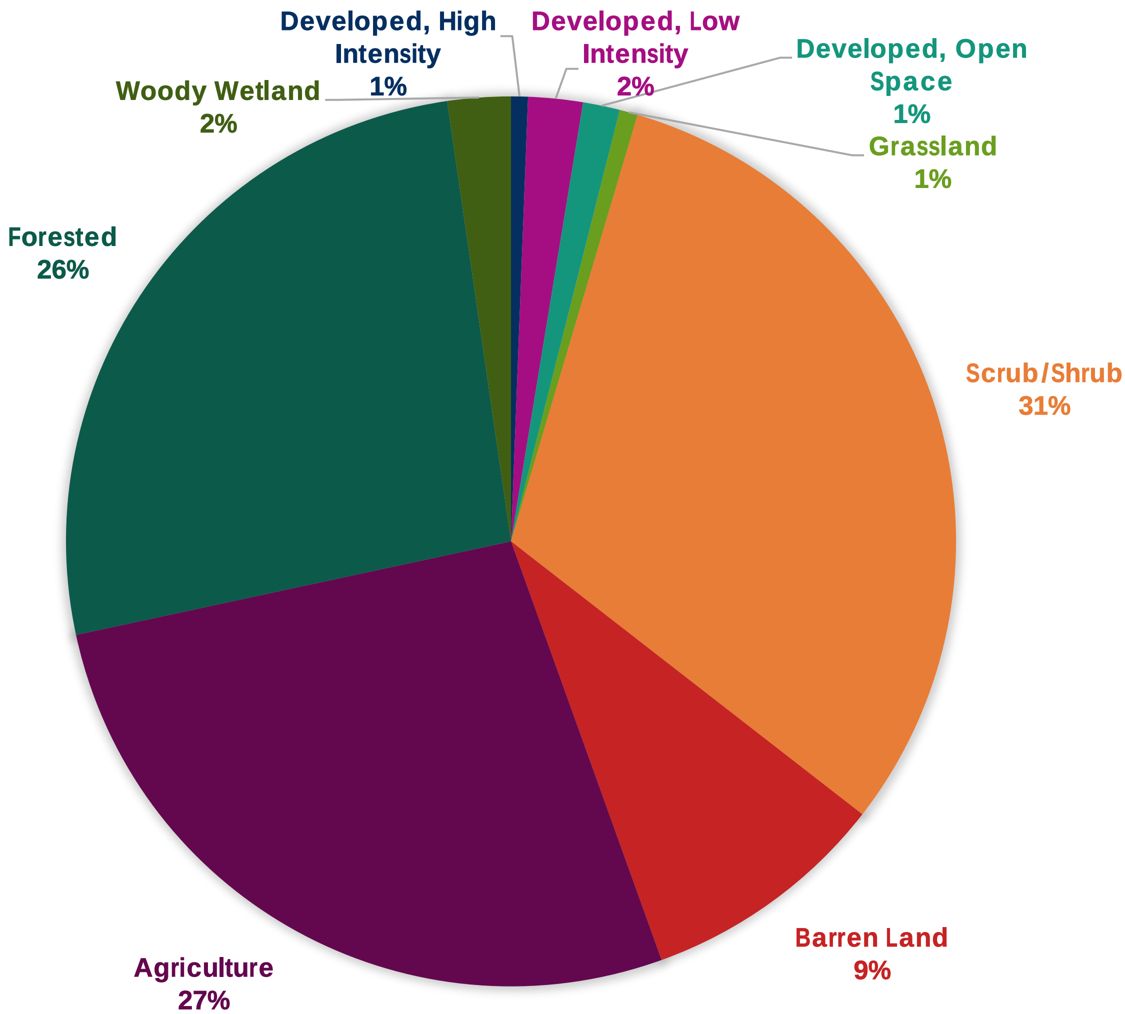


Figure 3: Accomack County Land Cover Percentages

HAZARD PREPAREDNESS
& COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Accomack County has participated in the hazard mitigation planning process since 2006. The County's primary risk is associated with coastal and storm water flooding. Although the County's Comprehensive Plan was updated in 2014, much of the content refers to dated data from the early 2000's. The comprehensive plan further emphasizes the need to protect groundwater, open space, historic resources, agricultural lands, National Aeronautics and Space Administration (NASA) Wallops Flight Facility (WFF), and to strengthen existing towns and communities.

Table 6: Accomack County Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
County	*		*		*	*													
Regional				*				*	*	*	*	*		*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

There have been six past Federal Disaster Declarations for flooding in the County. There are three severe repetitive loss properties and 37 NFIP-recognized repetitive loss properties, which is 12 more than there were in 2003 (FEMA Flood Risk Report 2015, FEMA NFIP Report December 2003). The Accomack-Northampton Regional Housing Authority indicated that they have a list of more than 70 residents that would like to have their homes raised (John Aigner, personal communication, July 13, 2016). Table 7 reveals that there has been a decrease in the total number of policies since 2011. For 2016, this count is estimated to actually be lower by the time this Plan is complete, as more homeowners learn of the changes to the Flood Insurance Rate Map (FIRM). Table 7 also shows the upward trend in the number of claims filed and the average pay per claim.

With the 2015 updates to the FIRM, there were changes to the associated Special Flood Hazard Area (SFHA) for the County. The total area of the SFHA increased by 12 square miles and decreased by 16.6 square miles for a net decrease of 4.6 square miles including 1,111 buildings. The area within the V zone increased by 3.6 square miles and decreased by 44.8 square miles for a net decrease of 41.2 square miles including 300 buildings. This is extremely important as 1,411 structures that previously were required to have flood insurance under a mortgage are no longer required to have even basic flood insurance coverage. Flood insurance is cost prohibitive for many residents in the County (Charles Pruitt, personal communication, July 14, 2016). Without insurance, should there be flooding, the recovery time for residents, businesses, and the overall community will be much longer.

The County participates in the Community Rating System (CRS) program in order to pass on a policy discount to residents and businesses in the unincorporated areas of the County. As of 2016, their CRS rating is an 8, providing a 10% discount.

Table 7: Summary of Accomack County's Past NFIP participation

	HMP 2006		**HMP 2011**		**HMP 2016**	
Date Joined	June 1, 1984		June 1, 1984		June 1, 1984	
	Total	**Unincorporated**	**Total**	**Unincorporated**	**Total**	**Unincorporated**
Total Policies	*unknown*	*unknown*	4,017	2,908	3,600 policies: 61 V-zone, 3,162 A-zone, and 377 other	2,306 policies: 59 V-zone, 2,001 A-zone, and 246 other
Policy Premium	*unknown*	*unknown*	$3,225,177	$2,222,279	$3,371,381	$2,044,239
Total Coverage	*unknown*	*unknown*	$784,621,700	$577,667,100	$783,148,000	$508,113,600
Total paid since 1978	$3,810,884	$3,434,634	$6,048,514	$4,379,826	$11,906,426	$9,578,778
Claims since 1978	525	460	740	570	1,062	833
Average Pay per Claim	$7,259	$7,467	$8,173	$7,683	$11,211	$11,449
HMGP	1999 Floyd 28 homes elevated (6 in Tangier); 2003 Isabel 53 homes (16 Saxis, 12 Tangier, 6 Wachapreague)		In 2011 applied to elevate 9 homes (1 Chincoteague, 1 Wachapreague), still underway.		Last application was submitted in 2013, but was not funded. Currently application being prepared for 2016 submission.	

FEMA NFIP Report, December 2003, April 2011, and January 2016,

HMGP

The County of Accomack has historically participated in the Hazard Mitigation Grant Program. After Hurricane Floyd in 1999, the County received a 28 home elevation project for homes located in the unincorporated portions of the County and in the Town of Tangier. See Table 7 for more details. As of 2016, a total of almost 100 homes in Accomack County have been elevated out of the floodplain and no houses have been relocated or razed under the program.

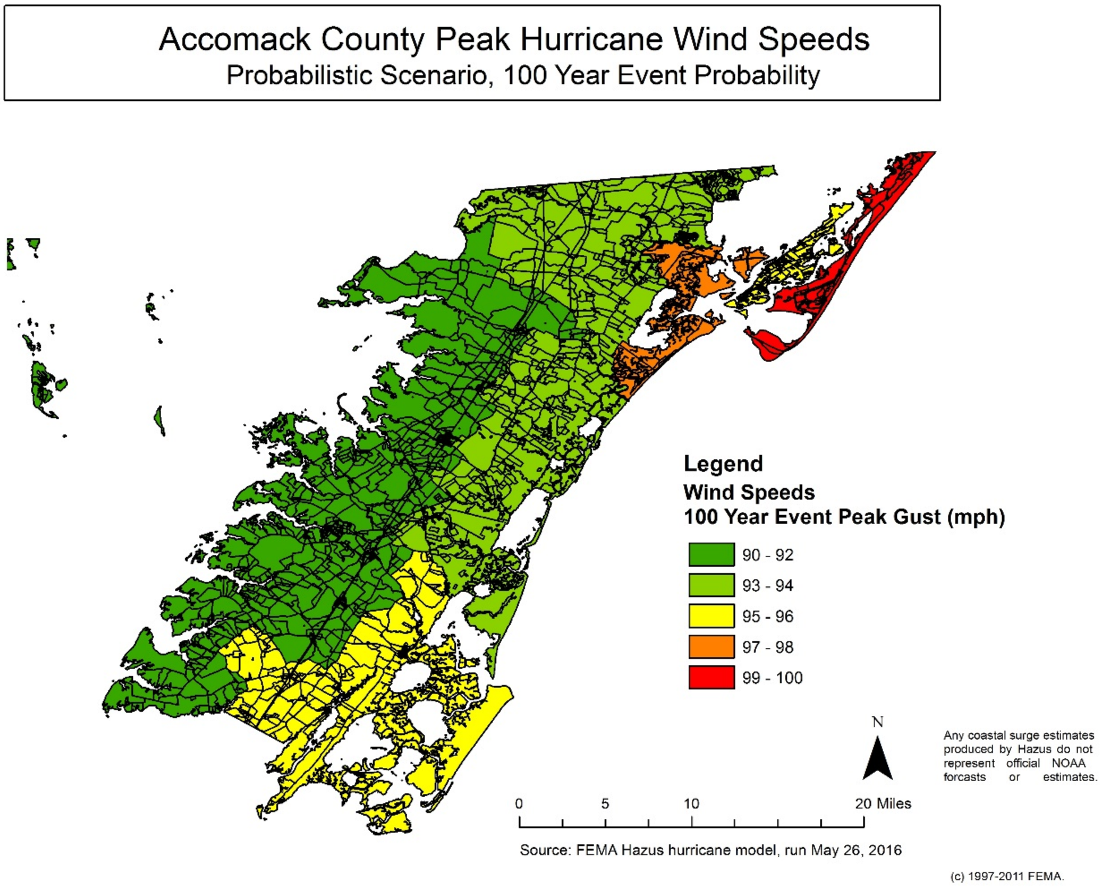
HAZARD PROFILE

WIND

The peak wind gusts predicted by Hazus during a 1-percent-annual-chance wind event are evidenced in Figure 5. About 386 of Accomack County's buildings are estimated by Hazus to be at least moderately damaged and 29 completely destroyed during such an event. This is about 1.5% of the total number of buildings. The majority of damages, about 90%, are to residential buildings. The total property damage losses predicted is approximately $63 million, of which about 82% is from damages to buildings, contents, and inventory and the remainder results from economic loss from income loss, relocation costs, loss rental income and wages.

In addition, the Hazus model predicts 264,672 tons of debris will be generated. Only about 10,350 tons (414 truckloads at 25 tons/truck) of this are construction debris, the rest is tree debris and the tonnage varies depending upon the method by which the debris is collected and processed.

Figure 4 : Accomack County Peak Hurricane Wind Speeds, 1-percent annual chance wind event, Hazus predictions



The County's Building Code is currently based on the 2012 Virginia Uniform Statewide Building Code (USBC), the USBC is periodically updated, and the County will update their code respectively. Our region lies within the 110 mph winds zone, and thus, the County requires structures be built to withstand winds of at least this strength (Bruce Herbert, Building Inspector, personal communications, August, 1, 2016). These standards affect many aspects of the construction, from the quality of the shear walls to the number of nails used to secure shingles.

For the anticipated damages from each category of hurricane, please see the Chapter 4: High Winds, Table 1. Additional wind hazards, which are also described in Chapter 4, are straight line winds, tornados, and nor'easters. Manufactured homes are at the highest risk to wind damages.

COASTAL EROSION

Accomack County is experiencing erosion along the bayside shoreline and the barrier island shorelines on the seaside. The inland seaside shoreline is relatively protected from erosion by the barrier islands, marshes, and bays to the east. That said, the shifting and erosion of the barrier islands and loss of marshes to habitat migration and rising seas, may leave the inland seaside shoreline in a more exposed position in the future.

The erosion rates on the barrier islands range from 7 to 17 feet per year on average, but a single high intensity northeaster or hurricane could erode more than that in just a few days. The Accomack County Comprehensive Plan emphasizes the importance of consulting with the VIMS Shoreline Situation Report to prevent building in high erosion areas, or those areas indicated to have a loss of greater than one foot per year. The Coastal Resilience Tool is finalizing an application that will show historic positions of the seaside barrier islands, and this will be available to the public in January of 2017.

Table 8 reveals the areas in the County identified by the 2002 VIMS *Shoreline Situation Report* and updated information from local County representatives. According to the VIMS Center for Coastal Resources Management 2016 Accomack County Shoreline Inventory, 46 of the 708 miles of shoreline surveyed are defended in some way, the majority of which (26.6 miles) are bulkheads.

Table 8 : Accomack County areas Experiencing Coastal Erosion

Area	Location Description	Erosion Rate (feet/year)	Mitigation Strategy	Other
Critically Eroding Areas				
Tangier Island, & Uppards	All coastlines, western shore of Tangier least in danger due to existing seawall	10+	Jetties, Seawalls, Enhancing the Uppards, Reinforcement of the eastern shoreline, Extend seawall on eastern shoreline	
Sluitkill Neck	Between Pungoteague and Matchotank Creeks	4-5 On Bayshore, 1.5 on mainland	Retain as is. Unsuitable for residential or recreational development	Includes Finneys, Scarborough, and Parker Islands
Severely Eroding Areas				
Saxis			Beach nourishment, Groynes, Jetty, Breakwater	
Scarboroughs Neck	Northern shoreline of Occohannock Creek	5	Continue as agricultural use	Unsuitable for residential development. Suitable for recreational camping.
Parkers Marsh	Between Chesconessex and Onancock Creeks	5	Retain as state natural area. Restrict development at Crystal Beach to relatively low value seasonal residences	Includes residentially developed Crystal Beach area
Freeschool Marsh	Between Saxis and mainland	1.9-4.9 (maximum along Saxis waterfront)	Retain as is.	Most is set aside as a wildlife refuge
Moderately Eroding Areas				
Hyslop Marsh	Between Craddock and Back Creeks	2-3	Retain as is.	None.

Nandua Creek	Southwestern Accomack Co.	2-3 in lower creek, 0 in upper creek	Continue as agricultural and lowdensity residential use	Lower creek unsuitable for residential development
Broadway Neck	Between Matchotank Creek and East Point	2 south of Thicket Point, no data for north of Thicket Point	High flood hazard should be considered before future development	The presence of old beach defenses at East Point indicates history of moderate erosion
Onancock Creek	Central Accomack Co. Bayside	Moderate erosion of sand beaches	Restrict additional development on lower part of creek	Localized erosion in areas such as at the end of Bailey Neck
Big Marsh	Between Chesconessex and Deep Creeks	0-3	Continue as agricultural and lowdensity residential use	Includes Schooner Bay development
Parksley	Between Hunting and Young Creeks	2 along beaches, 0 along remainder of creeks	Retain as marshland or agriculture	None.
Michael Marsh	Between Cattail and Messongo Creeks	1.3-1.7 along shore facing Beasley Bay	Retain as is.	Most is set aside as part of Saxis Wildlife Management Area

Assateague Island, an area vital to the economy in Accomack County, has experienced severe erosion and decisions are currently being made for the long-range plan for the National Wildlife Refuge, with regards to new locations for parking, beach access, interpretive structures, facility buildings, etc. Chincoteague Inlet is funded for both 2016 and 2017.

Just to the south of Assateague is Wallops Island, which is owned by the federal government and home to the NASA WFF, and a major economic driver for the County. In June of 2016, the United States Army Corps of Engineers (USACE) completed the Wallops Island beach nourishment, which cost almost $36 million (about $10 /yd^3 of sediment).

The restrictions within the Resource Protection Areas identified in the Chesapeake Bay Act typically prevent new construction within 100 feet of our waterways, and thus reduces increased exposure to erosion. However, erosion does cause additional problems for our navigable waterways, as the eroded sediments can fill channels and create a hazard for water-based transportation and businesses.

COASTAL FLOODING

According to the 2015 FEMA Flood Risk Report, 311.5 square miles of Accomack County are in the SFHA and 144.6 square miles are in the V zone. This is approximately 68% and 31% respectively of land area (excluding marsh or emergent wetlands) using the land cover data from NOAA presented in Figure 2. The three largest landholders are the Commonwealth of Virginia, the federal government, and The Nature Conservancy (TNC).

There are an estimated 27,422 buildings in Accomack County with a total building replacement value (excluding contents) of $3,540 M. Approximately 91.31% of the buildings (and 75.14% of the building value) are associated with residential housing. (Hazus, 2016)

It is estimated that a 1-percent-annual-chance flood event would incur at least moderate damage to 3,081 buildings in the County. This is over 10% of the total number of buildings. There are an estimate 665 buildings that are estimated to be completely destroyed. As to be expected, manufactured housing units obtain the most damage, with 663 being damage more than 50%. With this level of damages, Hazus estimates that 2,389 households will be displaced, of which, 5,024 (approximately 15% of the County's population) will seek temporary shelter in public shelters. The County estimates that 10% of the population is a more reasonable estimate for those that would seek temporary shelter (Doug Jones, personal communication, July 14, 2016).

The estimated building-related loss totals $287 million for building, content, and inventory. The additional economic loss from income loss, relocation costs, loss rental income and wages totals $6.45 million. Residential occupancies make up about 70% of the total losses, commercial about 14%, and industrial about 6%. Figure 4 provides a representation of geographic distribution of these losses by Census block.

Additionally, the Hazus model estimates that a total of 68,727 tons of debris would be generated during such a flooding event. This would require 2,749 truckloads (at 25 tons/truck) to remove the debris. The local County landfill cannot accommodate this quantity of debris, and thus would have to have the trucks sent inland.

Following hurricane Sandy in 2012, there were over 200 reported home damages in the County. However, within two weeks, about half of these had already been repaired, and about a quarter were being processed with their respective insurance companies. Between 15 and 20 homes received volunteer assistance for their repairs and two residents from two homes relocated off of the Eastern Shore. (Doug Jones, personal communications, July 14, 2016)

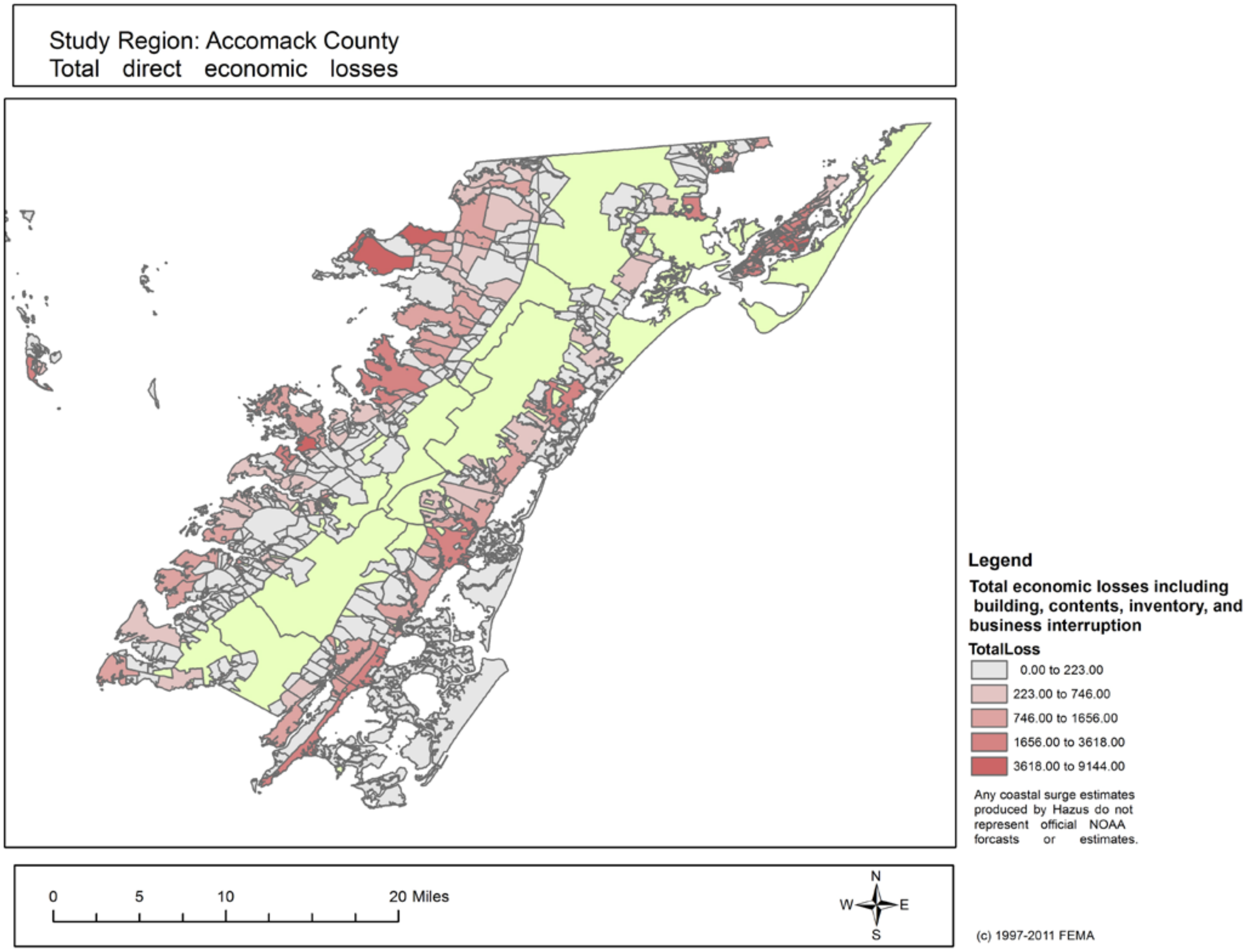


Figure 5 : Accomack County Total Economic Losses from a 1% annual chance Flooding Event

SEA LEVEL RISE

Based on 2010 U.S. Census data, 4,623 people in the County are on land below 3 feet elevation and 6,957 people are below 5 feet. Accomack County has 33,153 people in total. Of the County's 1014 miles of roads, 31 miles (3.1%) will be inundated with 1 foot of sea level rise (SLR) (estimated year 2025-2050), 115 miles (11.3 %) with 2 feet (2045-2090), and 183 (18%) with 3 feet (post-2060) (TIIVA, 2014). Another study by VIMS estimated 326 miles of roads in Accomack County were vulnerable to 1.5 feet of relative SLR when combined with a storm surge of 3 feet. Even small amounts of sea level rise make rare floods more common by adding to tides and storm surge. With 3 feet of sea level rise, there are many Towns, unincorporated communities, economically critical facilities (including NASA WFF and various working waterfront areas) that would be disconnected, inaccessible, or have the majority of the roads inundated with 3 feet of relative SLR. Without significant engineering solutions in the coming years, it should be expected that the livelihood and safety of communities and the integrity of the roadways in the County will largely decline. Figure 5 shows a map from the Transportation Infrastructure Inundation Vulnerability Assessment of one of the most susceptible areas to SLR effects in the County. According to a 2014 report prepared by Climate Central, the County has 41,816 acres of land below 5 feet MHHW.

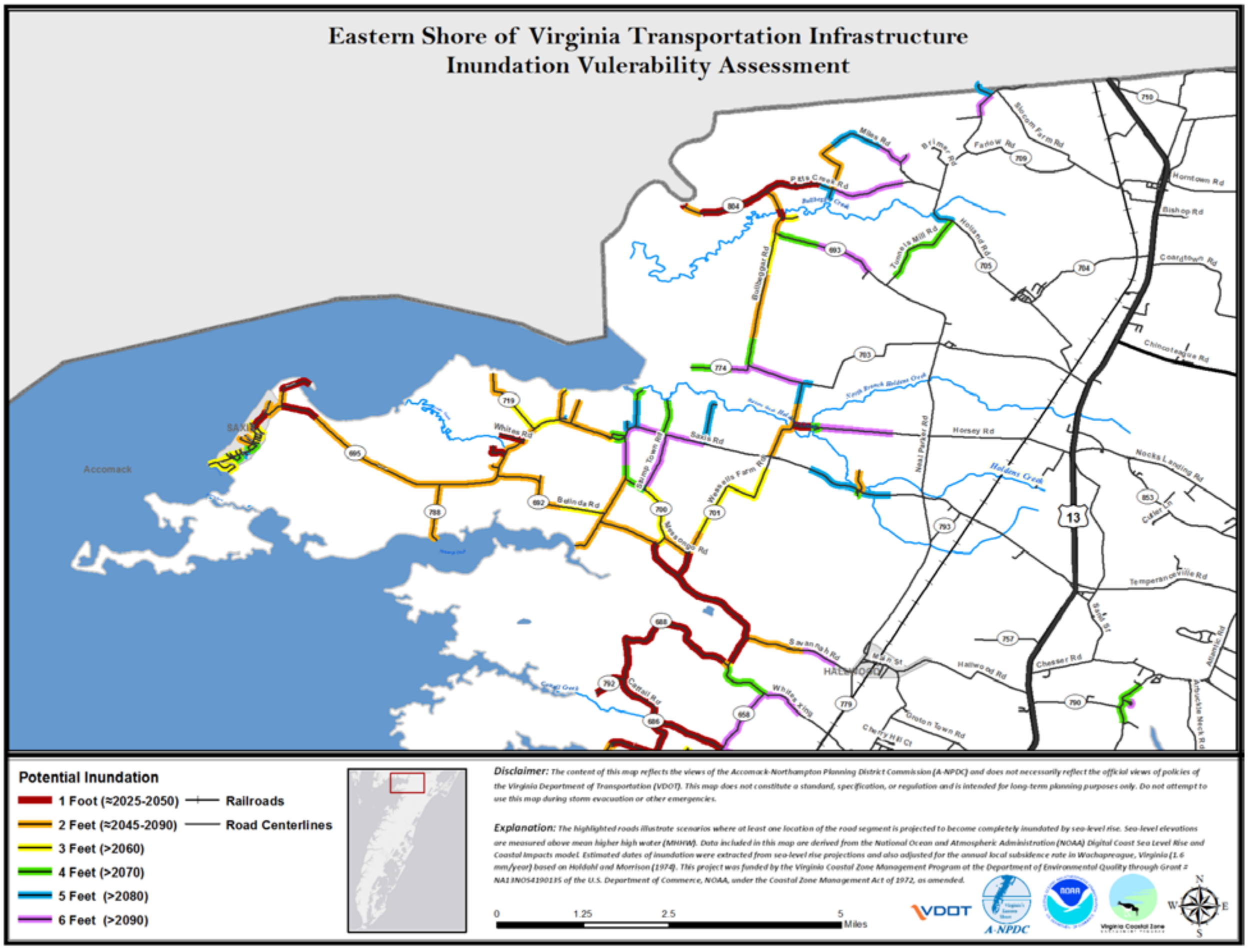


Figure 6: Northwestern Accomack County Transportation Infrastructure Inundation Vulnerability

STORM WATER FLOODING

Local officials identified various areas in the County that have storm water flooding problems. These areas include, but are not limited to the intersection of Route 13 and Route 175 in New Church, Horntown Road east of Route 13, Neil Parker Road in Sanford, parts of the villages of Pastoria and Mappsville, the low lying lands south from Messongo to Chesconnessex, parts of the Town of Accomac, Bayside Road between Shields and Craddockville, and the Family Dollar store in Tasley.

Figure 7: Accomack County Storm Water Flash Flooding July 1, 2016. Photo by Shannon Alexander, A-NPDC

Intense rain events, such as that on Friday July 1, 2016, can come without warning and have serious impacts to travel and safety. Slow moving storms moved over Accomack County brought nine inches of rain by evening in the Parksley area, where south bound U.S. 13 was forced to close. Throughout the County, homes were surrounded by and often inundated by water. The gauge in Onley measured 8.58 inches of rain. Ambulances and fire rescue vehicles struggled to reach individuals in need of aid. Luckily, there are alert systems in place that, if signed up for, will send alerts when such a flash flood warning is in effect, but often the waters are already rising by the time these are issued.

Educating residents about the risks associated with storm water flooding and standing water, such as septic contaminants and mosquito-borne illnesses, is an important step in mitigating potential negative impacts to the population.

Local officials identified various areas in the unincorporated portions of the County that have stormwater flooding problems These areas include, but are not limited to:

- New Church; Rt. 13 & Rt. 175
- Sanford
- Especially Neil Parker Rd (Sanford)
- Pastoria
- Mappsville

- Bayside Rd between Shields and Craddockville
- Family Dollar Store in Tasley
- Intersection of Locustville Rd & Drummondtown Rd
- Clam
- Messongo
- Belinda

The causes are typically from soil type, elevation, lack of proper ditch design and maintenance, or any combination of these.

HAZARDS OF LOCAL SIGNIFICANCE

Other hazards for Accomack County are described in the Regional Chapter. They include, but are not limited to: above and underground storage tanks, snow and ice, fire and drought, fish kills, and biological hazards.

WATER QUALITY

Since many people in the County rely on the fisheries and aquaculture industries, fish kills and the declining health of the Chesapeake Bay impact the residents and the economics of the region. In addition, bacterial impairments can discourage tourism and recreational use of our beaches and waters.

MOSQUITOS

Mosquito-borne illnesses such as West Nile and Zika virus pose a potential risk, especially with standing water from intense rain events and subsequent stormwater flooding.

SNOW AND ICE STORMS

With snow and ice storms there are often school closures, power outages, isolated communities (by water – Tangier, and roads to many locations) and economic issues from damages to agriculture, etc.

FIRE AND SMOKE

According to ACS estimates, in 2014 3,583 (25%) of Accomack County houses are heated with fuel oil, kerosene, etc. another 3,623 (25%) with bottled, tank, or LP gas, and also 460 (3%) wood as the primary house heating source. In times of low humidity and high winds, the County is susceptible to field and forest fires as well.

CRITICAL FACILITIES

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

Table 9 : Critical County Facilities in Accomack County

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
County-Owned Properties					
Schools: Tangier Combined, Chincoteague High and Elementary, Arcadia High	Storm Water Flooding Wind	7,708 ≤ 20 yrs old (~23%)	Major Disruption	Yes	Yes

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
and Middle, Kegotank Elementary, Metompkin Elementary, Accawmacke Elementary, Nandua High and Middle, Pungoteague elementary	Coastal Flooding (some) Fire, Ice	5,752 ≤ 15 years (~17%)			
911 Communications/ Emergency Operations Center (Accomac)	Wind Fire, Ice	45,000+	Devastating	Yes	Yes
Sheriffs Office & Jail Complex	Wind, Fire, Ice	~33,000	Major Disruption	No	Yes
Health Department	Wind, Fire, Ice	33,000	Minor Disruption	Yes	Yes
Social Services	Wind, Fire, Ice	~20,000	Major Disruption	Yes	Yes
Administration Building	Wind, Fire, Ice	~33,000	Minor Disruption	Yes	Yes
Public Safety Bldg. (Parksley)	Wind, Fire, Ice, Storm water flooding	~33,000	Major Disruption	Yes	Yes
Fire Training Center (Melfa)	Fire	~33,000	Minor Disruption	No	No
Building & Grounds Maintenance Shop	Wind, Fire, Ice, Flooding	~20,000	Minor Disruption	Yes	Yes
Veteran's Affairs Office	Wind, Fire, Ice	~500	Minor Disruption	Yes	Yes
County Garage	Wind, Fire, Ice, Flooding	~33,333	Major Disruption	Yes	Yes
Industrial Prkwy, Service Rd, & Atlantic Dr	Wind, Fire, Ice, Flooding	~20,000	Minor Disruption	No	Yes
Airport Complex	Wind, Fire, Ice, Flooding	~3,000	Major Disruption	No	Yes
North & South Landfills	Wind, Fire, Ice, Flooding (Coastal & Stormwater)	~33,000	Major Disruption	No	Yes
Mappsville Communications Tower	Wind, Fire, Lightening, Ice	~33,000	Major Disruption	Yes	Yes
Planning Office	Wind, Fire, Ice	~33,000	Minor Disruption	Yes	Yes
Lumber Mill Complex (Joynes Neck Rd)	Wind, Fire, Ice, Stormwater Flooding	~33,000	Inconvenience	No	Yes
Convenience Centers: Chincoteague, Fisher's Corner, Horntown, Makemie Park, Grangeville, Painter, Tasley	Wind, Fire, Ice, Flooding (Coastal and Stormwater)	~33,000	Major Disruption	Yes	Yes
County-Owned & Operated Public Utilities					
Industrial Park Water & Wastewater Systems	Wind, Fire, Ice, Flooding	~33,000	Major Disruption	No	Yes
Leachate Treatment Plant	Wind, Fire, Ice, Flooding	~33,000	Major Disruption	No	Yes
Accomac Water System	Wind, Fire, Ice, Flooding	~2,000	Major Disruption	No	Yes

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Health Dept. Water System	Wind, Fire, Ice, Flooding	~33,000	Major Disruption	No	Yes
Court Systems Buildings Complex	Wind, Fire, Ice, Flooding	~10,000	Major Disruption	No	Yes
DSS Water & Wastewater Systems	Wind, Fire, Ice, Flooding	~3,000	Major Disruption	No	Yes
Schools	Wind, Fire, Ice, Flooding	~10,000	Major Disruption	No	Yes

FINDINGS

1. During a 1-percent-annual-chance flood event the damages and economic losses are estimated to total about $293.5 million. During the same chance wind event, that total is $63 million. If these Hazus estimates are combined, which is a likely scenario during a hurricane, the damages are over $350 million. A high wind storm system that also resulted in 1-percent-annual chance flooding, is a significant threat to the County.

2. During a 1-percent-annual-chance flood event there are approximately 3,081 structures that are estimated to incur at least moderate damage, and 665 that would be completely destroyed, at a total cost of $287 million and additional disruption costs of $6.5 million. Over 2,000 households would be displaced, with over 10% of the population estimated to seek shelter. Several schools, fire stations, and EMS operations are vulnerable. Coastal flooding is the greatest threat to the County.

3. With the 2015 updates to the FIRM, 4.6 square miles, including 1,111 buildings, were removed from the SFHA and 41.2 square miles, including 300 buildings, were removed from the V zone. From April of 2011 to January of 2016, there has been a decrease of 602 policies in the unincorporated areas, and this number is estimated to continue to increase as more residents learn that flood insurance is no longer required. The changes in the FIRM are thought to create a sense of decreased vulnerability to flooding, and the resulting drops in policies may increase the rebound time for the County and its' residents following a flood event.

4. There are 38 repetitive loss properties and 3 severe repetitive loss structures in the County. There are over 70 owners who would like to receive assistance in raising their homes.

5. The Towns of Accomac, Keller, Melfa, and Painter do not participate in the NFIP as of 2016, but have storm water flooding issues. Many areas of storm water flooding are not identified by the current FIRMs. Residents and business owners in these areas cannot currently purchase flood insurance or be eligible for some loan opportunities.

Often drainage ditches are the culprit behind storm flooding, and thus maintenance and reevaluation of many systems may be needed to address this hazard.

6. High winds form a 1-percent-annual-chance event are predicted to cause at least moderate damage to 386 buildings and completely destroy 29. Property damages and economic losses would total approximately $63 million. Although this is significant, it is just over a quarter of the damage incurred by a 1-percent-annual-chance flooding event. About 90% of the damages are to residential buildings.

7. Most of the worst coastal erosion in Accomack County has occurred on the bay shoreline. Erosion also causes shoaling of channels and creeks, thus hindering waterway navigation and increasing maintenance dredging needs and costs.

8. There have been several factors that have increased the risk in the County since 2011. These include an increase in the number of vacant homes, an increase in the number of manufactured homes, an increase in the number of homes with no vehicle available, and an increase in the number of non-English speaking residents.

9. The County has identified other additional hazards including winter storms, sewage spills, drought, wildfire, hazmat incidents, heat waves, biohazards, and well contamination. Furthermore, the County faces secondary hazards from flooding such as poultry kills and mosquito-borne disease which could potentially impact the health of residents and the local economy. Of concern for wildfire and structure fire is the increasing difficulty with which the fire companies are having in securing sufficient volunteers to offer complete services.

NORTHAMPTON COUNTY

COUNTY PROFILE

Northampton County is the southernmost county on Virginia's Eastern Shore. It was settled by the English in 1614, named Northampton in 1642, and divided into Accomack County and Northampton County in 1663. The Eastern Shore played an influential role in the history of Colonial America. The present County seat in Eastville was founded in 1680 when a courthouse was erected there. Northampton has the oldest continuous court records in the country and is one of the oldest counties in the entire nation.

Figure 1: Northampton County Aerial Imagery

There are 6 incorporated towns in the County: Belle Haven (portion located in Accomack County also), Exmore, Nassawadox, Eastville, Cheriton, and Cape Charles.

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

According to the 2014 American Community Survey, the County had a population of 12,121, indicating that the population has been relatively stable and slightly declining since 2000. The median age for residents in Northampton County in 2014 was 48 years, which is about 11 years higher than that of both the state and nation, and is an increase of almost 6 years in age from 2000.

Table 1 : Northampton County Demographic Information

	2014*	2010	2000***
Population	12,121	12,389**	13,093
Median Age (Years)	48.0	47.8**	42.4
Disability	12.9%		
Income			
Median Household Income	34,656	$35,760*	$28,013
Poverty Level	17.1%	15.8%*	15.8%
Language			
Only English	10,547	11,117*	11,670
Other	482	403*	703
Spanish	401	379*	340
Ind-Euro	41	0*	18
Asian	34	24*	0

* ACS 2010-2014, ** U.S. Census 2010, *** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. Secondly, they can identify where disruptions in employment and income might occur in the aftermath of a disaster.

The County's primary economies are affiliated with agricultural, seafood and tourism with some of the largest employers in the County being Riverside Regional Medical Center, Northampton Schools, Bayshore Concrete Products Company, the CBBT, Ballard Fish and Oyster Company, and New Ravenna Mosaics (Virginia Employment Commission, 2016).

Riverside Shore Memorial Hospital has been a major employer in the County for years, but is in the process of relocating in Accomack County and will not be bringing the current staff to the new location, but will be going through an entirely new hiring process. As of 2014, over a quarter of the workforce was estimated to be in educational or health care services, this figure is expected to change with the relocation of the hospital.

The U.S. Census Bureau's Center for Economic Studies data indicate that over 1,500 of the employed residents' place of employment is greater than 50 miles from their home. This is important to consider for the community's ability to rebound following a severe event, as there are many variables that could prevent them from reaching their place of employment; damages to vehicle, damage to roadways or bridge systems, etc.

Table 2 : Northampton County Workforce

Civilian Employed Population						
Industry	**2014***		**2010***		**2000****	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Agriculture, forestry, fishing/hunting, or mining	522	10.5%	627	11.2%	411	7.9%
Construction	379	7.6%	473	8.4%	359	6.9%
Manufacturing	346	7.0%	403	7.2%	634	12.2%
Wholesale trade	340	6.8%	312	5.6%	187	3.6%
Retail trade	513	10.3%	532	9.5%	498	9.6%
Transportation and warehousing, and utilities	119	2.4%	300	5.3%	332	6.4%
Information	22	0.4%	41	0.7%	62	1.2%
Finance, insurance, real estate, and rentals	195	3.9%	318	0.7%	211	4.1%
Professional, scientific, waste management	516	10.4%	256	4.6%	240	4.6%
Educational and health care services	1,272	25.6%	1,270	22.6%	1,242	24%
Arts, entertainment, recreation, food	387	7.8%	537	9.6%	415	8%
Public Admin	122	2.5%	237	4.2%	295	5.7%
Other	233	4.7%	307	5.5%	291	5.6%
TOTAL CIVILIAN EMPLOYED POPULATION	4,966	-	5,613	-	5,177	-

Source: * ACS, 2010 – 2014; ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

According to Table 3, the County has seen a slow, but steady, decline in business presence over the last five years. The total civilian employed population (Table 2) and overall population (Table 1) have also experienced a decline.

Table 3 : Northampton County Business Types

Industry Code Description	**Total Establishments**		
	2014	**2012**	**2010**
Agriculture, Forestry, Fishing, and Hunting	8	8	**6**
Utilities	1	1	**1**
Construction	26	28	33
Manufacturing	11	9	9
Wholesale Trade	17	20	17
Retail Trade	61	70	77
Transportation and warehousing	3	2	3
Finance and insurance	18	19	18
Information	6	2	2

Real Estate and Rental and Leasing	15	12	11
Professional, Scientific, and Technical Services	23	21	19
Management of Companies and Enterprises	1	1	2
Administrative, Support, Waste Management	8	9	9
Education Services	4	5	5
Health Care and Social Assistance	37	40	36
Arts, Entertainment, and Recreation	5	7	6
Accommodation and Food Services	38	41	43
Other Services (except Public Administration)	39	37	40
Industries not classified	4	-	-
Total, All Establishments	325	332	337

Source: Census Zip Code Business Patterns, 2014

BUILT INFRASTRUCTURE

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 evacuate safely.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk.

As Table 4 reveals, there has been very little change in the number of housing units in the County in the last decade. Over a quarter of the total housing units in the County are vacant, which is an increase in about 7% since 2000. Often unoccupied houses are not properly maintained and can cause additional debris hazards during high wind events. County representatives indicated that often families own multiple homes, but that due to the decreasing population, one or more may be unused. County representatives also indicated that this high percentage could, in large part, be due to second homes, especially in the incorporated areas of the County, such as Cape Charles. The U.S. Census definition of a vacant housing unit includes those units entirely occupied by persons who have a usual residence elsewhere.

The *2009 Northampton County Comprehensive Plan* indicates that 13% of the housing in the County are single-wide mobile homes, and emphasizes their vulnerability and inability to maintain value. Manufactured homes are typically more susceptible to storm damages incurred from winds and flooding than other types of homes. The 2014 ACS estimates only 10% of housing units to be mobile homes, which should indicate an improvement in the resiliency of the housing infrastructure for the County.

In addition, the ACS estimates for 2014 reveal there are 36 occupied housing units without phone service available. These residents are a high risk, as they may not be able to reach out for aid in the event of an emergency.

Table 4: Northampton County Housing

	2014*	2010**	2000***
Total Housing Units	7,322	7,301	6,547
Occupied	5,237	5,323	5,321
Vacant	2,085	1,978	1,226
Owner-Occupied	3,662	3,553	3,649

Renter-Occupied	1,575	1,770	1,672
Median Housing Value	$162,500 (owner-occupied)	-	-

Source: * American Community Survey, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary. As of 2014, it is estimated 11% of the County's occupied residences are without even a single vehicle. Although a slight decrease since 2000, a significant number of people remain at high risk of not being able to remove themselves from harm's way in the event of a disaster. This, coupled with the 36 residences without phone service available, should be considered during the event of an approaching storm and potential mandatory evacuation. It is important to note that during times of heavy rain, particularly coupled with high tides and storm surge, many roads become inundated quickly. This situation will only worsen in the coming years with anticipated sea level rise.

The Chesapeake Bay Bridge Tunnel (CBBT) provides residents access to Virginia Beach and the greater Hampton Roads metropolitan area. Although the official evacuation route is north on Route 13, many residents of the County still use the CBBT. During the summer of 2016, proposals for the Parallel Thimble Shoal Tunnel project were received. Ideally this will ensure continued safe continuity between the Eastern Shore and the rest of the Commonwealth for safe travel, tourism, and to serve the over 1,000 residents who commute to work via the CBBT.

Table 5: Northampton County Vehicles Available per Households

Vehicles Available	2014*	2010**	2000***
None	598	563	672
One	1,731	1,911	1,988
Two	2,054	1,710	1,898
Three or more	854	904	763

* American Community Survey, 2010-2014, ** American Community Survey, 2006-2010, *** U.S. Census 2000

Star Transit provides substantial, daily services up and down the Eastern Shore. The Greyhound bus line offers travel times from the Eastern Shore across the Chesapeake Bay Bridge Tunnel, but only provides one stop in the region. The cost is moderate (about $20 each way to either Norfolk or Salisbury); however, this service would probably not run during an emergency, and does not have the capacity to evacuate all residents without a vehicle.

Although the region's airport is located in Accomack County to the north, the County does have a few private fields, such as Campbell and Belote, and the Steelman heliport.

Prior to the construction of the railroad in 1884, water-based transportation dominated the region and is still vital in the County. Used both commercially and recreationally for enjoyment and fishing activities, the waterways are essential to the economy of the County. Maintenance of the channels of the waterway in the County is of concern, particularly after large storm events where wind, wave, and flooding can greatly change the location of channels and increase the amount of erosion and thus the sedimentation of channels and harbors.

Although the train tracks are still active, they have not offered passenger services on the Eastern Shore of Virginia in over 50 years. They do, however, transport goods from Cape Charles to the south by rail barge, and although very vulnerable, the floating barge was just restored.

COMMUNITY SERVICES AND FACILITIES

Community facilities support the services and functions provided by the County government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the County and its citizens. It is important to note what facilities are available in case of a hazard, and it is important to make an inventory of facilities that could be affected by a hazard.

According to FEMA estimates using Hazus, none of the fire stations, police stations, or schools would be damaged during either a 1-percent-annual-chance flood or wind event.

PUBLIC SAFETY

Emergency services are delivered from three independent volunteer fire companies (Exmore, Cheriton, and Eastville) and two combination fire and EMS stations (Cape Charles and Nassawadox). There are 21 full-time and 16 part-time EMS positions. The move of the hospital is anticipated to increase costs for EMS for Northampton County and increase the transit times to the hospital Emergency Department. The Regional chapter and the respective town chapters have details on the capabilities of each response facility.

The Northampton County Sheriff's Department and County Jail are located in the Town of Eastville. In addition to the Sheriff and Major, there are 20 law enforcement deputies, 40 jail deputies, and six communications officers. In addition, the jail also employs eight people for medical and kitchen staff (Northampton County Sheriff's Office).

In addition to emergency response, the Department of Public Safety personnel provide disaster preparedness presentations, Emergency Response Training (CERT), community CPR training, and serve on regional committees to advance emergency services within the County and region. In 2012, the County established an Emergency Alert Program that provides critical information related to severe weather, road closures, missing persons, and evacuations (*Northampton County Emergency Services* web site, July, 2016).

MEDICAL SERVICES

Although Riverside Shore Memorial Hospital in Nassawadox has been providing medical services to the region for years, it is in the process of moving to Accomack County, where construction of a new facility is nearing completion. Please see the Public Safety section above for information about emergency medical and ambulance services.

Of the five Eastern Shore Rural Health System Medical Centers and four Dental Offices, there are two location in Northampton County, the Bayview Community Health Center and the Franktown Community Health Center with dental services. A new consolidated facility is planned in Eastville, which will combine the Franktown and Bayview Centers.

PARKS AND RECREATION

The Northampton County Department of Parks and Recreation maintains one park, Indiantown Park in Eastville (52 acres). Indiantown Park is equipped with picnic shelters, lighted softball field, playground, soccer field, recreation center, and 36-hole disc golf course. In addition to park maintenance, Northampton County Parks and Recreation offers programs such as summer camp, basketball, volleyball, softball, disc golf, dances, etc.

The County maintains four water access sites of varying infrastructure, none which incur any fee for use. These facilities include: Oyster Harbor, Willis Wharf Harbor, Morley's Wharf, and Red Bank Boat Ramp (owned by the VA Department of Game and Inland Fisheries, but maintained by the County). The beaches of Cape Charles, Kiptopeke State Park (which also offers a wide variety of educational programs), and the Savage Neck Dunes Natural Area Preserve provide the only sand beaches accessible by land.

The Eastern Shore of Virginia National Wildlife Refuge (NWR) and Fisherman Island National Wildlife Refuge (NWR) are located on the very southern part of the County. Although there is no public access to Fisherman Island NWR, there are a natural kayak/canoe and paved motor boat ramp available, as well as walking trails, Refuge Visitor Center, and many public programs.

The Nature Conservancy owns the majority of barrier islands on the Seaside of the County and all of their beaches are available for day use activities unless otherwise noted.

WATER SUPPLY AND WASTEWATER

Most residents rely on private wells and septic systems for their water supply and wastewater disposal. However, about a quarter of the County's population relies on the municipal water systems of Cape Charles, Eastville, Exmore, Bayview, Riverside and the County Complex. There are three waste water treatment plants (WWTP) in the County for residential sewage treatment, located in Cape Charles, Exmore, and Bayview. These facilities serve an estimated 15% of the year-round housing units in the County. The remaining residents rely on septic tank and drainfield systems, cesspools or pit privies. In the past, poor soils limited development on some vacant parcels of land in the County, but above-ground septic technologies have made some previously undevelopable parcels available for development. However, these systems are much more expensive to build and to maintain than traditional systems.

Discharge from WWTP and proper maintenance of private systems is important to maintain the health of both the surface and ground water. Although surface water in the County is not used for human consumption, it is important for recreation and shellfish harvesting, and thus water quality must be protected, in accordance with the State Water Control Law. According to the 2014 Virginia Department Environmental Quality (VDEQ) *Water Quality Assessment Integrated Report*, all of the bayside creeks and most of the seaside creeks in the County are considered impaired (see Figure 2) due to various causes such as pH, Enterococcus, Fecal Coliform, benthic-macroinvertebrate bioassessment, E. Coli, dissolved oxygen, etc.

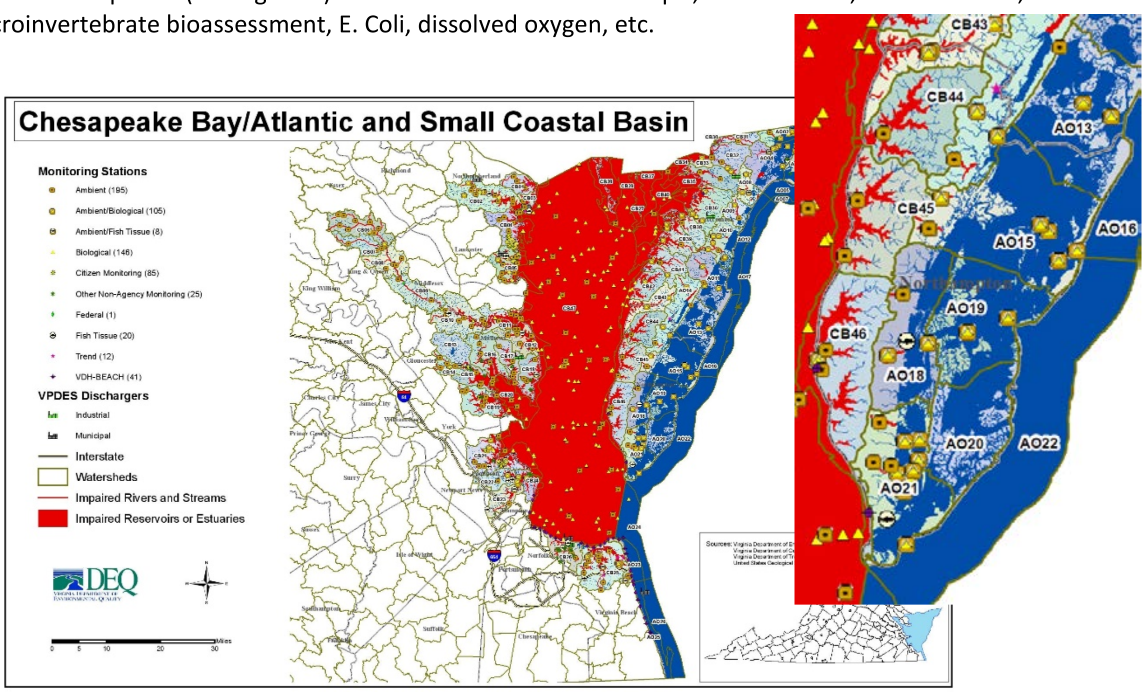


Figure 2 : Impaired Waters of the Chesapeake Bay/Atlantic and Small Coastal Basin area of Eastern Virginia

The Eastern Shore's designation as a sole source aquifer is discussed in the *2009 Northampton County Comprehensive Plan*, and strategies for preventing additional salt water intrusion can be found in the *Eastern Shore Ground Water Supply Protection and Management Plan*. The areas of the County near shorelines are expected to be most vulnerable to salt water intrusion and some intrusion has been experienced in specific areas such as the Town of Cape Charles where steps have been taken to treat their water for iron and salinity. The Eastern Shore of Virginia Ground Water Committee has historically and will continue to assist the County in monitoring the quantity and quality of ground water in the County.

SOLID WASTE

The County operates six waste collection sites, all of which offer recycling, some offer disposal of tires, and used oil, and scrap metal including appliances, but none accept commercial waste. The only landfill in the County closed in 2012, and the County now operates a single transfer station, located near the community of Oyster. The waste is regularly transferred to Bethel landfill by large tractor trailers. This meets the disposal needs for commercial operations, construction companies, and households.

POWER AND COMMUNICATIONS INFRASTRUCTURE

The main Accomack & Northampton Electric Cooperative (ANEC) power line was recently replaced between Tasley and Exmore. Maintaining and advancing our infrastructure is key to increasing our resiliency in the occasion of a hazard. In the last year there have been two 80-megawatt solar projects proposed in Accomack County and one 20-megawatt project in Northampton County. This is a new land use, and has required rezoning and additional permits.

The Eastern Shore of Virginia Broadband Authority (ESVBA) network of fiber cable stretches from Virginia Beach to the Maryland border and serves as the electronics 'backbone', by providing high-speed internet to both Counties. The majority of service is provided along Route 13 and there is a high percentage of underserved households in the County. Wide-spread high speed internet provides residents the capability to take advantage of educational opportunities, work from home, etc.

DRAINAGE DITCHES

The County relies on VDOT for the maintenance of ditches along state maintained roadways, but is responsible for maintenance of all ditches along county roads and between properties that drain state ditches. Often the process of securing property owner signatures to service ditches that run through multiple properties proves challenging and delays maintenance. See the Hazards - Stormwater section for additional information.

SCHOOLS

Schools are important to consider for disaster readiness and during an actual emergency. Schools offer an opportunity to teach children and adults how to effectively and efficiently respond to many emergency situations. However, they are also areas of concentrated high risk individuals, particularly primary schools with the youngest students. The Northampton County Public School Division has a Crisis Management Team that is responsible for emergency planning.

There are four schools in the Northampton County school system, two elementary schools, one 6-12 grade alternative school, and one comprehensive high school. In addition, there are four private schools in the County, including Broadwater Academy, Montessori School, Shore Christian Academy, and Cape Charles Christian School (all of which also have prekindergarten programs). According to FEMA estimates using Hazus, during a 1-percent-annual-chance wind event, all eight of the schools would be damaged to some degree. Occohannock Elementary is anticipated to suffer the most, perhaps creating enough damages to cause a closure of 106 days. There are also an estimated 17 daycare facilities in the County, some are located in Cheriton, Exmore, Machipongo, Nassawadox, Franktown, and Cape Charles. There are no emergency shelters in the County, but the Northampton High School serves as the designated refuge of last resort. According to the Hazus model, this school could incur damages causing a 54 day closure following this type of wind event.

CULTURAL RESOURCES

The only County owned museum is in its Administrative Building, which houses the oldest running court records in the nation. There are several additional cultural and historical entities, resources, and museums, including Cape Charles Historical Society, Eastern Shore's Own, Barrier Island Center, and Arts Council of the Eastern Shore to name a few. The Barrier Island Center offers an interpretive center that comprehensively teaches about the history of the Eastern Shore and its culture.

The County is steeped in history, and would ideally have a designated Virginia Heritage Trail. There have been past efforts to do so, but no progress has been made to date. Only 25 buildings in Northampton County are registered with the Virginia Department of Historic Resources (VDHR) as official Historic Places. The County Courthouse Historical District is part of the Eastville Historical District at the county seat of Eastville. In 2001 the VDHR completed the archaeological survey of the Chesapeake Bay shorelines and in 2003 the Atlantic coast shorelines associated with both Eastern Shore Counties. The latter was updated in April of 2016.

NATURAL ENVIRONMENT

Northampton County, entirely within the Atlantic Coastal Plain, is relatively flat with the elevation ranging from sea level to 40 feet above mean sea level. Flat areas are typically more prone to flooding problems, particularly where the water table is high and the hydric soils dominate.

There are five large creek basins leading to the Chesapeake Bay and six significantly smaller creeks on the east coast leading to a series of seaside marshes and bays and ultimately the Atlantic Ocean.

LAND USE LAND COVER

The total land and water area of the County is approximately 795 square miles, only 207 square miles of which is comprised of land surface area. The majority of land use consists of farms, forests, and marshlands, dotted with towns, villages, and hamlets. According to the 2012 Census of Agriculture, there were 147 farms in 2012. This is a decline of four farms and 7,710 acres since 2007. The *2013 Virginia Outdoor Plan* indicated that there were about 20 square miles of lands under conservation easements and 80 square miles of owned lands providing conservation.

In order to compare land cover percentages, open water was excluded in the analysis, the county wide results are presented in Figure 3. According to the NOAA C-CAP Land Cover Atlas, between 1996 and 2010 there was a net increase of 12.11% and 12.69% in developed area and in impervious surfaces respectively. Still, the County has a total of 4% of its lands classified as developed and the percent of the County that is wetland has remained fairly constant for the past two decades. Forested areas, woody wetlands and estuarine emergent wetlands have all shown slight declines during that time, with increases in developed land cover and open space development. There was also a decrease in barren lands, typically representative of the sandy cover of the barrier islands, this is coupled with an increase in open water (NOAA, C-CAP, accessed July, 2016), which can be attributed to coastal erosion and high rates of relative sea level rise.

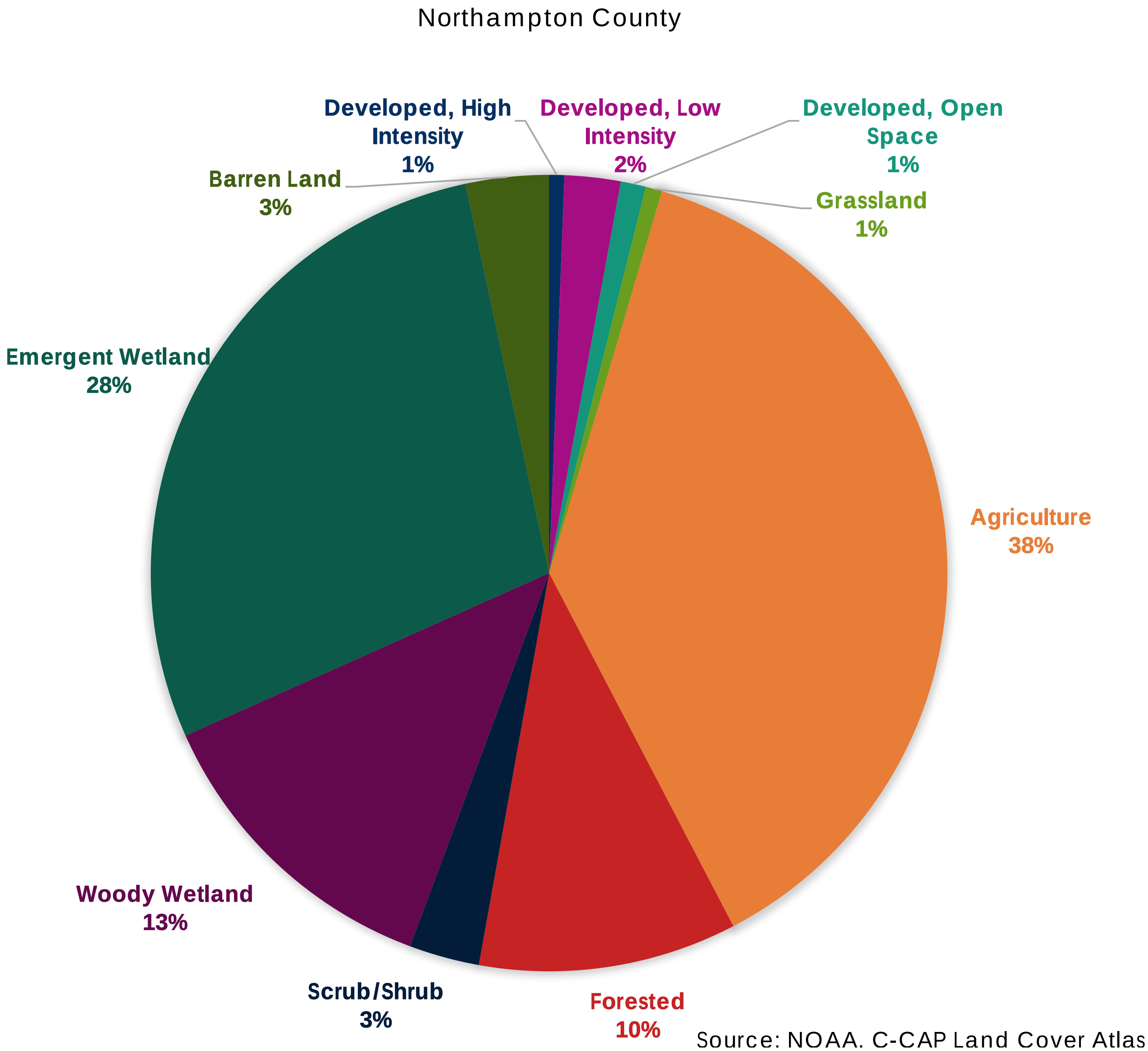


Figure 3: Northampton County Land Cover Percentages

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Northampton County has participated in the hazard mitigation planning process since 2006. The County's Comprehensive Plan was updated in 2009, and is in the process of another update.

Table 6: Northampton County Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
County	*		*		*	*													
Regional								*	*	*	*	*		*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

As of 2015, there have been seven Federal Disaster Declarations for flooding in the County and there are no repetitive loss properties (*FEMA Flood Risk Report*, 2015). Table 7 illustrates that there has been a decrease in the total number of policies since 2011. For 2011, this number is estimated to be lower even by the time this Plan is complete, as more homeowners learn of the changes to the Flood Insurance Rate Map (FIRM). Table 7 also shows the upward trend in the number of claims filed and the average pay per claim. The combination of these two trends could create major problems for the County should a major flooding disaster occur.

With the 2015 updates to the FIRM, there were changes to the associated Special Flood Hazard Area (SFHA) for the unincorporated areas of the County. The total area of the SFHA is now 221.8 square miles, representing a gain of 2.9 square miles and loss of 6.9 square miles for a net decrease of 4.0 square miles including 341 buildings. The area within the V zone is now 181.7 square miles, representing a gain of 2.9 square miles and a loss of 29.3 square miles for a net decrease of 25.7 square miles including 65 buildings. The 406 total buildings removed from the SFHA and V zone are no longer required to have flood insurance when under a mortgage (FEMA Flood Risk Report Northampton County, 2016). The number of buildings with policies, as shown in Table 7, decreased significantly from 2011 to 2016, which is extremely important as there are 139 previously insured buildings that no longer carry flood insurance. Without insurance, should a major storm cause flooding, it would take the resident, business, and overall community much longer to rebound following a disaster. Net loss of lands and buildings that are in the FIRM SFHA and V zone may give the residents and communities a misconception about vulnerability.

The County does not participates in the Community Rating System (CRS) program. The only Town in the County that participates in the program is Cape Charles. In 2011 there were 5 repetitive loss properties in the County, but according to the FEMA Flood Risk Report that came out in January of 2016, there are no longer any repetitive loss properties in the County.

Table 7: Summary of Northampton County's Past NFIP participation

	HMP 2006		**HMP 2011**		**HMP 2016**	
Date Joined	June 1, 1984		June 1, 1984		June 1, 1984	
	Total	**Unincorporated**	**Total**	**Unincorporated**	**Total**	**Unincorporated**
Total Policies	*unknown*	290	741	421	573 policies: 7 V-zone, 238 A-zone, and other 328	334 policies: 7 V-zone, 154 A-zone, and 173 other
Policy Premium	*unknown*	*unknown*	$651,356	$307,744	$420,385	$259,186
Total Coverage	*unknown*	*unknown*	$181,411,300	$106,673,300	$161,017,200	$93,259,300
Total paid since 1978	$104,131	$87,1780	$771,359	$740,073	$1,095,311	$1,003,415
Claims since 1978	30	24	78	67	102	87
Average Pay per Claim	$3,471	$3,633	$9,889	$11,046	$10,738	$11,533

HMGP	1999 Floyd 3 homes elevated, 2 in Battle Point and 1 in Oyster	Between 2006 & 2008 with Isabel funds, 7 homes in Oyster (all on Broadwater Circle) were elevated	1 home on Red Bank Road & 2 in Oyster were elevated in 2012. Last application was submitted in 2013, but was not funded. Currently application being prepared.

FEMA NFIP Report, July 2003, April 2011, and January 2016

HMGP

The County of Northampton has historically participated in the Hazard Mitigation Grant Program. To date 24 homes in the County have been elevated out of the flood plain, but no houses have been relocated or razed under the program. See Table 7 for more details.

HAZARD PROFILE

The County's primary risk is associated with coastal and stormwater flooding.

WIND

The peak wind gusts predicted by Hazus during a 1-percent-annual-chance wind event are between 90 and 93 mph for the County. Hazus damage estimates are flawed, as the input data is flawed. Because the data used to run the Hazus simulation for the County did not include the number of stories of the buildings, the Hazus estimate can be assumed to be a gross underestimate of damages that the County would incur. An estimated 127 buildings, just over 1% of the total number of buildings in the County, would be at least moderately damaged with winds of these speeds and an additional 740 buildings would incur minor damages (FEMA Hazus, 2016). An estimated seven buildings would be completely destroyed during such an event. Hazus estimates that residents from eight households would be expected to be displaced from their homes, and that 2 people would thus seek temporary shelter in a public shelter. The majority of all damages, about 43%, are to residential buildings. The total property damage losses predicted (again, recall that this is most likely an underestimate) is approximately $19.2 million, of which about 89% is from damages to buildings, contents, and inventory and the remainder results from economic loss from income loss, relocation costs, loss rental income and wages.

In addition, the Hazus model predicts 109,512 tons of debris will be generated. About 12,043 tons (69 truckloads at 25 tons/truck) of this is construction debris, the rest is tree debris and the tonnage varies depending upon the method by which the debris is collected and processed.

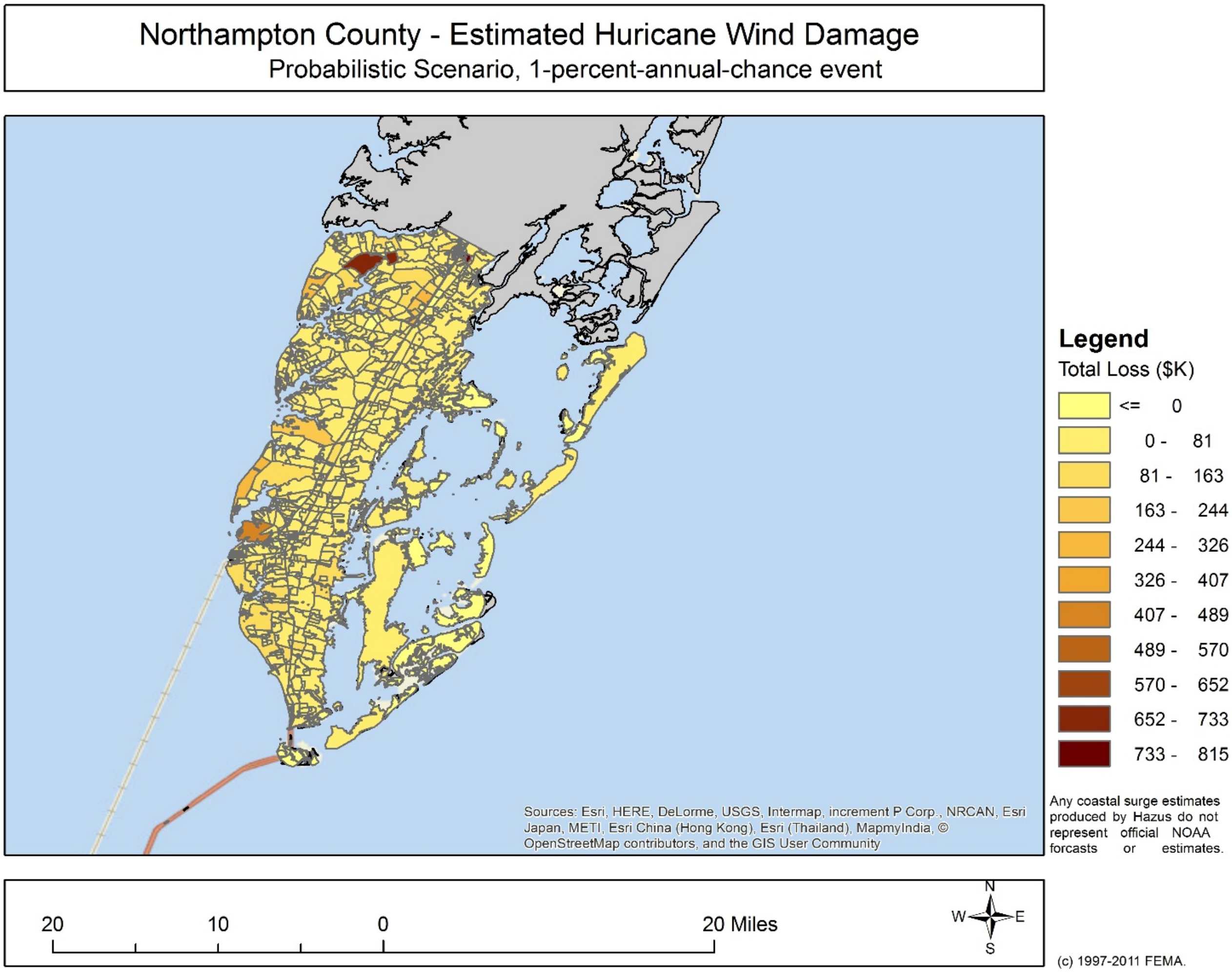


Figure 4: Northampton County Wind Damages by Census Block *Based on all single story buildings.

The Chesapeake Bay Bridge Tunnel (CBBT), the County's connection to the rest of the Commonwealth, does not allow campers, vehicles towing, or vehicles with external cargo when wind speeds exceed 40mph. When winds exceed 65 mph the CBBT can close to all traffic.

COASTAL EROSION

Northampton County is experiencing erosion along the bayside shoreline and the barrier island shorelines on the seaside. The inland seaside shoreline is relatively protected from erosion by the barrier islands, marshes, and bays to the east. That said, the shifting and erosion of the barrier islands and loss of marshes to habitat migration and rising seas, may leave the inland seaside shoreline in a more exposed position in the future.

The erosion rates on the barrier islands range from 7 to 17 feet per year on average, but a single high intensity northeaster or hurricane could erode more than that in just a few days. The Northampton County Comprehensive Plan Environment & Natural Resources Plan seeks to ensure that existing shorelines are preserved to the maximum extent possible, however, indicates that Barrier Islands remain in a natural state, without further defining this description. Considering the Barrier Islands protect the peninsular shorelines, it could be important to work further to target high erosion areas and have a Countywide plan to address this concern.

Table 8 illustrates the areas in the County identified by the 2002 VIMS *Shoreline Situation Report* and updated with 2016 information from local County representatives.

Table 8 : Northampton County areas Experiencing Coastal Erosion

Area	Location Description	Erosion Rate (feet/year)	Mitigation Strategy	Other
Critically Eroding Areas				
Tankards	Savage Neck, southwest of Eastville	20		
Moderately Eroding Areas				
Smith	Savage Neck, north of Tankards	with maintained groins & bulkheads, ~0	Groins, bulkheads	
Silver Beach	Occohannock Neck	with maintained groins, bulkheads, rip-rap, ~1	Groins, bulkheads, rip-rap (since the 1940's)	
Pickett's Harbor Beach	Between William b. Trower Bayshore NAP & Butler's Bluff	>1	None	
Butler's Bluff	Between Kiptopeke State Park & Arlington, bayside	with maintained groins, bulkheads, and breakwaters, ~ 0	Groins, bulkheads, and breakwaters	

COASTAL FLOODING

According to the 2016 FEMA Flood Risk Report, 222.2 square miles of the County are in the SFHA and 181.8 square miles are in the V zone. There are an estimated 8,529 buildings in the County with a total building replacement value (excluding contents) of $1.575 billion dollars. Approximately 72.5% of the building exposure are associated with residential housing (FEMA Hazus, 2016).

It is estimated that a 1-percent-annual-chance flood event would incur at least moderate damage to 132 buildings in the County. There are an estimated 18 buildings projected to be completely destroyed, all of which are manufactured homes. With this level of damages, Hazus estimates that 220 households will be displaced, of which, 132 people (approximately 1% of the County's population) will seek temporary shelter in public shelters.

The estimated building-related loss totals $57.77 million for building, content, and inventory. The additional economic loss from income loss, relocation costs, loss rental income and wages totals $100,000. Residential occupancies make up about 60% of the total losses, with commercial losses constituting about 30%, and industrial losses constituting about 7%. Figure 3 provides a representation of geographic distribution of these losses by Census block.

Additionally, the Hazus model estimates that a total of 4,778 tons of debris would be generated during such a flooding event. This would require 191 truckloads (at 25 tons/truck) to remove the debris. There is no County landfill, as current waste is shipped to Bethel County, and thus all of this debris, and thus would also have to be trucked inland.

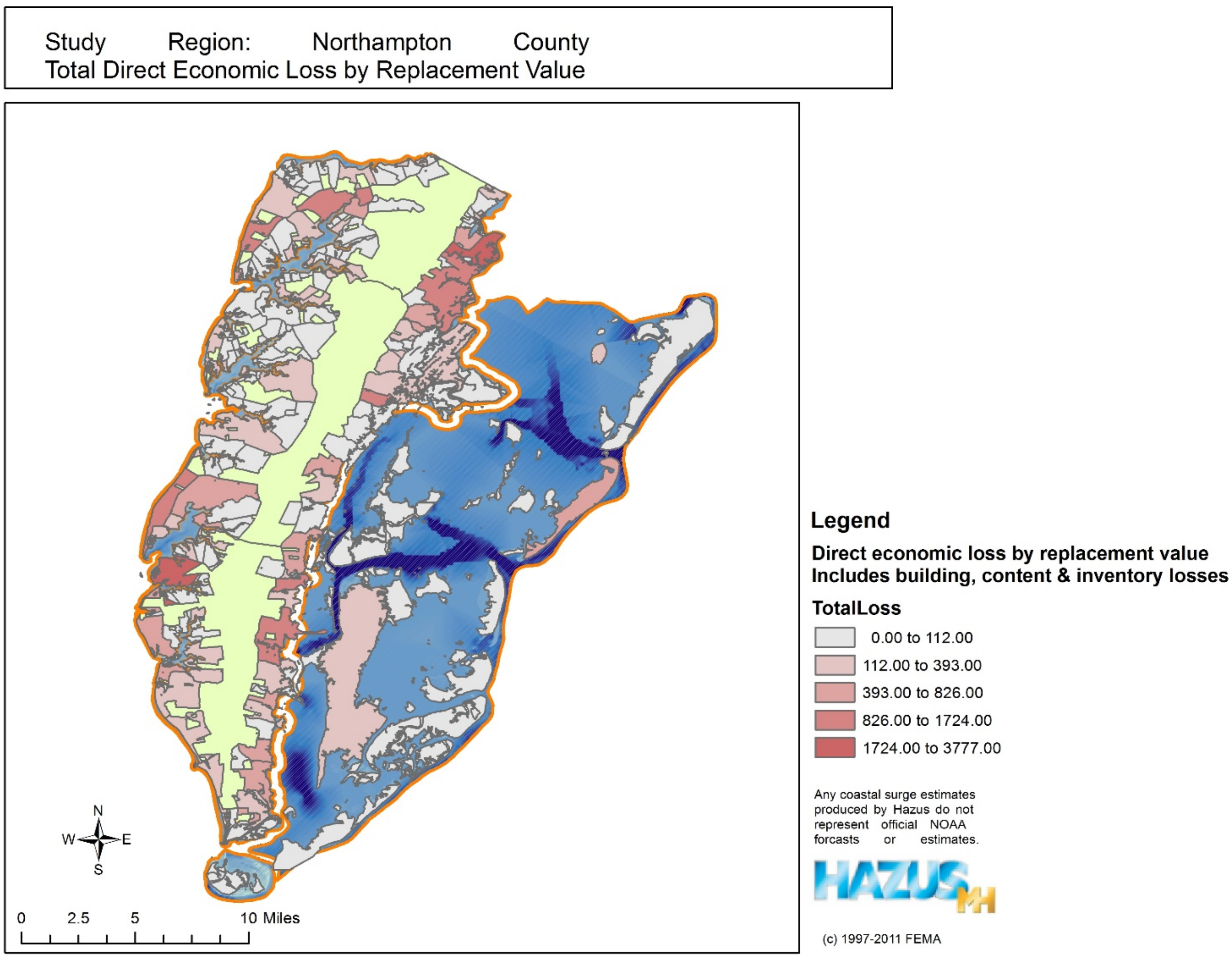


Figure 5: Northampton County Total Economic Losses from a 1% annual chance Flooding Event

SEA-LEVEL RISE

Of the County's 502 miles of roads, two miles (0.4%) is projected to be inundated with one foot of sea-level rise (SLR) (estimated year 2025-2050), 16 miles (3.2%) with two feet (within 2045-2090), and 26 (5.2%) with three feet (sometime after 2060) (*Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Asssessment (TIIVA)*, 2014). Even small amounts of SLR make rare floods more common by adding to tides and storm surge. With three feet of SLR, there are many communities and economically critical facilities (including various working waterfront areas) that would be disconnected, inaccessible, or have the majority of the roads inundated. Without significant engineering solutions in the coming years, it should be expected that the livelihood and safety of communities and the integrity of these roadways in the County will largely decline. Figure 4 shows a map from the TIIVA assessment of the areas more susceptible to SLR effects in the County.

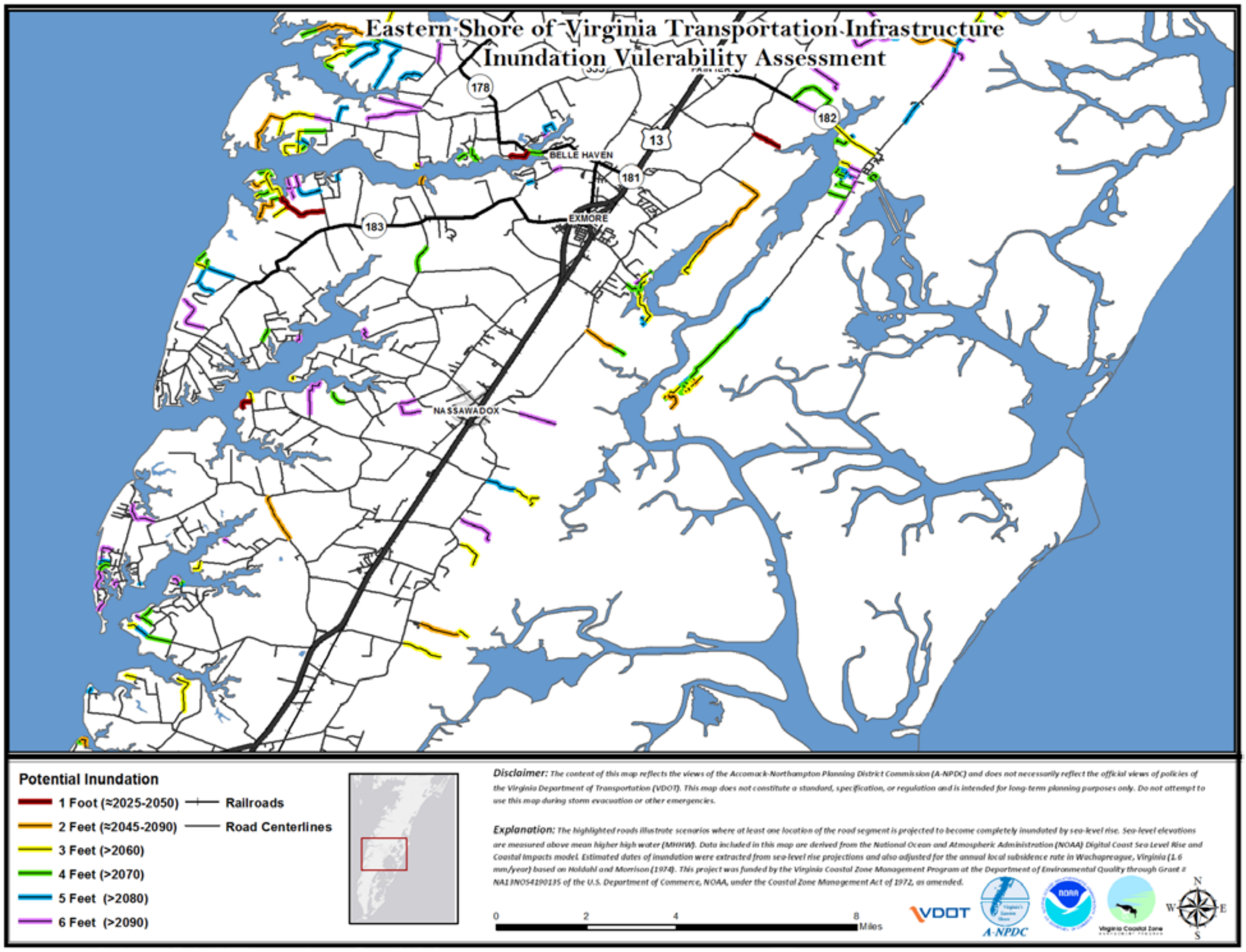


Figure 6: Northern Northampton County Transportation Infrastructure Inundation Vulnerability

STORMWATER FLOODING

Educating residents about the risks associated with stormwater flooding and standing water, such as septic contaminants and mosquito-borne illnesses, is an important step in mitigating potential negative impacts to the population.

Local officials identified various areas in the unincorporated portions of the County that have stormwater flooding problems. These areas include, but are not limited to:

- Village of Hare Valley
- Village of Weirwood
- Village of Cheapside - Between Arlington and Rt 13, septic systems and private wells
- Village of Townsend
- Village of Johnsontown

HAZARDS OF LOCAL SIGNIFICANCE

Additional hazards to those included below can be found in the Regional Level chapter.

WATER QUALITY

Since many people in the County rely on the fisheries and aquaculture industries, fish kills and the declining health of the Chesapeake Bay impact the residents and the economics of the region. In addition, bacterial impairments can discourage tourism and recreational use of our beaches and waters.

MOSQUITOS

Mosquito-borne illnesses such as West Nile and Zika virus pose a potential risk, especially with standing water from intense rain events and subsequent stormwater flooding.

SNOW AND ICE STORMS

With snow and ice storms there are often school closures, power outages, CBBT closures, and economic issues from damages to agriculture.

FIRE AND SMOKE

According to ACS estimates, in 2014 1,308 (25%) of Northampton County houses are heated with fuel oil, kerosene, etc. another 891 (17%) with bottled, tank, or LP gas, and also 159 (3%) wood as house heating source. In times of low humidity and high winds, the County is susceptible to field and forest fires as well.

CRITICAL FACILITIES

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

Table 9 : Critical Facilities in Northampton County

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
County-Owned					
County Courthouse Complex	Wind	Entire County	Devastating	No	Yes
Sheriff's Department/Emergency Operations Center	Wind	Entire County	Devastating	No	Yes
Fire/EMS	Wind	Entire County	Devastating	Yes	Yes
Regional Jail	Wind	Entire County	Devastating	No	Yes
Not County-Owned					
Chesapeake Bay Bridge	Wind, Flooding, Ice Tunnel	Entire Eastern Shore	Devastating	No	Yes

Riverside Shore Memorial Hospital	Wind	Entire Eastern Shore	Devastating	Yes	Yes
Cape Charles VORTAC Beacon	Wind, Flooding, Ice Coastal Erosion	Transcontinental air traffic	Inconvenience		
Schools	Wind	Entire County	Major Disruption	Yes	Yes
County Courthouse Complex Water Tower	Wind, Ice	500	Devastating	No	No
County Courthouse Complex Waste Water Treatment Plant	Wind	500	Disruption	No	Yes
Oyster, Willis Wharf Harbors	Flood, Wind, Ice		Disruption	No	Yes
Cell Phone/Communication Towers	Wind, Ice	Entire County	Devastating	No	Yes
Broadband Network	Flooding, Wind	Entire County	Disruption	No	No
Bayview Waste Water Treatment Plant	Wind	81 Residential Connections	Disruption	No	Yes

FINDINGS

1. The greatest threats to Northampton County are coastal flooding (~$58 mil) and high wind events (>$19 mil). Erosion, stormwater flooding, winter storm events, and water quality issues also pose significant threats to the County.

2. Established neighborhoods in the County are at great risk to damage in a wind event, not solely from wind, but from wind-damaged trees and other airborne debris. Damages reflected by Hazus are inaccurate, as they only assume single story buildings (based on County data).

3. Private flood insurance policies for homes within Special Flood Hazard Areas are becoming increasingly difficult to attain within the County. The new FIRM includes 406 fewer buildings in the SFHA and V zones. A combination of these factors has resulted in 139 fewer buildings being insured in 2016 than in 2011. This creates a vulnerability in the County and lessens the ability to rebound following a flood event.

4. The new FIRM shows a reduction in area within the SFHA and the V zone, which does not take in to account erosion rates, relative sea level rise, and may instill a false sense of security in the County about risk to flooding.

5. Isabel in 2003 proved to be an extremely damaging event for Northampton County despite being a Tropical Storm that did not make direct landfall within the County. The storm caused approximately $10 million and $3 million to the County's agricultural and aquaculture industries, respectively; widespread damage to trees; extensive coastal flooding; and destroyed the Ocean Cove Seafood building in Magotha that had withstood the great hurricane of 1933. Storms of similar or greater magnitude are likely to occur in the future and Isabel should serve as a great lesson for the County.

6. The Chesapeake Bay Bridge Tunnel is a critical facility that affects the local economy, communications, and emergency response capabilities.

7. It is expected that a bayside-focused disaster would be worse than a similar seaside disaster considering current pattern of development in the County and the greater exposure to storm-related hazards on the bayside.

TOWN OF BLOXOM

TOWN PROFILE

Bloxom is located west of the central spine of the Eastern Shore in Accomack County. The Town was established in the early 1800s as a farming community. The railroad was constructed in 1884 and the Town experienced significant growth. By the early 1990s, Bloxom and become a major produce shipping point on the Eastern Shore. As farm labor needs decreased in the 1930s, the population of Bloxom began to decline. By 1952, the railroad had ceased passenger service and the Town's high school had closed. The Town was incorporated in 1951 and has evolved primarily into a residential community (*Bloxom Town Plan*, 2000).

Figure 1: Bloxom Context and Boundary Maps

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 that 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

Between 1980 and 2000 the community reached a maximum population of 407 in 1980 and a minimum of 357 in 1990 (Bloxom Town Plan, 2000). The population of Bloxom was 395 in 2000 and has remained fairly stable, being 387 in 2010 (US Census, 2000; US Census, 2010). The median age for residents in Bloxom in 2010 was 36.4 years, signifying a population just under the national average of 36.8 years (US Census, 2010). With a younger population, there are often less potential for high risk populations during an emergency situation due to physical hindrances in mobility.

Mayor Callander pointed out that Table 1, does not reflect the increase in the Haitian population in the Town, which he estimates to be approximately 1% and the Town's Haitian and Latino year-round population is increasing (personal communications, January 25, 2016). This is important, as different language (Spanish, French and/or Creole) outreach materials need to increasingly be made available.

Town representatives also pointed out that the estimated median household income level indicated in Table 1 is most likely too high (Mayor Callander, personal communication, January 25, 2016). Typically the lower a household income the less able they are to mitigate hazards by installing, updating, or renovating their properties.

Table 1: Bloxom Demographic Information

	2014***	2013**	2010*	2000****
Population	422	406	387	395
Median Age	35.5	35.0	36.4	37.7
Disability	15	14	NA	NA
Income				
Median Household Income	$39,091	$38,068	$37,188	$25,000
Poverty Level	10.9%	14.5%	13.3%	NA
Language				
Only English	91.7%	86.7%	92.8%	89.4%
Other	8.3%	13.3%	7.2%	10.6%
Spanish	8.3%	13.3%	7.2%	10.6%

Source: * U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The town is primarily a residential community with the majority of employed residents commuting out of Town to work. NASA, Accomack County Schools, seafood industry, and Tyson and Perdue poultry processing plants are several major employers located near Bloxom (Bloxom Town Plan, 2000), these are reflected in Table 2 below primarily in the manufacturing, education, and wholesale categories. These companies often have policies in place to mitigate the economic impact for both the company and the employees, however, long-term closures would have strong negative impacts on the Town.

Table 2: Bloxom Local Workforce Industry

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	7	3.7%	25	10.3%	12	4.3%	15	8.8%
Construction	7	3.7%	16	6.6%	14	5.0%	17	10.0%
Manufacturing	23	12.2%	27	11.1%	10	3.6%	17	10.0%
Wholesale trade	20	10.6%	18	7.4%	24	8.6%	9	5.3%
Retail trade	36	19.1%	28	11.5%	48	17.1%	34	20.0%
Transportation and warehousing, and utilities	13	6.9%	14	5.8%	21	7.5%	9	5.3%
Information	0	0.0%	0	0.0%	19	6.8%	2	1.2%
Finance, insurance, real estate, and rentals	0	0.0%	0	0.0%	6	2.1%	14	8.2%
Professional, scientific, waste management	1	0.5%	4	1.6%	9	3.2%	8	4.7%
Educational, health care, social services	19	10.1%	43	17.7%	71	25.4%	15	8.8%
Arts, entertainment, recreation, food	13	6.9%	26	10.7%	40	14.3%	11	6.5%
Public Administration	27	14.4%	19	7.8%	12	4.3%	13	7.6%
Other	22	11.7%	23	9.5%	13	4.6%	6	3.5%
TOTAL CIVILIAN EMPLOYED POPULATION	188	-	243	-	280	-	170	-

Source: *American Community Survey, 2010 – 2014, **U.S. Census, 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Bloxom has stayed relatively stable with the small amount of businesses located in the town, keeping 10 establishments between 2009 and 2013. As shown in Table 3 below, the Town has seen growth in employees, with a 34% increase in the total employees within Bloxom, indicative of the success of the existing establishments. Knowing the number of people employed here aids rescue workers in the estimate of the dispersal of persons within the Town.

Table 3: Bloxom Business Establishment Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Construction	2	1	2

Wholesale Trade	2	2	2
Retail Trade	1	2	2
Transportation and warehousing	0	0	1
Professional, Scientific, and Technical Services	1	1	1
Health Care and Social Assistance	2	1	1
Other Services (Except Public Admin)	2	1	1
Total, All Establishments	10	10	10
Total Employees	44	30	29

Source: Census Zip Code Business Patterns, 2013

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk.

Bloxom is predominantly residential. The number of housing units is most likely closer to the U.S. Census 2010 figure of 184, versus the 2014 overestimate, as there were two buildings razed and not rebuilt, about five houses renovated, and no major construction (Mayor Callander, personal communication, January 25, 2016). Out of these housing units, only 15% were vacant in 2010 (U.S. Census) and the majority of homes in Bloxom are in good condition, with the exception of some areas on the west side of Town (*Bloxom Town Plan*, 2000). There are two new homes (2,000ft^2 and 3,000ft^2) currently under construction (Mayor Callander, personal communication, January 25, 2016).

Table 4: Bloxom Housing

	2014*	**2010****	**2000*****
Total Housing Units	198	184	175
Occupied	170	156	160
Vacant	28	28	15
Owner-Occupied	118	112	119
Renter-Occupied	52	44	41
Median Housing Value	$91,800	NA	NA

* American Community Survey, 2009 – 2014, **U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

Bloxom is served by a sufficient road system. Route 316 and 770 provide north-south access for the Town, and Route 187 provides east-west access. U.S. Route 13 is located two miles east of the town and provides regional access (*Bloxom Town Plan*, 2000). The Bay Coast Railroad also serves Bloxom, reflecting its early history as a major produce shipping point for the Eastern Shore. The Railroad could pose a potential hazard risk as it transports propane or could serve as an aid in evacuating residents during or following an emergency.

Vehicles available to households is one indicator of a household's ability to evacuate when necessary. Although ACS indicates that only 1 household is without access to a vehicle, Mayor Callander indicates that there are probably about 10 households without access to a vehicle (personal communication, January 25, 2016). However, for those in need of public transportation, Bloxom is on STAR Transit's silver, orange, gold, and blue lines with the stop being located at the Mini-Mart. The orange and gold are southbound, ending and Walmart and providing transfer opportunities for the southern routes that go as far south as Cape Charles. The silver takes riders as far as the Chincoteague municipal complex, where riders can transfer to the Pony Express, a seasonal circulator. Bloxom is actually the northern-most point on the blue line, but it is not the last stop. Riders can board in Bloxom and ride to Parksley, which is the last stop on the blue line.

Figure 2: STAR Transit Routes serving Bloxom

Table 5: Bloxom Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	1	9	13
One	72	94	61
Two	66	74	52
Three or more	31	59	28

* American Community Survey, 2009 – 2014, ** U.S. Census 2000

COMMERCIAL AREAS

The majority of commercial land is located along Bayside Drive and Shoremain Drive. Commercial land uses have previously included a florist shop, a grocery store, a go-cart race track, a used furniture store, a nursery, and a deli, but now are limited to the Mini-Mart and a hair stylist. The furniture business was destroyed by a fire in the last ten years, the go-cart track is now a soccer field, and the others have closed and not relocated (Mayor Callander, personal communication, January 25, 2016).

COMMUNITY FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard. Bloxom has a Town Hall, Town Hall Annex, the Police Department, and a Post Office. The Town of Bloxom does not have its own Public Works Department, but rather, relies on the County and private facilities in regards to water, drainage and road systems, parks, and boating facilities.

PUBLIC SAFETY

Police protection is provided by the Bloxom Police Department which currently has two cars and two part-time officers. The Bloxom Rescue Squad provides ambulance services. Fire protection is provided by the Bloxom Volunteer Fire Department (*Bloxom Town Plan*, 2000). The Fire Department is equipped with 2 full-time employees, many volunteers, 3 trucks (2 large sprayers and one high truck), brush truck, and 2 ambulances. All of these are capable of sourcing water from the refill pond behind the Firehouse. The Town Firehouse is equipped with a generator to supply back-up power in the event power is lost during a storm event.

Figure 3: The new Fire and Rescue Department under construction in 2011. The railroad is a vital and historic component of the Town and can be seen in the foreground. Photo by Curt Smith

Use of the Bloxom Town Hall pictured to the left in Figure 3 has been discontinued due to its condemnation, and the Town has been operating out of the Annex Police Department. The intent is to remodel the Police Department building, converting one bay into the Town Council chambers, as the Town plans to see he two aging police cars and purchase a single new vehicle (Mayor Callander, personal communications, January 25, 2016).

Figure 4: Bloxom Town Hall (Forefront) and Annex Police Department (behind)

WATER SUPPLY & SEWAGE DISPOSAL

Bloxom residents rely on private wells for potable water supply. In the past six years, there have been about 8 wells drilled to a deeper aquifer level than the existing wells, this is due to thought that the water level could be lowering. See the Natural Environment, Groundwater section on page 9 for more information.

Bloxom does not have a public sanitary sewer system, so sewage disposal is by septic systems. In addition, residential water supplies can be threatened by failing septic systems, which the majority of residences operate for waste disposal. Under the Chesapeake Bay Preservation Act, septic tanks are required to have pump-out service at least every five years.

SOLID WASTE DISPOSAL

Solid waste disposal is the responsibility of individuals and businesses, who can take their refuse to an Accomack County convenience center. The closest convenience centers to Bloxom are located at Fisher's Corner to the south and Makemie Park to the north.

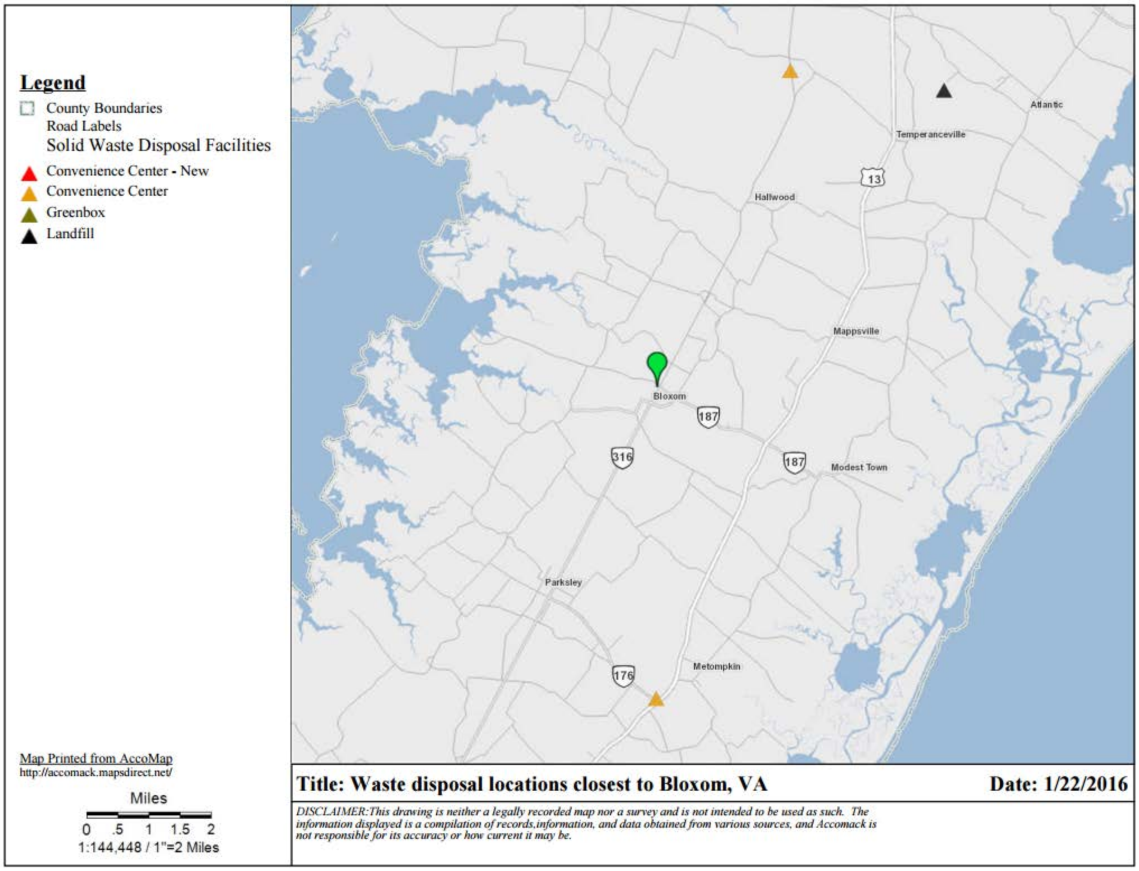


Figure 5: Locations of Waste Disposal Facilities near Bloxom

POWER AND COMMUNICATIONS INFRASTRUCTURE

The Town is serviced by multiple substations, none of which are located within Town limits, and thus are less likely to lose electric services. There has been a lease signed to have a broadband tower installed at the Town Hall/ Annex Police Station, which will improve information access options for the residents.

PARKS AND RECREATION

Although there are no Town own parks, the Town has leased the Town Square area from Bay Coast Railroad for several decades, and use this area along the railroad for the annual Bloxom Family Fun Festival, the car show, and more. The Town would like to potentially use the highest ground of this area as a place for a pavilion that could also serve as the staging area, since the Town currently doesn't have a designated staging area location.

STORM WATER DRAINAGE

In 2010 the Town petitioned the County to have the drains dredged. They had to have notarized permission from every homeowner along the drainage, then the appropriate permits from the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE) were obtained. The ditches were finally serviced in 2012, with payment being made by Accomack County. Since that time there has been very little problem with drainage and the roads no longer have rushing water during and following rain events. A Nor'easter in November of 2013 and Hurricane Matthew September of 2016 are the only two events that have caused some minimal flooding (Mayor Callander, personal communications, January 25, 2016).

SCHOOLS

There are no schools within the Town of Bloxom.

CULTURAL RESOURCES

East of the railroad and behind the soccer field, 2.7 acres of land is being donated to the Town. This is previous property of Dr. Kerns, a historic figure on the Eastern Shore.

NATURAL ENVIRONMENT

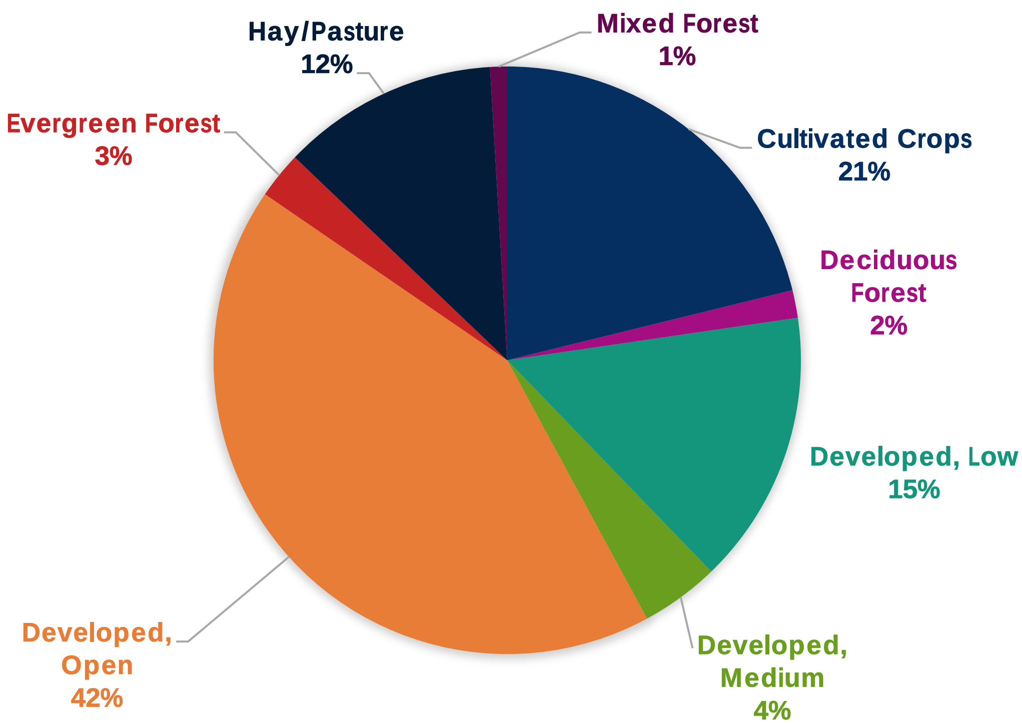
Bloxom lies within the Chesapeake Bay watershed and is drained by Muddy Creek and Guilford Church Branch, which drain the northern and southern parts of the Town, respectively. The elevation ranges from 15 feet to 35 feet with an average slope of 1%. This results in flooding due to poor drainage. Adding to the drainage problems are the soil types in Bloxom being largely hydric (*Bloxom Town Plan*, 1996).

LAND USE LAND COVER

Bloxom is mainly composed of low-density residential land uses. There is minimal agricultural land use in Town. Although the USGS data presented in Figure 5 indicates that 18% of the Town's land is cultivated crop, this is a vast overestimate, as only a portion of the eastern fringe of the Town property overlays agricultural fields, thus this must be representing the large grass yards and the Town Square area.

There is a small portion of wetlands within the Town. These non-tidal wetlands are located on the banks of Muddy Creek and Guildford Church Branch. There is also an area of non-tidal wetlands located to the east of Route 316. Wetlands are important to protect due to assisting with flood control and they serve as groundwater discharge and recharge areas (*Bloxom Town Plan*, 2000).

In the past, Bloxom has been limited in its development due to most of the soils being unsuitable for septic tank filter fields (*Bloxom Town Plan*, 2000), but new technologies in alternative (above ground) septic systems may change this.



Source: USGS. National Land Cover Dataset. 2011

Figure 6: Bloxom Land Use Land Cover Percentages

GROUNDWATER

The Town does not provide public water services, so all residents rely on individual private wells for their potable water supply. Most of the Town's water supply is withdrawn from the upper Yorktown aquifer. The Town lies slightly west of the important spine recharge area. Bloxom is located in Wellhead Protection Area C – Perdue Area. Major water withdrawers in this area are Perdue, the towns of Onancock and Parksley, and the Riverside Shore Rehabilitation Center. (*Bloxom Town Plan*, 2000). There have been a few times when the water has seemed to be low and wells have "sucked up sand" which most likely spurred the drilling of deeper wells in the last five years (Mayor Callander, personal communications, January 25, 2016).

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Bloxom has participated in the hazard mitigation planning process since 2011. Bloxom has not updated their comprehensive plan since 1996.

Table 6: Town of Bloxom Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning/Subdivision Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town of Bloxom has no identified Special Flood Hazard area and does not participate in the NFIP, but has expressed an interest in joining NFIP. Town residents could be eligible for preferred rates.

HAZARD MITIGATION GRANT PROGRAM

The Town of Bloxom has not participated in the HMGP.

HAZARD PROFILE

Storm water flooding has the greatest and most frequent impact on the Town.

WIND

No parts of Town lie in the wind borne debris hazard area near the shoreline, but lies in the area that can have 84 mph sustained winds during a 1%-annual-chance storm event and in the 110-120 mph design wind zone (Accomack County Building Code). Because its elevation is slightly higher than the surrounding areas, it is slightly more susceptible to higher winds. Although there is no record of tornadoes affecting the Town, there is always a possibility of these unpredictable storms, and residents should be knowledgeable about the best course of action to take should conditions demand so.

Most of the residential areas, particularly east of the railroad tracks, are older and have mature trees in and around the homes. During a high wind event falling branches or trees may damage some structures. A new firehouse was constructed in 2011 and was designed to withstand gusts of at least 110mph.

COASTAL EROSION

Due to its inland positions, the Town is not at risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area. The Town is within the X-zone, which is the 500-year floodplain, and is not likely to be affected by a 100-year flood. However, it is possible for the Town to be affected by a flood of that magnitude due to flat topography, an elevated water table, and poor drainage. Several small commercial areas are located in the center of the Town (Bloxom Town Plan, 2000).

STORM WATER FLOODING

Storm water flooding has traditionally had the greatest and most frequent impact on the Town. The Town lies on unsuitable soil for drainage and retains rainwater. During heavy rains the Town's roads historically flooded, and floodwaters have historically rushed down the main street in Town causing damage to property (Bloxom Town Plan, 2000), but not since the 2012 ditch maintenance described in the Storm Water Drainage section on page 7.

The location of the emergency ditch construction efforts are indicated by the blue line on Figure 6, which leads first to Guilford and Muddy Creeks and ultimately to the Beasley and then Chesapeake Bays. The Town does not finance the annual maintenance of ditches along roadways and relies on Accomack County and the Virginia Department of Transportation for ditch maintenance.

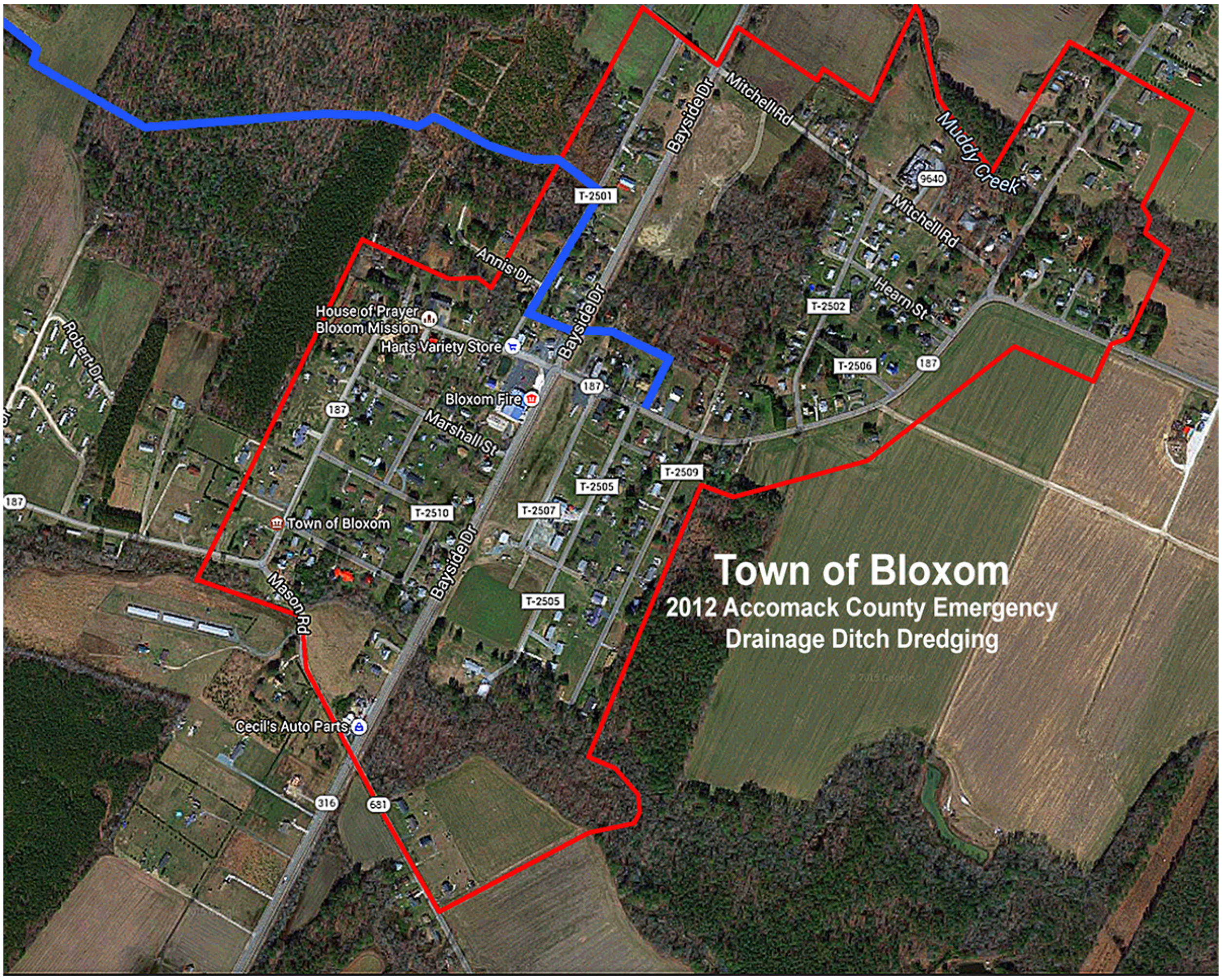


Figure 7: Town of Bloxom Emergency Ditch Dredging (Town boundary is red, Ditch is blue). Courtesy of Mayor Callander.

In specific instances, storm water has accumulated and caused flooding. Bloxom received a flood of this nature on September 3, 2003, just prior to Hurricane Isabel. A heavy rain occurred and water flowed to the railroad tracks, which acted as a dam, back flooding several homes. Figure 7 reveals the some of the damage incurred. Although the storm is called the Great Bloxom Flood of 2003, several areas were flooded including Bloxom, Clam, Guilford, Hallwood and Nelsonia. Although there were no estimates of the probability of the storm event, the entire 12-hour period including the initial storms in the afternoon would put this above the 100-year storm event level, which on the Eastern Shore is 7 to 8 inches in 12 hours. Persons who remember the Bloxom storm recall that the larger storm's rainfall occurred over approximately 2 hours, making this storm above the 100-year storm event. The 2-hour, 100-year storm on the Eastern Shore is between 4.5 and 5 inches of rain.

Figure 8: Greenhouse flooded in the Town of Bloxom on September 3, 2003. Photo by Franklin Kreisl

In 2006, the railroad was actually washed out at Bayside Road close to the Mason Road intersection. Luckily since 2012 there has been very little flooding, although the ditches will require maintenance soon and then regularly in order to maintain this state. The area between Bull and Bayside at Marshall Street still flood some where the old railroad station and grainery were located (Mayor Callander, personal communications, January 25, 2016). Due to lingering standing water from hurricane Matthew, the Bloxom Family Fun Festival scheduled for the first weekend of October had to be canceled (see Figure 8). None of the ditches in the Town have year-round standing water.

Figure 9 : Figure 8: Town Square flooding October 1, 2016 prevented the annual Town Family fun Festival.

Having reduced the chances of stormwater flooding reduces the risk to residents for well contamination, mosquito-borne illnesses, and property damages.

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

Bloxom faces a threat of ground water contamination from several major facilities in the vicinity. Major ground water withdrawers in the area are Perdue Foods, Byrd Foods, the Towns of Onancock and Parksley, and the Arcadia Nursing Center Home. The large withdrawals of ground water increase the possibility of water quality problems, including well interference, salt water intrusion, and deterioration of water quality. A liquid propane gas (LPG) storage facility with a capacity of 90,000 gallons was located on the east side of the Town. Town residents were concerned about the safety of these tanks and expressed concerns about similar facilities being located within the Town. The Town requested removal of the facility and now does not allow similar facilities to exist within the Town (Bloxom Town Plan, 2000, Verbal Communication with Town Officials, June 2011).

The residential wells in the Town are also potentially at risk of contamination from aboveground and underground petroleum storage tanks (AST and UST). Most homes in the Town are heated by oil, which is stored in these tanks. If not properly maintained, ASTs and USTs can pose a significant water quality risk to the Town. In addition, residential water supplies can also be threatened by failing septic systems, which the majority of residences operate for waste disposal. Bloxom Town Officials indicated that several residences on Back Street use lift stations that drain to a common drainfield located on the outskirts of the Town. If the integrity of the septic drain pipe is compromised in the future, it could pose a significant health risk to residential water supplies and surface water quality (Verbal Communication with Town Officials, June 2011).

WEATHER EXTREMES - SNOW AND ICE STORMS, DROUGHT, HEAT

Winter snow and ice storms have historically had adverse impacts on the Town including damage to trees and power lines and making roads impassable. A winter storm struck Bloxom in late December of 2010 creating blizzard-like whiteout conditions, extensive snow drifting that blocked roadways and compromised accessibility to and from the Town. Power losses were experienced and Town businesses were closed for days, creating potentially hazardous situations for residents and adverse impacts on the local economy.

The Town Firehouse is equipped with a generator to supply back-up power in the event power is lost during a storm event.

CRITICAL FACILITIES

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

Table 7: Town of Bloxom critical facilities

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Bloxom Town Hall and Annex	NA	X	X	Wind Stormwater Flooding	422+	Major disruption	No	Yes
Bloxom Fire & Rescue Department	NA	X	X	Wind Stormwater Flooding	Town and County Residents	Devastating	No	Yes

Post Office	NA	X	X	Wind Stormwater Flooding	600+	Major Disruption	Yes	Yes
Mini Mart (Gas Station)	NA	-	X	Wind Stormwater Flooding	422+	Inconvenience	No	Yes
Town Square	NA	-	X	Stormwater Flooding	600+	Inconvenience	No	Yes

FINDINGS

1. The hazards expected to have the greatest impact on the Town are stormwater flooding and high wind events, which have been experienced throughout the Town's history. Other hazards facing the Town are groundwater contamination, ice storms, drought, tornadoes, and mosquito-borne disease.

2. Although no part of the Town lies within any flood zone and there are no flood policies in the Town, however representatives have expressed interest in joining the NFIP so that residents may obtain flood insurance in case of severe storm water flooding.

3. Emergency maintenance and ditching in 2012 has alleviated the majority of stormwater flooding in the Town, however, this ditch needs regular maintenance, which it has not yet received.

4. Older construction and mature trees in residential areas increase risk from damages from wind and snow events, as branches are likely to come down causing secondary wind/snow damages and power outages.

TOWN OF CAPE CHARLES

TOWN PROFILE

The Town of Cape Charles was created in 1884 as a planned community at the southern terminus of the railroad. It is located in southern Northampton County on the Chesapeake Bay, and it was incorporated in 1886. An area west of the town on the Bay was incorporated in 1909, and it was called the Sea Cottage Addition. Further annexations occurred in the southern and northern portions of the neck in the 1990 (*ESVA Hazard Mitigation Plan,* 2011).

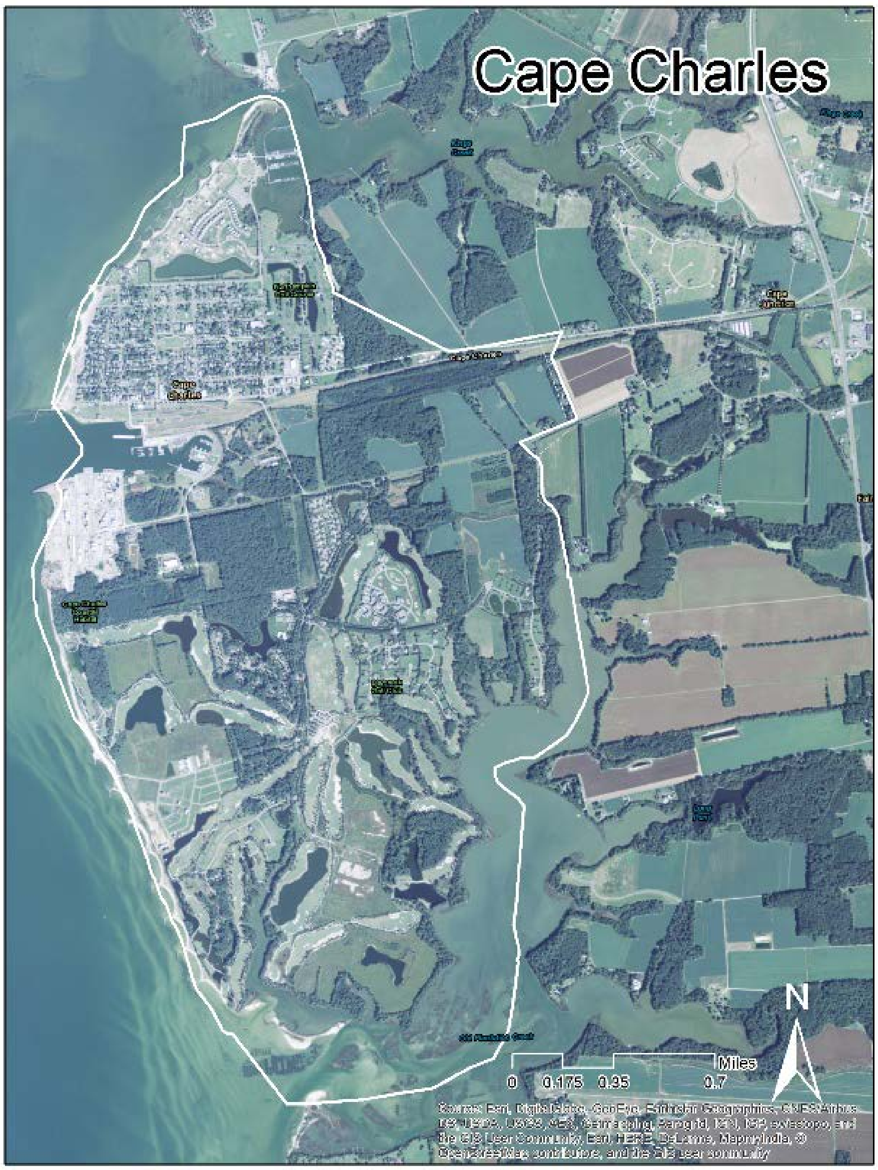


Figure 1: Cape Charles Aerial Map

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 that 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

The 2010 Census indicated that the Town had a population of 1,009, which is an 11.1% decline from the 1,134 people that lived in the Town during the 2000 Census (U.S. Census; 2000, 2010). The American Community Survey (ACS) estimate for 2014 matches that of the 2010 census (ACS, 2010 – 2014). The Town has become a popular destination for retirees, tourists, and second home owners in the last decade and is experiencing a greater influx of seasonal residents during the warmer summer months. This trend is expected to continue to grow in the future, and the Town is planning accordingly (*ESVA Hazard Mitigation Plan*, 2011). Town representatives indicate that the year-round population estimate for the most recent years might even be a bit high, however in the next 5 to 10 years this number is anticipated to grow significantly as owners that are currently leasing their properties will be retiring and move to the Town as their primary residence (Jeb Brady, Building Official, personal communications, June 8, 2016). These new residents will require additional outreach in hazard preparation and mitigation education.

Table 1 : Cape Charles Demographic Information

	2014***	2013**	2010*	2000****
Population	1009	1009	1009	1134
Median Age	NA	50.6	48.7	44.2
Disability	NA	62	NA	NA
Income				
Median Household Income	NA	$27,132	NA	$22,237
Poverty Level	NA	24.9%	NA	NA
Language	**	**	**	
Only English	94.8%	95.3%	95%	97.1%
Other	5.2%	4.7%	5%	2.9%
Spanish	1.5%	2%	2.3%	1.4%
Ind-Euro	2.8%	2%	2.2%	1.5%

* U.S. Census 2010, ** ACS 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Most of the local workforce in Cape Charles works in the Educational and Medical fields. There is also a large portion of the population working in Arts and Retail, reflective upon the large seasonal and tourist populations that come to the town (ACS, 2010 – 2014). Between 2000 and 2010 the workforce grew significantly. The estimated values provided by the American Community Survey for 2014 would indicate a severe and rapid decline in the workforce, but Town representatives indicated that this is inaccurate and a continued increase since 2010 is probably more accurate. This estimate may have come as a result of a decrease in employment at Bayshore Concrete, however that decline reached its low in 2014 and has now rebounded to approximately 300. (Jeb Brady, Building Official, personal communications, June 8, 2016).

Table 2: Cape Charles Workforce

Civilian Employed Population						
Industry	2014*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	15	4.5%	0	-	13	2.9%
Construction	21	6.3%	42	7.6%	31	7%
Manufacturing	17	5.1%	37	6.7%	68	15.3%
Wholesale trade	4	1.2%	9	1.6%	7	1.6%
Retail trade	49	14.7%	51	9.3%	30	6.8%
Transportation and warehousing, and utilities	2	0.6%	25	4.5%	31	7%
Information	3	0.9%	4	0.7%	10	2.3%
Finance, insurance, real estate, and rentals	15	4.5%	25	4.5%	19	4.3%
Professional, scientific, waste management	52	15.6%	56	10.2%	38	8.6%
Educational and health care services	85	25.5%	146	26.5%	85	19.1%
Arts, entertainment, recreation, food	46	13.8%	83	15.1%	51	11.5%
Public Admin	22	6.6%	41	7.5%	13	2.9%
Other	2	0.6%	31	5.6%	48	10.8%
TOTAL CIVILIAN EMPLOYED POPULATION	333	-	550	-	444	-

Source: *American Community Survey, 2010 – 2014; ** U.S. Census 2000

BUSINESSES

Business data provide basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Cape Charles has seen a steadily growing business market since 2000. Seasonal tourism and Bayshore Concrete provide opportunities for economic growth and development. The decline in total number of employees could be related to Bayshore Concrete employment trends (Jeb Brady, Building Official, personal communications, June 8, 2016). Many of the surrounding towns in Northampton County have citizens that commute into Cape Charles to work (*ESVA Hazard Mitigation Plan*, 2011).

Table 3 : Cape Charles Business Types

Industry Code Description	Total Establishments		
	2013	2011	2009
Agriculture, Forestry, Fishing and Hunting	1	1	1
Utilities	1	1	0
Construction	3	5	9
Manufacturing	2	2	2
Wholesale Trade	5	5	5
Retail Trade	15	14	19
Transportation and Warehousing	1	1	1
Information	1	1	2
Finance and Leisure	5	3	3
Real Estate and rental and leasing	3	3	5
Professional, Scientific, and Technical Services	10	6	7
Management of companies and enterprises	0	0	1
Administrative and Support and Waste Management and Remediation Services	2	2	2
Educational Services	2	2	3
Health Care and Social Assistance	5	5	5
Arts, Entertainment, and Recreation	1	4	3
Accommodation and Food Services	18	17	19
Other Services (Except Public Admin)	8	9	8
Industries not classified	0	0	1
Total, All Establishments	83	81	96
Total Employees	587	837	864

Source: Census Zip Code Business Pattern, 2000, 2011, 2013

BUILT INFRASTRUCTURE

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

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

According to the ACS, between 2000 and 2014 there was almost a 20% increase in housing units built in Cape Charles. This is a statement with which the Town of Cape Charles Building Official agrees, however does believe that there has not been any decrease in units between 210 and 2014 as the ACS indicates. The Town consists of an historic downtown area with many older, historic homes. Many of these homes either renovated seasonal homes, or they are older homes in poor condition (*Town of Cape Charles Comprehensive Plan*, 2009). There is also the Bay Creek Golf Resort which has two 18-hole golf courses as well as residential development (*ESVA Hazard Mitigation Plan*, 2011). Although property values have increased for homeowners, this has caused an increase in rent and housing prices that create difficulties for low and moderate income households (*Town of Cape Charles Comprehensive Plan*, 2009).

The high number of vacant housing units are primarily for seasonal, recreational, or occasional use in Cape Charles (U.S. Census; 2000, 2010). These kind of vacant buildings are typically kept well and pose less of a hazard during high wind events. Although it appears that there is a lack of available of vehicles for nearly a quarter of the population, this is also a result of the nigh number of second homes in the Town.

Approximately 150 of the older homes have been redeveloped and renovated since 2000 – this figure does not include new construction (Jeb Brady, Building Official, personal communication, November 22, 2016). Because Cape Charles has been in the SFHA for many years, new homes were built above BFE and many restorations involved raising the building and/or building new editions above BFE.

The highest density areas are in the Seabreeze complex, where the property has experienced significant erosion problems during storms in the past, and these populations could be considered high risk during an emergency situation.

Table 4 : Cape Charles Housing

	2014*	2010**	2000***
Total Housing Units	936	958	740
Occupied	498	516	536
Vacant	438	442	204
Owner-Occupied	278	247	248
Renter-Occupied	220	269	288
Median Housing Value	356,600	NA	NA

Source: * ACS, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

The local transportation system links the Town to the rest of the region. Routes 184 and 642 are the Town's two main arterial roads, and they intersect U.S. Route 13. The historic downtown area exhibits a historic grid system. There are also many alley ways, sidewalks, and multi-use paths through the Town. The railroad and harbor have played an important role historically to the Town, and continue to do so to this day (*Town of Cape Charles Comprehensive Plan*, 2009). There is an anticipated increase in industrial activity at the Harbor due a new Harbor Access Road, which will intersect Stone Road and include bike/walking lanes. This new project will aid in providing safe walkability to grocery stores and supplies before or after an emergency.

Cape Charles Harbor currently serves the Bay Coast Railroad, Bay Shore Concrete, United States Coast Guard, Mid-Atlantic Maritime Academy, commercial fisherman, and recreational boaters. New development has been proposed on private parcels around the harbor as well (*Town of Cape Charles Comprehensive Plan*, 2009).

There are only two roads leading into the Town, and so lack of accessibility is a risk factor for the Town. In the past, accidents have closed the main road leaving only one route accessible. Both roads have mature trees that could also close the road in a wind event. Ice and snow events occasionally threaten accessibility to the Town on both roads. According to the *ESVA Transportation Infrastructure Inundation Vulnerability Assessment*, roads in the historic area are more vulnerable to inundation than Bay Creek or other areas of the Town.

The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary. As of 2010, over a quarter of the Town's occupied residences are estimated to not own a vehicle (Table 5), however, much of this is attributed to the high percentage of second homes for which there is no locally registered vehicle. Stop numbers 1 – 3 & 29- 34 all serve the Town and immediate surrounding area with Star Transit's Yellow, Lower Shore Loops Line, which provides additional transportation options for residents of the Town to medical services, grocery stores, etc. There are an estimated 200 golf carts in the Town, these could serve as an important resource during times of emergency.

Table 5: Cape Charles Vehicles Available per Households

Vehicles Available	2010**	2000**
None	61	159
One	195	214
Two	155	118
Three or more	68	43

Source: * ACS, 2010 – 2014, ** U.S. Census 2000

COMMERCIAL AREAS

The main commercial activity in Cape Charles is located within the historical core of the Town. The historical commercial core has increased and will continue to do so as the demand for goods increases with the growing population. The expansion of commercial activity outside of the Historic District is predicted to occur around the Cape Charles Harbor and the northern part of Town along King's Creek as well (*Town of Cape Charles Comprehensive Plan*, 2009).

COMMUNITY SERVICES AND FACILITIES

Community facilities comprise all the public services and facilities provided by the Town to all residents. Those services include public water and sewage treatment facilities, police and fire departments, wharf, parks and recreation facilities, and solid waste management.

PUBLIC SAFETY

Cape Charles has the basic services required for the safety and convenience of its citizens. The Cape Charles Police Department works in conjunction with county and state resources there are 5 officers and 5 vehicles with potentially one more officer and vehicle coming on next year (Jeb Brady, Building Official, personal communication, June 8, 2016). The Cape Charles Volunteer Fire Company and the Cape Charles Rescue, Inc. also work cooperatively with other local fire companies and rescue squads to provide fire protection and emergency medical services (*Town of Cape Charles Comprehensive Plan*, 2009). There are no paid employees at the Fire Company, but there are about 10 auxiliary volunteers and about 20 volunteer firefighters. The Town employees that are also volunteers of the Fire Company are permitted to respond to calls while on the payroll, which aids in improved responses. The Fire Company is equipped with two engines, 95 foot aerial truck, 1 tanker, 1 brush truck, but no medics and/or ambulances, etc. (Jeb Brady, Building Official, personal communications, June 8, 2016).

SCHOOLS

Cape Charles Christian School is located in the historic district, but outside of the .2%-annual-chance flood zone. The school serves pre-kindergarten through eighth grade and has about 50 students.

PARKS AND RECREATION

Cape Charles has a variety of community facilities available including the Cape Charles Harbor, the public beach, the Fun Pier, and Central Park (*Town of Cape Charles Comprehensive Plan*, 2009). Putting a divided median in and new lighted sidewalks from Fig to the Bay along Washington Avenue. There is a plan to connect the entire town with none-motorized trails.

Cape Charles Beach is the only public beach in Northampton County. It provides an important recreational function and vital protection against hazards. Almost half of the historic area of Cape Charles is considered to be in the 500 year flood plain, but the beach is identified as being in the VE Zone (zone of high velocity waters). The wide shallow water area, the development of the dunes, and the breakwaters are necessary to provide a storm buffer between the Chesapeake Bay and the historic housing area (*Town of Cape Charles Comprehensive Plan*, 2009).

WATER SUPPLY AND WASTEWATER

The Town's public utility systems have allowed more dense development in Cape Charles than the rest of Northampton County. The Town prohibits new private deep wells and septic systems due to them threatening the Town's water supply (*Town of Cape Charles Comprehensive Plan*, 2009). According to the 2014 Drinking Water Consumer Confidence Report, the Town's drinking water, which originates from five active wells in the Upper and Middle Yorktown-Eastover Aquifers, only has one contaminant at violation level (a by-product of drinking water disinfection). The Cape Charles Waste Water Treatment Plant (WWTP) was upgraded in 2008 and although the design flow stayed the same, the amount of discharged nutrients has subsequently decreased to about a quarter of pre-retrofit levels.

SOLID WASTE

The Town contracts with Davis Disposal for weekly residential trash collection, which is transported to a county transfer station. There is also a community cardboard recycling bin from Davis Disposal and yard debris pick up weekly (Jeb Brady, Zoning Official, personal communications, June 8, 2016).

POWER AND COMMUNICATIONS INFRASTRUCTURE

The Town does not typically have problems with long-term power outages during or following storm events. Most mobile service is consistent throughout the Town. The Town of Cape Charles is part of the Eastern Shore Broadband Network Project, and has a community network that is connected to the fiber running the length of the Shore from the Maryland state line.

NATURAL ENVIRONMENT

There is an abundance of natural resources in Cape Charles. Wetlands, natural areas, and the public beach are present within the Town's boundaries and provide important buffers to natural hazards. They also provide an important economic function related to tourism and recreation that provide jobs for Northampton County (*Town of Cape Charles Comprehensive Plan*, 2009).

LAND USE LAND COVER

Cape Charles consists of land which is largely developed and agricultural. The north end of the town is where the historical, planned community exists with smaller pockets of urban development near the southern ends of the town. In Figures 2 and 3 on the following page, the USGS seems to have mislabeled the Cape Charles Natural Area Preserve as cultivated crop and the area south of the Preserve as barren, although it is a residential area. Despite this misappropriation, the overall trend towards increasing developed lands is valid. There are many challenges that accompany increased development and increased populations, from impervious surfaces and storm water to increased demand for utility and emergency services.

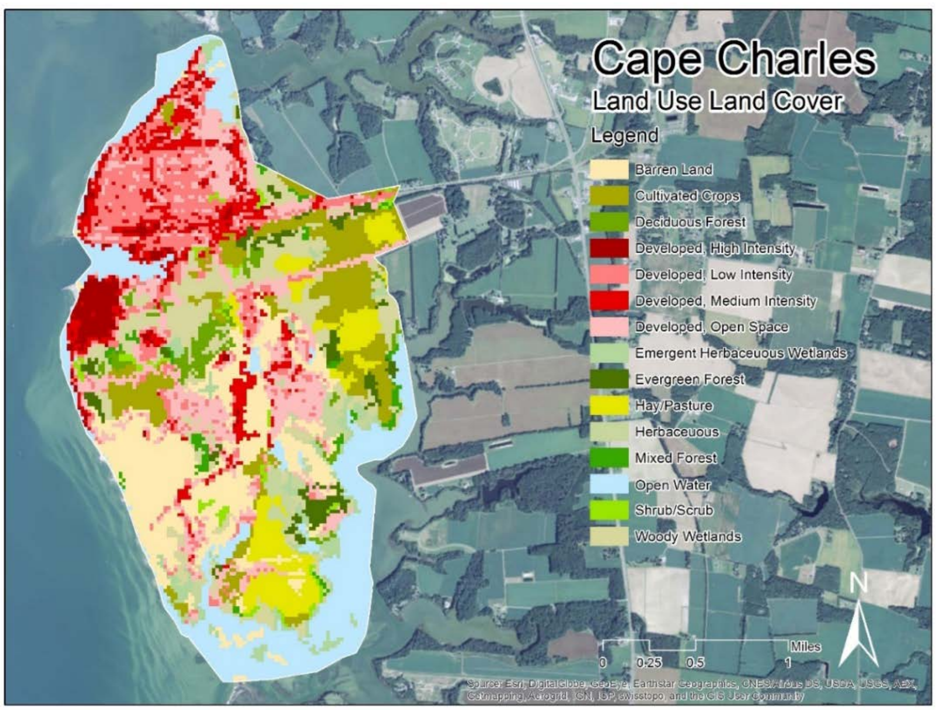
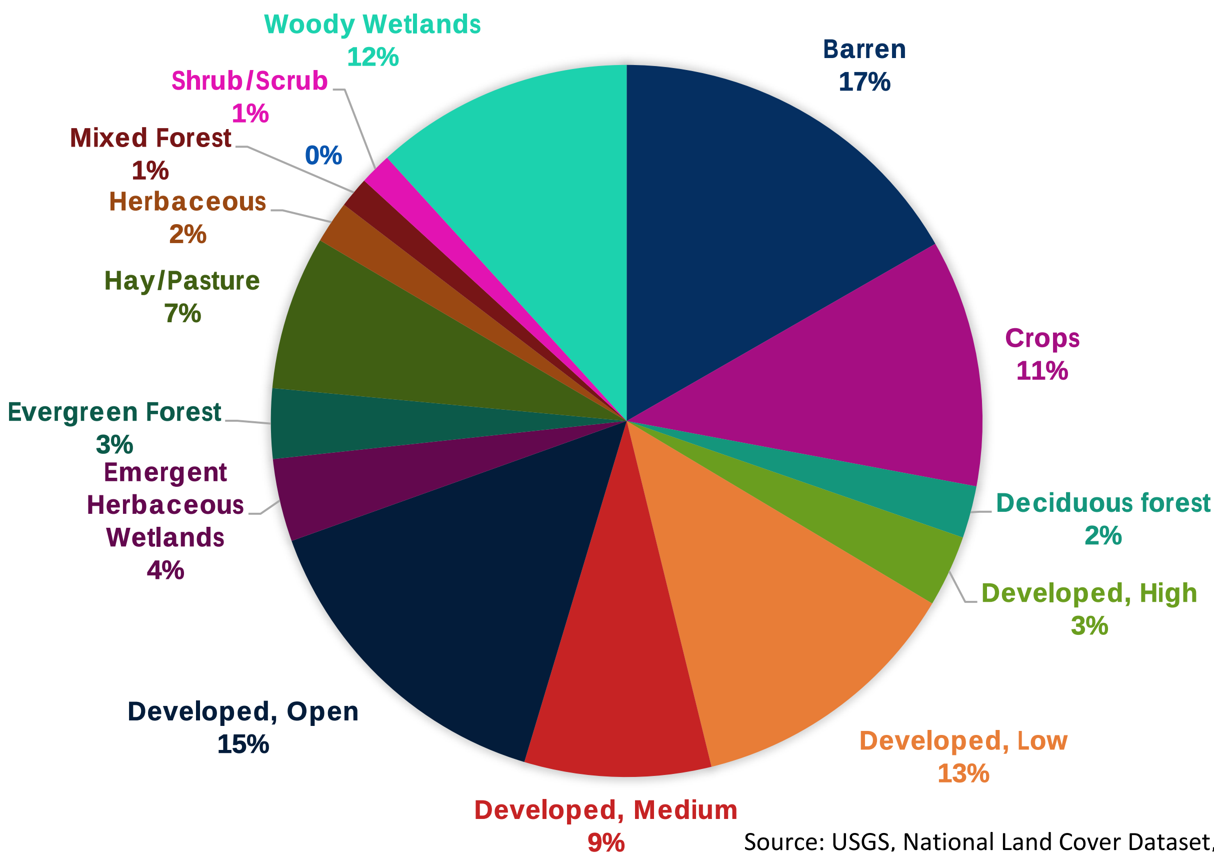


Figure 2 : Cape Charles Land Use Land Cover Map



Source: USGS, National Land Cover Dataset, 2011

Figure 3 : Cape Charles Land Use Land Cover Percentages

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Cape Charles has participated in the hazard mitigation planning process since 2006. The primary hazard for Cape Charles has been coastal flooding, storm water flooding, and winds associated with hurricanes and northeasters.

Cape Charles is currently updating its Comprehensive Plan. The previous update is from 2009, and it does not mention coastal hazards within the document. Due to the Town's participation in the hazard mitigation process, they use this document as the primary resource for preparing for coastal hazards.

The following table contains authorities, policies, programs and resources, and intentions or ability to expand to address reductions in hazard vulnerability.

Table 6 : Cape Charles Hazard Vulnerability Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*				*	*													
County			*																
Regional				*				*	*	*	*	*		*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

The Town has utilized post-disaster funds to repair the substantially damaged fun pier and to complete a beach renourishment.

NFIP

The Town joined the NFIP on February 2, 1983. The January 2016 FEMA NFIP insurance report shows that the Town has 234 flood insurance policies, a decrease of 82 policies since 2011, but still 51 policies more than in 2003. The new Flood Insurance Rate Map (FIRM) is most likely the cause of the vast reduction in the number of overall policies, however as of January 2016 there were still 150 low-risk policies, indicating that residents would still like to be prepared for flood events.

Cape Charles participates in the Community Rating System (CRS) program, which provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When a community completes specified activities, the insurance premiums of these policyholders in communities are reduced. The Town received an initial score of nine as a new participant meaning that residents receive a five percent discount on flood insurance, but anticipate a new score of 8 in the near future (Jeb Brady, Zoning Official, personal communication, June 8, 2016). The highest CRS score is a one. The Town is working diligently to improve its CRS rating to earn its residents an even greater discount in the future.

Table 7 : Summary of Cape Charles' past NFIP participation

	HMP 2006	**HMP 2011**	**HMP 2016**
NFIP (date joined)	February 2, 1983	February 2, 1983	February 2, 1983
Number of policies	183 15 not in SFHA	316: 266 A-Zone, and 50 other (not in SFHA)	234 policies: 84 A-Zone, and 150 other (not in SFHA)
Total Premium Amount	-	-	$159,120
Total Coverage Amount	-	-	$66,162,900
Number of Claims (since 1978)	6	9	13
Total Paid (since 1978)	$2,825	$25,304	$85,914
HMGP	NA	NA	NA
CRS Score (1 highest, 10 lowest)	NA	9 (5% policy discount)	9 (5% policy discount)

Source: FEMA NFIP Insurance Report 2006, 2011, January 2016

HMGP

The Town has not participated in the Hazard Mitigation Grant Program.

HAZARD PROFILE

WIND

During a 1% chance annual storm event, Cape Charles is estimated to sustain $1.41 million in wind damages (Hazus®) including costs from building damages, content damages, inventory, relocation, and lost income and wages. This is over $5 million less than the estimates from the 2006 and 2011 Hazard Mitigation Plans, but agreed to be more accurate (personal communication, June 8, 2016). A large portion of the Town is within the wind borne debris hazard area, which is defined as the area extending 1-mile inland from the shoreline. In 2003, it was estimated that there were 687 structures in the area, and the original methodology applied a formula to all of these structures. The new Hazus® model incorporates additional information, such as probable roofing material based on the type of building and wind patterns and roughness, which provides some insight into the difference in total damage estimates between the years.

In addition to direct wind damage, much of the Town has mature trees that are a potential secondary hazard to the structures in that area as well as accessibility for emergency services. As seen during Hurricane Isabel in 2003, historic northeasters, and other high wind events, structures are vulnerable to being damaged by large trees that come down. There are many mature trees within the Town that are vulnerable during a high wind event. The Cape Charles building stock in the older part of Town consists of larger historic homes (*ESVA Hazard Mitigation Plan*, 2011). The historic district is more susceptible to wind damages due to the fact that the buildings are newer, built to higher standards, and have fewer large trees.

Straight line winds also are a threat to the Town and were credited with some of the damaged incurred from the Cherrystone tornado, particularly damages to a crane at Bayshore Concrete. In mid-February 2012, the train storage building, built to withstand 110mph gusts sustained damages from straight line winds as well. These kinds of intense wind events may become more common with changes in the climate.

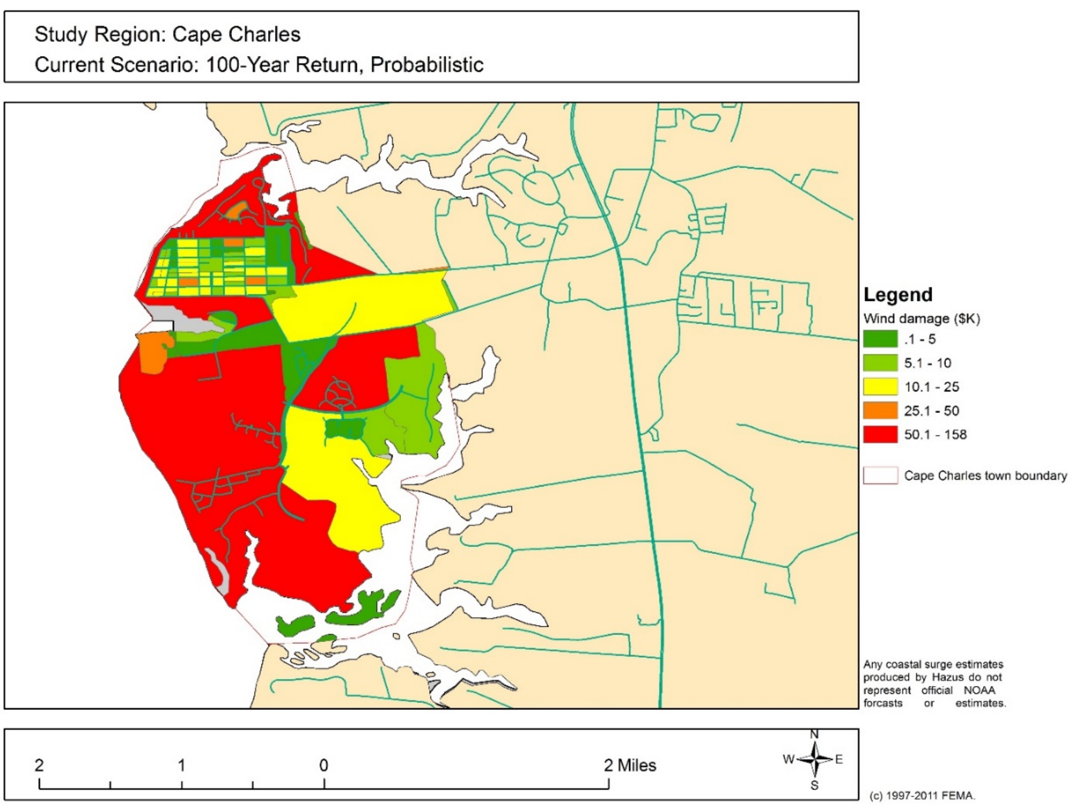


Figure 4 : Cape Charles Wind Damages by Census Block 1% Annual Chance Storm

COASTAL EROSION

During the past eight years the Town of Cape Charles has had an aggressive plan to mitigate erosion along its entire shoreline and harbor area. Twenty (20) offshore breakwaters have been built to protect the northern Marina Village, Town Beach, Harbor entrance and the Bay Creek Beach on the south. These have been built with both private and public funds. There are now three breakwaters at the mouth of the Harbor, and the height of the two older breakwaters were also increased. More breakwaters are required on the northern and central sections of the coastline. Mitigation could continue, but has been halted due to lack of funding from both public and private sources.

Last year the inner and outer harbor was dredged and the sand was used to nourishment the Town beach. Soon, they will dredge the Federal Channel and any sand spoil that is suitable will again be used to nourish the Town beach, most likely on Labor Day weekend (of 2016). The long-term intent is to add dunes on the northern end of the beach and perhaps be built higher from the sand fences (Jeb Brady, Building Official, personal communications, June 8, 2016).

FEMA's post-storm inspections show that most privately funded erosion control structures fail during storm events. FEMA notes in the Coastal Construction Manual that some communities choose to distinguish between erosion control structures that protect existing development and those that are constructed to create a buildable area on an otherwise unbuildable site. Buildings destroyed by erosion are not covered under a NFIP flood insurance policy.

During Hurricane Sandy in 2012, significant erosion occurred along the shoreline adjacent to the Seabreeze Apartment Building on Washington Avenue. These repair cost were not included in the NFIP claims. The erosion undermined the foundation of the apartment building to the extent that the building was deemed unsafe for occupancy. Seven families were displaced as result (Eastern Shore Post; November 2, 2012) for several months, but are now currently inhabited. About 15 feet of land eroded in about 2 hours (Jeb Brady, Zoning Official, personal communication, June 8, 2016). This building and the home on the adjacent house are within fifty feet of the shoreline and at immediate danger to damage from erosion during a storm event.

Also, during Sandy, the water almost got into the Shanty Restaurant. All of the stationary docks were completely submerged, but the roads were not submerged. In general, however, erosion to the more susceptible golf courses and beach is a higher threat to the Town than damages. There is some bulk heading to protect these areas on Nicklaus Drive, but some areas on Nicklaus Drive and on Palmer Drive are still in need of additional reinforcements. During Hurricane Isabel in 2003 and the November storm Nor'Ida of 2009, many portions of the northern section of the Town were eroded. (Jeb Brady, Zoning Official, personal communication, June 8, 2016)

COASTAL FLOODING

The Flood Insurance Study identifies that the greatest threat of flood inundation comes from hurricanes and northeasters. In 1935, a wooden bulkhead was constructed to protect the Town from surge water. Many times this bulkhead had to be refurbished or repaired. Dunes now protect the area of old Town from Washington Avenue to Mason Avenue from smaller floods. A series of offshore breakwaters exist off the public beach and the mouth of the harbor and are designed to prevent erosion and attenuate wave action. These provide protection against coastal flooding and are described in greater detail in the following Coastal Erosion section.

Using Hazus®, minimal flooding is anticipated during a 1% annual chance flood event, as shown in Figure 4. Only two buildings on six properties within the Special Flood Hazard Area are likely to be damaged, both belonging to the Town. The total damages are estimated to be almost $20,000 primarily from content and inventory losses.

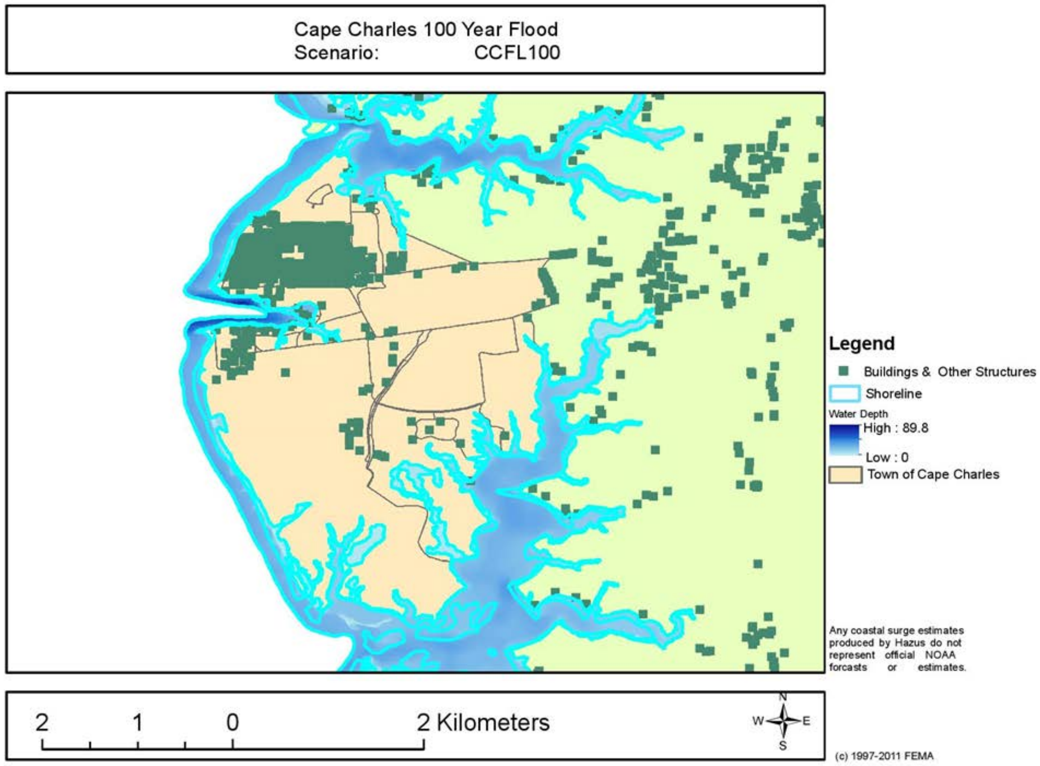


Figure 5 : Cape Charles 100 Year Flood Estimates

The 2015 FIRM removed half of a square mile of land from the Special Flood Hazard Area (SFHA), and with it some 431 buildings. Although the V Zone total area did not change, there was also a net loss of two buildings from this zone. The current estimated flood damage loss from buildings and contents just exceeds $20,000 according to Hazus®, which is a vast change from the 2011 estimated $52.9 million in structure and content damages (*ESVA Hazard Mitigation Plan*, 2011).

STORM WATER FLOODING

Several factors cause the Town of Cape Charles storm water system to be prone to flooding during significant rain events. The Town's storm water drains from east to west, ending at the Chesapeake Bay. The southern half of the Town has surface drainage only while the northern half of Town has an underground drain system. The Town continues to work with VDOT on maintenance but mitigation would be preferred. The responsibility of the maintenance of ditches along public streets within the Town falls on VDOT. The Peach Street and Washington Avenue intersection now drains to Crystal Lake instead of directly into the Chesapeake Bay which seems to help with storm water flooding in this area and will help with fresh water retention and reducing runoff.

Storm water flooding occurs during significant rain events at the intersection of Plum Street and Madison Avenue. During a northeaster in 2007, storm water completely inundated the streets of the western portion of the Town due to floodwaters being unable to drain at the time of the storm. Some homes experienced minor flooding during this event (Verbal Communication with Town Staff, 2010). During a short rain event on August 2, 2016, there was significant water flowing quickly over the intersection of Tazewell Avenue and Plum Street, which appeared to be a consistent problem throughout the Historic district (Shannon Alexander, A-NPDC, personal communications, August 3, 2016).

HAZARDS OF LOCAL SIGNIFICANCE

WATER SUPPLY CONTAMINATION

Contamination from saltwater intrusion has already been documented for the Town's water supply. With sea-level rise and continued drawdown of our sole-source aquifer, this is a continued concern for the Town.

SEA-LEVEL RISE

According to the *ESVA Transportation Infrastructure Inundation Vulnerability Assessment*, roads in the historic area are more vulnerable to inundation than Bay Creek or other areas of the Town, but the rail yard and harbor, two vital economic drivers, are first at risk. In addition, sea-level rise would threaten the Town beach, Bayshore Concrete, the Coast Guard Station, and various low lying areas in the area.

CRITICAL FACILITIES

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

Table 8 : Cape Charles Critical Facilities

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-Owned Facilities					
Waste Water Treatment Plant and Water Tower	Wind, Storm Water, Flooding	1,000+	Devastating	No	Yes
Police Departments & Municipal Building	Wind, Storm Water, Flooding	1,000+	Devastating	No	Yes
Central Park	Wind, Storm Water	1,000+	Inconvenience	No	Yes
Town Beach	Wind, Flooding, Erosion	1,000+	Major Disruption	No	Yes
Town Pier	Wind, Flooding, Erosion	1,000+	Major Disruption	No	Yes
Town Harbor	Wind, Flooding	Entire Town and region	Devastating	No	Yes

Pump Stations (4 in the old Town, 1 in the marina, 3 more in Bay Creek - those 3 are vacuum stations)	Storm Water, Flooding	1,000+	Major Disruption	No	Yes
Town Wells	Salt water intrusion	1,000+	Major Disruption	Yes	Yes
Public Works and Utility Buildings (behind Rayfield's Pharmacy) and vehicles (~30 including tractors)	Wind, Storm Water	1,000+	Minor Disruption	Yes	Yes
Other Critical Facilities					
Post Office	Wind, Storm Water, Flooding	Entire Town and surrounding area	Major Disruption	No	Yes
Riverside Medical Center	Wind, Storm Water	1,000+	Inconvenience	No	Yes
Pharmacy	Wind, Storm Water	Entire Town and Southern Northampton County	Major disruption	No	Yes
Volunteer Fire	Wind, Storm Water	Entire Town and Southern Northampton County (Cheriton to CBBT)	Major Disruption	No	Yes
Dredge Spoil Basin (Federally owned)	Erosion	1,000+		No	No
Coast Guard Station	Wind, Flooding, Storm Water	Entire Town and Chesapeake Bay Region	Major disruption	No	Yes
Cape Charles Christian School	Wind, Storm Water	Students and families	Inconvenience	No	Yes
Rail Yard	Wind, Flooding, Storm Water	Entire Town and region	Minor Disruption	Yes	Yes

Civic Center	Storm Water, Wind	1000+	Inconvenience	Yes	Yes
Museum & Welcome Center	Wind, Flooding, Storm Water	1000+	Inconvenience	Yes	Yes

FINDINGS

1. The new FIRM shows a reduction of 431 structures now located in the 100-year flood zone. This may increase a false sense of security in the Town about flooding.
2. The Town has 234 flood insurance policies, a decrease of 82 policies since 2011, but still 51 policies more than in 2003. The new FIRM is most likely the cause of the vast reduction in the number of overall policies, however as of January 2016 there were still 150 low-risk policies, indicating that residents would still like to be prepared for flood events.
3. The most reasonable worst-case scenario for the Town is a storm that pushes water toward Cape Charles and increase the tidal elevation.
4. The older historic homes were built with “basements” where the boiler was housed. Due to the high water table these basements could not be very deep and therefore the first floor above grade is generally above the flood level.
5. Most critical facilities are subject to flooding and high wind.
6. Multifamily dwellings at Washington Avenue are highly susceptible to damages during storm events, as evident by damages during Hurricane Sandy.
7. Transient population increase and updates to the older homes to make them more resilient to damages. The new FIRM and statement about misconception about vulnerability.
8. Cape Charles is located on a peninsula with only two roads entering or leaving town. If evacuation prior to a hurricane is delayed, a blocked road could preclude persons in hazard areas from taking refuge outside the Town. The official evacuation route is to the north parallel to the coast with at least 90 miles before an inland access is available. Early evacuation could be across two bridge-tunnel complexes and westward to higher ground.

TOWN OF CHERITON

TOWN PROFILE

Cheriton started out as a railroad town and can trace its beginnings to 1884, when the New York, Philadelphia, and Norfolk Railroad Company was extended from Maryland to Cape Charles. The land was owned by Dr. William Stratton Stoakley, who, in 1886 laid out the western part of his land as a town. Cheriton merged with another town called Sunnyside, where downtown Cheriton is currently located. The town prospered during the early 1900s due to its role as a local agricultural shipping point and service center. The Town of Cheriton became incorporated in 1951. Today, Cheriton has many historic homes and churches. (*Town of Cheriton Comprehensive Plan*, 2010)

Figure 1: Cheriton Context and Boundary Map

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 factors that relate 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

The Town of Cheriton had a population of 471 in 2014 according to the American Community Survey (ACS). This shows a steady population for the Town, aligning with both 2000 and 2010 (U.S. Census, 2000, 2010). The population provided by the ACS for 2013, however, is very high, and deemed inaccurate by Town Council Members. The number of disabled residents and the percentage of people living in poverty is also judged to be an underrepresentation, which is important to note in the efforts of responding to and assisting residents during a hazardous situation (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016). Town representatives estimate that about 40% of the population either have physical or mental limitations that would require that they need assistance during an emergency.

Table 1: Cheriton Demographic Information

	2014***	2013**	2010*	2000****
Population	471	624	487	499
Median Age	49.7	46.3	45.3	44.2
Disability	39	34	-	0
Income				
Median Household Income	32,969	28,393	35,550	26,429
Poverty Level	21.8%	16.5%	8.8%	NA
Language				
Only English	90.7%	87.1%	86.9%	98.1%
Other	9.3%	12.9%	10.4%	1.9%
Spanish	7.3%	10.4%	7.4%	1.5%
Indo-Euro	1.1%	1.8%	3.0%	0.4%
Other	0.9%	0.7%	0.0%	0.0%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORKFORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The Town of Cheriton's workforce is primarily a residential and retail/service-oriented community. Because of this, most people commute outside of the Town and work in retail trade, agriculture, or education/health services, or manufacturing (American Community Survey, 2010 – 2014). Businesses and industries near Cheriton that provide employment to residents include Bayshore Concrete (waterfront), commercial and recreational fishing, R & C seafood packing plant in Oyster (waterfront), VDOT Maintenance Facility, Northampton County offices in Eastville, Cherrystone Aquafarm (waterfront), and Cherrystone Campground (waterfront) (*Town of Cheriton Comprehensive Plan*, 2010). Most of these employment entities operate in waterfront areas, and thus are more exposed to winds and water damages during a storm event, which may slow the following recovery time for both the business, the workforce, and the Town.

Table 2: Cheriton Local Workforce

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	11	5.1%	6	2.4%	13	5.1%	16	7.0%
Construction	8	3.7%	16	6.3%	20	7.8%	11	4.8%
Manufacturing	3	1.4%	42	16.7%	42	16.4%	38	16.6%
Wholesale trade	42	19.4%	28	11.1%	12	4.7%	20	8.7%
Retail trade	11	5.1%	14	5.6%	0	0.0%	32	14.0%
Transportation and warehousing, and utilities	0	0.0%	0	0.0%	0	0.0%	14	6.1%
Information	5	2.3%	0	0.0%	18	7.0%	2	0.9%
Finance, insurance, real estate, and rentals	10	4.6%	11	4.4%	21	8.2%	5	2.2%
Professional, scientific, waste management	29	13.4%	48	19.0%	69	27.0%	10	4.4%
Educational, health care, social services	26	12.0%	22	8.7%	28	10.9%	41	17.9%
Arts, entertainment, recreation, food	17	7.8%	8	3.2%	4	1.6%	17	7.4%
Public Administration	24	11.1%	23	9.1%	24	9.4%	11	4.8%
Other	11	5.1%	6	2.4%	13	5.1%	12	5.2%
TOTAL CIVILIAN EMPLOYED POPULATION	217	-	252	-	256	-	229	-

Source: *ACS, 2010 – 2014, **U.S. Census 2000

BUSINESSES

Business data provide basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. They 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.

Before the turn of the century there were significantly more businesses, however, the number of businesses continues to decline. Economic opportunities within Cheriton are limited, there are few establishments within the Town itself and most residents commute to jobs outside of the town (*Town of Cheriton Comprehensive Plan*, 2010).

Table 3: Cheriton Business Types

Industry Code Description	Total Establishments			
	2015**	2013*	2011*	2009*
Agriculture, Forestry, Fishing, and Hunting	0	2	2	2
Construction	4	2	3	2
Manufacturing	1	1	1	1
Wholesale Trade	3	3	5	4
Retail Trade	1	2	4	5
Finance and Leisure	2	1	1	1
Real Estate and Rental Leasing	2	2	3	1
Professional, Scientific, and Technical Services	2	2	2	2
Administrative and Support and Waste Management and Remediation Services	2	2	2	2
Health Care and Social Assistance	2	2	4	5
Accommodation and Food Services	4	2	1	2
Other Services (Except Public Admin)	4	4	2	4
Total, All Establishments	26	25	31	32
Total Employees	-	323	285	316

Source: *Census Zip Code Business Patterns, 2009, 2011, 2013; **Town representatives, personal communication

BUILT INFRASTRUCTURE

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 towards safety.

Cheriton identified specific design goals for its 'Gateway Commercial Character Area' in their 2010 Comprehensive Plan, indicating a desire to avoid the existing, strip commercial development trend, driving business into the existing downtown area, while preserving the family appeal of the Town.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. The 2014 American Community Survey figure for the total number of housing units indicated in Table 4 is thought to be too high, and the U.S. Census data from 2010 indicating 243 much more accurate. The majority of properties are occupied, and again the 2010 data closer to correct according to local Town Council members (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

Table 4: Cheriton Housing

	2014*	**2010****	**2000*****
Total Housing Units	276	243	239
Occupied	219	211	219

Vacant	57	32	20
Owner-Occupied	163	146	155
Renter-Occupied	56	65	64
Median Housing Value	$173,900	NA	NA

* ACS, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

Cheriton has an adequate road system which is maintained by the Virginia Department of Transportation. Route 13 provides good regional access and directs major traffic flow away from the town, while Business Route 13 provides safe access into and out of Town. Generally there seem to be no major traffic problems in Cheriton, although visibility at the intersection of Route 13 and Cherrystone Road has been identified as a problem, due to speeding traffic and high volume of campers which create visibility limitations. In addition, tractors using Route 13 as a means of transportation has been identified as a hazard for both motorists and tractor operators (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

Vehicles available to households is one indicator of a household's ability to evacuate when necessary. Table 5 states that there are 25 residencies without a vehicle available, however, it is very likely that the number is higher (closer to the 2010 estimate), as Town representatives indicated such a high percentage of residents whom are unable to move themselves due to physical or psychological barriers. Star Transit serves the Town, connecting it to the rest of the Eastern Shore, with its stop being found at the Town Parking Lot. The railroad runs through Cheriton, although it does not stop, primarily on its way to and from Bayshore Concrete Products Corporation in Cape Charles. The line could potentially pose a risk as a hazard if carrying any hazardous materials, but also could be utilized following a hazard event to move people or product.

Another concern that arose was that of small tractors being hit by semi-tractor trailers, as there have been 3-4 fatal incidents in the last couple of years (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

Table 5: Cheriton Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	25	53	34
One	108	86	75
Two	58	92	79
Three or more	28	44	29

* American Community Survey, 2010 – 2014, ** U.S. Census 2000

COMMERCIAL AREAS

The downtown area is no longer an important local retail center. Those that are in within the Downtown are well maintained and the owners have exhibited pride in the buildings and shops; however, about half of the commercial buildings stand vacant in the area, some of which are in need of repair. U.S. Route 13 has directed traffic away from Business Route 13 and downtown Cheriton, and the presence of Cheriton's business district is not obvious to highway travelers (*Town of Cheriton Comprehensive Plan*, 2010). A new Visionary Committee has been formed for the Town, which will focus on murals, farm stands, fitness focus, etc. (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

COMMUNITY FACILITIES & PUBLIC WORKS

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

The Northampton County Sheriff's Department, four officers, and the Virginia State Police provide police protection for Town residents. Fire protection for the Town is provided by about 25 volunteer firefighters and 5 volunteer non-firefighters in the Cheriton Volunteer Fire Department. This station has a primary engine, engine/tanker combination, super brush truck (rescue and brush), and a teleport water tower (Town Clerk, personal communication Feb. 8, 2016). Ambulance service is provided by the Cape Charles Rescue (*Town of Cheriton Comprehensive Plan*, 2010).

WATER SUPPLY AND WASTEWATER

Residents rely on individual private wells and septic systems for their water supply and wastewater disposal. Due to new regulations, new septic field construction requires alternative disposal designs that avoid having the septic field too close to the water table (*Town of Cheriton Comprehensive Plan*, 2010).

SOLID WASTE DISPOSAL

Collection services are provided to the Town by Davis Disposal. Northampton County transfer station is located close by for disposal services as well.

PARKS AND RECREATION

There are no parks within the Town boundaries. Currently the Town is working on securing grant funds in order to create a park within town limits (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016). In 2014 and 2015 VDOT replaced many of the old sidewalks, however the privately owned sidewalks in front of the stores are in need of replacement and repair (M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

DRAINAGE DITCHES

Maintenance of drainage ditches is the responsibility of VDOT; however, maintenance is not sufficient (*Town of Cheriton Comprehensive Plan*, 2010).

SCHOOLS

No schools exist within the Town boundaries.

POWER AND COMMUNICATIONS INFRASTRUCTURE

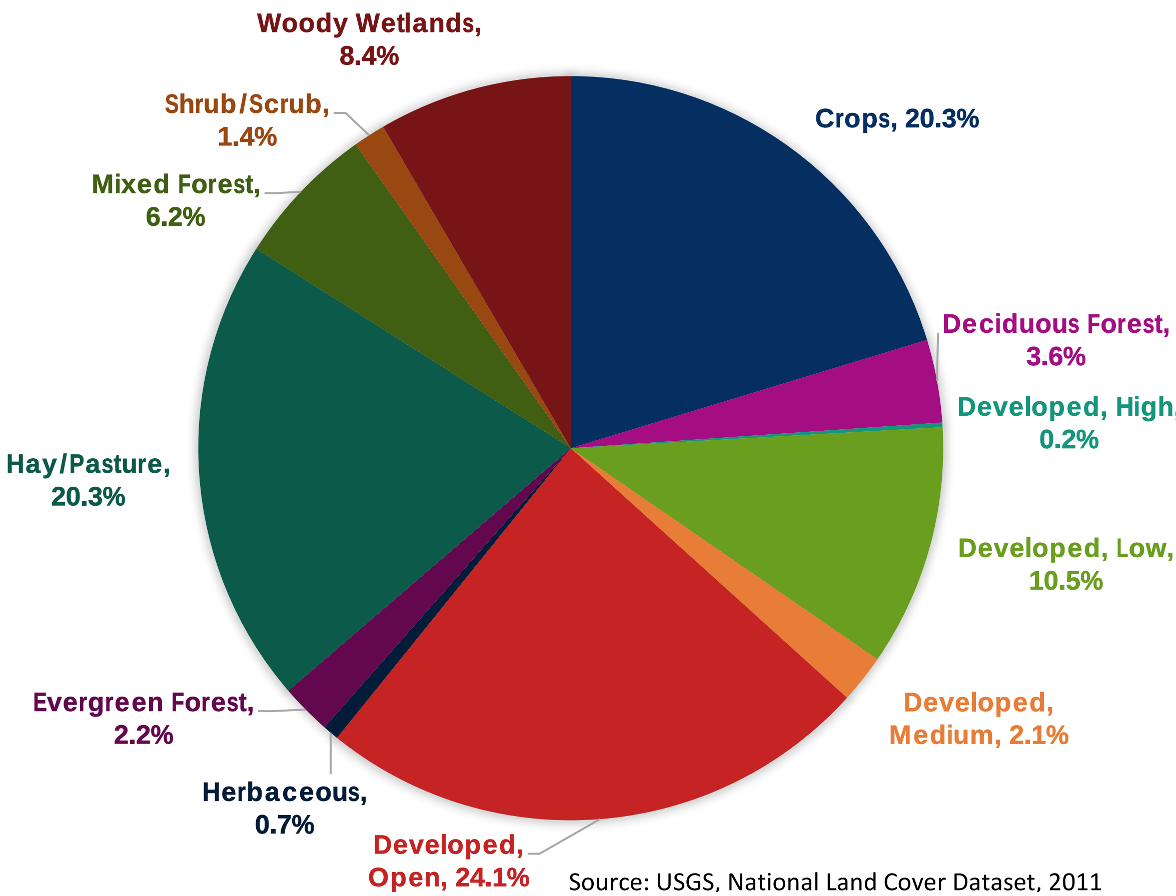
Chesapeake Bay Communications broadband comes through Town, and has contract with a new company in order to reach all of those that are not covered by broadband services. There is no substation in or adjacent to Town limits, but the Town does not typically experience lengthy service outages.

NATURAL ENVIRONMENT

Elevation in Cheriton ranges from 26 feet, from a high point of 36 feet where the Eastern Shore Railroad crosses Sunnyside Road, to a low point of 10 feet where Eyrehall Creek crosses Route 13. The small elevation change of 26 feet results in overall slopes in Cheriton of less than 2%, which contributes to flooding due to poor drainage.

LAND USE LAND COVER

Today the Town of Cheriton consists of 647 acres, reflecting an increase of 362 acres due to an annexation from the County of Northampton in 1997 (*Town of Cheriton Comprehensive Plan*, 2010). The primary land use in development of some degree, however, open developed is typically attributed to transportation infrastructure.



Source: USGS, National Land Cover Dataset, 2011

Figure 2: Cheriton Land Use Land Cover Percentages

GROUND WATER

The Town does not provide water, potable water is supplied by individual private wells, which withdraw from ground water aquifers. The Town’s water supply is mostly withdrawn from the upper Yorktown aquifer. The majority of land in Cheriton lies within the spine ground water recharge area and is in Wellhead Protection Area E. Protecting the spine recharge is important to assure good quality and large quantities of ground water on the Eastern Shore (*Town of Cheriton Comprehensive Plan*, 2010).

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Cheriton has not participated in the hazard mitigation process before and have formerly been covered under the county's hazard mitigation plan.

Table 6: Cheriton Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*				*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM
& HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town has no identified Special Flood Hazard Areas and does not participate in the NFIP. Residents and business owners in these Towns can purchase preferred risk policies.

HMGP

The Town has not participated in the HMGP.

HAZARD PROFILE

COASTAL FLOODING

The Town is almost entirely out of the flood zone (Zone X), except for the areas at the headwaters of both Kings and Eyrehall Creeks, where there are small portions in the 0.2%-annual-chance flood zone and in the A-zone with a BFE of 5 feet. There are very few businesses or residents that are near these flood zones.

COASTAL EROSION

No structures are at immediate risk to coastal erosion.

WIND

No parts of the Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the coast. The Town lies in the 110-120 mph design wind zone (Northampton County Building Code).

STORM WATER FLOODING

Drainage and flooding are problems in Cheriton due to the flat topography and inadequate maintenance of drainage ditches. The Comprehensive Plan notes that drainage is not adequate and needs to be improved (*Town of Cheriton Comprehensive Plan*, 2010).

There is storm water flooding on Mill Street and Cherrystone Road (*ESVA Hazard Mitigation Plan*, 2011 & M. Mears & G. Hardesty, personal communications, Jan. 14, 2016).

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

Due to the high permeability of the soils in Cheriton, they are generally not well suited for septic tank filter fields. When soils are saturated, waste may not be sufficiently treated (*Town of Cheriton Comprehensive Plan*, 2010).

ICE & SNOW STORMS

2009 & 2015

FIRE & SMOKE

In the 1950's two fires almost destroyed downtown. Many of the buildings were rebuilt using brick, but there are still a lot of wooden structures.

TORNADOES

July 2014 Photos

CRITICAL FACILITIES

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

Table 7: Cheriton Critical Facilities

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Cheriton Town Office	n/a	n/a	X		471	Major Disruption	Y	Y
Cheriton Fire Department	n/a	n/a	X		471+	Devastating	Y	Y
Head Start					~80			Y
Child Care					~80			Y
Star Transit					~235	Major Disruption		Y
Service Station					471+	Major Disruption		Y
Post Office					471+	Major Disruption		Y

TOWN OF CHINCOTEAGUE

TOWN PROFILE

Chincoteague is a barrier island that is characterized by a series of ridges that run in a northeast-southwest direction that were formed approximately 2,000 to 4,000 years ago when the island was connected to the south end of Assateague Island. An inlet eventually formed at what is now the north end of the island separating Chincoteague and Assateague. A spit subsequently developed off the south end of Assateague serving as a barrier that has sheltered Chincoteague Island from erosion. The Accomack County Soil Survey shows that there are nine types of soil on Chincoteague. Several landform types are present including tidal salt marshes, dunes, beaches, intermingled dunes and marshes, coastal upland or floodplain, and fill.

Figure 1: Chincoteague Context and Aerial

The Town's economy has always been closely tied to natural resources and scenic beauty. Prior to the mid to late 1800s, the inhabitants of the island primarily subsisted by farming and raising cattle and sheep. As the demand for oysters grew throughout the 1800s, the seafood industry became the Town's main source of income. The seafood industry expanded to include clams, crabs, and fish during the 1900s and Chincoteague became widely known as a seafood capital (*Town of Chincoteague Comprehensive Plan*, 2015).

When the causeway to the Island was constructed in 1922, the Town's primary economy began to shift from seafood to tourism. Chincoteague is now heavily dependent on the tourist industry. Many visitors come to enjoy Assateague Island National Seashore and the small coastal town atmosphere (*Town of Chincoteague Comprehensive Plan*, 2015). In the 1950s, the tourist accommodations included rooming houses and small hotels. The island now includes over 21 hotels or motels, as well as four campgrounds and various vacation/rental homes to support the tourism industry during the 21st century and contributes approximately 80% of Accomack County's tourist-related tax revenue (*Town of Chincoteague Comprehensive Plan*, 2015).

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 factors that relate 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. The following sections are intended to provide insight in the make-up and characteristics of the community and how it relates to hazard vulnerability.

DEMOGRAPHICS

The Town has experienced a significant population growth as it has become an increasingly popular tourist destination. The first significant population gain occurred leading up to the 1990s and has continued into the 21st Century. The population grew 21% from 3,572 to 4,317 between 1990 and 2000 (U.S. Census, 2000). The 2010 Census indicated that the Town experienced a decrease in population from 2000 to 2010, but the Town has appealed this count and estimates 3,600 as the full year resident population, which will also affect the ACS estimates for subsequent years. The median age for residents in Chincoteague in 2014 was 52.1 years, indicating a population older than the national average. The Police Department and Emergency Services track individuals that are oxygen dependent and/or bedridden in order to provide special attention during emergency events, however indicate that there are less than 10 persons on this list (Bryan Rush, Emergency Management Coordinator, personal communication, January 21, 2016).

Chincoteague is a gateway community providing a single point of access to the National Wildlife Refuge and Seashore in Virginia with an estimated 1.5 million visitors per year. With tourism as the primary industry on the island, the Town experiences a peak population of over 15,000 seasonal residents and tourists during the summer months (*Town of Chincoteague Comprehensive Plan*, 2015). Planning for hazards with regards to such a significant seasonal population change is a challenge that Chincoteague has taken many steps to address.

Table 1: Chincoteague Demographic Information

	2014***	2013**	2010*	2000****
Population	2,933	2,965	~~2,941~~ 3,600	4,317
Median Age	52.1	49.5	52.0	46.1
Disability	156	191	NA	NA

Income				
Median Household Income	$45,430	$38,036	$33,109	$28,514
Poverty Level	11.4%	16.5%	18.9%	NA
Language				
Only English	96.6%	97.0%	93.0%	96.0%
Other	3.4%	3.0%	7.0%	4.0%
Spanish	1.5%	0.4%	4.2%	2.1%
Ind-Euro	2.0%	2.6%	2.8%	0.8%
Asian				0.9%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORKFORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Chincoteague shows a great deal of work force surrounding the tourism market in arts, recreation, food, and entertainment. There is also a lot of people working in professional, scientific, and waste management which reflects upon the location of Wallops Island nearby with NASA employees. There is also a trend of new mobile businesses, primarily restaurants. These mobile business are able to evacuate their business and thus can be much faster to bounce back following a storm. Unlike these mobile businesses, many of the restaurants, hotels, and entertainment businesses are susceptible to flooding and would take longer to recover following a storm.

Table 2: Chincoteague Local Workforce

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	58	4.3%	51	3.7%	72	5.3%	122	5.8%
Construction	96	7.0%	87	6.3%	62	4.5%	285	13.6%
Manufacturing	25	1.8%	20	1.5%	64	4.7%	103	4.9%
Wholesale trade	14	1.0%	16	1.2%	30	2.2%	54	2.6%
Retail trade	142	10.4%	87	6.3%	56	4.1%	333	15.9%
Transportation and warehousing, and utilities	19	1.4%	0	0.0%	17	1.2%	56	2.7%

Information	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Finance, insurance, real estate, and rentals	84	6.2%	77	5.6%	103	7.6%	116	5.5%
Professional, scientific, waste management	226	16.6%	201	14.6%	187	13.7%	88	4.2%
Educational, health care, social services	183	13.4%	296	21.5%	277	20.3%	210	10.0%
Arts, entertainment, recreation, food	350	25.7%	339	24.6%	251	18.4%	431	20.6%
Public Administration	99	7.3%	133	9.7%	173	12.7%	163	7.8%
Other	66	4.8%	69	5.0%	71	5.2%	131	6.3%
TOTAL CIVILIAN EMPLOYED POPULATION	1,362	-	1,376	-	1,363	-	2,092	-

Source: *American Community Survey, 2010 – 2014, ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Chincoteague supports a seafood industry that has been a vital component of the town's economy for generations. The town also supports a growing aquaculture industry. Both industries are vulnerable to economic losses as a result of coastal flooding. Storm events have had adverse impacts on the local seafood industry in the past by damaging facilities and gear as well as damaging oyster and clam beds.

There is a significant risk of economic losses to the tourist related businesses if a spring northeaster caused a functional shut down of access to the beach during the summer tourist season. A late summer hurricane could also cause the tourist season to be shorter than usual and cause functional losses. Although the NASA facility is a large employer and the NASA launches at Wallops can be a tourist attraction, they also can influence tourism and fisheries by forcing beach and waterway closures at the time surrounding scheduled launches. (Bryan Rush, Emergency Management Coordinator, personal communication, January 21, 2016)

Table 3: Chincoteague Business Types

Industry Code Description	Total Establishments		
	2013	2011	2009
Construction	11	17	15
Manufacturing	1	1	1
Wholesale Trade	0	1	3
Retail Trade	33	30	31
Transportation and Warehousing	1	1	1

Information	4	5	4
Finance and Leisure	3	3	3
Real Estate and rental and leasing	12	13	12
Professional, Scientific, and Technical Services	4	5	5
Administrative and Support and Waste Management and Remediation Services	3	3	1
Health Care and Social Assistance	7	7	6
Arts, Entertainment, and Recreation	4	5	6
Accommodation and Food Services	50	44	46
Other Services (Except Public Admin)	12	14	15
Total, All Establishments	145	149	152
Total Employees	707	701	747

Source: Census Zip Code Business Patterns, 2009, 2011, 2013

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Though Chincoteague supports a substantial residential population, there is also a large portion of housing available as seasonal rentals for the warmer summer months. Table 4 shows over half of the housing units as vacant, which is indicative of these second homes and rental properties. These properties provide an important economic vitality to the community of Chincoteague and are typically well kept and so do not create additional hazards of vacant, dilapidated structures. There are four campgrounds and many mobile homes or trailers that are coastal and prone to damages from storms.

Table 4: Chincoteague Housing

	2014*	**2010****	**2000*****
Total Housing Units	4,371	4,517	3,970
Occupied	1,427	1,417	2,068
Vacant	2,944	3,100	1,902
Owner-Occupied	1,160	1,070	1,639
Renter-Occupied	267	347	429

Median Housing Value	$244,000	NA	NA

* American Community Survey, 2010 – 2014, ** U.S. Census 2010, ***2000

TRANSPORTATION

Vehicles available to households is one indicator of a household's ability to evacuate when necessary. However, the high count reflected in Table 5 could be due to second homes for which the owner's vehicle is registered to their primary address. For those that do not have access to a vehicle, the Island Trolley provides regular transportation around the Island for a fare of only $0.25. Star Transit's orange route connects the Island to the rest of the Eastern Shore of Virginia.

Table 5: Chincoteague Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	141	112	177
One	405	482	721
Two	697	809	945
Three or more	184	190	225

* American Community Survey, 2010 – 2014, **2000

Chincoteague Island is served by paved public streets that includes 21 miles of roadway. There is also another 21 miles of private roadway and access easements that are in various states of private owner maintenance. At the time of Hurricane Sandy, during an interview with the Daily Press, Bryan Rush, the Emergency Management Coordinator said that most of the roads on the Island were inundated, some under three feet of water.

Originally built in 1922, the causeway was updated with a 3/4 mile-long Chincoteague Bridge built over Black Narrows and Lewis Creek Channel and a 729-foot long, low profile Connector Bridge to Marsh Island that were completed by VDOT in April 2010 at a cost of $68.7 million (*Town of Chincoteague Comprehensive Plan,* 2015). The Town is completely reliant on State Route 175 which includes approximately 5 miles of causeway over tidal marshland in addition to these bridges. Shown in Figure 2 from the *ESVA Transportation Infrastructure Inundation Vulnerability Assessment*, at least part of this causeway is subject to inundation with either 2 feet of sea-level rise or with 2 feet of storm water flooding at mean high water under current conditions. This holds true for the majority of the roads on the Island, some of which are subject to flooding with only one foot of water. In fall of 2012, Hurricane Sandy left approximately 3,500 people trapped on the Island, as the causeway was not passable (Daily Press, Steve Szkotak).

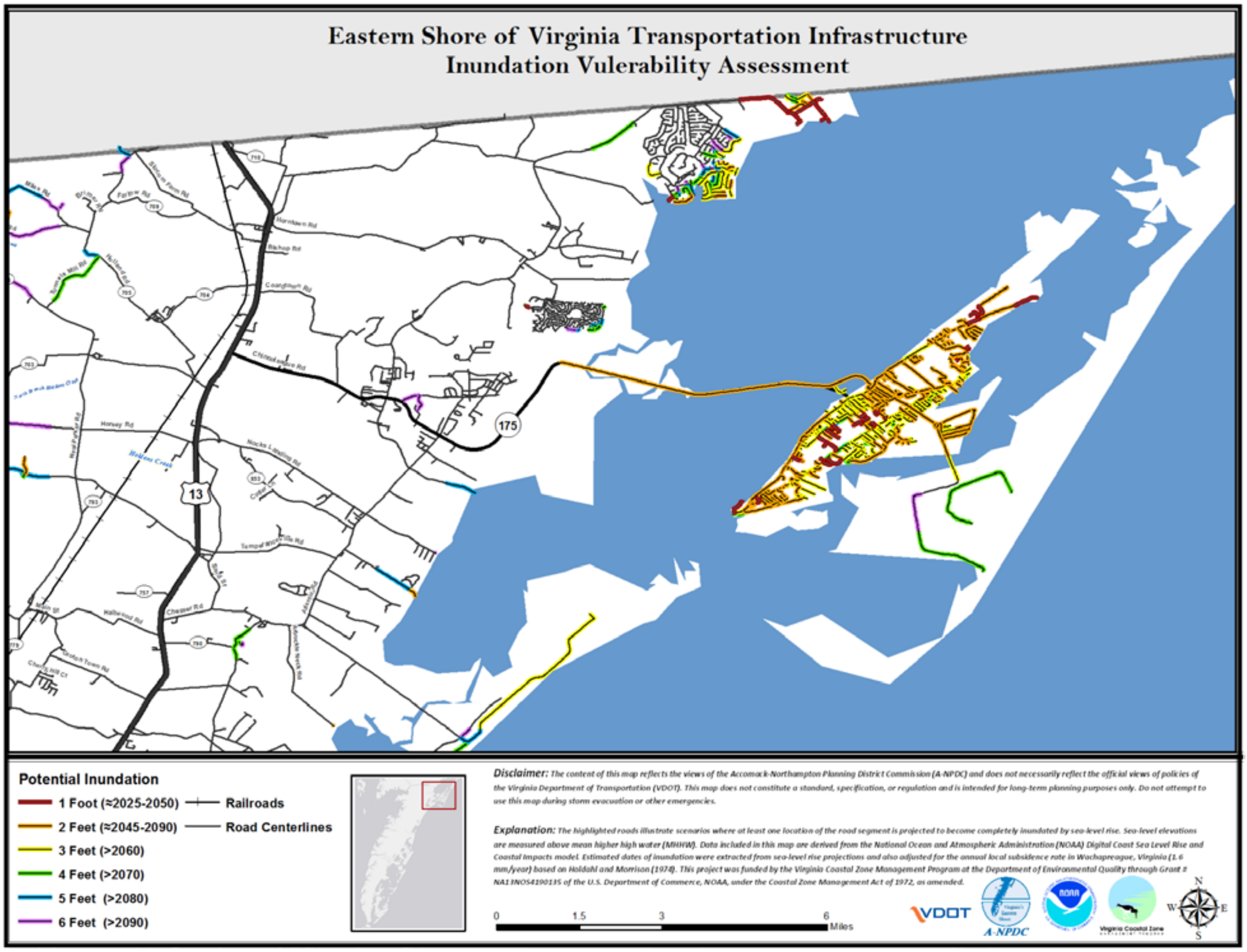


Figure 2: Town of Chincoteague Transportation Infrastructure Inundation Vulnerability

COMMUNITY FACILITIES

Community facilities are facilities required to support the services provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard. Community facilities in Chincoteague includes the Chincoteague Police Department, the Chincoteague Volunteer Fire Company, Schools, the Town Office, and several recreational entities. The Public Works Department manages the daily operations related to the Town's water, drainage and road systems, parks, and boating facilities.

PUBLIC SAFETY

Fire and emergency services are provided by the Chincoteague Volunteer Fire Company, a combination of paid and volunteer fireman supported by the Town and Accomack County. The Department owns four pumper/engines, a 75-foot ladder truck, a rescue squad, and two Advanced Life Support ambulances. The Chincoteague Police Department is the Island's primary law enforcement agency and employs 10 full time officers (*Town of Chincoteague Comprehensive Plan*, 2015).

There is no shelter located on the island, and so if the causeway floods and residents are unable to evacuate, as they were for a short time during Hurricane Sandy in 2012, they must stay in location (at home or with neighbors/friends).

MEDICAL SERVICES

There is the Chincoteague Community Health Center, run by Eastern Shore Rural Health, and the Island Family Medical, a health center affiliated with the Peninsula Regional Medical Center, that provide the primary health services for the Island (*Town of Chincoteague Comprehensive Plan*, 2015).

PARKS AND RECREATION

There are a variety of recreational facilities available on the Island. There are a number of boat landings maintained by the Town. There is a new waterfront park, the Robert N. Reed Downtown Waterfront Park that serves 1,500 visitors annually. The park also contains 10 boat slips available for rent to transient boats. There is also the Donald J. Leonard Park that has over one acre of waterfront land left in its natural state and the Chincoteague Veteran's Memorial Park. The Chincoteague Recreation Convention Center is used for special events, like graduations and meets most of the needs of the Island's civic and volunteer organizations. The Chincoteague Island Library provides recreational, educational, and job research opportunities.

CULTURAL RESOURCES

There are two museums in Chincoteague: Museum of Chincoteague Island (previously known as the Oyster and Maritime Museum) and the Refuge Waterfowl Museum (*Town of Chincoteague Comprehensive Plan*, 2015).

WATER SUPPLY AND WASTEWATER

Chincoteague Island residents are dependent on underground wells on the mainland for drinking water. Eight separate well fields, all located on land owned by the Town of Chincoteague or within a perpetual easement located on NASA property, serve the pumping station. There are currently 4 deep wells and 5 shallow wells for public water supply, with a total capacity of the working wells of approximately 1.5 million gallons per day (MGD). Depths vary from 63 feet to 256 feet. While the danger of contamination is considered minimal, vigilant monitoring activities on land near the wells is critical (*Town of Chincoteague Comprehensive Plan*, 2015).

There are around 70 miles of Town-owned and maintained water mains on the island. Pumped water is chlorinated at the well site and then pumped 5 miles to the island via transmission lines. Proper maintenance of these transmission lines is vital to the success and safety of the Town. The water reaches the Town's water works, where it is filtered and then enters a 200,000 gallon elevated storage tank. It is then distributed to the Town's 3,550 water customers. The town has considered installing an additional 1,000,000-gallon tank or two high-rise tanks to meet demand (*Town of Chincoteague Comprehensive Plan,* 2015).

In the 1980's the Town updated the length of the transmission line to a larger capacity pipe, while maintaining the smaller pipe for use during peak demand and during maintenance to the newer line. Having two separate pipes capable of brining freshwater to the Island is a positive step, however, both pipes are at risk to salt water contamination and/or damages which would jeopardize the water for all residents on the Island. Of additional concern is the limited storage capacity of water on the Island, which is about a one day supply during peak tourism season (*Town of Chincoteague Comprehensive Plan,* 2015).

There is no central sewerage collection and treatment on the Island. Wastewater is disposed of by discharge directly into seepage pits, cesspools, holding tanks/septic tanks and drain fields, or one of a few new engineered, residential sewerage systems. The maintenance of these sewage systems is provided by periodic pumping by private firms (*Town of Chincoteague Comprehensive Plan*, 2015).

In 2012 the Chincoteague Wastewater Advisory Committee revisited the idea of a centralized wastewater treatment system. This was spurred by the changes to the Health Code which required expensive individual lot septic systems that were required to meet advanced technology standards. (*Town of Chincoteague Comprehensive Plan*, 2015) Although there is still no central sewage collection and treatment system, with the County's aid, the Town continues to look into grant opportunities to move in this direction and completed a Wastewater Management Plan in June 2013.

SOLID WASTE

The Town provides weekly pick up of regular household waste through a private hauling company, a bulk trash service, and the County provides a recycling center. The Town public work trucks are used for this service. So long as the trucks are not damaged during a hazard event, then the Town will be able to serve their own community in the removal of debris. There are two County Convenience Centers nearby as well, in the Horntown and Makemie Park areas.

POWER AND COMMUNICATIONS INFRASTRUCTURE

Power is brought to the Island in large lines suspended by concrete utility poles then contained in the new bridge infrastructure to Marsh Island where they are then submerged below the highly trafficked Chincoteague Channel. These lines were recently reinforced and new footers were installed for the poles. The five miles of lines and inability to access them during extreme flooding is a vulnerability for the Town. During Irene the combination of salt-accumulation and sustained winds of about mph caused an island-wide power outage for eight hours. The lines had to be cleaned with fresh water prior to power being reinstated. (Bryan Rush, Emergency Management Coordinator, personal communication, January 21, 2016).

DRAINAGE DITCHES

Maintenance of drainage ditches and storm drains in Town is the responsibility of VDOT. Because the majority of the development in the Town is within 3-7 feet of sea level, often water must await lower tides to flow from the drainage ditches on the Island into the surrounding water (*Town of Chincoteague Comprehensive Plan*, 2015).

SCHOOLS

Two public schools are located in the Town of Chincoteague: Chincoteague Elementary School and Chincoteague Combined Middle/High School.

NATURAL ENVIRONMENT

Chincoteague Island is commonly believed to be an ancient barrier island. It was formed around 4,000 years ago, as the forces of wind, waves, and ocean deposited sand parallel to the Eastern Shore mainland. Erosion formed breaks in these barrier islands and allowed the rising sea to flood the flatlands behind the island. The flats are now the marshes, channels, and bays between Chincoteague and the mainland. Assateague Island joined the north end of Chincoteague Island around 2,000 to 4,000 years ago. Tom's Cove Hook is following a much similar pattern as the one that formed Chincoteague (*Town of Chincoteague Comprehensive Plan*, 2015). How these interactions continue to occur will have an impact on Chincoteague's ability to prepare for hazards, especially in relation to coastal erosion and hurricanes.

Above the shoreline, the land is typically flat with elevations on the Island rarely exceeding 10 feet. The upland ridges of the island are composed of well-sorted sand particles – and as a result are high in strength, low in compressibility, and highly permeable and porous (*Town of Chincoteague Comprehensive Plan*, 2015). This means that as long as these areas are protected from wind and waves, they can bear heavy rainfall and drain water quickly.

LAND USE LAND COVER

Most of Chincoteague Island's shorelines consists of tidal and non-tidal wetlands, as shown in Figure 3 below. There are also artificially stabilized shorelines made up of bulk heading and riprap along the commercial waterfronts and privately owned areas. In many of these places the shoreline has been built or filled in, and many piers extend out into the water. The marshlands surrounding Chincoteague have high value for wildlife and wildfowl and are closely associated with the fish spawning and nursery areas. They also help prevent erosion and help keep the shoreline stable (*Town of Chincoteague Comprehensive Plan*, 2015). There is a large area of vacant land seen in the northern parts of Chincoteague, these serve to drain storm water. The Town includes about 37 square miles of total area, only about a quarter of which (9 square miles) is land.

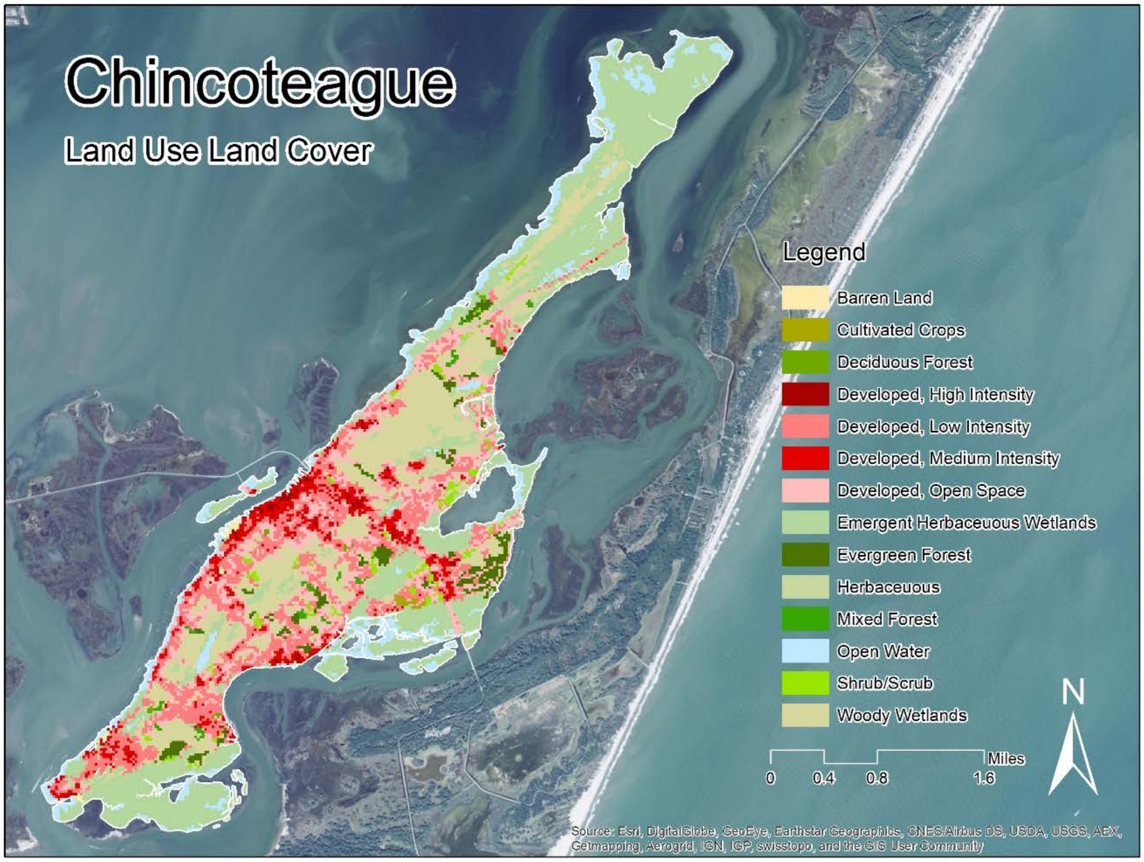


Figure 3: Chincoteague Land Use Land Cover (NLCD 2011)

Aside from natural wetland areas, low and medium developed areas dominate the Town, as shown in Figure 4 below. Developed areas are characterized by 30% or greater of constructed materials (e.g. asphalt, concrete, buildings, etc.).

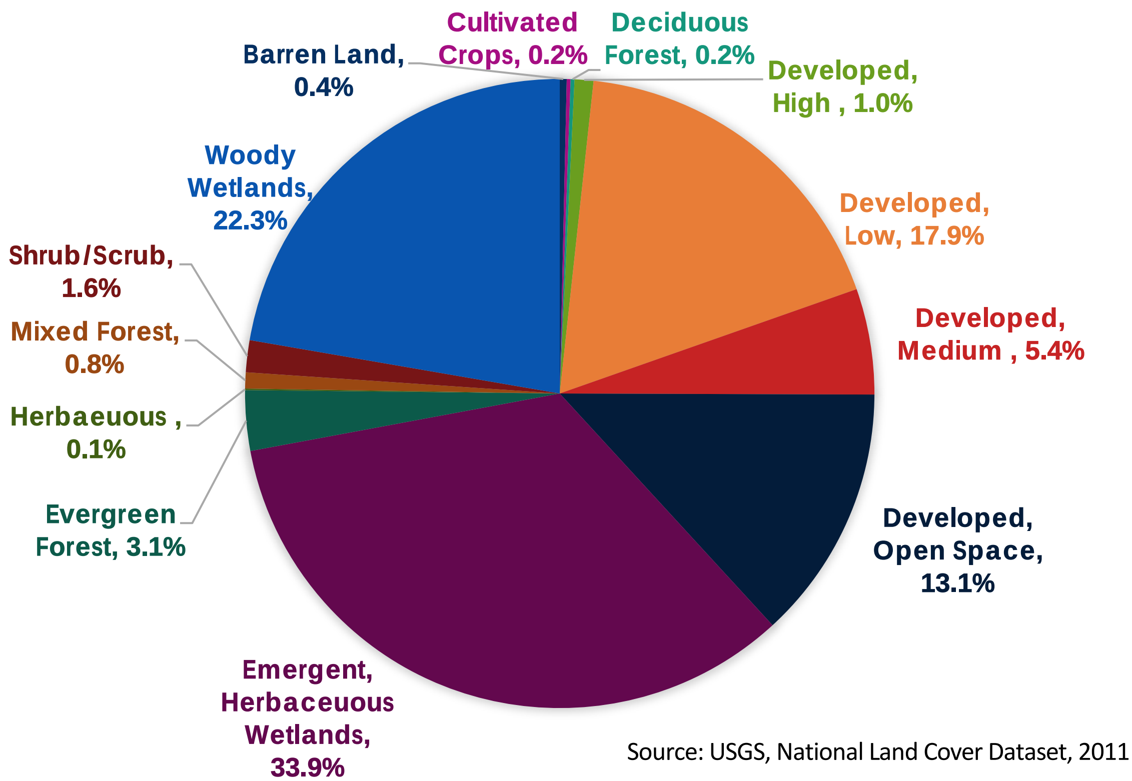


Figure 4: Chincoteague Land Use Land Cover Percentages

GROUND WATER

Due to a high ground water table and storm water drainage limitations, the Town is susceptible to periodic flooding (*Town of Chincoteague Comprehensive Plan*, 2015). The resulting standing water increases the risk of insect borne diseases. High ground water and saturated soil conditions increase the risk of tree downs, decrease the functionality of septic systems, and can move pathogens and excess nutrients hundreds of feet much more quickly than under normal conditions.

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Chincoteague has participated in the hazard mitigation planning process since 2006.

Table 6 : Town of Chincoteague Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan (updated	Zoning (updated 1992) &/or Subdivision Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*	*		*	*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

Chincoteague participates in the Community Rating System (CRS) of the Federal Emergency Management Agency's National Flood Insurance Program (NFIP). The NFIP provides participants protection against catastrophic damage of loss from flooding. Communities participate in the NFIP by adopting and enforcing local ordinances that reduce future flood losses by regulating new construction. These measures include the adoption of floodplain zoning provisions, designed to limit damage to structures in flood hazard areas. Measures also include the adoption of special building codes for affected areas. Homeowners, renters, and business owners living in communities that participate in the NFIP are eligible for federally backed flood insurance.

The Community Rating System rewards communities that voluntarily take steps beyond the minimum requirements of the Flood Insurance Program with discounts on flood insurance premiums. Eligible activities fall under one or more of the following categories: flood preparedness; flood damage reduction; mapping and regulations; and public awareness.

In 2003, Chincoteague improved its rating to Class 8, entitling the community to a 10% discount on flood insurance premiums. Chincoteague's current rating is Class 8. The town had 530 NFIP policies in 2003 and 819 in 2011 that reduce the risk of financial loss experienced following a hazard event (FEMA NFIP Insurance Report, July 2003 and May 2011). Depending on the distribution of NFIP polices, these should provide a portion of the cost of repair. Purchasing NFIP contents insurance is not usually required unless the property is being used to secure a loan. In this case, NFIP building insurance is a requirement to receive a mortgage on the property. Most of the covered losses will be for repair of existing buildings and will not be for replacement of personal property. In 2003, there was approximately $46.3 million in properties that are uncovered for residential structural loss. This amount rose to approximately $89.5 million in 2011 for the Town. In 2003, private residential property owners would have suffered an estimated $107.9 million in structural and contents damage in the event of a 100-year flood. In 2011, this estimate has risen to approximately $208.3 million (Eastern Shore of Virginia Coastal Flood Vulnerability Assessment, 2006 and 2011).

The Town joined the NFIP on March 1, 1977. Wave height analysis wasn't included for the Town until June, 1984. Accomack County also joined the NFIP at this time. Approximately, twenty-five percent of the existing Town has had floodplain regulation from 1977 while the remainder of the Town was administered by Accomack County from 1984 to 1989.

Chincoteague had three Flood Insurance Rate Maps (FIRMs) prior to the most recent 2015 FIRM. The 1984 FIRM shows the old Town boundaries and the 1992 FIRM shows the rest of Chincoteague Island. In 1989, the Town of Chincoteague annexed the remainder of Chincoteague Island and as a result both the 1984 FIRM and 1992 FIRM are incorrect in showing the Town's boundaries. An updated FIRM was provided to the Town by FEMA with an effective date of March 16, 2009.

The 2015 FIRM removed 0.6 square miles from the SFHA, which removed 1,167 buildings from the SFHA, such that they are no longer required to have insurance if they are under a mortgage. Couple this with the increase in rates, and the conditions for decreases in the number residents choosing to maintain insurance coverage. Previously all properties were at the Base Flood Elevation (BFE) of 7, 8 or 9 feet, but the new FIRM has the majority of the commercial and most densely populated area at 4 feet BFE, with the highest BFE now at 6 feet BFE. Construction standards are focused around this FEMA value, and so, if an under estimate, buildings are typically not built high enough, and mitigation moneys to raise buildings would only cover costs to construct to BFE. This can decrease the ability of the residents and the community to rebound following a large flooding event that may vary from the FIRM reflected exposure risk. The new FIRM is represented in Figure 5. The FIRM does not take into account any changes in relative sea-level rise or increases in storm frequency.

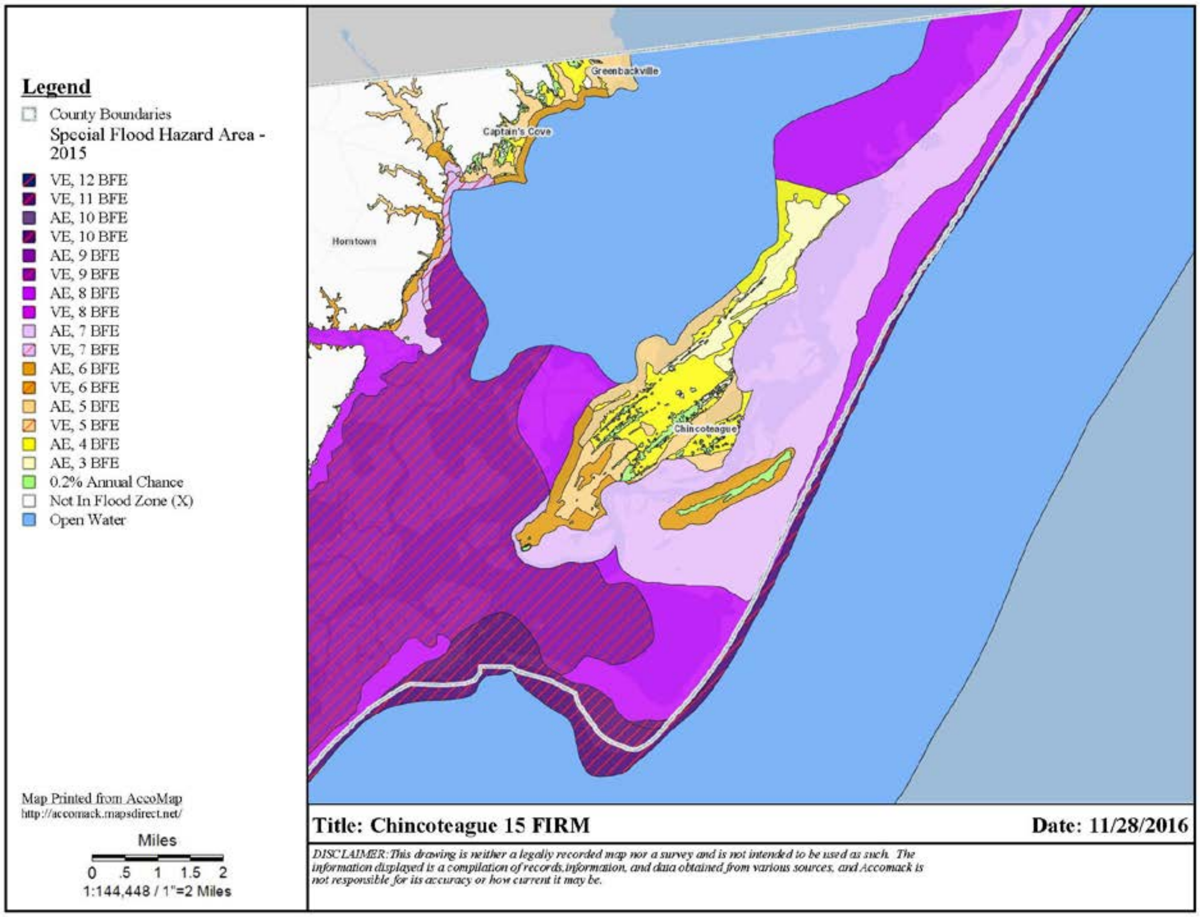


Figure 5: Map Showing FIRM Base Flood Elevations Within the Vicinity of Chincoteague; Map Courtesy of Accomack County's Accomap Mapping Service.

The number of claims has been increasing over the last decade, as indicated in Table 7.

Table 7: Federal Emergency Management Act NFIP Insurance Report

	Town of Chincoteague			Accomack County	Accomack County Total
	2003	2011	2015		
Total Premium	-	$787,740	$1,116,627	$2,044,239	$3,371,381
V-Zone	-	-	0	59	61
A-Zone	-	-	982	2,001	3,162
No. Policies	530	819	1,050	2,306	3,600
Total Coverage	$57,295,800	$159,316,400	$228,216,700	$508,113,600	$783,148,000

Total Claims Since 1978	21	42	74	833	1,062
Total Paid Since 1978	$60,438	$265,372	$531,240	$9,578,778	$11,906,426

Source: FEMA NFIP Insurance Report, 2003, 2011, 2015

DISASTER ASSISTANCE

In the past, floods that have covered the entire island, such as the 1933 hurricane and the Ash Wednesday Storm of 1962, have garnered federal assistance. However, there is no guarantee that the President would declare a disaster for a specific storm. If a federal disaster was declared, then some Federal Disaster Assistance would become available. The average housing assistance in medium sized states, such as Virginia, is $1,675 per home (CFR-Emergency Management and Assistance, 2002). This housing assistance can include lodging reimbursement, rental assistance, home repair or home replacement. There were 2,068 households in Chincoteague in 2000 and 4,480 in 2009 (Census 2000; 2005-2009 American Community Survey 5-Year Estimate). If all of these households applied and received the average assistance, the total federal assistance that might be available for repair of the homes would be $3.5 million in 2003 and $7.5 million in 2009, far short of the funds needed in both years.

There is currently some limited Federal Disaster Assistance for personal property such as loss of clothing, household items, et cetera and other necessary costs such as cleanup. For medium sized states, the average amount of this assistance is $2,106 (CFR-Emergency Management and Assistance, 2002). If all the households received the average assistance the total assistance that might be available for contents replacement would be $4.4 million in 2003 and $9.4 million in 2009, far short of the funds needed in both years.

The 2000 Census showed that there were approximately 542 houses with a mortgage and these homes are valued at approximately $85,317,500. The July 2003 NFIP insurance report showed that there were 530 policies for $57,295,800 in 2003. In 2011 the number of policies in the Town had increased to 819 covering $159,316,400 (FEMA NFIP Insurance Report, May 2011) and the number of mortgages had risen to 635 in 2009 (2005-2009 American Community Survey 5-Year Estimate) It appears that most of the flood insurance policies are on mortgaged houses and that as mortgages are paid off owners are dropping their flood insurance. It also appears that those policies are not covering all the losses that would occur in the 100-year flood.

In addition, it appears that few businesses have flood insurance and those that may have flood insurance likely only insure the structure and not the contents. Depending on depth of flooding, the displacement time for a one story commercial structure could be anywhere from 62 days (flood 1 foot above floor) to 302 days (flood 8 feet above floor).

HMGP

The Town has participated in the HMGP through A-NPDC and the adoption of an approved Hazard Mitigation Plan for Chincoteague in September 2006 and December of 2011. The Town and A-NPDC are currently working on a project with FEMA and VDEM to reconstruct one severe repetitive loss property. There are Coastal Barrier Resource Areas located along Assateague Island and the northern tip of Chincoteague that would not be eligible for HMGP and Pre-Disaster Mitigation funding.

HAZARD PROFILE

The primary hazard for Chincoteague has been coastal flooding associated with hurricanes and northeasters, as identified in the *Flood Insurance Study* for Chincoteague.

WIND

ASCE 7-98 defines the Wind Borne Debris Hazard Area as within 1 mile of the coast where basic wind speed is equal to or greater than 110 mph (3 sec gust). Chincoteague is within the 110-120 mph range. The coast of Assateague Island and Wallops Island generally are further than 1 mile from Chincoteague. The southern tip of Chincoteague is the only place that falls near or within this zone. There are two mobile home parks in this area, one of which is featured in Figure 6. There are approximately 180 units in the park most threatened worth approximately $6.8 million. Assuming, a 110 mph (3 sec gust) event, which is the 1%-annual-chance event in hurricane prone areas, Chincoteague could expect that many of these mobile homes would be a complete loss. It should be noted that the Floodplain Ordinance adopted by the Town in September 2006 requires elevation and anchoring for all new or substantially improved structures.

Figure 6: Mobile Home Park on the Southern Tip of Chincoteague Island; Photo Courtesy of Capt'n Bob's Marina.

According to the Hazus model, 2,080 buildings are estimated to incur a total of $63,170,460 in damages during a 1%-annual-chance event. As shown in Figure 7, the buildings in census blocks on the central eastern coast of the island are anticipated to have the highest amount of damages. In addition to man-made vulnerabilities, natural areas, particularly on Assateague Island are substantial. Where the pine beetle has killed or weakened many of the pines, they are more susceptible to wind damage and do not form as substantial a wind barrier for the Town.

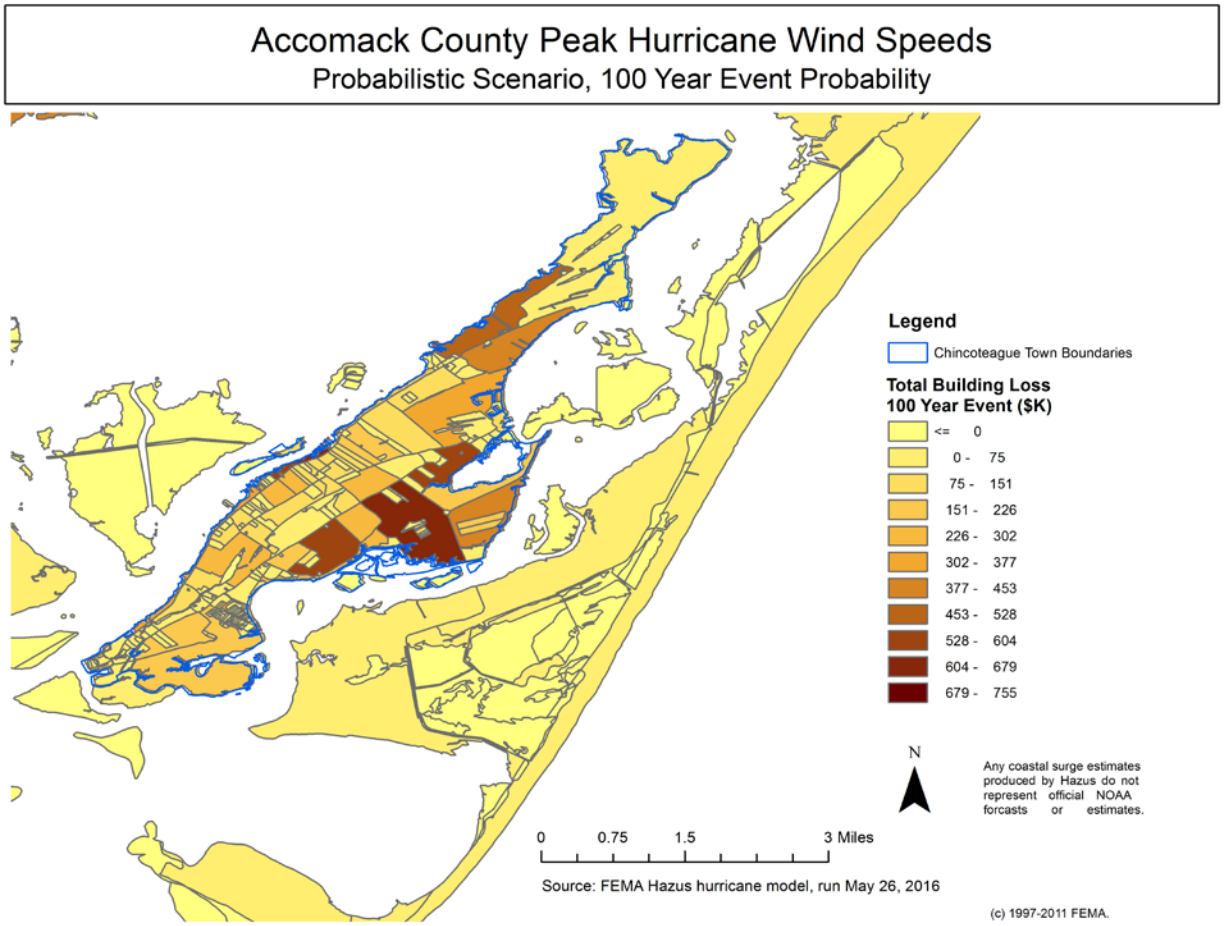


Figure 7 : Chincoteague Wind Damages by Census Block

COASTAL EROSION

Currently, the town itself is not experiencing a great deal of shoreline erosion. The island, located in Chincoteague Bay behind Assateague Island, is not currently exposed to the harsher wave climate of the Atlantic Ocean, although this is changing as the shape and extent of Assateague Island shifts. Assateague Island serves as a barrier protecting Chincoteague from coastal erosion. Natural changes to the Tom's Cove hook have significantly increased the width of the Chincoteague inlet in recent years causing greater high tides and erosion of the marshland at the south end of Chincoteague.

With the erosion of islands and marsh areas adjacent to the Town, there is subsequent siltation and filling of the surrounding waterways. For both the fishing and tourism industries, safely navigable waterways, with sufficient depth, are vital to the economy and the way of life.

In 1934, a jetty was constructed at the north end of Assateague Island to prevent shoaling at Ocean City Inlet. The jetty has successfully kept the inlet to the north navigable, but has starved Assateague Island of sediment and greatly accelerated erosion and island transgression. These impacts make the island vulnerable to inlet formation during storm events. Should an inlet breach Assateague, the island of Chincoteague could be exposed to greater flood elevations, wave energy and experience increased coastal erosion. Base flood elevations on Chincoteague are currently reduced by 4 to 5 feet due to the sheltering effect of Assateague Island (AccoMaps GIS).

A 50 year shoreline restoration project was completed for Wallops Island approximately 5 miles to the south of Chincoteague. The beach replenishment was almost negated by Hurricane Sandy in 2012, however the extension of a seawall protect significant federal property investments and may impact sand movement in the vicinity of Chincoteague inlet.

Approximately, 11.2% of the island's shoreline is hardened with bulkheads or riprap. Most of this is along commercial areas and privately owned land. Approximately 15 structures are located close to the shoreline with little buffer if erosion were to occur at that location. In several locations, critical infrastructure such as the Route 175 Causeway and portions of South Main Street come within several feet of the shoreline. A variety of shoreline management tools will be needed to promote a balance between perimeter marshland protection and meeting community needs for recreation, working waterfronts, and real estate value.

COASTAL FLOODING

Almost the entire town is located within the 100 year floodplain. Most areas are designated as an A-zone, with only a slim edge of the southern shore of the Town located in a V-zone. The *Flood Insurance Study* for Chincoteague includes a wave analysis. The town's A-zones then are likely coastal A-zones where waves under 3 feet can be expected in the 1%-annual-chance flood. This poses additional risk above ordinary A-zones and is included in the adoption of Base Flood Elevations (BFE) by FEMA. The BFE ranges from 3 feet to six feet for the Town. See the National Flood Insurance Program & Hazard Mitigation Grant Program section for additional information about the new FIRM and Town coverage.

Representations of estimated flooding and damages are featured in Figures 8 and 9. Where figure 8 shows the estimated damages in dollars, Figure 9 shows the percentage of the building anticipated to be destroyed, which is obvious in the high percent of damage to the buildings on the south end of the island where there are two mobile home parks.

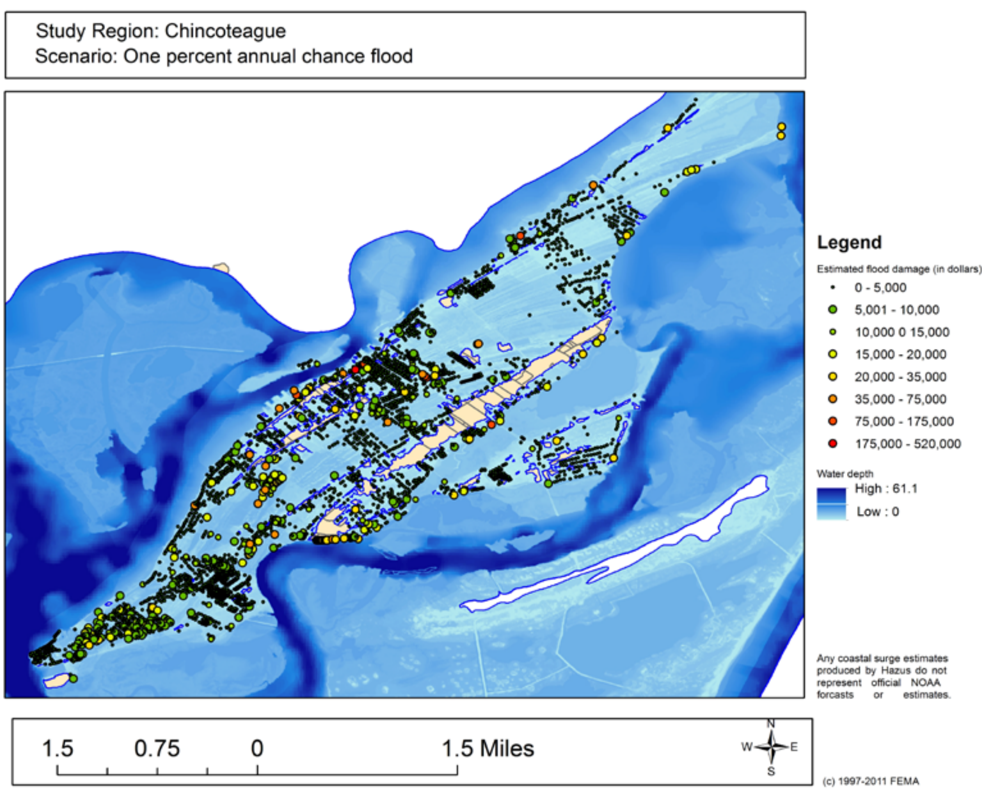


Figure 8: Chincoteague Hazus Estimated Flood Damages

Study Region: Accomack County
Percent Building Damaged on Chincoteague

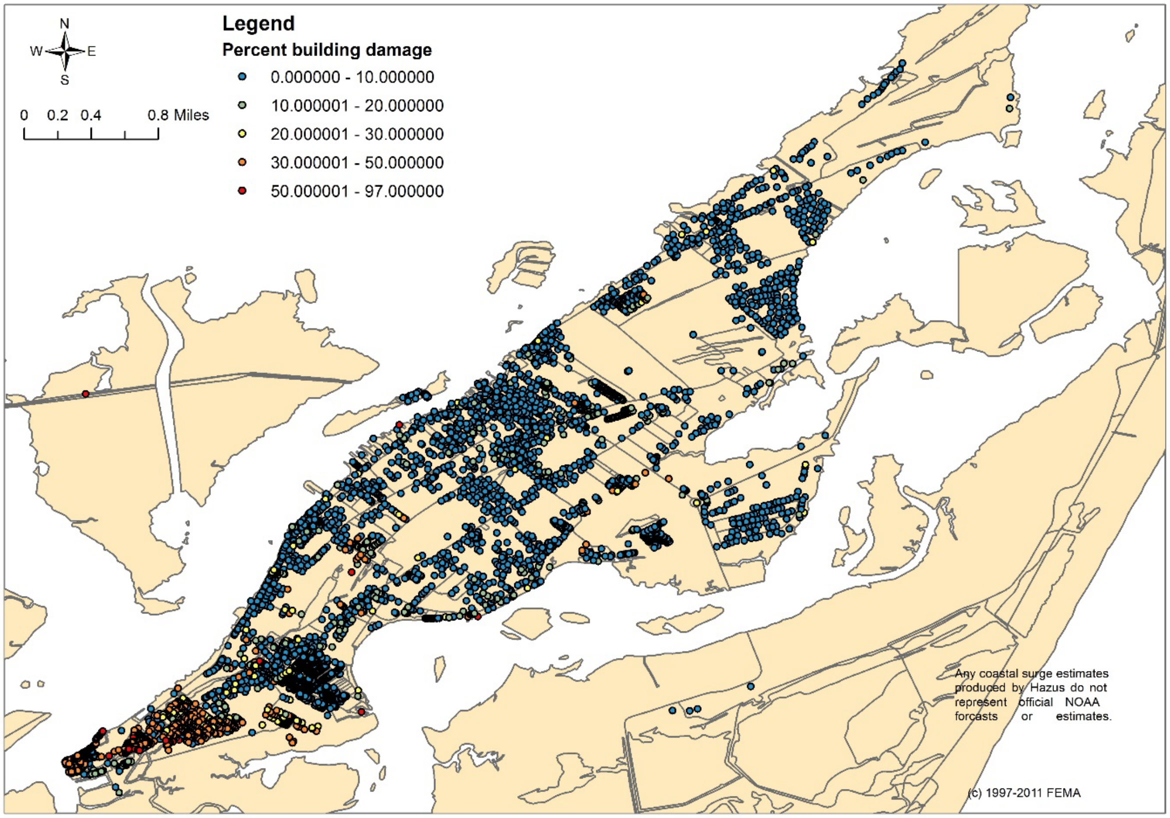


Figure 9: Chincoteague Hazus Estimated Percent Building Damages during 1%-Annual-Chance Event

The Town has a significant number of older homes not built to current building code standards for high winds and flooding conditions. All structures on the island are at high risk to coastal flooding. An estimate of residences built prior to the National Flood Insurance Program (pre-FIRM) is 2,016. There are approximately 609 additional residences built before the wave analysis. Some of these structures should be classified as pre-FIRM since they were built in the unincorporated areas of Accomack County prior to 1984 and annexed into the town in 1989. Prior to 1984, structures were built to the stillwater elevations. The Flood Insurance Supplemental Study shows that wave crest increases the Base Flood Elevation by 0.8 to 1.1 feet. All pre-FIRM and pre wave analysis structures are at greater risk of flood damage than post-FIRM structures built after June 1984.

The Hazus model estimates that over half of the properties in the Town would incur damages to the building and/or content, but that only about 2% of the total value ($685 million) would be lost. This totals to about $15 million anticipated in building, content, and business disruption losses during a 1%-annual-chance flooding event. Estimates from the 2006 and 2011 HMP indicated approximately $107 million and $208 million respectively in damages from a 1%-annual-chance storm event. Part of the reason for the huge decrease to the 2016 figure is the difference in technique, however a large reason for the change is due to the changes in the FIRM, upon which the Hazus model is based.

Additionally, in such a storm event, Hazus estimates that 19,799 tons, about 792 truckloads, of debris would be generated. Particularly as there is no emergency shelter on Chincoteague Island, it is also important to note that Hazus estimates 809 households will be displaced and that 1,901 people will seek temporary shelter in public shelters.

For Hurricane Sandy the Town's cumulative initial damage assessment found that there were $1.8 M in losses to homes and businesses. Of these, 80% of single family homes, 90% of multi-family homes, 80% of mobile homes, and 70% of businesses had flood insurance policies. In addition, public properties (including public buildings, utilities, and equipment) losses were estimated to total $267,000, the majority of which ($250,000) from debris removal. Considering Hurricane Sandy was not a direct hit, had worse effects on the Bayside of Accomack County, and was not even close to the magnitude of a 1%-annual-chance flooding event, these are substantial damages.

Two commercial districts are located on the island, along Maddox Boulevard and the original downtown area on Main Street. Both of these areas are located in A zones and for the most part lie below 5 feet in elevation. In August 2011, there were 1,269 business licenses within the Town Many of these licenses are for home based businesses and vacation rental homes since U.S. Census Business Patterns zip code data for Chincoteague indicated only 149 business establishments employing 755 persons and 162 businesses employing 807 persons in 2001 and 2008, respectively.

In addition to damages to typical building structures, intensive flooding can such saturate the ground that beyond impacting ability of a septic system to function, they can actually be extremely damaged. In May of 2016 Jon Richardson from the health department recalls his experience, "during Sandy, we actually had mounds that completely washed away along Main Street on Chincoteague and a few tanks floated out of the ground and had to be re-installed." This is not only a fiscal cost, but also a human health risk.

All of the risks associated with coastal flooding, coastal erosion, and stormwater flooding can be anticipated to intensify with the increases in relative sea-level that have been observed and are estimated to continue.

STORM WATER FLOODING

Chincoteague produced a Storm Water Master Plan, Phase 1 in 2011, which assessed locations in the Town vulnerable to storm water flooding and prioritized improvements for specific drainage issues. Although Phase 2 of the Plan was not completed in 2013 as intended, there was a flood elevation evaluation completed for both Fowling Gut and Hallie Whealton Smith Ditch in 2013. The plan outlines suggested storm water mitigation actions for Phase II including development of a storm water GIS database, a phased survey of drainage systems, an analysis of selected existing drainage systems, and suggesting site specific improvements. Chincoteague is interested in utilizing HMGP funding to implement Phase II of the master plan.

Like many coastal areas on the Eastern Shore, much of the localized flooding that occurs during rainfall events is the result of inadequate storm drainage systems and flat topography. In addition, the Island is subject to tidal flooding which can exacerbate flooding from a rain event, particularly if it coincides with a prolonged high tide even after the weather system has passed (Storm Water Master Plan, Phase I, 2011).

HAZARDS OF LOCAL SIGNIFICANCE

The Town's other hazards include, but are not limited to, the following:

OFF-SHORE SHIPPING

On February 28, 2004, a tanker carrying 3.5 million gallons of ethanol exploded and sunk off of the coast near Chincoteague. Although the ethanol evaporated and the fuel oil slick moved out into the ocean, an accident of this nature could have adverse impacts on the area's coastal environments and habitats. This is a significant concern for the Town with the adjacent shipping channel and so much of its economy reliant on the tourism and seafood industries and the major draw for the area the National Seashore on Assateague Island. An event of this nature could affect the economy for years.

GROUNDWATER CONTAMINATION

In October 2007 there was a reported leak at the Chincoteague Delmarva Substation. Tank related leaks and spills are caused by mismanaged or poorly designed underground and aboveground (this Substation has both) and containers designed to hold a variety of potential polluters. They may pose a risk to human health and/or the environment.

In addition, drought conditions would increase the demand of water for irrigation, but decrease the amount of aquifer recharge, increasing the Town (and region) susceptibility to salt water intrusion contaminating the drinking water supply. (Drought Response and Contingency Plan (DRCP), within the Town's Water Supply Plan (WSP))

There are three active Non-National Priorities List (NPL) and one archived superfund sites near the Town. The archived site is the Chincoteague Landfill, which was inspected and archived in the late 1980's, as it poses no threat and requires no clean up action. The other three sites, Nasa Wallops Island, Chincoteague Naval Auxiliary Air Station and Naval Aviation Ordinance Test Station, are considered active Non-NPL, which means that they may still pose some health risks to the surrounding community, but they are not considered the most hazardous waste sites by the Environmental Protection Agency (EPA).

LAUNCHES

The NASA Wallops Flight Facility Range Safety Officer establishes a safety performance envelope around the launch site as well as a circular hazard area in the event of a launch failure. This perimeter has been set in the past at 8,500 feet allowing for safe observation from Chincoteague.

On October 28, 2014, the Antares rocket exploded upon liftoff, however, no one was killed, there were few injuries, and no hazardous materials were found on Chincoteague Island. Despite the fact that this kind of incident could have had much more severe consequences, the program was stalled for almost two years, with the next Antares rocket launching successfully on October 17, 2016. It also brought attention to the hazards associated with the launches and the economic repercussions associated with a possible closure of the facility.

THUNDERSTORMS

Thunderstorms during warm weather months pose a significant threat to the Town. Lightning and high winds associated with thunderstorms are potentially hazardous especially during the annual Pony Penning event each third week in July. This event attracts tens of thousands of people to the pony swim, pony auction and fireman's carnival. During 2004, while thousands were attending the events a thunderstorm passed through and caught many out in the open.

WEATHER EXTREMES – SNOW/ICE & HEAT WAVES

Other significant hazards commonly experienced on the island include ice/snow storms and heat waves. Heat waves, unlike ice/snow storms, occur during the height of the tourist season when the population is at its greatest, putting a larger number of people at risk. Ice/snow storms regularly cause damages to trees and power lines and make access to and around the Town difficult

TORNADOES

In August of 2011 there was a tornado that spawned from Irene, which downed trees and caused roof damage. In July of 2000 there were three waterspouts reported by on-duty Coast Guard just off-shore. Having storm shelters in place and information regarding these is very important. Distribution of educational materials could mitigate potential life loss during such events.

CRITICAL FACILITIES

Town officials evaluated high priority hazards that may affect Chincoteague's critical facilities. All of the Town's critical facilities are located in hazard areas.

Figure 10: Firehouse on Chincoteague Island. Photo by Elaine Meil.

Table 8: Critical Facilities and their Relative Importance to the Town.

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No. of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-owned Facilities								
Chincoteague Municipal Complex	X	X	X	Wind Manmade	4,000+	Major Disruption	No	Yes
Chincoteague Fire Station	X	X	X	Flooding Wind Manmade	4,000+	Major Disruption	Yes	Yes
Chincoteague Community Center (parking lot serves as the POD)	-	-	X	Flooding Wind Fire Manmade	4,000+	Major Disruption	Yes	Yes
Chincoteague Harbor of Refuge and Dock	X	X	X	Wind Flooding Manmade Erosion	4,000+	Devastating	No	Yes
Chincoteague Water Supply & Distribution	X	X	X	Wind Flooding Fire Loss of Power	4,000+	Devastating	No	Yes

				Manmade Erosion				
Chincoteague Municipal Complex and Public Works Building	-	-	X	Wind Flooding Manmade	4,000+	Major Disruption	Yes	Yes
Not Town-owned Facilities								
Emergency Medical Centers	X	X	X	Wind Flooding Fire Loss of Power	4,000+	Major Disruption	Yes	Yes
ANEC Power Delivery Substation	x	X	X	Wind Flooding Manmade Loss of Power Erosion	4,000+	Devastating	No	Yes
Banks	x	X	X	Wind Flooding Fire Loss of Power Manmade	3,000+	Devastating	No	Yes
Hotels, Motels, Restaurants, Convention Center	X	X	X	Wind Flooding Fire Loss of Power Manmade	12,000+	Devastating	No	Yes
Coast Guard Station	-	X	X	Wind Flooding Fire Loss of Power	15,000+	Major Disruption	Yes	Yes
Route 175 Causeways & Bridges	-	X	X	Wind Flooding Manmade Erosion	30,000+	Devastating	No	Yes
Collector Streets (Maddox, Chicken City, Ridge, Church)	-	X	X	Wind Flooding Manmade	4,000+	Major Disruption	No	Yes
Communications Network	-	X	X	Wind Flooding Manmade	4,000+	Major Disruption	Yes	Yes
Storm Drainage System	-	X	X	Flooding Erosion	4,000+	Major Disruption	No	Yes
Post Office	-	-	X	Wind Flooding Manmade	4,000+	Major Disruption	Yes	Yes

Schools	-	-	X	Wind Flooding Manmade	4,000+	Major Disruption	Yes	Yes
Gas Stations	-	-	X	Wind Flooding Manmade	4,000+	Major Disruption	Yes	Yes

FINDINGS

1. The 2015 FIRM removed 1,167 buildings from the SFHA and lowered the BFE for the entire Island, which may lead to underinsured residents and businesses and a false sense of security in the Town about flooding vulnerability.

2. The new FIRM lowers the BFE for many buildings, this may be an inaccurate assessment of flood water levels during a 1-percent-annual-chance storm. The result is that homes obtaining assistance through HMGP may not be adequately improved to mitigate the true risk of flooding in the Town.

3. Post-FIRM buildings built with solid walls in A-zones that are affected by wave action could be damaged or destroyed though in compliance with the NFIP regulations.

4. Chincoteague is dependent on the tourist industry. A northeaster or a hurricane, causing a 100-year flooding event, could cause tremendous economic problems if the tourism industry was partially shut down thru the summer season.

5. The water distribution system is dependent on power on both the island and the mainland. Without power, water cannot be pumped to the island and fire suppression is a concern. There are no dry hydrants on the island since they do not work well in the salt water environment. The Town is dependent on residual pressure in the water tanks and Mutual Aid from other fire companies to combat fire during power outages. Water mains located along the Route 175 Causeway and bridges are critical infrastructure at risk from major storm events.

6. Potential damages are increasing due to increased storm and tidal exposure from expansion of Chincoteague Inlet.

7. The Storm Water Master Plan Phase 1 and 2 were completed in 2011 and 2013 respectively, and provide an efficient and accurate flood mitigation for Town implementation.

TOWN OF EASTVILLE

TOWN PROFILE

Eastville is located near the central spine of the Eastern Shore in the central region of Northampton County and encompasses approximately 160 acres. Approximately 60% drains into the Chesapeake Bay and 40% drains into the Atlantic Ocean. The Town has a rich history dating back to its establishment in 1677 when the community was known as “the Hornes” and was the site for colonial court. Eastville was incorporated in 1897 and has a wealth of 18th century buildings in Town. Eastville is the Northampton County seat and the Courthouse houses the oldest continuously documented court records in the nation. The Town has developed and changed modestly over time with the construction of the railroad and U.S. Route 13, which bisect the Town. The Town’s predominant land-use is residential with a relatively smaller commercial district (*Eastville Comprehensive Town Plan*, 2005).

Figure 1: Town of Eastville Aerial Map

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 that 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

The 2010 Census indicated that the Town had a population of 305, which is a 33.4% increase from the 203 people that lived in the Town during the 2000 Census. Since then, there is an estimated 236 people residing in the town in 2014 (American Community Survey, 2010 – 2014). This is a 22% decrease from the population in 2010. The median age for residents in Eastville is currently 39.1 and signified a population similar to that of the national average and younger than the Northampton County average. Almost all residents speak English, so hazard mitigation materials and outreach in other languages is not necessary for Eastville.

Table 1: Eastville Demographic Information

	2014***	2013**	2010*	2000****
Population	236	252	305	203
Median Age	39.1	48.8	37.4	40.8
Disability	0	8	NA	NA
Income				
Median Household Income	73,333	50,000	55,179	36,250
Poverty Level	11.0%	NA	NA	NA
Language				
Only English	100%	100%	NA	98.9%
Other				1.1%
Ind-Euro				1.1%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The Eastville workforce is largely professional or educational. The highest civilian employed population can be seen in 2014 when compared with 2010, with almost a 25% increase in employed civilians (American Community Survey 2010 – 2014; U.S. Census, 2010)

Table 2: Eastville Local Workforce

								Civilian Employed Population
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	10	9.4%	10	10.1%	7	8.8%	9	11.4%
Construction	16	15.1%	7	7.1%	5	6.3%	4	5.1%

Manufacturing	4	3.8%	0	0.0%	2	2.5%	7	8.9%
Wholesale trade	1	0.9%	2	2.0%	0	0.0%	4	5.1%
Retail trade	13	12.3%	21	21.2%	15	18.8%	5	6.3%
Transportation and warehousing, and utilities	7	6.6%	5	5.1%	7	8.8%	2	2.5%
Information	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Finance, insurance, real estate, and rentals	0	0.0%	0	0.0%	0	0.0%	3	3.8%
Professional, scientific, waste management	21	19.8%	23	23.2%	16	20.0%	8	10.1%
Educational, health care, social services	20	18.9%	27	27.3%	8	10.0%	22	27.8%
Arts, entertainment, recreation, food	6	5.7%	0	0.0%	0	0.0%	7	8.9%
Public Administration	8	7.5%	4	4.0%	20	25.0%	1	1.3%
Other	0	0.0%	0	0.0%	0	0.0%	7	8.9%
TOTAL CIVILIAN EMPLOYED POPULATION	106	-	99	-	80	-	79	-

Source: *ACS, 2009 – 2013, ** U.S. Census 2000

BUSINESSES

As the site of Northampton County Seat, the primary activity in Eastville is government, justice, and government services (*Eastville Comprehensive* Plan, 2000). The number of businesses in Eastville has stayed relatively stable, between 40 and 45. The number of employees, however, has declined between 2009 and 2013 by 47.8%.

Table 3: Eastville Business Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Agriculture, Forestry, Fishing, and Hunting	1	1	1
Construction	3	3	4
Manufacturing	1	1	1
Wholesale Trade	1	0	1
Retail Trade	7	9	8
Transportation and Warehousing	1	1	1
Information	1	1	1
Finance and Insurance	2	3	3
Real Estate and Rental and Leasing	3	1	1
Professional, Scientific, and Technical Services	9	9	7
Administrative and Support and Waste Management and Remediation Services	3	2	3
Health Care and Social Assistance	1	2	4
Accommodation and Food Services	2	3	3
Other Services (Except Public Admin)	6	6	6
Industries not classified	1	0	0
Total, All Establishments	43	42	44
Total Employees	117	176	224

Source: Census Zip Code Business Patterns, 2009, 2011, 2013

Source: Census Zip Code Business Patterns, 2013

BUILT INFRASTRUCTURE

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 evacuate.

HOUSING UNITS

The housing stock in Eastville is primarily occupied and non-rental. According to the American Community Survey, there has been a significant increase in the number of housing units since 2010. Eastville's housing is in relatively good condition (*Eastville Comprehensive Plan*, 2000), which is important during high wind events.

Table 4: Eastville Housing

	2014*	2010*	2000***
Total Housing Units	104	79	75
Occupied	92	69	69
Vacant	12	10	6
Owner-Occupied	65	49	50
Renter-Occupied	27	20	19
Median Housing Value	267,900	NA	NA

Source: * ACS, 2009 – 2013, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

U.S. Route 13 provides regional access and directs major traffic flow away from the town, while Business Route 13 provides safe access into and out of the Town. Public transportation is provided by STAR Transit which provides daily bus service along Route 13, as well as a good connector route across the Chesapeake Bay Bridge Tunnel. The streets and sidewalks are generally in good condition. The Town employs a person to clean the streets, curbs, and gutters on a regular basis (*Eastville Comprehensive Plan,* 2000).

According the American Community Survey, there are very few households that without a vehicle, which indicates a capability for almost all residents to readily evacuate if needed.

Table 5: Eastville Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	2	0	5
One	28	36	19
Two	52	26	28
Three or more	10	33	14

Source: * ACS, 2009 – 2013, ** U.S. Census 2000

COMMUNITY SERVICES AND FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard.

COMMERCIAL AREAS

There is little commercial activity in the center of Town. Commercial activity consists of a number of law offices, a funeral home, an insurance company, and a thrift shop. Other commercial establishments within the Town include a bank and a convenience store located on Route 13, as well as a restaurant and day care center located east of Route 13 (*Eastville Comprehensive Plan,* 2000*)*.

PUBLIC SAFETY

Fire protection for the Town is provided by the Eastville Volunteer Fire Department. Police protection is provided by the Northampton County Sheriff's Department, and the Virginia State Police also provide additional services. Ambulance service is provided by the Cape Charles Rescue Squad, located in Bayview (*Town of Eastville Comprehensive Plan*, 2000).

WATER AND SEWER

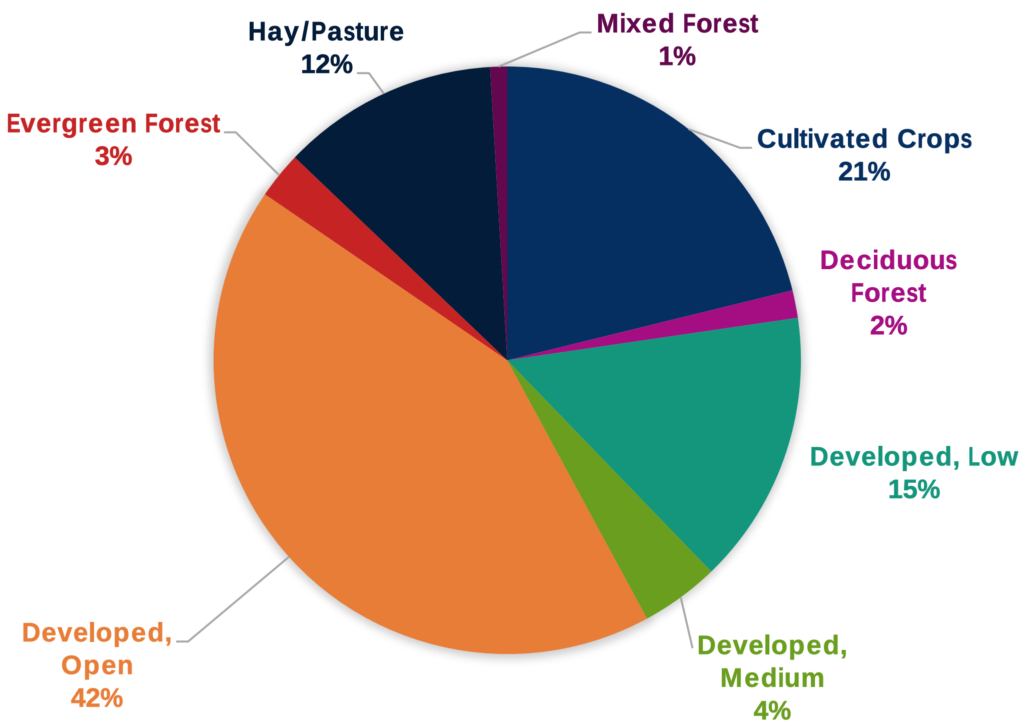
The Town of Eastville relies on two wells, the primary well is located in the vicinity of Northampton County Sheriff's Department, at the intersection of Route 13 and Route 631. The backup well is located just outside the town's corporate limits, situated near the Town's water tank which is located east of the northern section of Courthouse Road. The water supply is good in both quantity and quality. The Town has a generator to serve as a backup source for electricity for the water pump (*Town of Eastville Comprehensive Plan*, 2000).

NATURAL ENVIRONMENT

Elevations in Eastville range from approximately 22 feet above mean sea level in the westernmost part of Town to 40 feet above mean sea level in the eastern portion. There are no perennially flowing surface water bodies in the Town. Drainage ditches on the eastern half of Town drain towards Indiantown and Taylor Creeks and ultimately to the Atlantic Ocean. Drainage ditches on the western side of Town drain towards the Gulf and ultimately to the Chesapeake Bay.

LAND USE LAND COVER

The Town of Eastville is comprised of 160 acres of land, most of which is developed. The developed land is primarily residential with single-family housing situated on large lots. The Town contains a limited amount of undeveloped land that is used of agriculture. These percentages are easily seen in Figure 2.



Source: USGS. National Land Cover Dataset. 2011

Figure 2: Eastville Land Use Land Cover Percentages

GROUND WATER

The Town of Eastville provides public water through a well which withdraws water from ground water aquifers. The Town's water supply is mostly withdrawn from the upper Yorktown aquifer. The majority of the Town lies within the Eastern Shore's spine recharge area. Limiting impervious surfaces in the spine recharge will allow rainfall to recharge the aquifers. The Town's water supply is protected by public well lots surrounding the Town's well, which offers wellhead protection, and there are state-mandated regulations restricting potential sources of contamination in the well lots.

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Eastville has participated in the hazard mitigation planning process since 2011. During the 2006 Hazard Mitigation Plan the Town defaulted to the County. The Town's primary hazard relates to storm water flooding.

Table 6: Town of Eastville Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committe	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State	*	*					*						*						
Federal		*																	

The Town's comprehensive plan has not been updated since 2000, and their zoning ordinance is from 1995. They don't emphasize many hazards other than the threat of ground water contamination.

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

The town does not participate in the NFIP and has not participated in the HMGP.

HAZARD PROFILE

Storm water flooding poses the greatest risk to the town and has the most frequent impact.

WIND

No parts of Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the coast. The Town lies in the 110 mph design wind zone (Northampton County Building Code).

The vast majority of homes were constructed prior to the 1970s and are now over 40 years old. The Town's aging building stock is at greater risk to damage from high wind events. Most of the residential areas are older and have mature trees around the homes. During a high wind event falling branches or trees may damage some structures and damage power lines. Town Staff indicated that hurricane-force winds will be extremely damaging to residences, Town facilities, trees and electrical infrastructure.

Hurricane Gloria in 1985, Hurricane Isabel in 2003, and Tropical Storm Ernesto in 2006 all impacted the Town with high winds and saturated soils resulting in damaged and up-rooted trees. Downed trees are very hazardous to power lines and can cause extensive power outages. The Town's power grid serves Northampton County's Emergency Services including the regional jail, Northampton County Sheriff's Office, and Emergency Operations Center. In August 2011, power was lost during Hurricane Irene for nearly a day and many County facilities were impacted.

COASTAL EROSION

No structures are at immediate risk for coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area. The entire Town is located within the X zone, which is the 500-year floodplain. The threat of coastal flooding within the Town is considered to be minimal.

STORM WATER FLOODING

Storm water flooding poses the greatest risk to the town and has the most frequent impact. The Town relies on the Virginia Department of Transportation to perform maintenance on the main drainage ditches within the Town limits. Drainage issues are commonly experienced along Courthouse Road, Willow Oak Road east of Route 13, and at the northwestern side of the intersection of Route 13 and Willow Oak Road where the ditches aren't maintained as regularly. Willow Oak Road receives flood waters from the Holland Court area and the Town has needed to fund the maintenance of drainage ditches here in the past.

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

The Town faces a threat of ground water contamination from several sources including failed septic systems within Town and leaks and spills of petroleum based products from underground and aboveground storage tanks. In Eastville, residents and commercial businesses rely on on-site septic systems for waste disposal. The Town has a public water supply that is protected according to state-mandated wellhead protection regulations. The Town's water supply serves 169 hook-ups, 98 of which were within Town limits in 2005. The Town purchased a generator to serve as a backup power supply for the water pump serving the public water supply wells (Eastville Comprehensive Town Plan, 2005). No ground water problems currently exist in the vicinity of the Town, but increased water supply demand within the region could pose a future threat to ground water supply quantity and quality.

SNOW AND ICE

Winter snow and ice storms impacted the Town in the late 1990s and in 2010. These storms downed tree limbs and power lines and also forced local businesses to close for several days. Residents also had no electricity for several days. Emergency energy generation filled the needs for drinking water during the time of outage. Extreme cold weather events have historically caused damages to the Town's water distribution system. During these events, pipes froze and burst and the Town's water supply was at risk of contamination.

DROUGHT

The Town has significant agricultural lands that are impacted during droughts.

TORNADOES

Tornadoes have not historically hit within Town limits, but they have occurred on the outskirts of Town.

CRITICAL FACILITIES

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

Table 7: Eastville Critical Facilities

Facility	HMP '06	HMP '11	HMP '16	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-Owned Facilities								
Eastville Town Office/Police Department	-	X	X	Wind	13,000	Major Disruption	No	Yes
Eastville Water Tower	-	X	X	Wind, Ice	500	Devastating	No	Yes
Eastville Water Distribution System	-	X	X	Wind	500	Devastating	Yes	Yes

Eastville Municipal Wells	-	X	X	Contamination Storm water flooding	500	Major Disruption	Yes	No
Other Facilities (not Town-owned)								
Eastville Volunteer Fire Department	-	X	X	Flooding Wind	13,000	Devastating	No	Yes

FINDINGS

1. The hazards expected to have the greatest impact on the Town are stormwater flooding and high wind events, which have been experienced throughout the Town's history. Other hazards facing the Town are groundwater contamination, ice storms and drought.

2. Residential areas have older construction and many mature trees. During a wind event, branches and trees may come down causing secondary wind damage and power outages.

3. The Town has no Special Flood Hazard Areas, but does experience significant stormwater flooding. The Town has expressed interest in joining the National Flood Insurance Program so that residents can purchase flood insurance. Currently there is only one policy in force in the Town.

4. The Town is interested in continuing to cooperate with VDOT to maintain drainage ditches in and around the Town. In the past and currently the Town has needed to provide funding and perform maintenance on state ditches.

5. The Town's water distribution system is aging and becoming increasingly fragile and vulnerable to stormwater flooding events and extreme cold weather events.

TOWN OF EXMORE

TOWN PROFILE

Exmore resides in Northampton County near the border of Accomack County. It is located on the central spine of the Eastern Shore, and approximately doubled its physical size with the annexation of 2000 to now encompass 590 acres. It is an important commercial hub to the Eastern Shore. The town of Exmore was established in 1884 with the designation of the first stop in Northampton County for the New York-Pennsylvania-Norfolk Railroad. The railroad brought with it commerce due to the Eastern Shore's produce, and its growing tourist market to the barrier islands. The town became incorporated in 1950 due to a second wave of growth. Exmore became the transportation nexus for the Eastern Shore. To this day, the town has one of the largest concentrations of commercial activity in Northampton County. Route 13 allows Exmore to remain an important commercial hub for the Eastern Shore (*Town of Exmore Comprehensive Plan*, 2015).

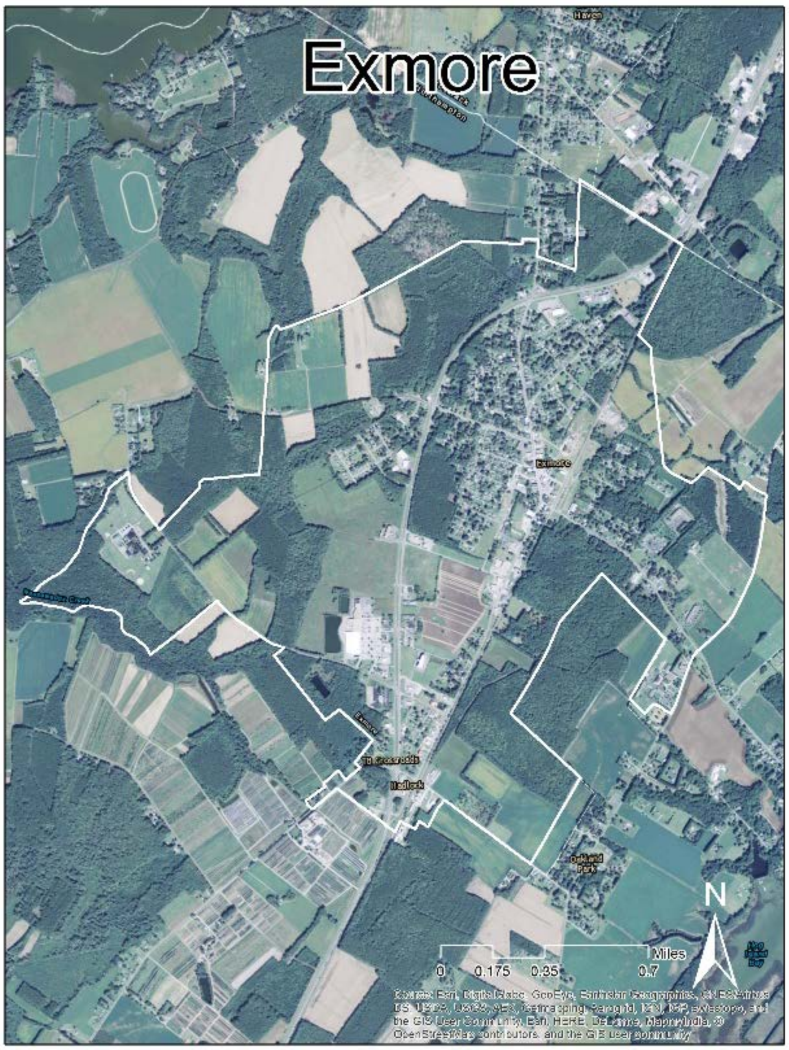


Figure 1: Exmore Aerial Map

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 that 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

The Town of Exmore had a population of 1,460 in 2010 (U.S. Census, 2010). Historically, the town's population ranged from 1,300 to 1,566 between 1950 and 1980 (U.S. Census, 1950, 1960, 1970, 1980). The largest dip in population occurred in 1990 to 1,115 people (U.S. Census, 1990). Since 2000, the population has remained relatively steady with an influx in 2010 due to the annexation that occurred then (U.S. Census, 2000). The transient population is thought to be substantial (*Town of Exmore Comprehensive Plan,* 2015).

Exmore has concentrations of senior and disabled residents in its Peter Cartwright Apartments, and Exmore Village I and II Apartment Villages.

Table 1: Exmore Demographic Information

	2014***	2013**	2010*	2000****
Population	1445	1460	1460	1136
Median Age	NA	37.7	44.4	38.6
Disability	NA	80	NA	NA
Income				
Median Household Income	NA	23,958$	NA	31,143$
Poverty Level	NA	30.4%	NA	NA
Language				
Only English	97.3%	NA	NA	97.1%
Other	2.7%	NA	NA	3.9%
Spanish	1.8%	NA	NA	2.0%
Ind-Euro	0.2%	NA	NA	0.8%
Asian	0.7%	NA	NA	0.0%

* U.S. Census 2010, ** American Community Survey 2010 – 2014, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The Exmore workforce is largely in retail trade, educational and health services, and accommodation and food services (American Community Survey, 2009- 2013). However, according to the U.S. Census Bureau, most of Exmore's work force is employed elsewhere.

Table 2: Exmore Local Workforce

Civilian Employed Population								
Industry	**2014**		**2012**		**2010**		**2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent

Agriculture, forestry, fishing/hunting, or mining	20	4.1%	39	5.5%	35	5.7%	14	2.7%
Construction	50	10.4%	46	6.5%	24	3.9%	50	9.8%
Manufacturing	38	7.9%	68	9.6%	64	10.3%	73	14.3%
Wholesale trade	27	5.6%	6	0.8%	17	2.7%	25	4.9%
Retail trade	91	18.9%	129	18.3%	86	13.9%	71	13.9%
Transportation and warehousing, and utilities	8	1.7%	15	2.1%	39	6.3%	20	3.9%
Information	0	0.0%	15	2.1%	19	3.1%	8	1.6%
Finance, insurance, real estate, and rentals	8	1.7%	26	3.7%	27	4.4%	10	2.0%
Professional, scientific, waste management	40	8.3%	44	6.2%	17	2.7%	21	4.1%
Educational, health care, social services	139	28.8%	207	29.3%	173	27.9%	130	25.4%
Arts, entertainment, recreation, food	38	7.9%	64	9.1%	65	10.5%	44	8.6%
Public Administration	9	1.9%	14	2.0%	9	1.5%	20	3.9%
Other	14	2.9%	33	4.7%	47	7.6%	26	5.1%
TOTAL CIVILIAN EMPLOYED POPULATION	482	-	706	-	619	-	512	-

Source: American Community Survey, 2010 – 2014

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

The largest employer in Exmore is manufacturing with Retail having the most establishments (Census Zip Code Business Pattern, 2013). Exmore has hotels in the Town that support a substantial transient population of travelers/tourists which is much greater during the summer season (*ESVA Hazard Mitigation Plan,* 2011).

The number of businesses in the Exmore zip code (not all are with the town limits) has remained relatively stable, but with shifts among types of businesses. The combined estimated annual payroll of all businesses in 2013 was around $20 million.

Table 3: Exmore Business Type

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Utilities	0	1	1
Construction	6	5	5
Manufacturing	3	3	3
Wholesale Trade	2	2	2
Retail Trade	27	30	31
Transportation and Warehousing	0	1	1
Finance and Leisure	8	6	6

Real Estate and Rental Leasing	4	2	3
Professional, Scientific, and Technical Services	1	2	2
Educational Services	2	2	2
Health Care and Social Assistance	13	8	9
Arts, Entertainment, and Recreation	2	1	1
Accommodation and Food Services	8	10	11
Other Services (Except Public Admin)	10	12	13
Total, All Establishments	86	85	90
Total Employees	913		

Source: Census Zip Code Business Patterns, 2013, 2011, and 2009

BUILT INFRASTRUCTURE

Hydric soils are a major limiting factor in Exmore due to their severe limitations in respect to constructing on-site septic systems. A majority of residents in Exmore utilize on-site septic systems for residential and commercial waste disposal.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

Table 4: Exmore Housing

	2013*	2010**	2000***
Total Housing Units	815	769	524
Occupied	751	682	475
Vacant	64	87	49
Owner-Occupied	337	341	302
Renter-Occupied	414	341	173
Median Housing Value	120,900	NA	NA

* American Community Survey, 2009 – 2013, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

There are a total of 815 housing units in Exmore. Nearly a quarter of the housing units do not have access to a vehicle in Exmore (American Community Survey, 2009 – 2013; U.S. Census 2000).

Table 5: Exmore Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	190	122	42
One	291	260	196
Two	200	170	174
Three or more	70	63	29

* American Community Survey, 2009 – 2013, ** U.S. Census 2000

COMMUNITY SERVICES AND FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It is important to note what facilities are available in case of a hazard, and it is important to make an inventory of facilities that could be impacted by a hazard.

PUBLIC SAFETY

Fire protection for the Town is provided by the Exmore Fire Department, for which there are two paid non-firefighting staff, 15 non-firefighting volunteers, and about 21 volunteer firefighters. The Exmore Police Department has five officers and serves about 1,400 people. (www.firedepartment.net & www.policeone.com)

PARKS AND RECREATION

The Exmore Town Park has been recently renovated and has had restrooms installed. The parking area has been enhanced and the Town is beginning to use the Park for activities and events beyond the playground, such as the Earth Day Festival of 2016.

CULTURAL RESOURCES

The closest public library is in Nassawadox, which is part of the Eastern Shore Public Library System. Exmore developed as a result of the railroad completed in 1884, and there are historic buildings that go back to this age, such as the train station pictured below.

Figure 2: Exmore Histsoric Train Station. Photo by A-NPDC staff

WATER SUPPLY AND WASTEWATER

The Town of Exmore has two wells, both of which are in need of replacement, which pump to a chlorination facility and to a water tower with a single-day storage capacity. The Town is working with the Virginia Department of Health to design and construct new wells and pumps, and is also in need of new distribution infrastructure.

Failing septic systems in the late 1990's lead to the construction of two sewage systems. The one on the north end of Town (1999) collects sewage from individual septic tanks to a mass drain field and the newer (2005) septic tank effluent pump modified individual septic tanks in the downtown area and diverts the settled effluent to a waste water treatment plant on the east side of town. This newer system is suffering from malfunctions and the USDA has granted Exmore $30,000 in planning funds to study sewer collection and treatment. (Exmore Comprehensive Plan, 2015)

SOLID WASTE

The Town provides pickup within limits to approximately 540 households and 75 businesses (http://www.co.northampton.va.us/). There is an Accomack County Convenience Center about four miles north of the Town on Route 13 in Painter.

POWER AND COMMUNICATIONS INFRASTRUCTURE

Electricity is provided by A & N Electric Cooperative, and all lines are less than 100 kilovolts. The Town does not typically experience long-term or widespread outages. Broadband service runs along Route 13, and thus through the Town, where there is also a regeneration facility.

SCHOOLS

Three schools are within the boundaries of the Town: Occohannock Elementary (public), Broadwater Academy (private), and Shore Christian Academy (private) (Exmore Comprehensive Plan, 2015).

NATURAL ENVIRONMENT

Exmore ranges in elevation from 27 to 43 feet above the mean sea level. There are no perennially flowing surface water bodies in the Town. Drainage ditches on the eastern half of the Town drain towards Parting Creek and the Atlantic Ocean. Drainage ditches on the western side of town drain towards Occohannock or Nassawadox Creeks and to the Chesapeake Bay. Hydric soils are the most prevalent soil type in the town, located on the eastern, southern, and western sides of the town. There are some highly permeable soils located in the northern and central areas of town (*ESVA Hazard Mitigation Plan*, 2011).

LAND USE LAND COVER

Prior to the annexation in 2000, residential development constituted the majority of the Town's development. Since 2000, however, in addition so several more residential areas, much farmlands and forested lands are now within town boundaries (Exmore Comprehensive Plan, 2015).

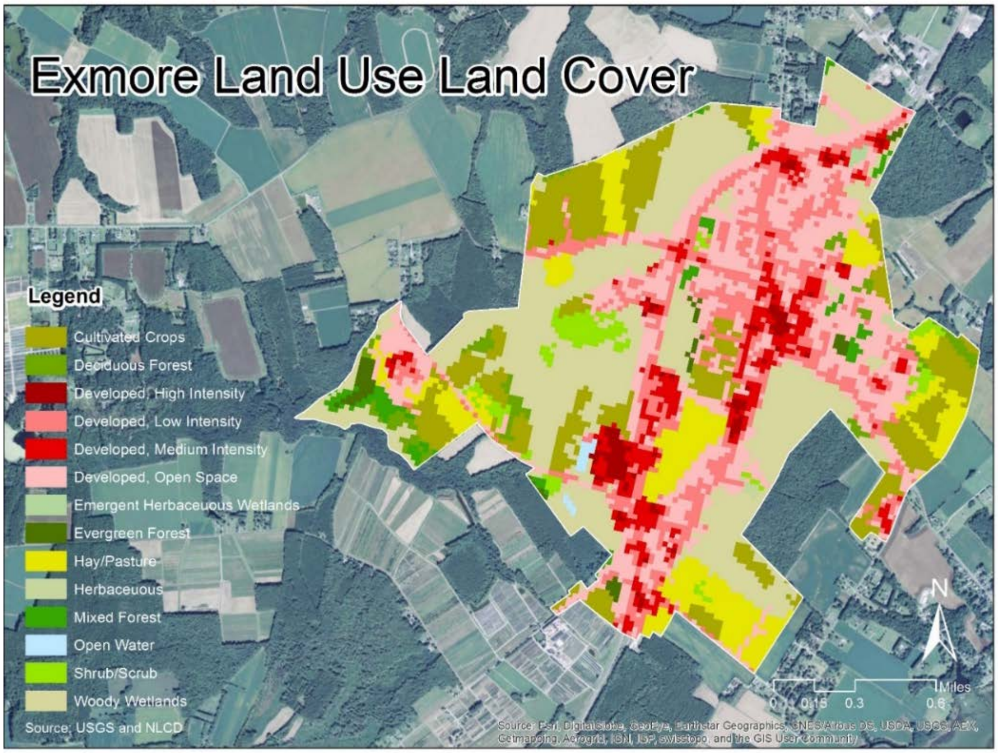


Figure 3: Exmore Land Use Land Cover Map

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS AND PLANNING

Exmore did not participate in the 2006 Hazard Mitigation Plan (HMP), but did become actively involved for the 2011 update. The following table contains authorities, policies, programs and resources, and intentions or ability to expand to address reduce vulnerability to hazards.

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Commitee	Navigable Waterways Commitee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*				*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

In 2011, storm water flooding was identified as the primary hazard putting Exmore residents at risk, which was affirmed as the primary risk in 2016.

Exmore updated its Comprehensive Plan in 2015, and storm water flooding rose to the top of issues identified by town residents as ones they wanted town leadership to address, along with high winds and threats of ground water contamination. The comprehensive plan included action steps to protect citizens from hazards by:

- Informing citizens of risks from stormwater flooding and wind hazards and how to protect themselves and property;
- Participating in the Hazard Mitigation Planning Team, the Disaster Preparedness Coalition, and other activities that help to coordinate resources; and
- Seeking hazard mitigation funds to alleviate effects of repeated stormwater flooding.

NFIP

Exmore joined the National Flood Insurance Program on February 8, 2001 as a No Special Flood Hazard Area Participating Community due to the town having no identified Special Flood Hazard Areas. Exmore has one policy totaling $35,000. Two claims totaling 5,982 USD has been made. These claims are likely the result of storm water flooding.

	HMP 2006	**HMP 2011**	**HMP 2016**
Date Joined	February 8, 2001	February 8, 2001	February 8, 2001
Classification	No Special Flood Hazard Area, Participating Community	No Special Flood Hazard Area, Participating Community	No Special Flood Hazard Area, Participating Community
Policies	1	1	2
Policy Dollar Amount	NA	$35,000	$615,000
Claims	NA	2	2
Claims Dollar Amount	NA	$5,982	$5,982

Table_: Summary of Exmore's past NFIP participation
*2006 information from the Accomack County section of the 2006 HMP.
Source: The Eastern Shore of Virginia Hazard Mitigation Plan, 2011, 2006

HMGP

Exmore has not participated in the Hazard Mitigation Grant Program.

HAZARDS AND RISK ASSESSMENT

Storm water flooding and wind are the two greatest threat to the Town.

WIND

No parts of the Town lie in the wind borne debris hazard area. This area extends 1-mlie inland from the coast. The Town lies in the 110 mph design wind zone (Northampton Building Code).

Most of the residential areas are older and have mature trees in and around the homes. During a high wind even falling branches or trees may damage some structures and damage power lines. Town staff indicate that hurricane-force winds will be extremely damaging to residences, Town facilities, trees, and electrical infrastructure. Although there have been no documented accounts of tornadoes in the Town limits, this is a hazard for which all localities on the Eastern Shore should be as prepared as possible. Two high wind events were recorded by the NWS in 2006 (50 mph), a derecho in 2012 (50 mph), and 11 more between 1984 and 2012. Total recorded damage from all events was approximately $115,000 in damage (2015 dollars) (Town representatives, personal communications, December 7, 2015).

The Hazus hurricane wind model indicates that there would be wind damages from a storm with a return period of 100 years. Such a storm could be expected to generate three-second gusts of between 90 and 93 mph in the vicinity of Exmore. Figure 4 reveals that the highest monetary damages are anticipated to be in the areas between Willis Wharf Road and Virginia Avenue on the east side of the railroad. Those census blocks include primarily residential structures, including some apartments.

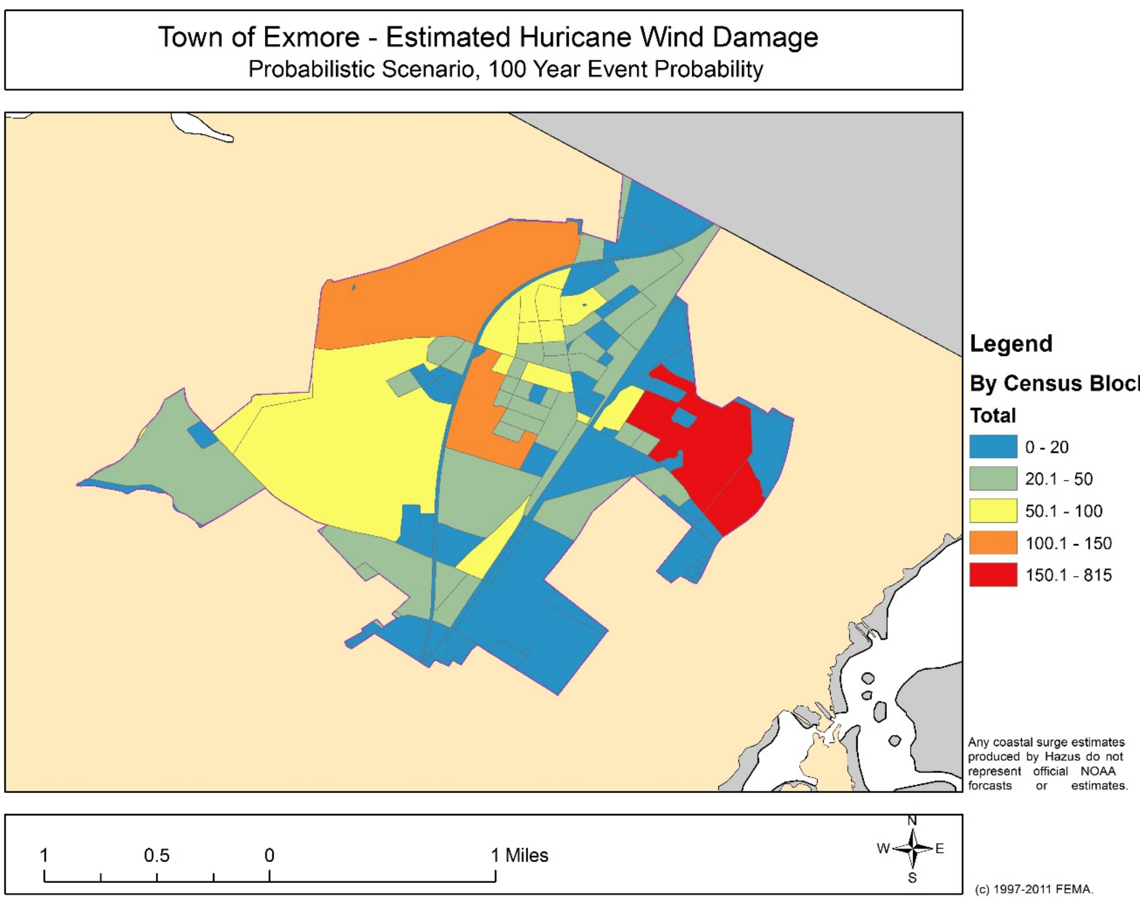


Figure 4: Exmore Hazus Estimated Wind Damages by Census Block

COASTAL EROSION

No structures are at immediate risk from coastal erosion.

COASTAL FLOODING

No portions of the town lie within a Special Flood Hazard Area. The entire town is located within the X zone, which means that it is no in the floodplain, and there is thought to be no threat of coastal flooding. That condition is unchanged since the 2011 HMP.

STORMWATER FLOODING

Town officials identified stormwater flooding as the hazard posing the greatest risk to Exmore, and the one that occurs with the most frequency. The public noted difficulties with stormwater flooding and it was also named the top concern for commercial businesses located in Exmore (Exmore Comprehensive Plan, 2015). The majority of the town contains hydric soils that are unsuitable for drainage and readily retain rainwater. These hydric soils are located within the eastern, southern, and western areas of the town. A small area of highly permeable soils is located in the northern and central areas of Town. The depth to groundwater for hydric soils is typically shallower than three feet below ground surface resulting in relatively less accommodation capacity than coarser-grained soils.

Table 6: Exmore Stormwater Flooding Areas

	HMP 2006*	**HMP 2011**	**HMP 2016**
Storm Water Flooding Area	Main street between Route 13 and Business Route 13 driveways septic systems crawlspaces	Monroe Avenue between Madison Avenue and Jefferson Street Westfield Avenue Virginia Street Main Street between Hadlock Road and Bright Street Poplar Avenue Broad Street in the vicinity of the grading shed Bright Avenue between Broad Street and Main street Main Street between Commercial street and Bright Avenue.	Town-wide, except along railroad tracks and New Roads housing area (west of US Route 13, and south of Occohannock Neck Road).
Source of Hazard	None listed	Hydric soils Depth to ground water is less than three feet Inadequately maintained drainage infrastructure	Hydric soils Depth to ground water is less than three feet Inadequately maintained drainage infrastructure Frequency of high-volume rainstorms.
Effects	None listed	None listed	Damage to buildings and other personal property Standing water public health hazard for mosquito-borne illnesses Water deep enough to affect mobility of non-automobile travelers Erosion cutting away parking lots

Source: Eastern Shore of Virginia Hazard Mitigation Plan, 2011, 2006

HAZARDS OF LOCAL SIGNIFICANCE

Exmore has additional hazards, some of which are included below:

SNOW AND ICE

A large ice storm impacted the Town in the late 1900s. The ice storm downed tree limbs and power lines and also forced the local businesses to close for several days. Residents also had no electricity for several days. Emergency energy generation filled the needs for drinking water during the time of outage. Extreme cold weather events have historically caused damages to the Town's water distribution systems. During these events, pipes froze and burst and the Town's water supply was at risk of contamination.

The NOAA's National Climatic Data Center records 37 instances of winter weather in Northampton County between 1996 and 2005. Exmore has a long stretch of U.S. Route 13 within its town limits, and winter weather pose an accident risk for residents and through-travelers, stretching its emergency response resources. Ice and snow also pose a slip and fall risk to portion of the population traveling by foot, wheelchair/scooter, or bicycle (25 percent of households to not have automobiles), and the concentrations of senior and individuals with disabilities. The services of STAR Transit, which provides transportation to seniors, low income populations and individuals with disabilities, are also affected by ice, snow, and flooding.

FIRE AND SMOKE

Officials noted the amount of vegetation cover that surrounds Exmore, a history of large fires in town, and the strain that fighting large fires places on its water system. For example, during a local restaurant fire, water system pressure dropped from 60 lbs. to 36 lbs., and public works employees were roused during the night to kick on another pump to keep water supply. A downtown fire in the 1980's required a foam truck from Wallops Flight Facility (the only fire company with fire suppression chemicals) to finally put out the fire. By the time is was finally extinguished, officials report it had burned from the downtown area almost to Countyline Road, as distance of about one mile. (Town representatives, personal communications, December 7, 2015).

GROUNDWATER CONTAMINATION

The Town faces a threat of ground water contamination from several sources including failed septic systems within the Town, leaks and spills of petroleum based products from underground storage tanks, and major industrial facilities within the area. In Exmore, approximately 25% of residences and commercial businesses are served by the Town's waste water treatment system and the remainder of residences and businesses are served by on-site septic systems.

The Town has a public water supply that is protected according to state-mandated wellhead protection regulations. Town Staff indicated that there are approximately 20 individual residential wells in Town that could potentially be impacted. Major ground water withdrawers in the area are Shore Memorial Hospital and Virginia Landing Campground (*Exmore Town Plan,* 2000). According to the *Ground Water Supply and Protection Management Plan for the Eastern Shore of Virginia*, no ground water problems currently exist within the vicinity of the Town, but increased water supply demand within the region could pose a future threat to ground water supply quantity and quality. The Town adopted a Water Conservation Ordinance in May 2011.

Exmore is currently drilling new wells, which should be online by May of 2017. These new wells are located in the paleo channels.

CRITICAL FACILITIES

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

Facility	2006 Plan	2011 Plan	2016 Plan	Hazards	No. of People Affected	Loss Potential	Relocation Potential	Retrofit Potentia l
Town-owned Facilities								
Exmore Town Office/Police Department Building		X	X	Storm water flooding Wind	1,460	Major disruption	Yes	Yes
Exmore Water Tower (located inside corporate village limits of Belle Haven)	X	X	X	Wind	1,460	Devastating	Yes	No
Exmore Municipal Wells		X	X	Storm water flooding Ground water contamination	1,460	Devastating	Yes	No
Exmore Water Distribution System		X	X	Storm water flooding Ice storms	1,460	Major disruption	No	Yes
Exmore Public Sewer Systems (2)		X	X	Storm water flooding	1,460	Major disruption	No	Yes
Exmore Town Park		X	X	Storm water flooding Wind	1,460	Inconvenience	No	Yes
Exmore Public Works			X	Wind, storm water flooding	1,460	Major disruption	Yes	Yes
Facilities not Town-owned								
Post Office			X	Storm water flooding	1,460	Inconvenience	Yes	Yes
Exmore Village/AP Apartments/			X	Wind, Fire	400+	Devastating	No	Yes
Power Sub-Station			X	Fire	1,460+	Devastating	No	Yes
CSB			X	Wind	500+	Major disruption	Yes	Yes
Communication tower (behind old A&N building)			X	Wind	?	Inconvenience	Yes	Yes
Associated grain bins			X	Wind	100+	Inconvenience	Yes	Yes
Exmore Volunteer Fire and Rescue Department		X	X	Storm water flooding Wind	1,460	Major disruption	No	Yes
Exmore area schools		X	X	Storm water flooding wind	1,460	Major disruption	No	Yes

FINDINGS

1. The hazards expected to have the greatest impact on the Town are storm water flooding and high wind events, which have been experienced throughout the Town's history. Other hazards facing the Town are groundwater contamination, ice and snow storms, drought, tornadoes, and mosquito-borne disease(s).

2. Most of the Town's residential areas have older construction and many mature trees around homes and churches. During a wind event, branches and trees may come down causing secondary wind damage and power outages.

3. The Town has no Special Flood Hazard Areas, but residents are purchasing flood insurance likely to protect their homes from potential impacts from stormwater damages.

4. The Town has identified undersized drainage pipes in the Downtown Business District of Town that cannot handle large amounts of rain water and cause flooding in the area.

5. The Town's water distribution system is aging and becoming increasingly fragile and vulnerable to stormwater flooding events.

6. The Town's system for managing wastewater has ongoing incidences of failure and is need of redesign and maintenance/repairs.

TOWN OF HALLWOOD

TOWN PROFILE

Hallwood is located near the central spine of the Eastern Shore in the northern portion of Accomack County and encompasses approximately 234 acres. The Town, like a number of other Eastern Shore towns, developed around the construction of the railroad in 1884. The Town's primary commercial activity in the 18th and 19th centuries was timber harvesting. A canning factory became a prominent feature in Town around the beginning of the 20th century. Hallwood has evolved primarily into a residential community since rail service began to decline in the early 1960s (*Hallwood Town Plan*, 2001).

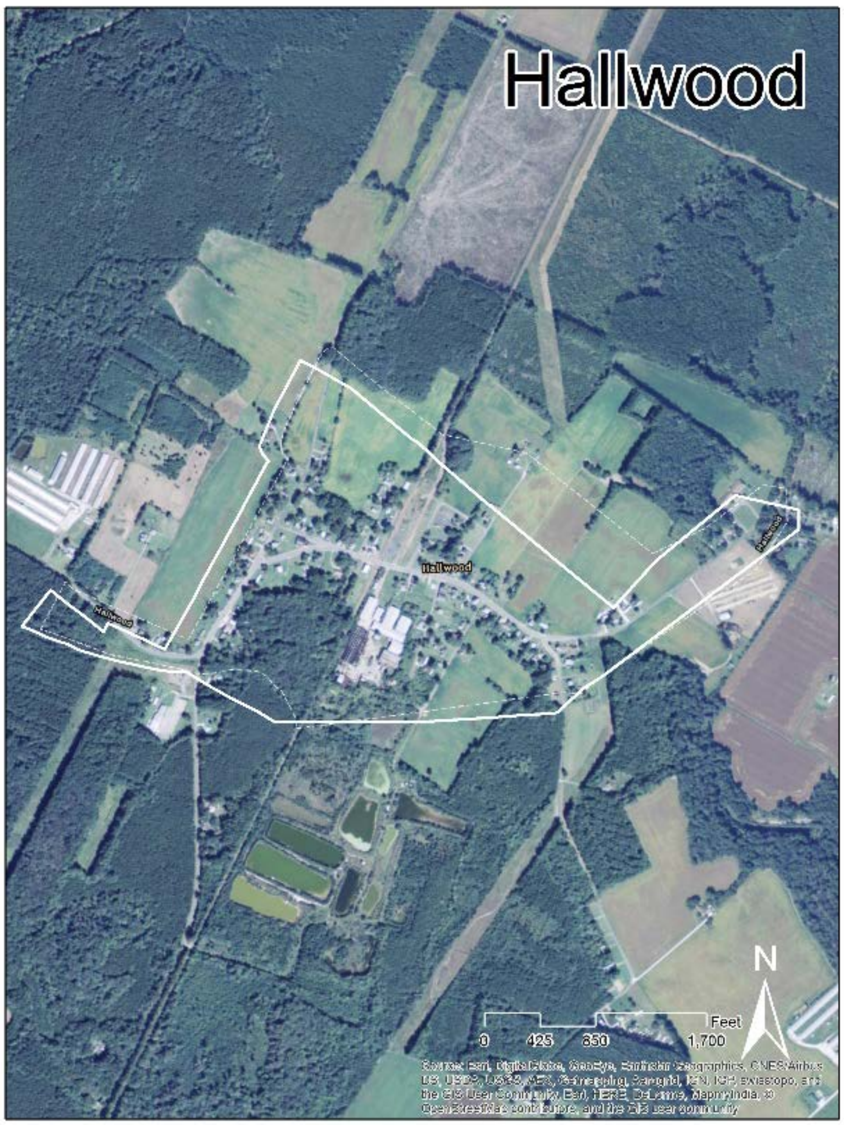


Figure 1 : Hallwood Satellite Imagery

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 that 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

The 2010 Census indicated the Town had a population of 206, which is a 29.0% decline from the 290 people that lived in the Town during the 2000 Census. The new populations as estimated by the American Community Survey are almost double the 2000 Census figures. The Town Council indicated that the population is most likely about the same as it was in 2010 (Town Council, personal communication, June 2, 2016). The median age for residents in Hallwood in 2014 was 34.0 years. This signifies a younger age than the county, state, and national average. According to the American Community Survey 5-year estimates for 2014, almost 50% of the households in Hallwood have one or more people under 18 and almost 40% with one or more people 60 years and over. Typically younger populations are lower risk populations during a hazardous event, however this low median age seems to be indicative of a large number of children, who require additional aid and attention during emergency situations.

Table 1 : Hallwood Demographic Information

	2010*	2000**
Population	206	290
Median Age (Years)	40.5	32.0
Disability	NA	NA
Income		
Median Household Income	$21,250	$29,861
Poverty Level	53.6%	NA
Language		
Only English	91.4%	NA
Other	8.6%	NA
Spanish	4.6%	NA
Ind-Euro	0.4%	NA
Asian	3.5%	NA

* U.S. Census 2010, ** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. Additionally, they can identify where disruptions in employment and income might occur in the aftermath of a disaster.

The Town is primarily a residential community with the majority of employed residents commuting out of Town to work. Several major employers are located near Hallwood including NASA, Accomack County Public Schools, and Tyson and Perdue poultry processing plants. There are also some agricultural lands, but the small fisheries operation just outside of the Town's corporate limits is no longer operating (Town Council, personal communications, June 2, 2016).

Table 2 : Hallwood Workforce

Civilian Employed Population						
Industry	**2014***		**2010***		**2000****	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Agriculture, forestry, fishing/hunting, or mining	5	4.7%	4	2.9%	14	10.6%
Construction	10	9.3%	5	3.7%	4	3.0%
Manufacturing	18	16.8%	41	30.1%	22	16.7%
Wholesale trade	6	5.6%	3	2.2%	10	7.6%
Retail trade	16	15.0%	12	8.8%	16	12.1%
Transportation and warehousing, and utilities	3	2.8%	3	2.2%	7	5.3%
Information	0	0.0%	0	0.0%	9	6.8%
Finance, insurance, real estate, and rentals	0	0.0%	0	0.0%	2	1.5%
Professional, scientific, waste management	16	15.0%	11	8.1%	10	7.6%
Educational and health care services	17	15.9%	30	22.1%	20	15.2%
Arts, entertainment, recreation, food	2	1.9%	8	5.9%	6	4.5%
Public Admin	2	1.9%	11	8.1%	2	1.5%
Other	12	11.2%	8	5.9%	10	7.6%
TOTAL CIVILIAN EMPLOYED POPULATION	107	-	136	-	136	-

Source: * American Community Survey, 2010 – 2014; ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

According to Table 3, the Town has seen a steadily declining business presence over the last five years, but the number of employees has remained somewhat constant. Due to its residential nature, most businesses in the town focus on retail and health care. Economic activity within the Town includes a post office, a small grocery store, a pool hall, and a wedding shop (*Hallwood Town Plan*, 2001).

Table 3 : Hallwood Business Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Construction	1	2	3
Retail Trade	2	1	1
Transportation and warehousing	0	0	1
Finance and insurance	0	0	1
Health Care and Social Assistance	1	2	2
Other Services (Except Public Admin)	1	1	1
Total, All Establishments	5	6	9
Total Employees	39	32	35

Source: Census Zip Code Business Patterns, 2013

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

The new estimates of housing units from the American Community Survey should be ignored as gross over estimates. Town representatives indicated that there are 86 liveable structures, only about 3 of which are unoccupied (Town Council, personal communications, June 2, 2016). The Town does have some dilapidated structures, and has expressed interest in their removal, however, neither the Town nor residents have the resources necessary to do so (Town Council, personal communication, June 2, 2016). Often unoccupied houses are not properly maintained and can cause additional debris hazards during high wind events.

Table 4: Hallwood Housing

	2014*	2010**	2000***
Total Housing Units	170	108	121
Occupied	130	74	100
Vacant	40	34	21
Owner-Occupied	87	49	75
Renter-Occupied	43	25	25
Median Housing Value	104,800	NA	NA

Source: * American Community Survey, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

State Route 692 provides east-west access, and State Route 779 provides north-south access to the Town, which is located less than two miles west of U.S. Route 13. The Eastern Shore Railroad runs through Town twice daily, once in each direction. A railroad siding owned by the Railroad Company is located within Hallwood's corporate limits (*Hallwood Town Plan*, 2001). Although it does not have a stop within Town limits, it poses a potential hazard risk as it transports propane or could serve as an aid in evacuating residents during or following an emergency.

Table 5: Hallwood Vehicles Available per Households

Vehicles Available	2014*	2010**	2000***
None	3	11	6
One	51	95	43
Two	47	41	37
Three or more	29	17	18

* American Community Survey, 2010 – 2014, ** American Community Survey, 2006-2010, *** U.S. Census 2000

The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary. As of 2014, it is estimated that only about 2% of the Town's occupied residences are without a vehicle, while Town representatives estimate that all housing units have at least one vehicle (Town Council, personal communication, June 2, 2016). Stop number 21 for Star Transit's Orange Line southbound and Silver Line northbound is the Hallwood Post Office, which provides additional transportation options for residents of the Town.

COMMUNITY SERVICES AND FACILITIES

Community facilities support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It is important to note what facilities are available in case of a hazard, and it is important to make an inventory of facilities that could be affected by a hazard. Community facilities include a public recreation facility, The Hallwood Town Park. There is also a Town Hall and Post Office (*Hallwood Town Plan*, 2001).

PUBLIC SAFETY

There are no public safety facilities in the Town. The Bloxom Volunteer Fire Department provides fire protection for the Town, and the Bloxom Rescue squad provides ambulance service. The Accomack County Sheriff's Department and the Virginia State Police provide police protection (*Hallwood Town Plan*, 2001). The Fire Department is equipped with two full-time employees, many active volunteers, three trucks (two large sprayers and one high truck), brush truck, and two ambulances (Bloxom Mayor Scott Callander, Personal Communication, January 25, 2016).

PARKS AND RECREATION

The Hallwood Town Park was built in 1984 and includes a picnic pavilion and tennis courts and is the only public recreational facility in the Town (*Hallwood Town Plan, 2001).*

WATER SUPPLY AND WASTEWATER

Residents rely on private wells and septic systems for their water supply and wastewater disposal (*Hallwood Town Plan,* 2001). In the past, poor soils limited development on vacant parcels of land in Hallwood, but above-ground septic technologies have made some previously undevelopable parcels available for development. Hallwood is located in Wellhead Protection Area B – Tysons Foods Area. Major water withdrawers from this area are Tyson Foods and the NASA Wallops Flight Facility. This wellhead protection area contains Accomack County's Northern Landfill and an unlined septage lagoon, which constitute the greatest visible contamination threats (*Hallwood Town Plan*, 2001).

SOLID WASTE

There are no solid waste facilities in the Town. The Town contracts with Davis Disposal for weekly residential trash collection, which is transported to a county landfill.

POWER AND COMMUNICATIONS INFRASTRUCTURE

The electric power substation just south of Town and the northern location of Hallwood may contribute the very low occurrences of power outages and the fast response of repair efforts. The longest recent outage recollected was during Hurricane Sandy, but only affected a small number of homes and only last about four hours. (Town Council, personal communication, June 2, 2016)

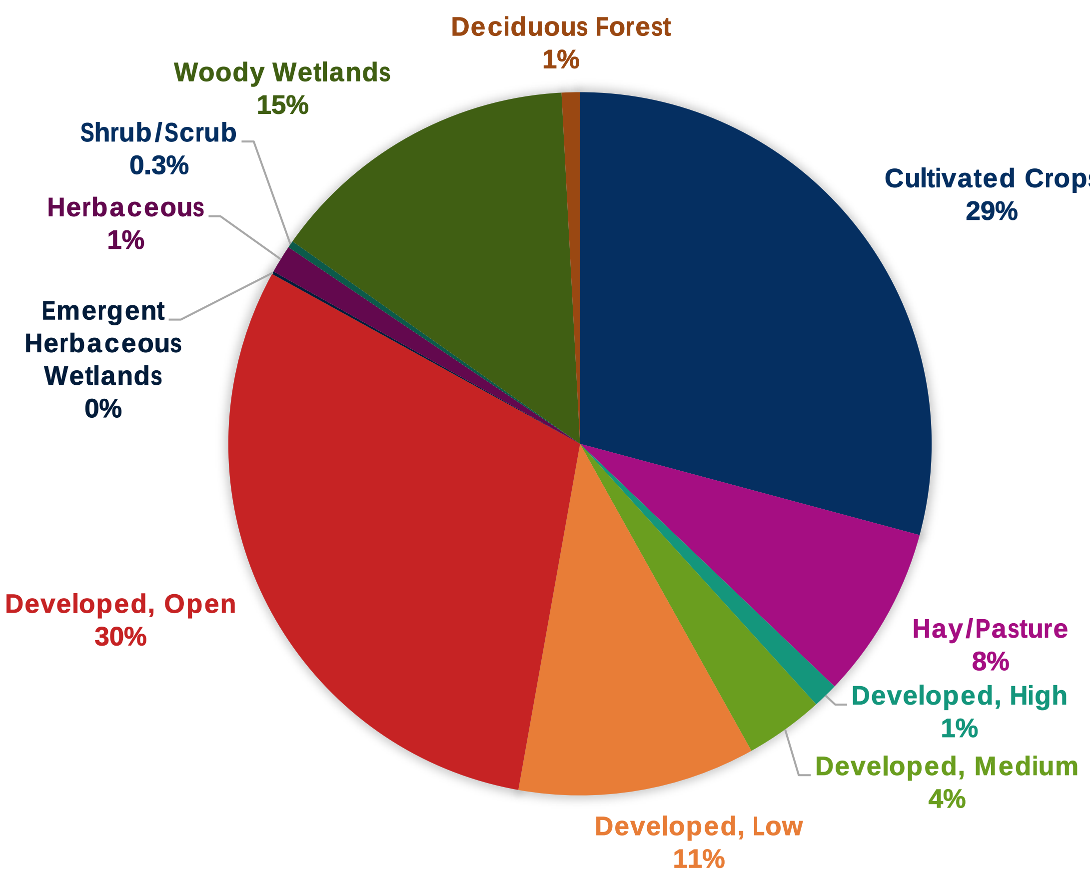
NATURAL ENVIRONMENT

Hallwood is relatively flat with the elevation ranging from 15 feet above mean sea level to 25 feet above mean sea level with a general downward slope from east to west. Slopes are under 2% for the majority of the Town, which can lead to flooding problems due to poor drainage. Adding to these flooding problems are the presence of hydric soils which are characteristically wet and poorly drained. The soils are not suitable for septic systems due to the hydric, highly permeable soils and have a shallow to ground water table, between 0 – 18 inches (*Hallwood Town Plan,* 2001).

LAND USE LAND COVER

The total land area of Hallwood is 234 acres, with the majority of development being residential. Developed areas are scattered throughout the Town. Agricultural land use is prevalent in the north and northeast parts of the Town. Cultivated crops include tomatoes, soybeans, grains, and cover crops. Land adjacent to the Town is predominantly agricultural (*Hallwood Town Plan,* 2001).

Figure 2: Hallwood Land Use Land Cover Percentages



Source: USGS, National Land Cover Dataset, 2011

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Hallwood has participated in the hazard mitigation planning process since 2011. The Town's primary risk is associated with storm water flooding. Hallwood's comprehensive plan has not received a major update since 2001, and the zoning ordinance was adopted in 1993. The comprehensive plan further emphasizes the need for storm water management practices, and also emphasizes a concern for failing septic systems, underground and aboveground storage tanks, and contamination of wells.

Table 6: Hallwood Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional								*	*	*	*	*		*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The July 2003 NFIP insurance report showed that there were 6 A zone policies within the Town and no claims for flood damage had been made. These 6 policyholders were probably paying more than they should for flood insurance since they are no longer in an A zone. In 2016, Hallwood had only 1 NFIP policy, for a property not located within a flood zone, totaling $350,000.00 in coverage (FEMA NFIP Insurance Report, 2016). The Town has had only one claim that was rewarded $4,293 since joining the NFIP in 2000 (FEMA NFIP Insurance Report, January 2016). This claim was the result of storm water flooding as a result of thunderstorm in 2003. The Town does not participate in the Community Ranking System (CRS).

Table 7: Summary of Hallwood's Past NFIP participation

	HMP 2006	**HMP 2011**	**HMP 2016**
Date Joined	May 1, 2001	May 1, 2001	May 1, 2001
Policies	6	2	1
Policy Dollar Amount	Overcharged	$364,400	$350,000
Claims	NA	1	1
Claims Dollar Amount	NA	$4,923	$4,923

Source: The Eastern Shore of Virginia Hazard Mitigation Plan, 2016, 2011, 2006

HMGP

The Town has not participated in the Hazard Mitigation Grant Program.

HAZARD PROFILE

Storm water flooding has the greatest and most frequent impact on the Town.

HIGH WIND

No parts of the Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the shoreline. The Town lies in the 110 – 120 mph design wind zone (Accomack County Building Code).

Most of the residential areas are older and have mature trees in and around the homes. During a high wind event, falling branches or trees may damage structures or power lines. Figure 3 below shows the 2016 Hazus® estimates by Census block for wind damages during a 100-year storm. Total losses from buildings, contents, wages, incomes, rentals, and inventories is estimated to be about $166,000, the vast majority of this sum being derived from the building and content damages.

During a high wind event, abandoned dilapidated buildings pone a threat, as they add to the debris that can become wind-borne and inflict sever property damages. Town representatives estimate that the rusty, no-longer used water tower on the property of the old fishery canning facility is over 75 years old, and thus poses an additional hazard (Town Council, personal communication, June 2, 2016).

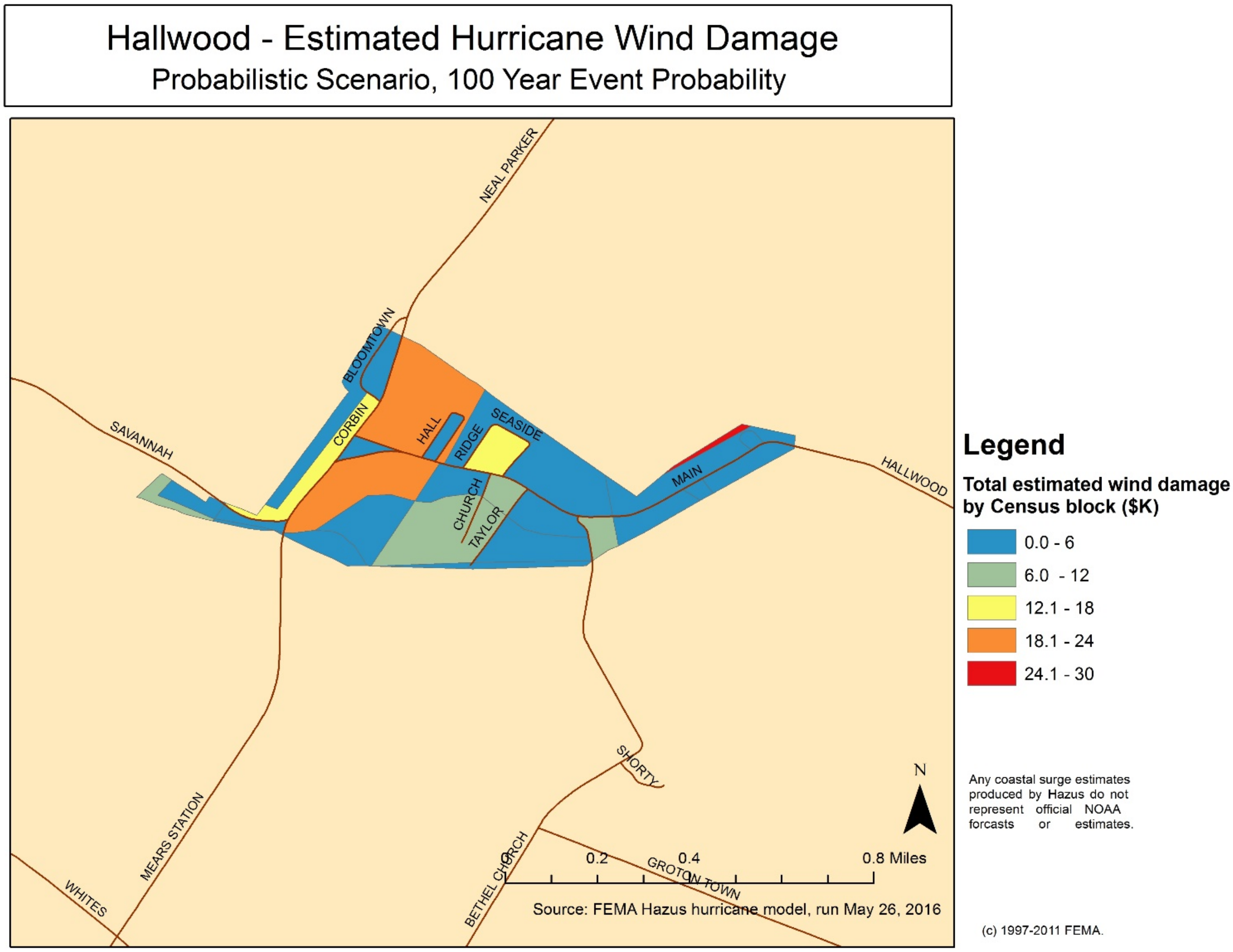


Figure 3 : Hallwood Estimated Hurricane Wind Damage

COASTAL EROSION

No structures or areas within the Town are at immediate risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area. One very small area in the southwestern corner of the Town is located within the 500-year floodplain (FEMA FIRMs, 2015). Previous FIRMs included the western two-thirds of the Town within the 500-year floodplain. While a significant portion of the Town is no longer included in the 500-year floodplain according to the 2015 FIRMs, the threat of coastal flooding is still considered to be minimal.

STORM WATER FLOODING

Storm water flooding has the greatest and most frequent impact on the Town. The Town on poorly drained soils which retain rainwater. During heavy rains the Town’s roads are often flooded and floodwaters have historically rushed down the main street in Town causing damaged to property (*Hallwood Town Plan*, 2001). The Town relies on VDOT for the maintenance of ditches along roadways throughout the Town, but Town representatives indicated that there has been no maintenance of any of the ditches or culverts in many years (Town Council, personal communications, June 2, 2016). During Hurricane Sandy, one home at the junction of Fitzgerald and Main suffered from storm water flooding to the extent that the furnace was ruined.

Educating residents about the risks associated with storm water flooding and standing water, such as septic contaminants and mosquito-borne illnesses, is an important step in mitigating potential negative impacts to the Town residents.

Table 8: Hallwood Storm Water Flooding Tracking

	HMP 2006	HMP 2011	HMP 2016
Cause of Hazard	NA	Unsuitable soil for drainage and retains rainwater	Culverts running beneath VDOT roadways are too small; Soil type
Where is the flooding?	NA	Throughout the Town	Adjacent to the RxR, past Bethel Church Road, particularly on Main Street

HAZARDS OF LOCAL SIGNIFICANCE

The residential wells in the Town are also potentially at risk of contamination from aboveground and underground petroleum storage tanks (AST and UST). Most homes in the Town are heated by oil, which is stored in these tanks. If not properly maintained, ASTs and USTs can pose a significant water quality risk to the Town. In addition, residential water supplies can also be threatened by failing septic systems, which the majority of residences operate for waste disposal.

Winter snow and ice storms have historically had adverse impacts on the Town including damage to trees and power lines and making roads impassable. A winter storm struck in late December 2010 creating blizzard-like whiteout conditions and extensive snow drifting that blocked roadways and prevented accessibility to and from the Town.

The Town does not have a fire department and relies on the fire departments of neighboring communities. This puts the Town at greater risk for fire damage. Specifically, there are numerous fields in the vicinity of the Town that are prone to catching fire, especially during droughts. These fires have the potential of spreading to residences in the Town.

CRITICAL FACILITIES

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

Table 9 : Critical Town Facilities in Hallwood

Facility	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town Hall	Storm Water Flooding Wind	206	Major Disruption	No	Yes
Post Office	Storm Water Flooding	206	Major Disruption	No	Yes

	Wind				
Town Park	Wind	206	Inconvenience	No	No

FINDINGS

1. The hazards expected to have the greatest impact on Hallwood are storm water flooding and high wind events, which have been experienced throughout the Town's history. Other significant hazards facing the Town are ground water contamination, fires, snow or ice storms.
2. Hallwood's residential areas are typically older and contain older construction and many mature trees around homes and churches in the Town. In addition there are some dilapidated buildings and water tower that are no longer in use. High wind events bringing down branches and trees pose a significant threat in the form of secondary wind damage and power outages and unmaintained structures provide a source of wind-borne debris.
3. Undersized drainage pipes exist within Town that regularly cause storm water to back up causing flood damages to structures within Town.

TOWN OF KELLER

TOWN PROFILE

Keller is located near the central spine of the Eastern Shore in south central Accomack County and comprises 172 acres. The town was originally called Pungoteague Station and was established around a railroad station. Keller was incorporated in 1951 with the railroad being central to activities.

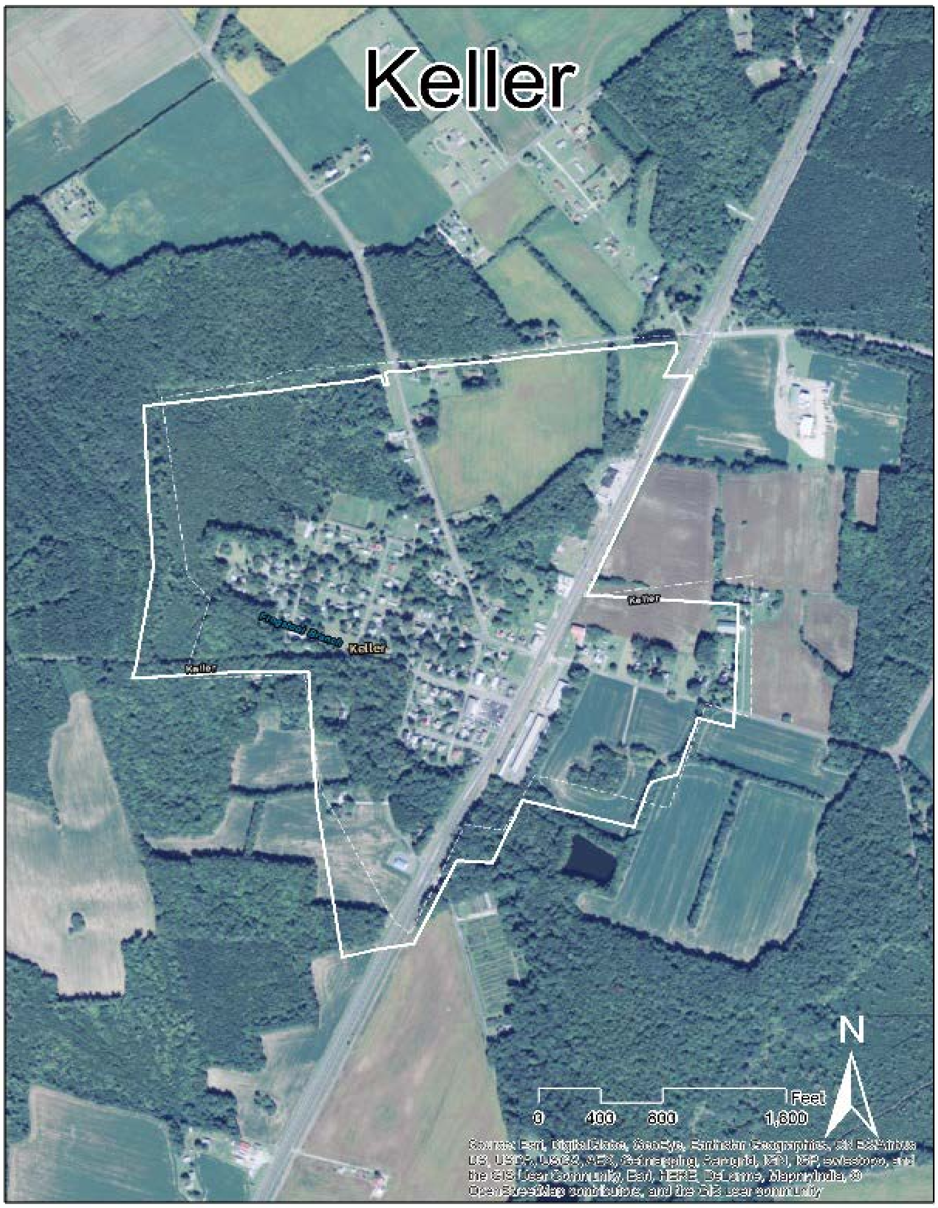


Figure 1: Town of Keller Aerial Imagery

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

Although the Town population has declined since the mid-1900's, Table 1 shows that for the last two decades the population has stayed about the same, at about 178 (American Community Survey, 2010 – 2014, US. Census, 2000, 2010). The median age for the Town is 47.5 (U.S. Census, 2010). Almost 40% of the residents are under 18 years of age (ACS, 2010-2014), which may be a higher risk during or following a storm, as these minors may require additional attention in case of evacuation, etc.

Table 1: Keller Demographic Data

	2014*	**2013***	**2010****	**2000*****
Population	178	151	178	173
Median Age	37	37.9	47.5	40.2
Disability	NA	NA	NA	NA
Income				
Median Household Income	$18,875	$15,625	$49,375 ACS: $18,984	$25,500
Poverty Level	NA	47.7%	NA	NA
Language				
Only English	100%	100%	75%	97.6%
Other than English	0%	0%	25%	2.4%
Spanish	0%	0%	9.6%	2.4%
Other	0%	0%	15.4%	0.0%

Source:* American Community Survey 2009 – 2013, ** US Census 2010, *** US Census 2000

Town officials point to the 2010 Census figures as being anomalous and inconsistent with their knowledge of the town (Keller Town Council, personal communication, November 4, 2015). Although the population may be accurate, the median household income and the languages spoken do not seem to be accurate.

WORKFORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The local workforce primarily consists of manufacturing and education. This is reflecting of Keller being primarily a residential, white collar community (*Keller Town Plan*, 1986). The workforce saw a significant drop between 2010 and 2014.

Table 2: Keller Local Workforce Industry

	Civilian Employed Population							
Industry	**2014***		**2012***		**2010***		**2000****	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Construction	5	13.9%	5	20.8%	18	27.7%	5	8.3%
Manufacturing	10	27.8%	0	0.0%	0	0.0%	13	21.7%
Wholesale trade	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Retail trade	4	11.1%	0	0.0%	12	18.5%	10	16.7%
Transportation and warehousing, and utilities	0	0.0%	0	0.0%	0	0.0%	4	6.7%
Information	0	0.0%	0	0.0%	0	0.0%	2	3.3%
Finance, insurance, real estate, and rentals	2	5.6%	2	8.3%	2	3.1%	1	1.7%
Professional, scientific, waste management	0	0.0%	0	0.0%	4	6.2%	4	6.7%
Educational and health care services	9	25.0%	10	41.7%	18	27.7%	16	26.7%
Arts, entertainment, recreation, food	0	0.0%	3	12.5%	7	10.8%	3	5.0%
Public Admin	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other	6	16.7%	4	16.7%	4	6.2%	2	3.3%
TOTAL CIVILIAN EMPLOYED POPULATION	36	-	24	-	65	-	60	-

Source: *American Community Survey, 2010 – 2014, **U.S. Census, 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Keller is primarily a residential community, which is reflective upon the low number of businesses within the community. However, the Town does have the only new automotive dealership, Kool Ford, and a large building materials distributor, 84 Lumber.

Table 3: Keller Business Establishment Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**

Retail Trade	3	3	4
Transportation and Warehousing	0	1	1
Finance and insurance	1	1	1
Real Estate and Renal Leasing	1	0	0
Professional, Scientific, and Technical Services	1	2	2
Health Care and Social Assistance	2	2	2
Other Services (Except Public Admin)	1	1	1
Total, All Establishments	9	10	11
Total Employees	63	64	52

Source: Census Zip Code Business Patterns, 2013, 2011, 2009

BUILT INFRASTRUCTURE

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 towards safety. Keller's soils and their inability to support on-site septic systems prevent the Town from developing more housing or commercial areas (*Keller Town Plan*, 1986).

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk.

More than likely there are still closer 87 housing units in the Town, as there were in 2010, as it is unlikely that 11 housing units were either destroyed or razed in four years. Keller's housing market is relatively stable, consisting primarily of single-family housing. There are some substandard housing structures within the Town (*Keller Town Plan*, 1986).

Table 4: Keller Housing

	2014*	2010**	2000***
Total Housing Units	76	87	90
Occupied	54	68	72
Vacant	22	19	18
Owner-Occupied	42	47	47
Renter-Occupied	12	21	21
Median Housing Value	$129,200	NA	NA

Source: *American Community Survey 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

U.S. Route 13 is Keller's most visible transportation feature, bisecting the town with 18,000 vehicles per day. The four-lane principal arterial is part of the national defense Strategic Highway Network (STRAHNET), a national system of highways necessary to support U.S. military operations, part of the National Highway System, and the Eastern Shore's only hurricane evacuation route. Bay Coast Railroad parallels U.S. Route 13. Its 130-pound rail is maintained to meet Federal Railroad Administration Class-II Standards (*Keller Town Plan*, 1989).
Vehicles available to households is one indicator of a household's ability to evacuate when necessary, and Table 5 reveals very little risk from this status.

Table 5: Keller Resident Vehicles

Vehicles Available	**2014***	**2010***	**2000****
None	1	0	9
One	20	25	18
Two	20	28	40
Three or more	13	16	5

Source: *ACS, 2010-2014; **U.S. Census, 2000

COMMUNITY FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

Keller does not have its own police department. Police protection is provided by the County Sheriff Department and the State Police. Fire protection is provided by the Melfa Volunteer Fire and Rescue Company. The Painter and Wachapreague Volunteer Fire & Rescue Companies also responds to calls from Keller.

WATER SUPPLY & SEWAGE DISPOSAL

All residential treatment of wastewater is done through on-site septic systems. The Town has no public water supply and residents and commercial users are solely reliant on private wells (*Keller Town Plan*, 1989).

SOLID WASTE DISPOSAL

Town residents are responsible for their own waste disposal. There are two free Accomack County convenience centers located nearby, the Grangeville center on Wachapreague Road, and the Painter center on Wayside Drive. The County landfill is also only about 2.5 miles from the Town, just west on Route 620.

POWER AND COMMUNICATIONS INFRASTRUCTURE

The Town's location on Route 13 typically allows for ease of access for any repairs to the power line system. This location also provides access to the broadband optic cable which runs on Route 13.

PARKS AND RECREATION

There are no Parks within the Town.

STORM WATER DRAINAGE

The County and VDOT are responsible for the majority of the ditch maintenance in the Town. Because storm water flooding poses the greatest risk to the Town, and because all residents are reliant on private wells for their water supply, and septic systems for wastewater disposal, this is of the upmost importance to pursue and complete.

SCHOOLS

There are no schools within the Town of Keller.

NATURAL ENVIRONMENT

Keller encompasses 172 acres. Elevations in the Town range from approximately 35 to 45 feet above mean sea level, and slopes are typically less than 2%. Most of the soils in Keller are not ideal for development due to the majority soil type being unsuitable for individual land based waste water treatment facilities, like septic systems (*Keller Town Plan*, 1989), however, new technologies are changing this.

LAND USE LAND COVER

Forests, development, and agriculture are the three highest uses of land for the Town.

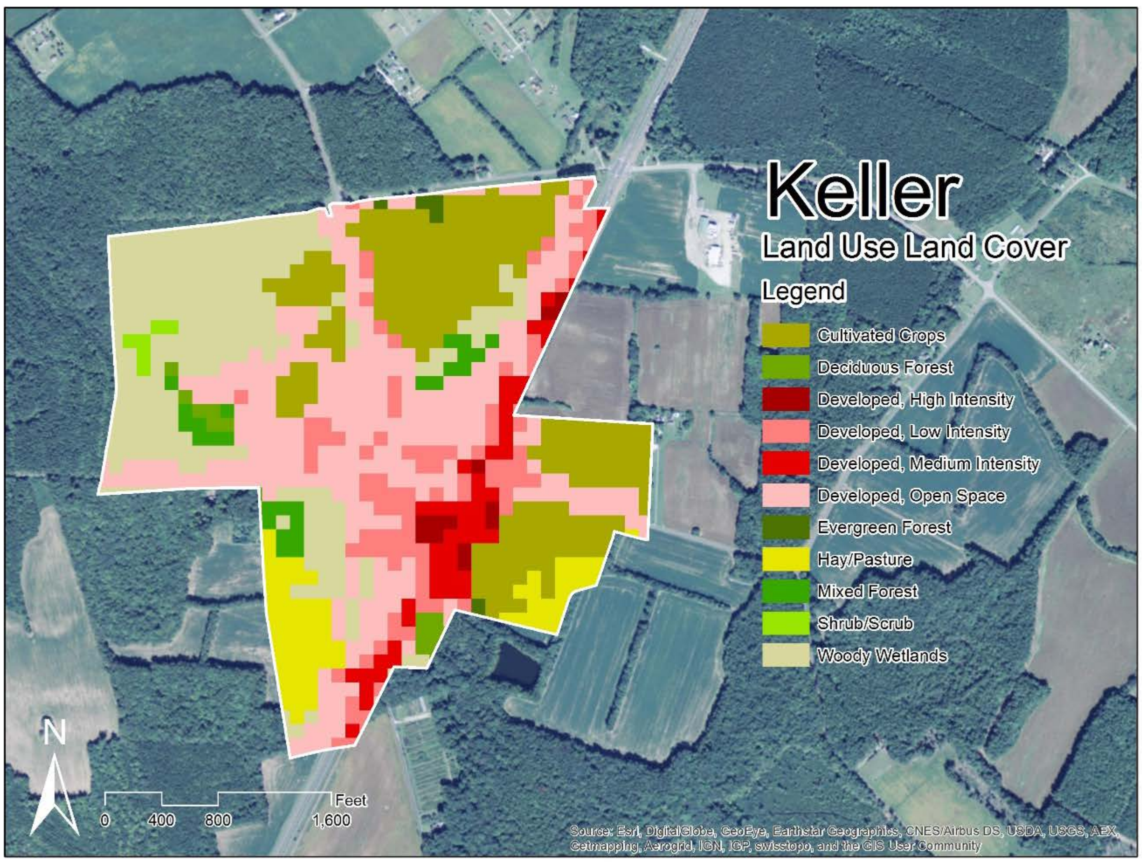


Figure 2: Keller Land Use Land Cover

GROUND WATER

The Town faces a threat of ground water contamination from several sources including failed septic systems within Town, leaks and spills of petroleum based products from underground storage tanks, and major industrial facilities within the area.

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Keller participated in the hazard mitigation planning process since 2011. The Town's primary risk associated with hazards is storm water flooding. Keller's comprehensive plan has not been updated since 1989. The Town is interested in pursuing and updated comprehensive plan. The plan from 1989 does emphasized drainage problems within the Town.

Table 6: Town of Keller Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning/Subdivision Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town does not currently participate in the NFIP, but has expressed interest in potentially joining the program.

HMGP

Keller has not participated in the HMGP.

HAZARD PROFILE

Stormwater flooding poses the greatest risk to the Town and has the most frequent impact.

HIGH WIND

No parts of the Town lie in the wind borne debris hazard area. This area is defined as the area extending one mile inland from the coast. The Town lies in the 110 – 120 mph design wind zone (Accomack County Building Code). Most of the residential areas are older and have mature trees in and around the homes. During a high wind event falling branches or trees may damage some structures or power lines. All power and communication lines in Town are above ground and susceptible to wind damage.

Keller has experienced several historic wind events from hurricanes and northeasters that have damaged trees and power lines in Town. The town also has a number of derelict buildings which could pose a danger of flying debris or collapse in high winds (Keller Town Council, personal communication, November 4, 2015).

COASTAL EROSION

No structures are at immediate risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area or within the X Zone, which is the 500-year floodplain. The threat of coastal flooding within in the Town is considered to be minimal.

STORM WATER FLOODING

Storm water flooding poses the greatest risk to the Town and has the most frequent impact. The majority of the Town contains soils that are poorly drained and readily retain rainwater. The Town's poorly drained soils are located primarily in the central and northern portions of Town. The intersection where N R North Street approach U.S. Route 13 from the northeast is a particularly frequently flooded location pointed out by town officials (Keller Town Council, personal communication, November 4, 2015).

Keller regularly experiences storm water flooding during heavy rain events. Drainage problems in Town have been attributed to the soil characteristics, lack of sufficient topography for drainage, and lack of maintenance to existing drainage culverts. The *Keller Town Plan* identifies a need for upgraded drainage culverts and states that funding sources are lacking to implement the improvements. The Town relies on the Virginia Department of Transportation to perform maintenance on the main drainage ditches within the Town limits. Accomack County received grant funds to improve drainage and allocated some funding to Keller to address drainage problems. This is the first time this funding has been made available and the Town does not think it can rely on it for drainage maintenance in the future. Drainage issues are commonly experienced at the intersection of Center Avenue, West Street, and Lee Street and the northern end of West Street. Town officials indicate that these areas have poorly maintained ditches that have silted with sediment and become overgrown with vegetation. The ditch near the intersection of

Lee Street and Center Avenue is hardly recognizable. Town officials indicate that there has been no residential or commercial property damage within Town as results from storm water flooding.
The town has historically experienced severe storm water flooding events. Town officials recall at least two major flooding events where streets were inundated with rain water to the point where resident's streets were inundated with rain water to the point where residents were traveling down the streets in boats in the areas of Town that still experience flooding today. These flood waters remained for about 24 hours. The majority of houses in Town are elevated and Town officials do not remember structures being inundated during these flood events.

Table 7: Stormwater Problem Areas in Keller

	HMP 2011 & HMP 2016
Flooding Problem Areas	Central and northern parts of the town. Intersection of Center Avenue West Street Lee Street Northern end of West Street
Critical Facilities Identified	Keller Town Office Keller Post Office
Cause of Hazard	Soils poorly drain and tend to retain rainwater Lack of sufficient topography for drainage Lack of maintenance to existing drainage culverts

HAZARDS OF LOCAL SIGNIFICANCE

FIRE AND SMOKE

The Town does not have a fire department and relies on the fire departments of neighboring communities. This puts the Town at greater risk for fire damage. Specifically, there are numerous fields in the vicinity of the Town that are prone to catching fire, especially during droughts. These fires have the potential of spreading to residences in Town, especially since there are houses in Town that are dilapidated and most houses are located in close proximity to one another.

ICE AND SNOW

The Town historically has been impacted by snow and ice storms that have left residents stranded for extended periods of time. Since the Town has a relatively elderly average population, these residences are at a greater risk during these events. Additionally, the Town relies on VDOT to maintain the roads during these events.
It was suspected that a tornado destroyed a commercial building and damaged another commercial building in Town in 1998.

HAZARDOUS MATERIALS

The U.S. Route 13 highway corridor runs through Town putting residents at greater risk from HAZMAT incidences resulting from traffic accidents involving tractor trailers carrying hazardous materials. In addition, a chemical production facility is located just on the outskirts of Town limits. This facility contributes to greater traffic containing hazardous materials through Town. Hazardous materials are transported through Town via the railroad, but this form of transportation is not as prevalent as it once was.

Figure 3: U.S. Route 13 and the railroad are shown in Keller. Photo by Curt Smith

CRITICAL FACILITIES

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

Table 8 : Town of Keller Critical Facilities

Facility	Hazards	HMP 2006	HMP 2011	HMP 2016	No. of People Affected	Loss Potential	Relocation Potential	Retrofit Potential
Keller Town Office	Storm Water Flooding Wind	-	X	X	178	Major disruption	No	Yes
Keller Post Office	Storm Water Flooding Wind	-	X	X	>500	Major disruption	No	Yes

Figure 4: The Keller Town Office is at risk from storm water flooding and wind damage. Photo by Curt Smith

FINDINGS

1. Stormwater flooding and high wind events have historically been and currently are the main hazards facing the Town.
2. The Town of Keller does not currently participate in the NFIP, but is interested in joining the program so that residents and businesses can purchase flood insurance.
3. Secondary hazards facing the Town are HazMat incidents impacting water and air quality, winter storms, groundwater contamination, drought, and fire.
4. The Town has identified areas that have poorly maintained drainage ditches that regularly cause stormwater flooding hazards. The Town is interested in mitigating these problems.

TOWN OF MELFA

TOWN PROFILE

The Town of Melfa encompasses 165 acres along the south central spine of Accomack County (Figure 1). Melfa developed around a railroad station in 1884. In the early 1900s Melfa was a site of industries, including a canning factory, bottling company, three sawmills, two dairies, a barrel factory, and two hatcheries. Presently, Melfa is largely residential. The town became incorporated in 1951 with the purchase of a fire engine (*Town of Melfa Comprehensive Town Plan*, 1997).

Figure 1: Melfa Aerial Imagery

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 that 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

After an initial decline of about 50 people between 2000 and 2010, Melfa is believed to have retained a relatively stable population, according to estimate from the American Community Survey (Table 1). Although the median age seems to be increasing, Town representatives have noticed an increase in the number of children in the Town and believe that the 2013 estimate is most likely too high (Mayor Denise Bendick, personal communication, January 27, 2016). Most, if not all, Melfa residents speak English as their primary language.

Table 1: Melfa Demographic Information

	2014*	**2013****	**2010*****	**2000******
Population	411	383	408	450
Median Age	44.9	48.3	43.0	38.0
Disability	NA	12	NA	NA
Income				
Median Household Income	NA	$38,684	$34,097	$37,361
Poverty Level	NA	15.4%	29.2%	NA
Language				
Only English	100%	100%	96.1%	94.2%
Other				
Spanish	0.0%	0.0%	1.6%	4.4%
Other Indo-Euro	0.0%	0.0%	2.3%	1.3%

*Annual Estimates of the Residential Population: 2010 – 2014, ** American Community Survey 2009 – 2013, *** US Census 2010, **** US Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Melfa is primarily a residential community, where the majority of employed residents commute to work outside of Town.

Table 2: Melfa Local Workforce Industry

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	25	10.2%	31	12.8%	4	1.8%	3	1.3%

Construction	7	2.8%	20	8.2%	15	6.9%	14	6.0%
Manufacturing	19	7.7%	12	4.9%	19	8.7%	32	13.7%
Wholesale trade	13	5.3%	16	6.6%	0	0.0%	16	6.9%
Retail trade	28	11.4%	25	10.3%	43	19.7%	43	18.5%
Transportation and warehousing, and utilities	8	3.3%	13	5.3%	18	8.3%	10	4.3%
Information	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Finance, insurance, real estate, and rentals	9	3.7%	5	2.1%	17	7.8%	8	3.4%
Professional, scientific, waste management	21	8.5%	5	2.1%	13	6.0%	5	2.1%
Educational and health care services	54	22.0%	69	28.4%	69	31.7%	47	20.2%
Arts, entertainment, recreation, food	22	8.9%	10	4.1%	8	3.7%	17	7.3%
Public Admin	22	8.9%	14	5.8%	10	4.6%	27	11.6%
Other	18	7.3%	23	9.5%	2	0.9%	11	4.7%
TOTAL CIVILIAN EMPLOYED POPULATION	246	-	243	-	218	-	233	-

Source: *ACS, 2010 – 2014, ** U.S. Census 2000

One of the largest employers of residents of the Town is the manufacturing industry, shown in Table 2, which is most likely dominated by poultry processing positions. These companies often have policies in place to mitigate the economic impact for both the company and the employees, however, long-term closures would have strong negative impacts on the Town. There would be a ‘domino effect’ from such a closure, as employees of in that industry wouldn’t have spending dollars for rent, local shops, nor family necessities, and other dependent agricultural businesses would be at a loss as well.

BUSINESSES

Business data provide basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. They 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.

Table 3 presents business information for the entire zip code (23410) area, not just the incorporated Town. The Town itself only has about 15 business licenses, including Boggs Sewer and a home beauty shop (Mayor Denise Bendick, personal communication, January 27, 2016).

Table 3: Melfa Business Establishment Types

Industry Code Description	Total Establishments		
	2014	2012	2010
Construction	4	6	6
Manufacturing	3	3	4
Wholesale Trade	5	5	3

Retail Trade	8	8	7
Real estate and rental and leasing	0	0	1
Transportation and Warehousing	3	4	4
Professional, Scientific, and Technical Services	5	4	5
Administrative and Support and Waste Management Remediation Services	4	3	3
Health Care and Social Assistance	1	1	0
Arts, Entertainment, and Recreation	1	1	2
Accommodation and Food Services	2	2	4
Other Services (Except Public Admin)	5	5	5
Total, All Establishments	41	42	44

Source: Census Zip Code Business Pattern, 2013, 2011, 2009

BUILT INFRASTRUCTURE

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 evacuate.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Mayor Denise Bendick indicated that the U.S. Census values for 2010 in Table 4 are still probably the most accurate (personal communication, January 27, 2016).

Table 4: Melfa Housing

	2013*	2010**	2000***
Total Housing Units	218	202	205
Occupied	170	179	183
Vacant	48	23	22
Owner-Occupied	143	179	144
Renter-Occupied	27	42	39
Median Housing Value	$143,500	NA	NA

Source: * ACS, 2009 – 2013, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

U.S. Route 13 and Bay Coast Railroad run northeast to southwest through the town, parallel to each other, and are two of the town's dominant features. Route 13 is designated as part of several essential highway networks, including the national defense Strategic Highway Network (STAHNET), a national system of highways necessary to support emergency mobilization and peacetime movement of equipment to support U.S. military operations1, part of the National Highway System2, and the Eastern Shore's only hurricane evacuation route.3 Furthermore, the state of Virginia has named U.S. Route 13 a "Corridor of Statewide Significance," on which the long-distance movement of people and good is emphasized (VDOT).

Average daily traffic in this section of Route 13 was about 20,000 in 2014, with about 92 percent being 2-axle vehicles. Another six percent are tractor trailers, and the rest are a mix of heavy multi-axle trucks, buses, and other vehicle configurations (VDOT).

The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary, or obtain necessary supplies to make hazard mitigation preparations. The number of households with no vehicle is relatively low According Census data, most Melfa households have at least one available for travel (Table 5).

Table 5: Melfa resident vehicles

Vehicles Available	2014*	2010*	2000**
None	2	7	7
One	49	78	78
Two	67	102	102
Three or more	52	28	28

Source: * ACS, 2009 – 2013, ** U.S. Census 2000

Melfa is on Star Transit's purple and red routes. Although there are not regularly scheduled stops in town, it is part of the deviated route system and drivers will stop at Vance's Furniture with advance notice.

Although the railroad does not have a stop within Town limits, it poses a potential hazard risk as it transports propane or could serve as an aid in evacuating residents during or following an emergency.

COMMERCIAL AREAS

The traditional center of town is located on the east side of the railroad tracks. Businesses include Vance's furniture and appliance store, a well and septic service company, Shore Engineering, Eastern Shore Termite, an antique/flea market, a real estate company, Mr. Detail, and a storage company.

As with many small towns on the Shore, as business become more oriented to the highway rather than the railroad, new businesses chose to locate directly on U.S. 13. Since the railroad prevents development directly on the east side of Route 13, Melfa's highway-oriented development is all on the west side. It includes two gas stations (Doughty's and Shore Stop), Fosque's Upholstery, Got Grass, a karate studio, and a tax preparation and book keeping business.

COMMUNITY FACILITIES

[1] Strategic Highway Network, USDOT, www.fhwa.dot/policy/ 2004cpr/chap18.htm
[2] FHWA, http://www.fhwa.dot.gov/planning/national_highway_system/nhs_maps/virginia/va_virginia.pdf
[3] Virginia Department of Emergency Management, http://www.vaemergency.gov/sites/default/files/Final2014hurricaneguide.pdf

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

Police protection is provided by the Accomack County Sheriff's Department and Virginia State Police. The State Police post for the Eastern Shore is located about one mile northeast of Melfa.

The Melfa Volunteer Fire and Rescue Company was organized in May 1950 in the aftermath of the "Eastern Sunday Fire." Presently the Company operates a fleet of six apparatus, including tow advanced life support ambulances, two engines, a 2,500 gallon tanker, and a brush truck. Additionally there are three trailers and a support/tow vehicle operated by the hazmat Team, and the Eastern Shore C.E.R.T. Disaster Response trailer are kept on the station property. The station has three bays and was built in 2002. In addition to serving Melfa, the station serves portions of Bobtown, Boston, Hacks Neck, Harborton, Keller, Texacotown, Savageville, and various outlying areas (Melfa V.F.R.C., www.easternshorefire.com/station-10/).

Figure 2 : Melfa Volunteer Fire and Rescue Company building on Hatton Avenue includes 3 bays, a community room, bunk rooms, restrooms, station watch room, laundry room, offices, & storage areas.

WATER SUPPLY AND WASTEWATER

Melfa residents rely on private wells for their water supply and private septic systems for disposal. These residential wells are potentially at risk of contamination from aboveground and underground petroleum storage tanks (AST and UST). Most homes in the Town are heated by oil, which is stored in these tanks. If not properly maintained, ASTs and USTs and gas station storage tanks can pose a significant water quality risk to the Town.

SOLID WASTE DISPOSAL

The Town has a trash truck and offers pick up each Monday, which is delivered to the Accomack County landfill. Additionally, residents can take their refuse to a county convenience centers, of which the closest is the Grangeville facility on Wachapreague Road. The Town also offers spring and fall clean up opportunities free of charge within the Town.

PARKS AND RECREATION

The Melfa Town Park at the end of Woodland Avenue offers a lit baseball field and picnic area.

DRAINAGE DITCHES

The Town enlists the services of a private contractor to complete an annual ditch cleaning for litter and brush removal. Maintenance of drainage ditches along roads is a VDOT responsibility, which Town representatives indicated was a five year plan. In the summer of 2015 the Town paid the County to replace the culvert pipe by the Town Hall. This effort has prevented street flooding considerably. Woodland Avenue floods entirely during heavy rain events, particularly by Shore Engineering, as it is also in need of a culvert pipe (Mayor Denise Bendick, personal communication, January 27, 2016).

SCHOOLS

Although there are no schools within Town limits, the Eastern Shore Community College is less than a mile south of the Town and there is a day care with a private license on Ridge Avenue.

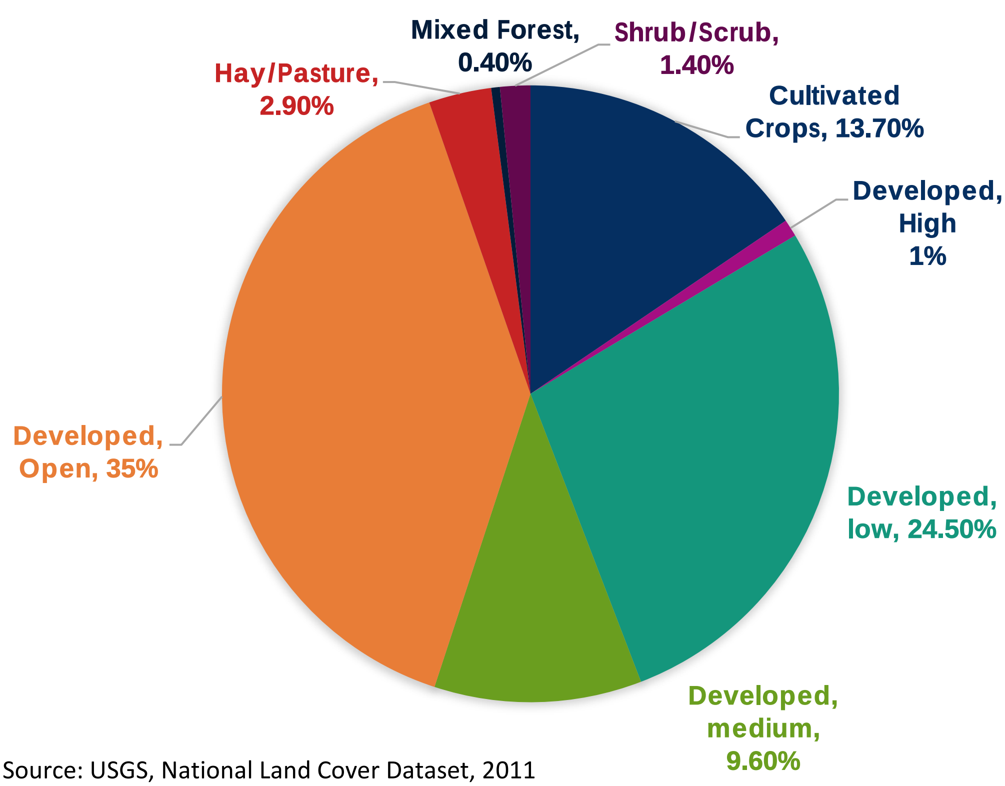
HISTORIC OR CULTURAL RESOURCES

There is a plaque indicating the tallest point on the Eastern Shore within the Town boundaries. The Town Hall is in a historic store building.

NATURAL ENVIRONMENT

Melfa lies within the Chesapeake Bay watershed. The town itself is relatively flat, with most of the town ranging in elevation from 45 to 50 feet above sea level, although the highest point on the Shore is located west of Route 13 and is over 51 feet in elevation. Melfa is not located within the 100-year or 500-year floodplain.

LAND USE LAND COVER



Source: USGS, National Land Cover Dataset, 2011

Figure 3: Melfa Land Use Land Cover Percentages

Melfa has a land area of 160 acres. Approximately 60% of the land area is developed (Figure 3), with residential land use being the predominant land use category. As Figure 4 demonstrates, the majority of the developed land use areas surround Route 13 and there is very little in the way of forest or shrub habitats.

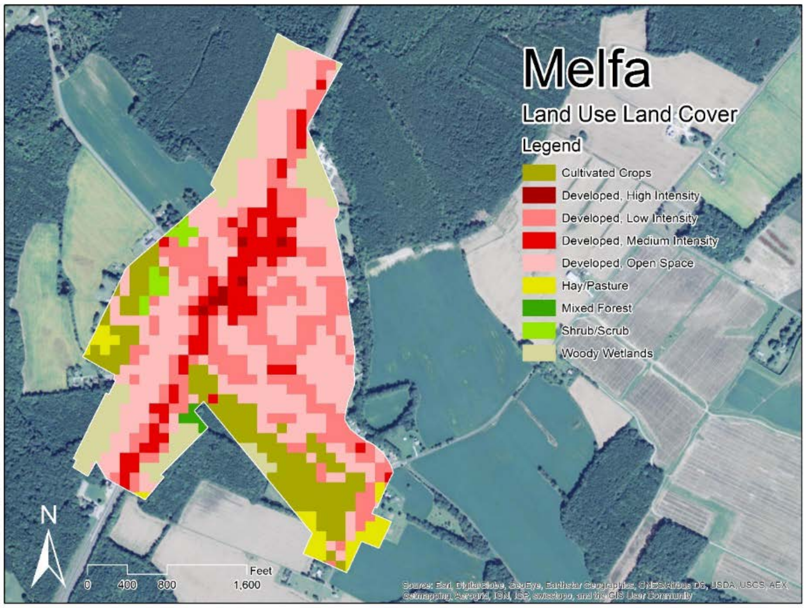


Figure 4: Melfa Land Use Land Cover Map

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Melfa has not previously participated in the hazard mitigation planning process. The Town's primary risk is associated with storm water flooding.

Table 6 : Town of Melfa Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOODING INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

Melfa does not participate in the NFIP program.

HMGP

Melfa has not participated in the HMGP

DISASTER ASSISTANCE

Following severe flooding of the Melfa Town Park and the area around the storage unit, FEMA grant allowed for the installation of culvert piping that has improved the stormwater flooding situation.

HAZARDS PROFILE

Stormwater flooding has the greatest and most frequent impact on the Town.

WIND

No parts of Melfa lie in the wind borne debris hazard area. This area extends 1-mile inland from the coast. The Town lies in the 110 – 120 mph design wind zone (Accomack County Building Code).

Most of the residential areas are older and have mature trees in and around the homes. Falling branches or trees may cause damage to structures during a high wind or ice event.

Although there are no records of any tornado damage in the Town, there have been tornadoes in the region, and preparation is important.

COASTAL EROSION

No structures are at immediate risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within areas designated by FEMA as flood zones. The threat of coastal flooding within the Town is considered to be minimal.

STORMWATER FLOODING

Melfa is underlain by some soils that are unsuitable for drainage and rainwater. Arapahoe mucky loam (very poorly drained) and Nimmo sandy loam (poorly drained) are the dominant soil types, along with Munden sandy loam (moderately well drained) and Bojac sandy loam (well drained). Installation of culvert pipes has lessened the stormwater flooding in the Town, however, Woodland Avenue is still in need of a culvert, as currently the ditch simply drains into the street.

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

The Town faces a threat of ground water contamination from failed septic systems within the Town, leaks and spills of petroleum based products from underground storage tanks, and from railroad cars passing through town.

ICE & SNOW STORMS

Ice and snow storms, particularly coupled with strong winds, have caused damages to properties in the past, and have caused power outages.

CRITICAL FACILITIES

The following table lists the critical facilities and their relative importance to the Town. Nandua High School, not in the Town, is critical, as it serves as the shelter of last resort for residents. Additionally the State Police Office and the Eastern Shore Community College, although outside of the Town limits, are critical to the Town.

Table 7: Melfa Critical Facilities

Facility	**HMP 2006**	**HMP 2011**	**HMP 2016**	**Hazards**	**No of People Affected**	**Loss potential**	**Relocation Potential**	**Retrofit Potential**
Town-owned Facilities								
Melfa Town Office	-	-	X	Stormwater Wind Fire	411	Major Disruption	Yes	Yes
Melfa Volunteer Fire and Rescue Company (HazMat/CERT storage)	-	-	X	Stormwater Wind	5,000+	Devastating	Yes	Yes
Town Park	-	-	X	Stormwater Wind Fire	411+	Inconvenience	No	Yes
Other Facilities								
Melfa Post Office	-	-	X	Stormwater Wind Fire	500+	Major Disruption	Yes	Yes
Internet Towers	-	-	X	Stormwater Wind	411+	Inconvenience	Yes	Yes

				Fire				
Gas Stations	-	-	X	Stormwater Wind Fire	500+	Major Disruption	Yes	Yes
Nandua High	-	-		Stormwater Wind Fire				

FINDINGS

1. Although no part of the Town lies within any flood zone and the highest point on the Eastern Shore is located within boundaries, due to soil types and flat topography, stormwater flooding is the most common hazard experienced by the Town. Additional culverts have been successful in mitigating stormwater flooding in the past, and the Town would like to see additional culverts be installed.

2. The Melfa Volunteer Fire and Rescue Company is vital to the Town and surrounding area not only for fire and rescue, but also as the location of important assets to the region for Hazard Materials and C.E.R.T. response.

3. Due to an aging building stock and mature trees, wind and ice storms pose a significant threat to the community through direct damages and damages to power distribution infrastructure.

TOWN OF NASSAWADOX

TOWN PROFILE

Nassawadox is a town in Northampton County. It is 5 miles south of Exmore and 25 miles north of the Chesapeake Bay Bridge Tunnel. The name derives from the Native American word for "land between two waters." It's made up of an area of 0.4 square miles and is located on U.S. Route 13. There was little evidence of a community where Nassawadox now exists in the late 1800s. A mail route and post office were influential on the development of the Town. The Pennsylvania Railroad was established in 1884 and allowed the Town to expand further. The Town is home to the Shore Memorial Hospital, one of the Eastern Shore's largest employers (*Nassawadox Comprehensive Plan*, 2000).

Figure 1: Nassawadox Context and Boundary Maps

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

The Town of Nassawadox had a population of 499 in 2010 (U.S. Census, 2010). This is a 13% decrease in population when compared to 2000. Town representatives have discredited the results from the American Community Survey in Table 1. They indicate that the figures from the 2010 U.S. Census are much more accurate, and that the population and medium household incomes shown for 2013 and 2014 are too high and that the poverty level revealed for 2014 is too low. The median age in 2010 was 61.8 years, revealing a population significantly older than the statewide or nationwide population. This is important information, as during an emergency, this population could be considered high risk and require additional support. (personal communication, January 27, 2016)

Table 1: Nassawadox Demographic Information

	2014***	2013**	2010*	2000****
Population	771	698	499	572
Median Age	50.1	46.6	61.8	53.5
Disability	31	23	NA	NA
Income				
Median Household Income	45,000	45,769	35,893	21,250
Poverty Level	14.3%			
Language				
Only English	99.9%	100.0%	96.7%	97.1%
Other	0.1%	0.0%	3.3%	2.9%
Spanish	0.1%	0.0%	0.0%	2.9%
Asian	0.0%	0.0%	3.3%	0.0%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORKFORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The workforce is largely in educational and health services. This is reflective upon Shore Memorial Hospital being located within Nassawadox. The hospital is a major economic drive for not just Nassawadox, but it also supports the entirety of the Shore in relation to jobs and health services. Even though the hospital is a major employer for the shore, the majority of Nassawadox residents commute to work outside of the Town (*Nassawadox Comprehensive Plan,* 2000). This is likely to increase dramatically following the completion of the new hospital near the Town of Onley. The hospital in Nassawadox will be systematically closing in the coming years. Local businesses, particularly restaurants, retailers, and the pharmacy will be negatively impacted by the move of the hospital as well.

Table 2: Nassawadox Local Work Force Industry

	Civilian Employed Population							
Industry	**2014***		**2012***		**2010***		**2000****	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	17	6.3%	15	6.5%	16	5.8%	3	1.8%
Construction	19	7.1%	8	3.5%	16	5.8%	4	2.4%
Manufacturing	32	11.9%	15	6.5%	19	6.9%	11	6.6%
Wholesale trade	24	8.9%	18	7.8%	16	5.8%	1	0.6%
Retail trade	18	6.7%	19	8.3%	15	5.5%	26	15.6%
Transportation and warehousing, and utilities	7	2.6%	3	1.3%	0	0.0%	4	2.4%
Information	19	7.1%	0	0.0%	2	0.7%	7	4.2%
Finance, insurance, real estate, and rentals	0	0.0%	4	1.7%	10	3.6%	10	6.0%
Professional, scientific, waste management	1	0.4%	0	0.0%	3	1.1%	13	7.8%
Educational and health care services	92	34.2%	77	33.5%	99	36.0%	58	34.7%
Arts, entertainment, recreation, food	27	10.0%	51	22.2%	48	17.5%	17	10.2%
Public Admin	0	0.0%	8	3.5%	11	4.0%	6	3.6%
Other	13	4.8%	12	5.2%	20	7.3%	7	4.2%
TOTAL CIVILIAN EMPLOYED POPULATION	269	-	230	-	275	-	167	-

Source: *American Community Survey, 2010 – 2014, **U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

The largest employer in Nassawadox is the Shore Memorial Hospital. The hospital is the fourth largest employer on the Eastern Shore (*Nassawadox Comprehensive Plan*, 2001). This explains why the number of businesses is relatively low and the number of employees being high. Many of the employees commute from outside the Town. The hospitals location has attracted medical services, community health services, and mental health services to be located within the Town (*Nassawadox Comprehensive Plan*, 2001). As mentioned in the Workforce section, the hospital's intentions to move north will inevitably impact the businesses in the Town, although the surrounding doctor offices will remain in the Town.

Table 3: Nassawadox Business Establishments

	Total Establishments		
Industry Code Description	**2013**	**2011**	**2009**
Mining, Quarrying, and Oil and Gas Extraction	1	0	0
Construction	3	4	4
Manufacturing	1	2	3
Wholesale Trade	3	2	3
Retail Trade	6	9	7

Finance and Leisure	3	3	4
Management of Companies and Enterprises	1	1	1
Administrative and Support and Waste Management Remediation Services	1	2	2
Health Care and Social Assistance	13	12	15
Accommodation and Food Services	4	4	4
Other Services (Except Public Admin)	2	2	2
Total, All Establishments	39	42	43
Total Employees	658	764	891

Source: Census Zip Code Business Pattern, 2013, 2011, 2009

BUILT INFRASTRUCTURE

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 evacuate.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

Town representatives indicate that there were only about 3 homes constructed since 2010, and thus the American Community Survey estimate for 2014 is extremely high. They also indicated that the 2010 and 2014 figures for vacant housing units indicated in Table 4 are about twice the actual number. Nassawadox has an ordinance that governs hazardous structures to enforce the repair or clearance of dilapidated buildings (*Nassawadox Comprehensive Plan,* 2000), which restricts the vacant homes to those that are in decent condition. This is important in reference to hazards due to dilapidated structures creating dangerous scenarios for surrounding neighbors during high wind events.

There are at least two high density housing developments in the Town, Dogwood and Saw Mill Apartments. Often high density housing areas are the lower cost option for residents and can be more vulnerable to displacement and are least able to access safe and affordable housing after a disaster (Viverios, et al.).

Table 4: Nassawadox Housing

	2014*	**2010****	**2000*****
Total Housing Units	317	239	207
Occupied	264	188	186
Vacant	53	51	21
Owner-Occupied	NA	127	124
Renter-Occupied	NA	61	62
Median Housing Value	125,000	NA	NA

* American Community Survey, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

U.S. Route 13 bisects the town making automobile transportation convenient for residents. Public transportation is made available through STAR transit, with bus routes along U.S. Route 13. The Eastern Shore Railroad runs through the middle of the town, servings as freight carrier connecting Hampton Roads with the Delmarva Peninsula. The railroad does not make a stop in the Town as part of its daily operations. Streets and sidewalks are maintained by VDOT and are generally in good condition (*Nassawadox Comprehensive Plan,* 2000). Table 5 points out that there are about 30 households which do not have a vehicle available, but Town representatives believe that the more accurate figure is the 20 households indicated for 2010. However, the representatives also indicated that there are less than 300 vehicles registered in the Town, and the figures for 2010 in Table 5 would indicate more than 375 vehicles available in the Town. (personal communications, January 27, 2016) The number of homes without access to a vehicle is important to note, as in emergency situations, they would be unable to evacuate or more to a safer area without assistance.

Table 5: Nassawadox Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	32	20	44
One	92	64	51
Two	86	121	77
Three or more	54	26	20

* American Community Survey, 2010 – 2014, ** U.S. Census 2000

COMMERCIAL AREAS

Route 13 runs through the middle of the downtown area of the Town. There are three commercial clusters located along U.S. Route 13 at State Route 606, State Route 678, and state Route 609. Between these clusters are residential housing. The commercial center consists of a restaurant, several variety shops, a bank, a Post Office, lumber yard, and a library.

COMMUNITY FACILITIES

Community facilities are facilities required to support the services and for the Town, these functions are provided by the Northampton County government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard. Some facilities located within the town include a Post Office, and the Northampton County Free Library.

PUBLIC SAFETY

Public safety is extremely important in a hazard scenario. Police protection is provided by the Northampton County Sheriff's Department and the Virginia State Police. Fire protection for the town is provided by the Nassawadox Volunteer Fire and Rescue, which has 34 members, 15 of whom are active fire and rescue members. Equipment at the facility includes an ambulance, engine, tanker, brush unit, rehab unit, and utility vehicle. The department responds to calls throughout Northampton County (Nassawadox Comprehensive Plan, 2000), particularly the area between Exmore and Eastville, including Hare Valley, Franktown, Bayford, Vaucluse Shores, Marionville, Red Bank, Wierwood, Birdsnest, Treherneville, and other outlying areas.

The Northampton County Health Department is located just out of the Town limits.

WATER SUPPLY AND WASTEWATER

Residents rely on individual private wells for their water supply. Some residents rely on individual septic systems for their wastewater disposal, but the Town invested in a central public sewage system, which they have found to be overly expensive and unnecessary. The hospital was one of the main entities driving conversion to a waste water treatment plant (WWTP), and now that the hospital is moving north, there are questions concerning the future of the WWTP.

SOLID WASTE

The Town residences benefit from fee free weekly residential pickup by Davis Disposal. Commercial waste is collected by private haulers and must be taken to Accomack County. The Birdsnest Northampton County Convenience Center is only four miles south of the Town on Route 13.

POWER AND COMMUNICATIONS INFRASTRUCTURE

There are no electric substations in the Town. Because the Town lies on the Route 13, it typically does not have lengthy power outages (despite the presence of older trees) and is able to take advantage of the broadband fiber cable for internet services.

PARKS AND RECREATION

There is a park located within the jurisdiction, but it is no longer owned by the Town. A privately owned baseball complex is also located within the Town limits. The Northampton Free Library is located in Nassawadox.

STORM WATER DRAINAGE

The Town does not finance the annual maintenance of ditches along roadways throughout the Town and relies on the Virginia Department of Transportation for ditch maintenance. Ditches on private land are contracted by the Town for maintenance as close to annually as necessary and affordable.

SCHOOLS

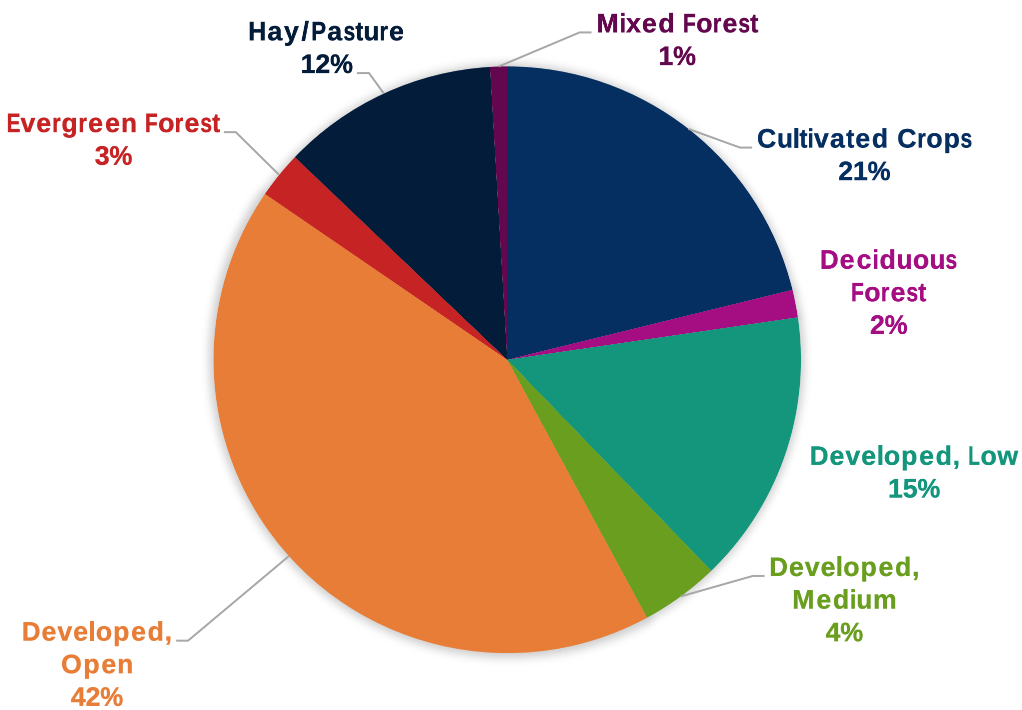
There are no schools or known daycare facilities in Nassawadox.

NATURAL ENVIRONMENT

Nassawadox is very flat, with sloped ranging from 0% to 2%. Most of the land is at an elevation of 35 to 40 feet above sea level. The soils in Nassawadox are either hydric or highly permeable, with a depth to groundwater of 0 – 36 inches. Hydric soils are a major limiting factor in Nassawadox due to their severe limitations in respect to constructing on-site septic systems. A majority of residents in the Town utilize on-site septic systems for residential and commercial waste disposal. The presence of groundwater near the surface can cause septic system failure resulting in ground water contamination (*Nassawadox Comprehensive Plan*, 2001).

LAND USE LAND COVER

Nassawadox is just over 50% developed, as indicated in both Figure 2. With only about 5% natural forest and shrub cover, and an excess of developed areas, areas with high percentage of constructed materials (including asphalt, concrete, buildings, etc.), the Town is more susceptible to storm water complications and issues. Cultivated crop covers about a fifth of the Town, indicating the importance of agriculture in our area.



Source: USGS. National Land Cover Dataset. 2011

Figure 2: Land Use Land Cover Percentages

GROUND WATER

The Town's water supply is obtained from groundwater through individual private wells. The majority of the Town lies within the spine recharge area. It is critical to protect the spine recharge area in order to assure the continuance of good quality and large quantities of groundwater on the Eastern Shore. Although barren land has remained undeveloped due to the soils being unsuitable for septic systems, new technologies in above ground septic options may allow further development. Any development needs to be done with consideration of the effects of impervious surfaces on groundwater recharge and quality (*Nassawadox Comprehensive Plan*, 2000).

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Nassawadox did not participate in the 2006 or 2011 HMP, but deferred to the county for hazard preparedness and was only mentioned within the context of the National Flood Insurance Program. The Town has not updated its Comprehensive Plan since 2000, but its zoning ordinance was amended in 2015.

Table 6 : Town of Nassawadox Hazard mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committe	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

The Town of Nassawadox joined the NFIP program on May 8, 2007 (FEMA Community Status Book Report, June 2011). Nassawadox does not have any identified Special Flood Hazard Areas. NFIP data for Nassawadox indicates that there is one policy covering $280,000 for a structure located in the Town. The policy is not located in a Special Flood Hazard Area indicating that storm water flooding may be a concern within the Town. There have not been any claims filed since the Town joined the NFIP in 2007 (FEMA NFIP Insurance Report, May 2011).

Nassawadox does not have any identified Special Flood Hazard Areas, but have joined the NFIP.

Table 7: Summary of Nassawadox Past NFIP Participation

	HMP 2006	HMP 2011	HMP 2016
Date Joined	Did not join NFIP	May 8, 2007	May 8, 2007
Classification	NA	No identified Special Flood Hazard Area	No identified Special Flood Hazard Area
Policies	NA	1	2
Policy Dollar Amount	NA	$280,000	$630,000
Claims	NA	0	0
Claims Dollar Amount	NA	NA	NA

Source: The Eastern Shore of Virginia Hazard Mitigation Plan, 2011, 2006

HMGP

The Town has not participated in the Hazard Mitigation Grant Program.

HAZARD PROFILE

Stormwater flooding has the greatest and most frequent impact on the Town.

WIND

No parts of the Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the Bay shoreline. Many of the housing stock is aging, but most are well maintained. There are a significantly high number of mature trees and particularly after extensive rain event saturate the soils, these can pose a threat to buildings, roadways, and electric services.

Tornados and straight line winds, despite their infrequency in the region, pose a threat to the Town.

COASTAL EROSION

The Town is not at risk to coastal erosion due to inland location.

COASTAL FLOODING

Nassawadox does not have any identified Special Flood Hazard Areas.

STORMWATER FLOODING

Following heavy rain events, the Town experiences severe drainage problems, resulting in flooding, particularly north of Rogers Drive and perpendicular to Pine Avenue (Nassawadox Comprehensive Plan, 2000 and personal communication, January 27, 2016). In the Woodstock residential area here was a ditch put in when the subdivision developed, but it has not been maintenance regularly to ensure continued proper operation.

HAZARDS OF LOCAL SIGNIFICANCE

GROUNDWATER CONTAMINATION

Groundwater quality is threatened by contaminants that are discharged, leached, or disposed into the ground. The major contamination threats to groundwater in Nassawadox are on-site septic system failure, underground storage tanks, and above ground storage tanks (Nassawadox Comprehensive Plan*,* 2000). Nassawadox is in Wellhead Protection Area E.

SNOW AND ICE

Beyond potential road hazards, snow and ice can pose a hazard by increasing stress on mature trees and causing branches to come down, damaging buildings, vehicles, and/or hindering transportation.

FIRE AND SMOKE

Around 1920 a combination hotel, barroom, and theater building burned down. The replacement building is brick with asphalt roofing, but the majority of the remaining downtown businesses are wooden and connected.

CRITICAL FACILITIES

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

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
No Town-Owned Facilities								
Other Facilities								
Volunteer Fire Department	NA	NA	X	Fire, Wind, Snow and Ice	10,000	Devastating	Yes	Yes
Park & Baseball Complex	NA	NA	X	Fire, Wind, Stormwater	1,000	Inconvenience	No	Yes
Northampton Free Library	NA	NA	X	Fire, Wind, Snow and Ice, Stormwater	10,000	Inconvenience	No	Yes
Post Office	NA	NA	X	Fire, Wind, Snow and Ice, Stormwater	1,000	Major Disruption	No	Yes

Shore Stop (gas station)	NA	NA	X	Fire, Wind, Stormwater	2,000+	Major Disruption	No	Yes
Water tower (at hospital)	NA	NA	X	Fire, Wind, Snow and Ice	1,000+	Major Disruption	No	Yes

FINDINGS

1. Due to the Town's central location, the hazards expected to have the greatest impact on the Town are stormwater flooding and high wind events. There are no defined Special Flood Hazard Areas within the Town, but the Town does participate in the NFIP and there is one insurance policy in force.

2. The Town does not own any property or facilities.

3. With the relocation of Riverside Shore Memorial Hospital out of the Town, there is a concern that the Town will not be as economically viable or resilient.

4. The relocation of Riverside Shore Memorial Hospital out of the Town is leaving uncertainty as to the maintenance and future of the waste water treatment facility.

5. Residential areas have older construction and many mature trees. During a wind event, branches and trees may come down causing secondary wind damage and power outages.

TOWN OF ONANCOCK

TOWN PROFILE

The Town's port was founded to collect tax on tobacco and other products exported from Accomack County. In 1680, the Act of Cohabitation set aside 50 acres at the head of Onancock Creek for development of a town center. This area was called Port Scarburgh, but was quickly changed to Onancock. Accomack's county seat was located here until 1693 when a new courthouse was built in the nearby Town of Accomac. The Town was a major port on the Eastern Shore allowing access to Baltimore's markets. The Town declined after 1884 when the railroad was built further inland (Onancock Town Plan, 2004). Today, the Town includes 665 acres (just over a square mile) and is a residential center, service area and small active port with 95 business establishments, many in its old downtown (2008 Zip Code Business Patterns).

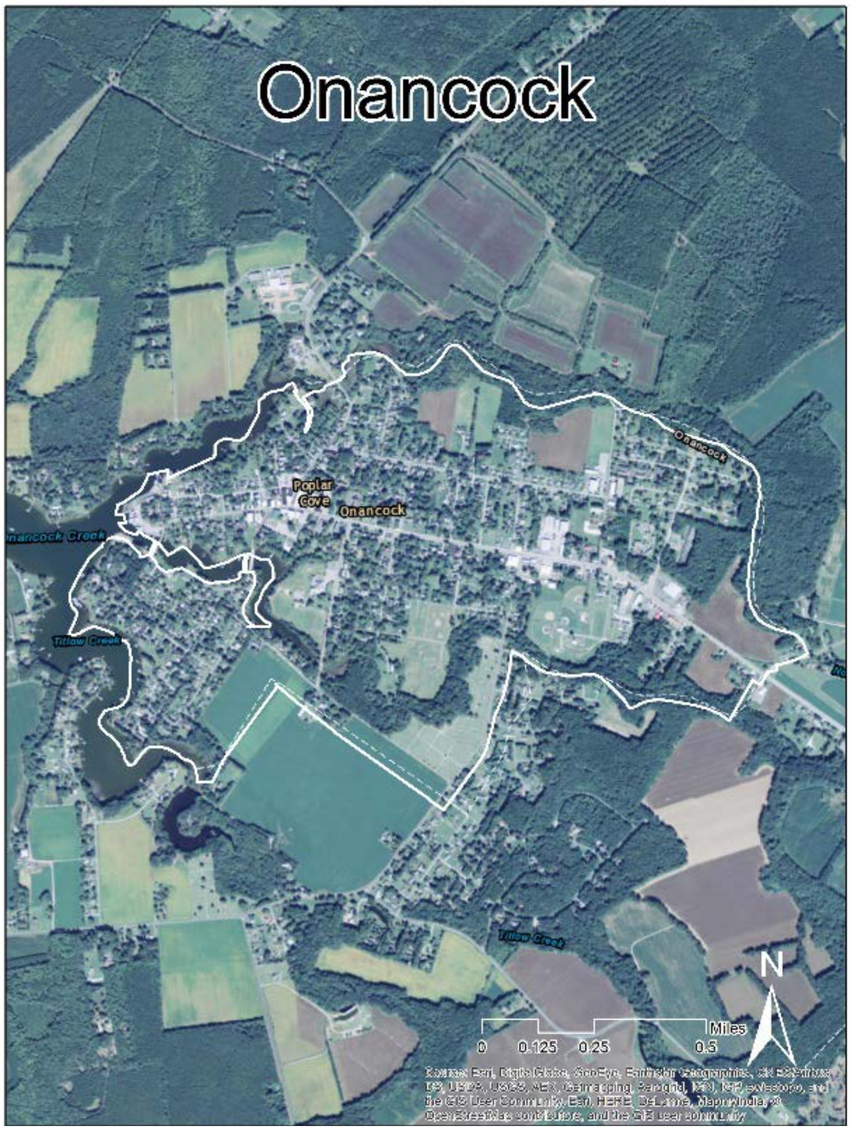


Figure 1 : Onancock Satelite Imagery

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 that 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

The 2010 Census indicates that the Town had a population of 1,263, which is a 17.2% decline from the 1,525 people that lived in the Town during the 2000 Census. The most recent American Community Survey estimate from 2014 has the population at 1,226. The median age for residents in 2014 was 51.6, signifying an older population than the national average.

Table 1 : Onancock Demographic Information

	2014***	2013**	2010*	2000****
Population	1,226	1,381	1,263	1,525
Median Age	51.6	50.1	51.1	45.3
Disability	101	73	NA	NA
Income				
Median Household Income	$39,927	$40,313	$41,372	$28,214
Poverty Level	30.1%	25.6%	21.2%	NA
Language				
Only English	92.7%	94.7%	93.5%	94.0%
Other	7.3%	5.3%	6.5%	6.0%
Spanish	0.3%	0.9%	6.3%	4.1%
Ind-Euro	6.6%	4.2%	0.2%	0.8%
Asian	0.0%	0.0%	0.0%	0.1%
Other	0.3%	0.2%	0.0%	0.0%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORKFORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. Additionally, they can identify where disruptions in employment and income might occur in the aftermath of a disaster.

The majority of the work force in Onancock work in educational, health care, and social services. They also work in retail trade, reflective of the downtown retail area, and manufacturing due to the close proximity of various industrial poultry plants nearby. Following an emergency situation that caused significant negative impacts to the tourism industry, the rebound for the Town would most likely also be negatively impacted. However, the significant amount of the workforce employed in education, construction, professional services, utilities, and more would be in high need and thus the negative impact would hopefully be lessened.

Table 2 : Onancock Workforce

Civilian Employed Population						
Industry	**2014***		**2010***		**2000****	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Agriculture, forestry, fishing/hunting, or mining	15	3.0%	16	2.2%	11	1.8%
Construction	21	4.2%	72	10.0%	36	6.0%
Manufacturing	91	18.1%	88	12.2%	86	14.3%
Wholesale trade	6	1.2%	47	6.5%	51	8.5%
Retail trade	49	9.7%	76	10.6%	81	13.5%
Transportation and warehousing, and utilities	5	1.0%	27	3.8%	11	1.8%
Information	10	2.0%	11	1.5%	16	2.7%
Finance, insurance, real estate, and rentals	37	7.4%	22	3.1%	24	4.0%
Professional, scientific, waste management	37	7.4%	47	6.5%	37	6.2%
Educational, health care, social services	143	28.4%	126	17.5%	131	21.8%
Arts, entertainment, recreation, food	48	9.5%	94	13.1%	42	7.0%
Public Administration	33	6.6%	73	10.2%	48	8.0%
Other	8	1.6%	20	2.8%	26	4.3%
TOTAL CIVILIAN EMPLOYED POPULATION	503	-	719	-	600	-

Source: * American Community Survey, 2010 – 2014, ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Onancock is one of the few incorporated towns in the region that has an entity responsible for increasing the success of the community in order to enhance the quality of life for the citizenry. The Onancock Business & Civic Association fills this role and is an excellent resource for new residents, entrepreneurs, and information about businesses in the Town.

Onancock was once an active maritime shipping center for locally grown produce. Though it remains an active maritime port of seafood landings and commodity imports, the rail and truck shipping industry supplemented the transport of locally grown produce. The majority of Onancock's industry focuses on retail and commercial areas. There are also construction and food services throughout Onancock.

Table 3: Onancock Business Types

Industry Code Description	Total Establishments		
	2013	**2011**	**2009**
Agriculture, Forestry, Fishing and Hunting	1	1	1
Construction	12	10	11

Industry Code Description	Total Establishments		
	2013	**2011**	**2009**
Manufacturing	2	1	1
Wholesale Trade	1	2	2
Retail Trade	14	11	14
Information	4	4	4
Finance and Insurance	5	4	4
Real Estate and Rental and Leasing	7	6	8
Professional, Scientific, and Technical Services	8	11	10
Management of Companies and Enterprises	1	1	1
Administrative and Support and Waste Management and Remediation Services	3	4	5
Health Care and Social Assistance	9	9	9
Arts, Entertainment, and Recreation	2	4	4
Accommodation and Food Services	10	10	8
Other Services (Except Public Admin)	11	14	14
Total, All Establishments	90	92	96
Total Employees	590	518	533

Source: Census Zip Code Business Patterns, 2013

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary. The Town of Onancock does has some higher density, multi-family accommodations on the northwest area of town. During educational outreach, these areas would be well-suited for additional focused attention.

The trend revealed in Table 4 below show a steady increase in the number of total housing units in the Town. The majority of these units are single-family housing and are owner-occupied. The presence of substandard housing in Onancock has been greatly reduced the last 40 years. There is still a presence of some substandard houses that have peeling paint, leaking roofs, and windows and doors in disrepair (*Onancock Town Plan*, 2004).

Table 4: Onancock Housing

	2014*	2010**	2000***
Total Housing Units	794	753	733
Occupied	649	594	656
Vacant	145	159	77
Owner-Occupied	394	350	411
Renter-Occupied	255	244	245
Median Housing Value	$183,000	NA	NA

* American Community Survey, 2010 – 2014, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

Market Street (Route 179) serves as Onancock's primary street, and provides a direct route in and out of the Town to Highway 13. Other major roads in Town include Hill Street (Route 179), Liberty Street, and North Street. Hill Street connects to communities from the South such as Cashville, East Point, and Pungoteague. The most active internal collector roadways in Town are Kerr Street and Boundary Avenue. VDOT maintains approximately 75% of the Town's roadways, with the Town maintaining the remaining 25% (*Onancock Town Plan*, 2004).

STAR Transit offers weekday bus service to Chincoteague and Cape Charles, with stops to all major communities, shopping centers, health care facilities, and government offices. The seasonal Tangier Ferry offers regular service to Tangier Island, and offers foot passengers and bicyclists the opportunity to connect to other boats travelling to Reedville, Virginia and Crisfield, Maryland (*Onancock Town Plan*, 2004).

Table 5: Onancock Vehicles Available Relative to Households

Vehicles Available	2014*	2010**	2000***
None	94	105	95
One	284	274	256
Two	172	218	200
Three or more	99	118	100

* American Community Survey, 2010 – 2014, ** American Community Survey, 2006 – 2010, *** U.S. Census 2000

Individuals with personal vehicles can most often more easily remove themselves and their families from harm's way in the case of an emergency. As of 2014, about 15% of the Town's occupied residences are without even a single vehicle according to Table 5 above.

COMMERCIAL AREAS

Commercial activity in the Town is concentrated in three areas along Market Street. The first is concentrated along Market Street and clustered into three distinct areas, separated from each other by residential land uses. This commercial area is referred as the "business highway" area and includes a laundromat, car service stations, and other businesses. The second commercial area is the downtown area located farther west on Market Street. This is the Town's "Main Street" and is characterized by one-story and two-story brick buildings. Commercial activity in this area consists of local government administrative offices, services and retail shops, and offices. The third area of commercial activity is located on Onancock Creek, known as the Onancock Wharf. Commercial uses include retail stores, a sand and gravel loading area, an oil company, a seasonal ferry service, and commercial fishing operations.

COMMUNITY SERVICES AND FACILITIES

Community facilities comprise all the public services and facilities provided by the Town to all residents. Those services include public water and sewage treatment facilities, police and fire departments, wharf, parks and recreation facilities, and solid waste management.

PUBLIC SAFETY

The Town employs five full-time police officers, headquartered at the police station on North Street next to the Town Hall. Fire protection and rescue service is provided by the Onancock Volunteer Fire Department, Inc. The volunteer fire department serves the Town of Onancock and the outlying areas of Deep Creek, Chesconessex, Bayside, Cashville, Nebo, East Point, and part of Savageville. There are 40 active members, 4 paid full-time firefighters, 26 volunteer firefighters, and 10 non-firefighting volunteers, providing 24/7 coverage of EMT/fire fighters paid by Accomack County. The department currently operates three fire engines, one brush fire truck, and one ambulances (Lisa Fiege, *personal communication, June 2, 2016*).

PARKS AND RECREATION

Onancock's Town Square is located on Market Street and covers an area of about half an acre. It features a gazebo and a monument to General Edmund R. Bagwell. The Northeast Onancock Community Park is about 14 acres and has a basketball court, playground equipment, and benches. There are fields in the Town at Fireman's Field with no active courts or maintained fields. The fields at the water tower are leased for recreational sports use. Onancock landing park (from Market St to the creek) with dingy docks, kayak launch, near the wharf. The Onancock School and surrounding recreational opportunities including a nature trail maintained by the Master Naturalists and fields for soccer, frisbee, etc.

WATER SUPPLY AND WASTEWATER

The Town has a municipal water system supplied by groundwater wells at Hartman Avenue. Well depths are about 265 feet, and sodium hypochloride is injected into the water at the water tank. Two smaller, back-up wells are located at the Parker Street site, along with a pump station. The water tower is 168 feet high and contains 300,000 gallon elevated storage tank. Water is distributed through two, four, six, and eight inch water lines.

The Town owns and operates a wastewater treatment facility located on North Street. The facility serves all residents and businesses in Town, as well as Airport Industrial Park, and several businesses and commercial establishments located on the west side of Route 13 south of Route 179 in Onley. The facility was updated in 2012 from a capacity of 250,000 gallons per day to 750,000 gallons per day. There are still a few septic systems in the Town, less than ten total (Lisa Feige, personal communication, June 2, 2016).

SOLID WASTE

The Town contracts with Davis Disposal for weekly residential trash collection, which is transported to the Northern Accomack County Landfill. Most residents also use the Tasley Convenience Center regularly and so this is an important resource for the Town.

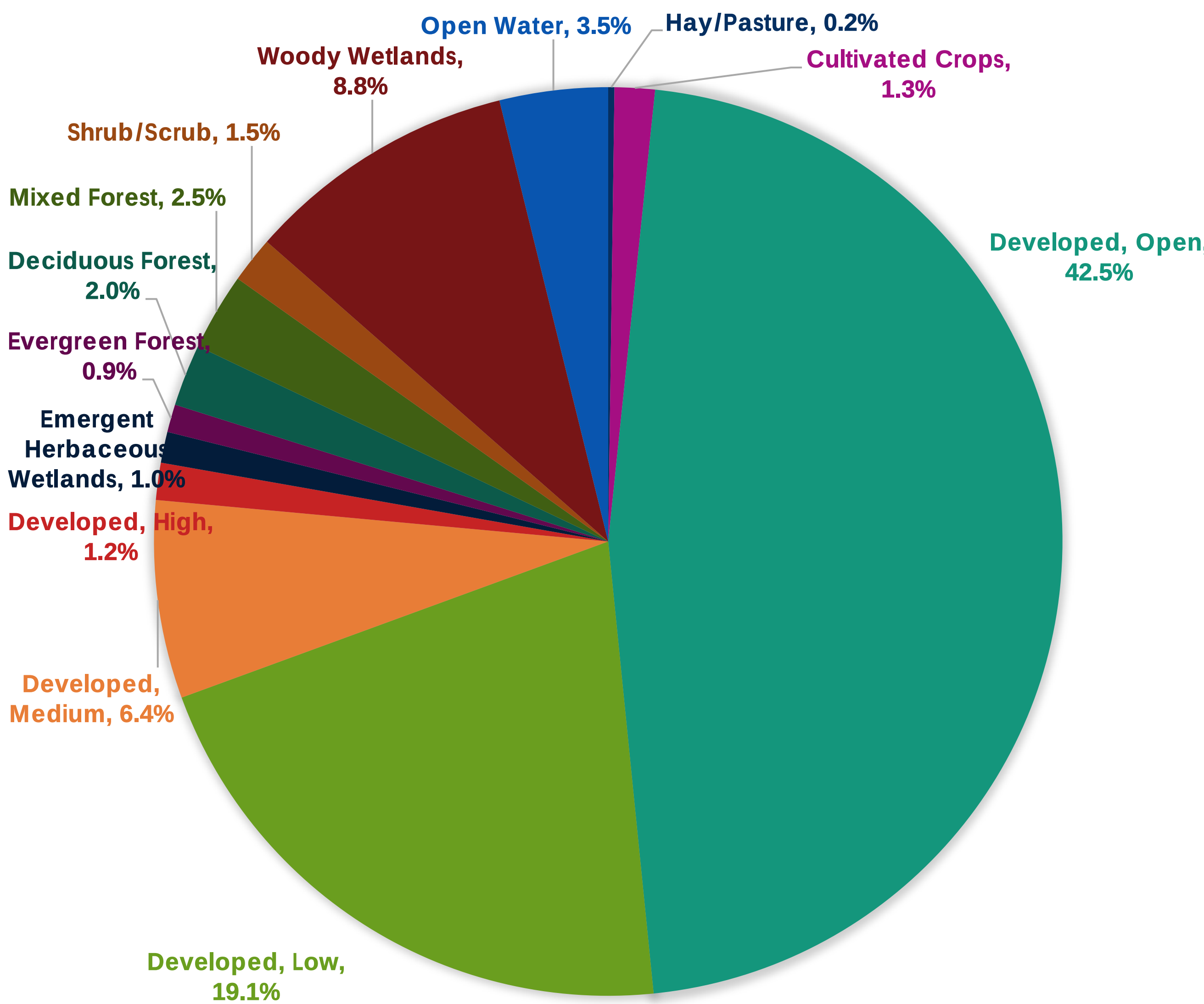
POWER AND COMMUNICATIONS INFRASTRUCTURE

Eastern Shore Communications has a contract with the Town to have a receiver on the Water Tower for broadband. AT&T antennae for wireless service and the broadband transmission is also on the water tower. Landline telephone service is primarily provided by Verizon and Charter Communication, the latter of which is housed in the Town). The water tower, therefore, is vital in providing communications during and following emergency situations. Onancock is served by multiple power substations, and so is less likely to have widespread power loss during a hazardous event.

NATURAL ENVIRONMENT

LAND USE LAND COVER

Almost 70% of Onancock is developed (see Figure 2), however this includes green space, such as parks and large grass yards. This trend can easily be seen in the satellite imagery for the Town, presented in Figure 1, where the majority of the Town is residential. The percentage of wetland area is somewhat low relative to the waterfront property, approximately 3.3 miles, and many of the homes on waterfront properties are less than 80 feet from the water's edge. Because wetlands act as sponges during flooding events, typically areas with more extensive wetland fair better during these events. That said, the elevation of much of Onancock is over 20 feet, thus the Town is less sensitive to flooding, except the westernmost areas of the Town. Onancock has an official Tree Board, and thus improves their green space and long-term green-scape planning.



Source: USGS. National Land Cover Dataset. 2011

Figure 2 : Onancock Land Use Land Cover

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Onancock has participated in the hazard mitigation planning process since 2006. The Town's primary risk is associated with coastal flooding.

Table 6 : Onancock Hazard Mitigation Resources

	Ordinances, Plans															Resources, Committees			
Agency	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Zoning Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional								*	*	*	*	*		*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town joined the NFIP on December 15, 1981. Between April 2011 and January 2016, according to the respective NFIP insurance reports, the Town had two flood insurance claims totaling $13,954.00, which is just less than their premium of $14,483.00. To date, the Town hasn't participated in the Community Ranking System (CRS). Unlike many of the coastal Towns on the Eastern Shore, the amount of land in the SFHA remained the same with the new 2015 FIRM. Although the area in the SFHA remained 0.1 square miles, the delineation shifted slightly, removing two buildings from the zone and adding three buildings, for a net increase of only one building in the SFHA.

Table 7 : Summary of Onancock's past NFIP participation

	HMP 2006	HMP 2011	HMP 2016
NFIP (date joined)	December 15, 1981	December 15, 1981	December 15, 1981
Number of Policies	-	30 policies	23 policies: 4 A-zone, and 19 other
Total Premium Amount	-	$15,897	$14,483
Total Coverage Amount	-	$8,660,200	$6,899,700
Number of Claims (since 1978)	0	0	2
Total Paid (since 1978)	-	-	$13,954
HMGP	NA	NA	NA
CRS Score (1 highest, 10 lowest)	10	10	10

Source: FEMA NFIP Insurance Report April 2011, January 2016

HMGP

The Town has never participated in the Hazard Mitigation Grant Program.

HAZARD PROFILE

WIND

The Town is not located in the wind borne debris hazard area. However, most of the residential areas have mature trees. High winds could damage trees within the Town and this might lead to some damage to houses and outbuildings. The Town constructed a water tower in 2008 on the east side of town that was built to withstand high wind events. Major Town facilities, including the wastewater treatment plant and water supply tower, are equipped with back-up power supplies in the event of a power outage.

Figure 4 reveals the estimated dollar value of damages for each Onancock census block that would result from wind damages from a hurricane that has a 1% chance of occurring each year. The total damages for the entire

Town, is estimated to be just over $3 million. About half of this total is from building damages, over 15% from content losses, and over 20% from rental and relocation costs. The total also incorporates losses from income, wages, and inventory.

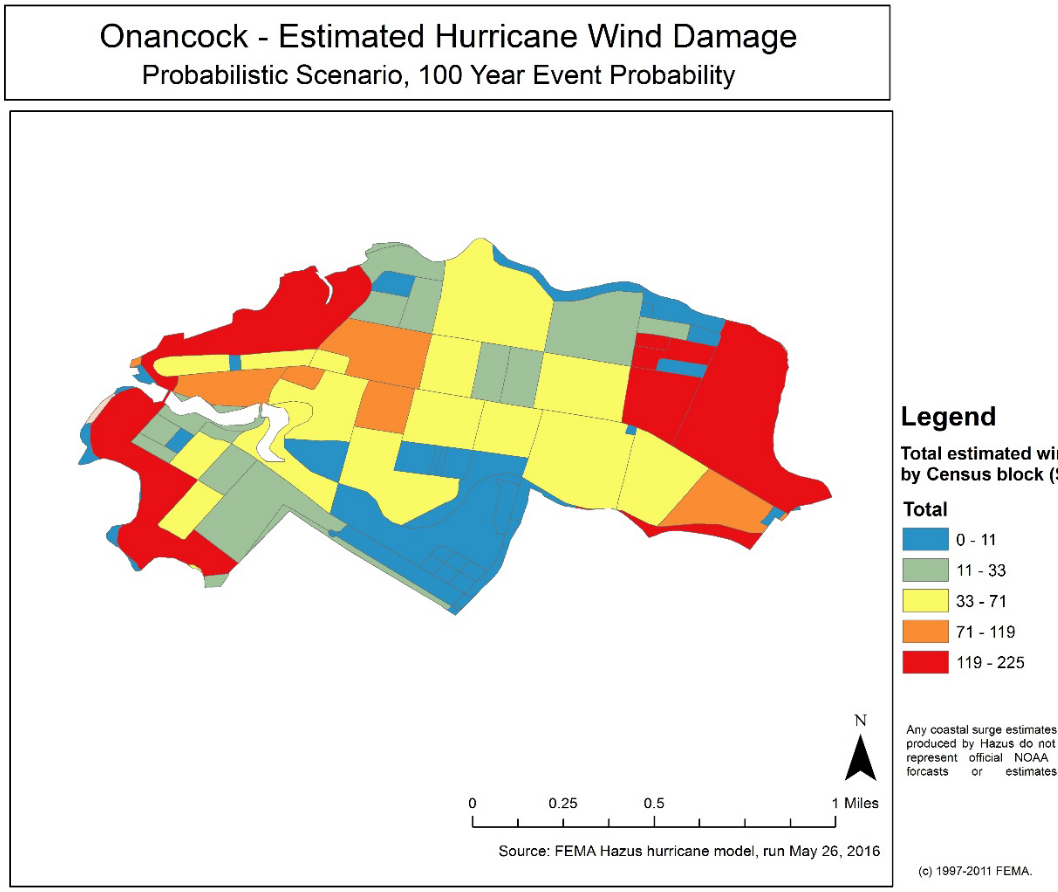


Figure 3 : Onancock Hazus® Estimated Wind Damages

COASTAL EROSION

Although there is some erosion risk around Onancock, no structures located in the Town appear to be vulnerable to coastal erosion at this time. The initial dredging of the Onancock Creek in the 1800's allowed the Town to develop and prosper. Regular dredging and maintenance of the Onancock Creek channel to prevent shoaling and ensure navigability is vital for the economics of the Town.

COASTAL FLOODING

The Flood Insurance Study (FIS) for Onancock, completed in 1981, identifies that the greatest threat of flood inundation comes from hurricanes and northeasters. Development within the floodplain is minimal (Onancock FIS). The Town is located inland from the Chesapeake Bay. Onancock Creek, North Branch and Titlow Creek border the Town on three sides. In addition, Joynes Branch bisects the Town creating a northern and southern section.

According to the 2014 FEMA Flood Risk Report, the Town of Onancock still does not have any identified V zones. The Town, however, does have A zones located near the Town Wharf and along the three branches of Onancock Creek. Approximately 12 properties are located in the flood zone, nine of which are estimated by Hazus® to incur damages to structures during a 100-year storm event. During such an event it is expected that the buildings would receive about $192,000 in building damages, just over the expected damages in 2011. There would also be about $213,000 in content loss, and $150,000 in losses from business interruption, for a total of just over $555,000 in total losses. There are only four NFIP policies in the A-Zone, indicating that 7 properties and 5 structures that are in the flood zone are uninsured (FEMA NFIP Insurance Report, January 2016). The Hazus® model also estimate that there will be a total of 1,051 tons or 42 truckloads of debris generated during a 100-year storm.

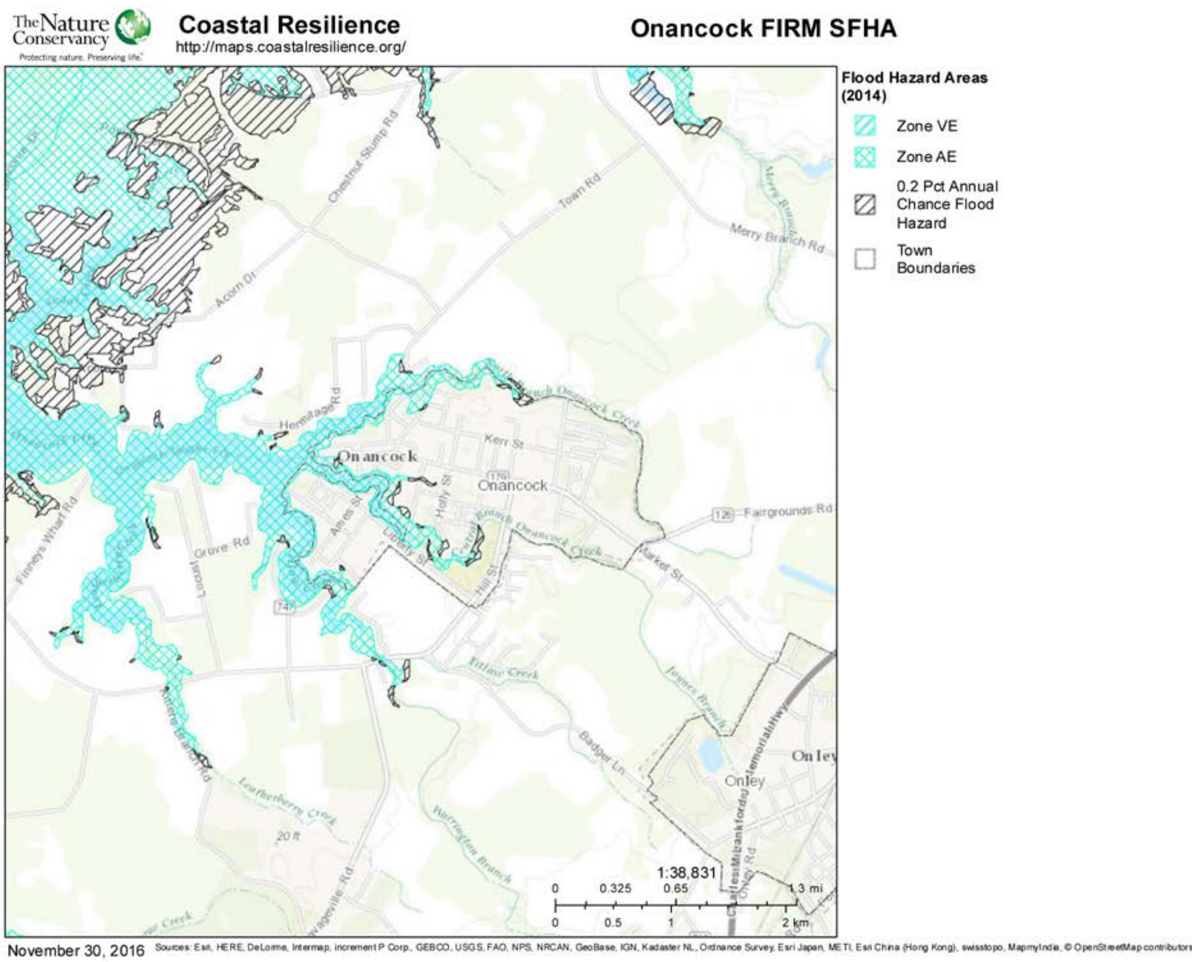


Figure 4: Onancock Special Flood Hazard Areas Identified, as presented in the TNC Coastal Resilience mapping tool

The Town also has three facilities that are affected by flooding, the wastewater treatment plant, Onancock Wharf, and the Harbormaster's House. The wastewater treatment plant could contaminate Onancock Creek and North Branch and to a lesser extent the Chesapeake Bay if it failed during a flood event. Recent improvements to the plant have lessened threats from coastal and stormwater flooding and in turn have reduced the threat of contamination to the creek. The Town now has 4,000 gallon storage and dispensing tank at the Wharf. The new Onancock Wharf Harbormaster's House, completed in 2014, was built several feet higher than the previous building and thus is more resilient to flooding damages (Mayor Jones & Lisa Fiege, personal communications, June

2, 2016). Figure 3 below reveals a more and more common flooding situation at the wharf in Onancock (Mayor Jones, personal communications, June 2, 2016). Recent repairs were made to the wharf parking lot and drain approaches, but flooding during storm events remains a problem.

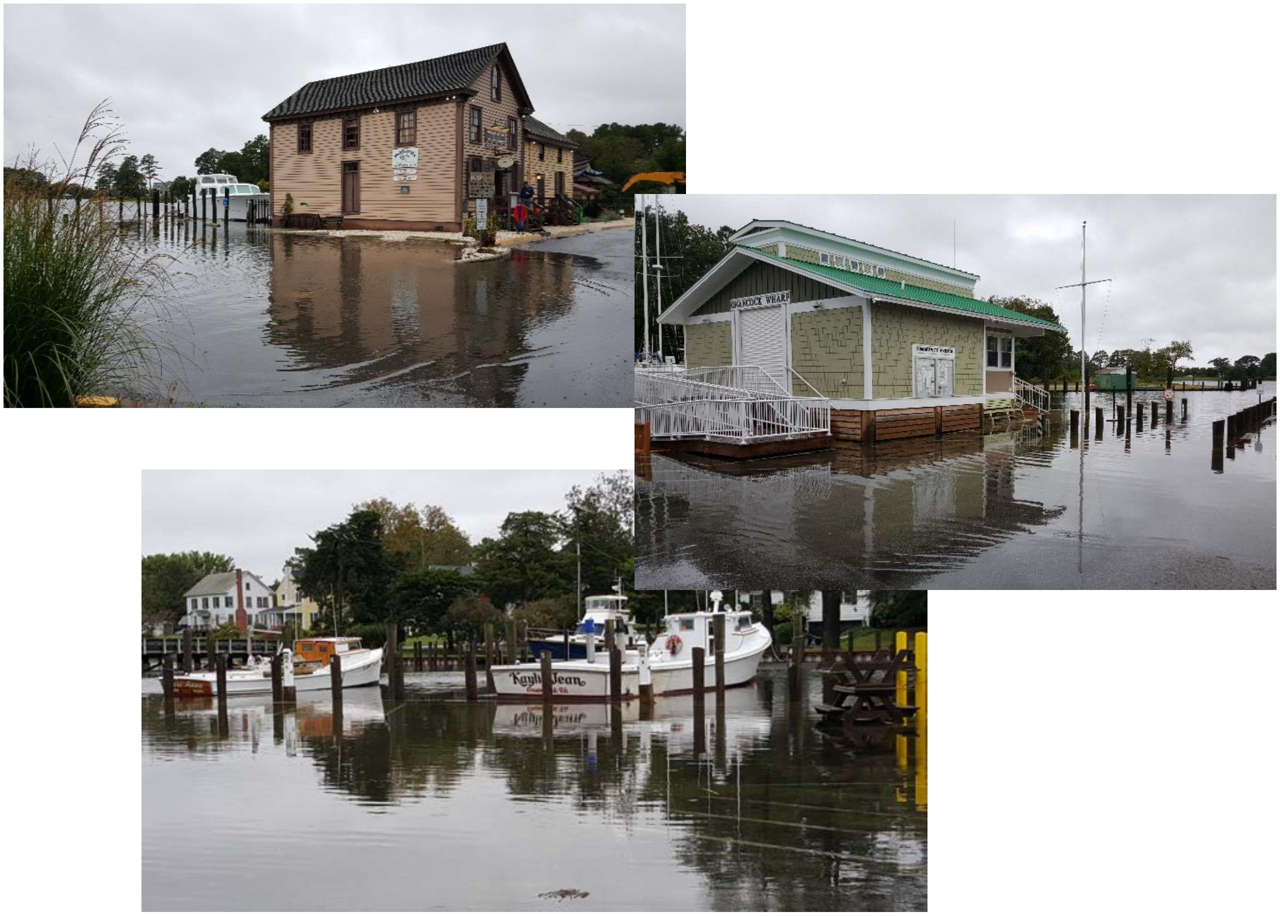


Figure 5: Clockwise from top: The historic Hopkins Store, the new Harbormaster's House, and the parking lot, all of the Onancock Wharf during the October 2015 North American storm complex, largely influenced by Hurricane Joaquin. Photo by Connie Morrison

STORM WATER FLOODING

An additional 19 structures carry flood insurance, but are not located in a flood zone (FEMA NFIP Insurance Report, January 2016). This may indicate potential storm water flooding issues within the Town. The total number of NFIP policies rose from 10 in 2003 to 30 in 2011, but fell to 23 in 2016 (FEMA NFIP Insurance Report, July 2003, May 2011, January 2016).

The soil in Onancock drains well compared to many areas on the Eastern Shore and due to its coastal location, there is a change in elevation (reaching sea level approaching the surrounding creeks). Despite this, the Town still experiences some stormwater flooding problems, including the Police Office. Of particular concern is Lilliston Ave, (west of Lee St), which is partly paved right off of Market. VDOT is responsible for the maintenance of the ditches adjacent to state owned roads, however there are several roads that are owned by the Town, and for which the Town is responsible for maintenance.

Onancock subcontracts to have a twice weekly April through October Town-wide spray for reducing the number of mosquitos and the associated diseases.

HAZARDS OF LOCAL SIGNIFICANCE

Due to the existence of the new fuel tanks at the wharf, there is a potential for a Hazmat incident to cause damage to Onancock Creek, North Branch and the existing homes on King Street and commercial buildings on Market Street and Onancock Wharf. There are also houses located on the creek outside of the Town's boundaries that could be damaged by an incident.

Onancock's location on the Onancock Creek and its direct connection to the Chesapeake Bay cause the Town to be vulnerable to two types of saltwater intrusion. Wells further inland could lead to vertical movement of brackish water found below the lens of potable water. Because all of the Town residents rely on the municipal water system, which is supplied by groundwater wells, this is of high concern. Further south on the Bayside, the Town of Cape Charles has already experience salt water intrusion.

Hindrances to navigation or a lack of channel maintenance would negatively impact the Town economically.

CRITICAL FACILITIES

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

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-owned Facility								
Town Office	X	X	X	Wind Fire	Town Residents	Inconvenience	No	Yes
Police Office			X	Wind Stormwater Fire	Town Residents	Major Disruption	No	Yes
Town Wharf, related properties and fuel tanks	-	-	X	Wind Ice Flooding Fire	2,000 +	Inconvenience	No	Yes
Waste Water Treatment Plant	X	X	X	Flooding Wind	Entire Town and properties on Onancock Creek	Devastating	No	No
Water Supply Tower	X	X	X	Wind Stormwater	1,500	Major Disruption	No	No
South Street Pump Station	X	X	X	Flooding Stormwater	Town Residents	Disruption	No	Yes
Other Critical Facilities								
National Guard Armory	X	X	X	Wind Fire			No	

Fire Station	X	X	X	Wind Stormwater	2,000 +	Major Disruption	No	Yes
Telephone Company Exchange Building	X	X	X	Wind Stormwater Fire	Entire Eastern Shore	Major Disruption	No	
Corner Mart & Royal Farms (gas stations)			X	Wind Stormwater Fire				
Bagwell Oil	X	X	Facility Removed	NA	NA	NA	NA	NA

SUMMARY STATEMENTS

1. The greatest threat to the Town is the secondary effects of flooding. A 1%-annual-chance flood event would directly impact 9 structures within the Town and cause an estimated $555,806 in damages.

2. Most of the residential areas are older construction with mature trees. During a storm wind or snow/ice event, branches and tress may come down causing secondary wind damage and power outages.

3. A 1%-annual-chance wind event is estimated to affect 65 buildings and cause about $3 M in damages.

4. The Town constructed a new water and wastewater facility with increased capacity and backup power supply.

5. There are several higher occupancy housing areas in the Town that may not have access to personal vehicles and may require additional efforts in outreach for education about preparation for hazard events and for assistance during and following an event.

TOWN OF ONLEY

TOWN PROFILE

Onley is located near the central spine of the Eastern Shore in south central Accomack County and encompasses approximately 486 acres. The Town was originally known as Cross Roads until its name was changed to Onley after the name of Virginia Governor Henry Wise's home on Onancock Creek in the latter part of the 19th century. The Town, like a number of other Eastern Shore towns, developed around a railroad station built following the construction of the railroad in 1884. The railroad spurred a thriving downtown which included the headquarters of the Eastern Shore Produce Exchange. The Produce Exchange was the first cooperative marketing organization and proved to be a vital component of the flourishing potato market on the Shore. The Town was incorporated in 1950 and experienced a series of fires in the early 1970s that destroyed much of its business district. At that time the Town's commercial activity began to relocate westward to Route 13. Today, the western portion of Onley along Route 13 is the site of the largest concentration of commercial activity in Accomack County and the remainder of the Town remains largely residential. (Onley Comprehensive Town Plan, 2010).

Figure 1: Onley Aerial Imagery

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 that 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. The following sections are intended to provide insight in the make-up and characteristics of the community and how it relates to hazard vulnerability.

DEMOGRAPHICS

The Town's population grew from 415 in 1960 to an estimated 530 in 2015 (U.S. Census, 1960; John Pavlik, Zoning Administrator, personal communication, February 18, 2016). The median age for residents in 2014 was 50.0, signifying an older population than the national average (American Community Survey, 2014). Often older populations are considered vulnerable populations with respect to hazardous or emergency situations in the area.

Although the 2010 U.S. Census median household income seems very high, one justification could be that there was a large portion of the population nearing retirement and at their highest of their pay range.

Table 1: Onley Demographic Information

	2014***	2013**	2010*	2000****
Population	502	598	516	496
Median Age	50.0	45.3	48.6	46.3
Disability	31	33	NA	NA
Income				
Median Household Income	59,643	80,813	74,417	36,750
Poverty Level	13.3%	10.9%	NA	NA
Language				
Only English	87.8%	89.8%	97.0%	91.3%
Other	12.2%	10.2%	3.0%	8.7%
Spanish	8.0%	9.6%	3.0%	3.8%
Indo-European	4.2%	0.5%	0.0%	1.1%
Asian	0.0%	0.0%	0.0%	3.8%

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORKFORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The majority of the workforce in Onley works in education, health, and social services. There are also substantial portions of the population that work in wholesale trade and construction. While wholesale could indicate seafood distributors, who would probably not be quick to rebound following a large storm event, however, those employed in construction would most likely have many opportunities for contracts. The Eastern Shore regional hospital is relocating just west of the Town limits and it’s expected that commercial growth associated with the hospital will increase along the Route 13 corridor in Onley.

Table 2: Onley Local Workforce Industry

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	3	1.1%	0	0.0%	10	3.0%	9	3.9%
Construction	27	9.5%	38	10.7%	16	4.8%	15	6.5%
Manufacturing	23	8.1%	17	4.8%	0	0.0%	28	12.1%
Wholesale trade	30	10.6%	54	15.3%	49	14.8%	3	1.3%
Retail trade	14	4.9%	35	9.9%	45	13.6%	11	4.7%
Transportation and warehousing, and utilities	7	2.5%	8	2.3%	0	0.0%	5	2.2%
Information	0	0.0%	38	10.7%	39	11.8%	9	3.9%
Finance, insurance, real estate, and rentals	3	1.1%	20	5.6%	24	7.3%	19	8.2%
Professional, scientific, waste management	13	4.6%	9	2.5%	17	5.1%	11	4.7%
Educational, health care, social services	123	43.3%	98	27.7%	91	27.5%	59	25.4%
Arts, entertainment, recreation, food	12	4.2%	9	2.5%	0	0.0%	37	15.9%
Public Administration	17	6.0%	16	4.5%	23	6.9%	15	6.5%
Other	12	4.2%	12	3.4%	17	5.1%	11	4.7%
TOTAL CIVILIAN EMPLOYED POPULATION	284	-	354	-	331	-	232	-

Source: *ACS, 2010 – 2014, ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Onley is one of the larger commercial centers of the Virginia Eastern Shore. Because of its location on Route 13, this area is the County's hub of commercial activity. Businesses located adjacent to Route 13 include a variety of retail stores and services, restaurants, a grocery store, three banks, two motels, and professional offices. A Wal-Mart is built on land adjacent to Onley's southern border. The Town is already showing an increase in the number of businesses (Table 3), and with the new hospital set to open in the beginning of 2017, we can expect further increases in the number of support businesses, such as hotels and restaurants.

Table 3: Onley Business Types

Industry Code Description	Total Establishments		
	2013*	2011*	2009*
Construction	6	6	7
Manufacturing	1	1	1
Wholesale Trade	1	3	2
Retail Trade	27	28	30
Information	1	2	2
Finance and Insurance	6	7	8
Real Estate and Rental and Leasing	3	3	4
Professional, Scientific, and Technical Services	3	3	4
Management of companies and enterprises	0	0	1
Administrative and Support and Waste Management and Remediation Services	2	2	2
Educational Services	1	0	0
Health Care and Social Assistance	10	9	9
Arts, Entertainment, and Recreation	1	3	4
Accommodation and Food Services	14	12	14
Other Services (Except Public Admin)	12	14	16
Total, All Establishments	88	93	104
Total Employees	1,273	1,230	1,138

Source: *Census Zip Code Business Patterns, 2013, 2011, 2009

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk. Vehicles available to households is one indicator of a household's ability to evacuate when necessary.

Between 2000 and 2010, there were a significant number of housing units constructed, with the majority of them being single-family residential (U.S. Census, 2000, 2010). Although Town representatives indicated that the number of vacant housing units indicated in Table 4 was too high for each year, they confirm that there seems to me an increase in the number of homes that are occupied by renters as opposed to owners (John Pavlik, Zoning Administrator, personal communication, February 18, 2016). Several of the houses scattered throughout the Town are in various states of disrepair and are in need of rehabilitation (*Town of Onley Comprehensive Plan,* 2010).

Table 4: Onley Housing

	2014*	2010**	2000***
Total Housing Units	403	377	271
Occupied	313	321	223
Vacant	90	56	48
Owner-Occupied	198	229	166
Renter-Occupied	115	92	57
Median Housing Value	166,700	NA	NA

Source: * American Community Survey, 2009 – 2013, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

U.S. Route 13 provides north-south access, and State Rotes 179 and 789 providing east-west, making automobile traffic very convenient for Town residents. Streets in Town are maintained by VDOT and are generally in good condition. Public transportation is available through STAR Transit, with bus routes along Route 13. STAR Transit offers weekday bus service from Cape Charles to Chincoteague with stops at all major communities, shopping centers, health care facilities, and government offices.

The Bay Coast Railroad runs through the eastern portion of Town, serving as freight carrier connecting Hampton Roads with the Delmarva Peninsula. As part of its daily operations, however, the Railroad does not make a stop in Town. The Railroad right-of-way is maintained by Town Public Works. An old freight station is located on the right-of-way, which is currently leased by the Town of Onley until the year 2034. The station is undergoing renovation by a civic organization, the Society of Preservation of the Onley Train Station.

Sidewalks in Onley are maintained by VDOT, and many of the sidewalks are in various states of disrepair. Approximately 25% of the streets in Town are serviced by sidewalks (*Town of Onley Comprehensive Plan*, 2010).

Table 5: Vehicle Availability (per residence)

Vehicles Available	**2014***	**2010***	**2000****
None	34	4	21
One	67	53	79
Two	116	70	72
Three or more	96	70	47

Source: * American Community Survey, 2009 – 2014, ** U.S. Census 2010

Looking at Table 4 and 5, it can be determined that of the 313 occupied housing units, 34 of them have no vehicle. In the case of an evacuation or an emergency situation which required immediate relocation, this portion of the Town's population is extremely vulnerable and would be in need of additional attention.

COMMERCIAL AREAS

The majority of the commercial land is located along Route 13. There are various shopping plazas along the main corridor of the highway, including the Four Corners Plaza and opposite shopping areas. There is also a small concentration of businesses along Main Street, the Town's original business district (*Town of Onley Comprehensive Plan*, 2010). Just outside of the Town limits are additional concentrated business areas such as Chesapeake Square and a Wal-Mart, which is actually built partially in the Town limits and partially in the unincorporated area of Accomack.

COMMUNITY FACILITIES

Community facilities include the services and functions provided by the Town government, in coordination with other public and private agencies. Such facilities are essential to support the Town and its development to enhance the overall quality of life for its residents. Community facilities include necessities such as public safety services, solid waste collection, mosquito control, and street lighting (*Town of Onley Comprehensive Plan*, 2010).

PUBLIC SAFETY

Police protection is provided by five sworn officers employed by the Town, with back up service provided by the Onancock Police Department, Accomack County Sheriff's Department, and the Virginia State Police. Fire protection and ambulance service are provided by the Onley volunteer Fire and Rescue Company, which is equipped with two ambulances, two pumpers, brush truck, and rescue squad. Accomack County Public Safety Department staffs the Onley Fire and Rescue Company with Fire-Medics on a 24 hours basis seven days a week (*Town of Onley Comprehensive Plan*, 2010).

Figure 2: Onley Volunteer Fire and Rescue Department. Photo by Ann Devletian, 2003-04

TOWN OFFICE

Onley's Town Office, built in the late 1970s, houses the Town's administration services and Police Department. The Town employs a Town Treasurer, a part time clerk, and a part time Zoning Administrator, to carry out administrative, zoning, and financial functions of the Town.

The Town has purchased land adjacent to the existing Town Hall to construct a new Town Office. Once constructed, the Police Department will be the sole occupant in the existing building. The Town is interested in constructing the new facility to more stringent building codes that would lessen the risk of flooding and wind damage.

Figure 3: Onley Town Office & Police Department. Photo by Ann Devletian, 2003-04

PARKS AND RECREATION

There are no Town owned park facilities in the Town, but the Town does own the land where the train station once stood.

SOLID WASTE

The Town of Onley provides weekly residential trash collection services, contracted out to Davis Disposal. Private contractors are responsible for emptying large dumpsters within the Town that are used primarily by commercial establishments (Town of Onley Comprehensive Plan, 2010).

WATER SUPPLY AND WASTEWATER

Residents and businesses in Onley rely on individual private wells for their water supply. All residents use private on-site septic systems for sewage and wastewater disposal, and the majority of businesses treat wastewater and sewage through mass drain-fields. Several businesses on Route 13 utilize a sewage trunk line which is connected to a wastewater treatment facility in Onancock (*Town of Onley Comprehensive Plan,* 2010). The Wal-Mart, only partially within Town limits, has its own sewage disposal system.

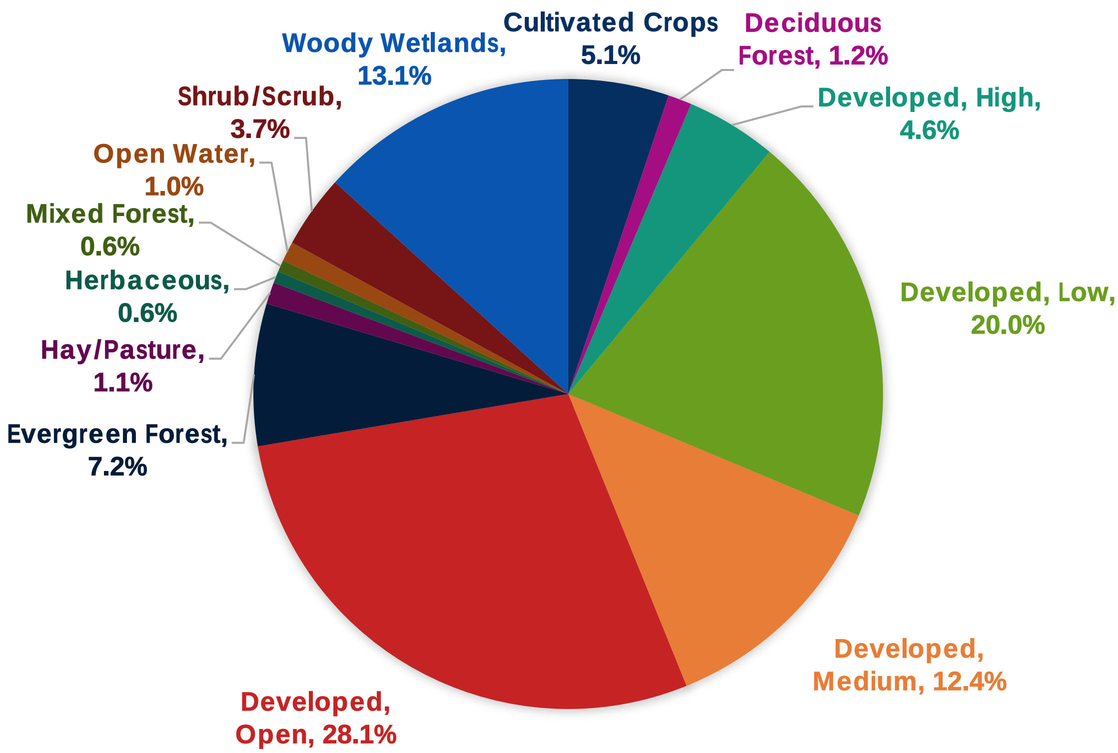
DRAINAGE DITCHES

The Town subcontracts trash removal services for the ditches in order to help prevent stormwater flooding. It is the responsibility of VDOT to provide further maintenance of state roadways.

NATURAL ENVIRONMENT

Elevations in Onley range from approximately 35 to 45 feet above mean sea level. Surface water in the Town is limited to the end segment of Joynes Branch, a small tributary stream of Onancock Creek and the Chesapeake Bay which extends approximately 700 feet into the Town forming a short segment of the Town's northeastern boundary (*Onley Comprehensive Town Plan*, 2000). Soils in Onley are a major limiting factor to development due to their ability to support on-site septic systems.

LAND USE LAND COVER



Source: USGS, National Land Cover Dataset, 2011

Figure 4: Onley Land Use Land Cover Percentages

The total land use of the Town is 486 acres. Figure 4 reveals that of this, 65.1% is developed. The majority of the residentially-zoned developed land is single-family housing. Commercial land use accounts for 20% of the total acreage in Onley, most of which is concentrated around Route 13 (*Onley Comprehensive Town Plan*, 2010). There is 34.9% of land that is undeveloped in Onley, some of this is composed of wetlands that are important to filter storm water runoff (*Onley Comprehensive Town Plan*, 2010).

GROUNDWATER

Residents of Onley obtain their drinking water through individual private groundwater wells. There are 83 acres of Onley contained within the recharge spine. This recharge spine is important to maintain good quality of ground water for Eastern Shore residents. Onley is located in Wellhead Protection Area C – Perdue Area. Major water withdrawals from this area are the Perdue Poultry Processing Plant, Pacific Tomato Growers packing facilities, Helena Chemical in Tasley, the towns of Onancock and Parksley, Riverside Shore Rehabilitation Center, Nandua High School, and Nandua Middle School. This Wellhead Protection Area is the largest on the Shore.

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PLANNING

Onley has participated in the hazard mitigation planning process since 2011, before then the Town defaulted to the County plan. The Town's primary risk is associated with storm water flooding.

Table 6: Town of Onley Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local		*			*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town does not participate in the NFIP, and has not expressed interest in participating.

HMGP

Onley has not participated in the HMGP.

HAZARD PROFILE

Storm water flooding poses the greatest risk to the Town and has the most frequent impact.

WIND

No parts of Town lie in the wind-borne debris hazard area. This area extends 1-mile inland from the coast. The Town lies in the 110-120 mph design wind zone (Accomack County Building Code).

Most of the residential areas are older and have mature trees in and around the homes. During a high wind event falling branches or trees may damage some structures and cause power outages as much of the Town is served by aboveground power lines. Historically, hurricanes and northeasters have caused damages in Town.

COASTAL EROSION

No structures are at immediate risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area or within the X zone, which is the 500-year floodplain. The threat of coastal flooding within the Town is considered to be minimal.

STORM WATER FLOODING

Storm water flooding poses the greatest risk to the Town and has the most frequent impact. Approximately 40% of the Town contains hydric soils that are unsuitable for drainage and readily retain rainwater. The Onley Town Comprehensive Plan indicates that the Town's hydric soils are located primarily on the eastern side of Route 13 with minimal areas on the western side of Town. The depth to ground water in these areas is typically less than three feet. The hydric soils within Onley are a major limiting factor for development as there are severe limitations with respect to their capacity to support on-site septic systems. All residents in Onley utilize on-site septic systems for residential waste disposal. Flood septic drain fields can pose a health risk to residents during and following a storm event. A secondary hazard from standing water associated with poorly drained hydric soils is the potential for mosquito-borne diseases that could impact the health of residents. The Town does implement a mosquito-control program to mitigate this problem.

The Town relies on the Virginia Department of Transportation to perform maintenance on the main drainage ditches within the Town limits.

Beginning with the November Northeaster of 2009, the Town experienced prolonged and extensive storm water flooding throughout the winter of 2009-2010. Transportation in the Town was restricted by flood waters throughout the winter. Historically, flood waters have had prolonged retention times due to poorly drained soils and inadequately maintained and designed drainage ditches in Town. The Town wishes to remediate storm water flooding hazards by cooperating with VDOT and implementing mitigation strategies.

Areas which experience the most significant flooding are:

- Drainage from the Wal-Mart property to adjacent areas in Town
- Drainage adjacent to Rat Trap Creek on the southern and eastern portions of Town
- Along Forest Street
- Along Badger Lane
- Main Street near the eastern boundary of Town
- Residential area between Coastal Boulevard, Main Street, and Route 13

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

The Town faces a threat of ground water contamination from several sources including failed septic systems within Town, leaks and spills of petroleum based products from underground storage tanks, and major industrial facilities within the area. In Onley, all residential treatment of wastewater and sewage is done through on-site septic systems with approximately 253 on-site septic systems within Town limits. The majority of commercial sewage and wastewater is treated at four mass drainfields that exist in or adjacent to the Town (Onley Comprehensive Town Plan, 2010). The Town has no public water supply and residents and commercial users are solely reliant on private wells. Large withdrawals of ground water in the vicinity increase the possibility of well interference, salt water intrusion, and a deterioration of water quality (Onley Comprehensive Town Plan, 2010).

In April of 2016 the petroleum storage tanks for the Valero gas station were removed. New tanks were installed west of Route 13 with the new Royal Farms gas station and shop. The Wine Rack Exxon station recently replaced their tanks (John Pavlik, Zoning Administrator, personal communication, February 18, 2016). Aged tanks can pose a threat to the groundwater supply.

SNOW AND ICE

A large ice storm impacted the Town in the late 1990s. The ice storm downed tree limbs and power lines and also forced local businesses to close for several days. Residents also had no electricity for several days.

FIRE AND SMOKE

In the 1970's here was a re on Main Street that destroyed a majority of those buildings. They were rebuilt with a lower profile.

CRITICAL FACILITIES

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

Table 7: Onley Critical Facilities

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential

Town-Owned Facilities								
Old Town Office/Police Department	-	X	X	Flooding Stormwater Wind Fire	516	Major Disruption	Yes	Yes
Only Volunteer Fire & Rescue Department	-	X	X	Stormwater Flooding Wind	516+	Major Disruption	No	Yes
Other Facilities								
Post Office	-	-	X	Flooding Stormwater Wind Fire	516+	Inconvenience	Yes	Yes
Riverside Hospital (just outside of Town limits)	-	-	X	Flooding Stormwater Wind Fire	10,000+	Devastating	No	Yes
Gas Stations	-	-	X	Flooding Stormwater Wind Fire	516+	Major Disruption	No	Yes

FINDINGS

1. The hazards expected to have the greatest impact on the Town are stormwater flooding and high wind events, which have been experienced throughout the Town's history. Other hazards of local significance include groundwater contamination, ice storms, drought, and mosquito-borne disease.

2. Much of the residential areas have older construction and mature trees around homes and churches. During a wind event, branches and trees may come down causing secondary damages and power outages.

3. The combination of poorly drained soils and inadequate drainage has resulted in some stormwater flooding problems for residents and businesses. The Town is interested in mitigating these problems through drainage assessments, design, and construction projects.

TOWN OF PARSKLEY

TOWN PROFILE

Parksley is located in central Accomack County, and it was originally a planned development that was founded in 1885 along the railroad. It became incorporated in 1904 and in 1906 became the first town on the Eastern Shore to have electricity. Parksley was Virginia's only Civil Air Patrol base during World War II and operated from April 16, 1942 to August 31, 1943. The railroad defined the town's growth and prosperity. Even today it remains a prominent feature of activity (*Town of Parksley Comprehensive Plan*, 2006).

Figure 1: Parksley Context and Boundary Maps

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 that 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

Parksley's population has remained relatively stable between 1960 and 2014 with the population reaching a high of 1,072 in 2013 and a low of 837 in 2000 (U.S. Census, 2000; U.S. Census, 2010; American Community Survey 2009 – 2013). The 2014 American Community Survey 2010 – 2014 prediction has the population at 941. As reflected in Table 1 below, the median age for residents in Parksley in 2014 was 32.9 years, signifying a younger population. This demographic shift could be as a reflection of an increase in young migrant families with multiple children taking up residence in the Town. Typically younger adult residents are less of a high risk population in times of hazards, however families with young children can also need assistance in the case of an emergency situation.

Table 1: Parksley Demographic Information

	2014***	2013**	2010*	2000****
Population	941	1,072	842	837
Median Age	32.9	31.6	40.1	40.6
Disability	81	68		
Income				
Median Household Income	$50,000	$42,917	$43,625	$35,313
Poverty Level	11.4%	16.2%	14.1%	NA
Language				
Only English	83.7%	82.6%	83.7%	NA
Other	16.3%	17.4%	16.3%	NA
Spanish	11.4%	14.5%	10.1%	NA
Indo-Euro	4.9%	2.9%	2.0%	NA
Asian	0.0%	0.0%	4.2%	NA

* U.S. Census 2010, ** American Community Survey 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

The household income reflected by the American Community Survey data in Table 1 is estimated to be a significantly higher than the true value (Mayor J. Eichelberger, personal communication, January 14, 2016). This overestimate masks the ability of the Town to rebound in the event of disaster.

WORKFORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Table 2: Parksley Local Workforce

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent

Agriculture, forestry, fishing/hunting, or mining	31	6.6%	31	6.1%	44	8.1%	7	1.7%
Construction	34	7.2%	38	7.5%	36	6.6%	36	8.9%
Manufacturing	70	14.9%	70	13.7%	64	11.8%	74	18.3%
Wholesale trade	22	4.7%	27	5.3%	22	4.1%	12	3.0%
Retail trade	61	13.0%	57	11.2%	57	10.5%	63	15.6%
Transportation and warehousing, and utilities	22	4.7%	30	5.9%	7	1.3%	12	3.0%
Information	8	1.7%	7	1.4%	8	1.5%	0	0.0%
Finance, insurance, real estate, and rentals	26	5.5%	4	0.8%	3	0.6%	19	4.7%
Professional, scientific, waste management	8	1.7%	9	1.8%	21	3.9%	27	6.7%
Educational and health care services	87	18.5%	98	19.2%	81	14.9%	76	18.8%
Arts, entertainment, recreation, food	43	9.1%	73	14.3%	82	15.1%	28	6.9%
Public Admin	29	6.2%	29	5.7%	80	14.7%	30	7.4%
Other	29	6.2%	37	7.3%	38	7.0%	21	5.2%
TOTAL CIVILIAN EMPLOYED POPULATION	470	-	510	-	543	-	405	-

Source: *ACS, 2010 – 2014, ** U.S. Census 2000

One of the largest employers of residents of the Town is the manufacturing industry, shown in Table 2, which is most likely dominated by poultry processing positions. These companies often have policies in place to mitigate the economic impact for both the company and the employees, however, long-term closures would have strong negative impacts on the Town. There would be a 'domino effect' from such a closure, as employees of in that industry wouldn't have spending dollars for rent, local shops, nor family necessities, and other dependent agricultural businesses would be at a loss as well.

BUSINESSES

Business data provide basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. They 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.

Table 3 reveals a loss of eleven business establishments in Parksley since 2009. The Town is largely retail due to the historic downtown area supporting many small local shops and restaurants, but in the last several year, has seen businesses such as Fresh Pride, Shay Refrigeration, Shore Bank, Lunch Box, What's Your Fancy either close or move out of the Town. Remaining businesses, such as Jaxon's Hardware, are still open, but employ fewer employees do to economic challenges. There are also some health services and construction businesses located within Parksley. The county library board recently voted to relocate the library's main branch to Parksley in the former Fresh Pride grocery store that would be repurposed and expanded. The library will bring more clients to small businesses and restaurants in the Town, and make the Town more attractive for potential residents.

Table 3: Parksley Business Establishment Types

	Total Establishments		
Industry Code Description	**2013**	**2011**	**2009**
Agricultural, Forestry, Fishing, and Hunting	1	1	1

Construction	5	7	8
Manufacturing	1	1	1
Wholesale Trade	1	1	1
Retail Trade	13	15	14
Transportation and Warehousing	1	1	2
Information	1	1	1
Finance and Leisure	1	1	1
Real Estate and Rental and Leasing	1	2	1
Professional, Scientific, and Technical Services	2	3	5
Administrative and Support and Waste Management Remediation Services	2	3	3
Health Care and Social Assistance	4	4	7
Arts, Entertainment, and Recreation	1	1	0
Accommodation and Food Services	3	3	3
Other Services (Except Public Admin)	8	10	8
Total, All Establishments	45	54	56
Total Employees	295	405	461

Source: Census Zip Code Business Pattern, 2013, 2011, 2009

The number of employees working in Parksley, provided in Table 3 above, give a good indication of the number of people present in the Town during workweek business hours. During an emergency event it is important to know the approximate number and distribution or location of people, so that their presence is known and they may be more efficiently assisted.

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk.

Parksley's housing has remained relatively stable over the last decade. Although the American Community Survey data shown in Table 4 below would indicate with a 16.5% increase in housing development from 2000 to 2014, Census data from 2010 refute that estimate, as do local town representatives according to billing records (Mayor J. Eichelberger, personal communications, January 14, 2016). It is believed that the actual number of vacant housing units is closer to 30 rather than 58 or 108, which is important, as often unoccupied homes pose more of a hazard during hazards due to lack of maintenance or unsecured yard debris.

Table 4: Parksley Housing

	2014*	**2010****	**2000*****
Total Housing Units	485	407	405
Occupied	380	349	363
Vacant	105	58	42
Owner-Occupied	255	240	256
Renter-Occupied	125	109	107

Median Housing Value	$131,900	NA	NA

* American Community Survey, 2010-2014, **U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

Parksley is served by an adequate road system, with State Route 316 providing north-south access for the Town. Route 176 is located east of Parksley and intersects Route 13, the major north-south transportation corridor that bisects the Eastern Shore. The streets are maintained by the Virginia Department of Transportation and are in primarily good condition, although due to resurfacing, some are now believed to be too high. Alleys are maintained and owned by the Town. Sidewalks in the town are owned and maintained by either VDOT or private property owners (Mayor J. Eichelberger, personal communications, January 14, 2016). With the library moving into town, an improvement in the Town's walkability is a high priority.

The railroad runs directly through Town, and although it does not have a stop within Town limits, it poses a potential hazard risk as it transports propane or could serve as an aid in evacuating residents during or following an emergency. The number of vehicles per household, Table 5 below, seems to be approximately the same in 2014 as it was in 2000. The 2010 data presented is thought to be an over estimate (Mayor J. Eichelberger, personal communication, January 14, 2016). The measure of vehicles available to households is one indicator of a household's ability to evacuate when necessary. The number of households with no vehicle is relatively low, and there is a Star Transit stop at the Farmer's Market, easily accessible for Town residents.

Table 5: Parksley Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	17	17	20
One	160	204	168
Two	141	212	114
Three or more	62	58	61

* American Community Survey, 2010 – 2014, ** U.S. Census 2000

COMMERCIAL AREAS

The central business district is located near the center of town along the railroad tracks. It contains a variety of retail stores, services, eating establishments, and professional offices. The business district went under extensive revitalization in 1986 which included improvements on the storefronts, expansion of existing retail areas and services, drainage improvements, extensive landscaping, and the installation of parking lots, sidewalks, a Farmer's Market Pavilion, street lights, benches, and trash receptacles.

On Bennett Street, Goring Company, a machine shop is the only industrial facility in the Town. Just south of Parksley there is an active Industrial Agriculture facility that could affect the Town in the case of hazard at that location and also could have impacts on the economy.

COMMUNITY FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard. Community facilities in Parksley include Parksley Police Department, Fire Department, the Town Office, and a Farmer's Market.

PUBLIC SAFETY

Police protection is provided by the Parksley Police Department, stationed at the Municipal Building on Dunne Avenue. The Town employs three police officers and three police cars. Fire protection and ambulance services for the Town and surrounding area, approximately 7,500 people, are provided by the Parksley Volunteer Fire Department, located on Dunne Avenue and shown in Figure 2. The Fire Department operates three ambulances, two engines, one tanker, one air trailer, one brush truck, one utility vehicle and one rehab vehicle (*Parksley Comprehensive Plan,* 2006). The Fire Department is the designated emergency staging area and the Pavilion is the area for dispensing emergency supplies (e.g. food, medicines, etc.) (*Parksley Comprehensive Plan,* 2006).

Figure 2: Parksley Fire Department

WATER SUPPLY & SEWAGE DISPOSAL

The Town operates a public water supply system with ground water wells. There are two deep production wells operated on a regular basis, with a third well available for emergency backup operations and Fire Department use. Water is chlorinated at the well site and then pumped to a 75,000 gallon elevated storage tank for distribution. There are several wellhead protection measures in place, such as fencing and locked well caps (*Parksley Comprehensive Plan,* 2006).

Figure 3: Parksley Water Tower. Photo by Curt Smith

Parksley's potable water supply is obtained from ground water through a municipal supply system. Parksley is located in Wellhead Protection Area C- Perdue Area. Major water withdrawers in this area are Perdue, the towns of Onancock and Parksley, and Riverside Shore Rehabilitation Center. Additional large withdrawals could have an impact on water quality from salt water intrusion and deterioration of water quality.

SOLID WASTE DISPOSAL

The Town provides solid waste collection services with the Town-owned collect truck on a weekly basis for Parksley residents and twice a week for commercial establishments through use of a Town-owned garbage truck. Solid waste is hauled to the Accomack County Landfill for disposal (*Parksley Comprehensive Plan,* 2006).

PARKS AND RECREATION

The Parksley Town Park is equipped with playground equipment, tennis courts, benches, and an athletic field. The Town also owns the Parksley Scout House, located adjacent to the Town Park. Across the street from the Park is the Parksley Middle School, with an athletic field that provides additional recreational opportunities. Parksley is also home to the Eastern Shore Railway Museum (*Parksley Comprehensive Plan,* 2006).

DRAINAGE DITCHES

Maintenance of drainage ditches and storm drains in Town is the responsibility of VDOT. Stormwater drains are located in the commercial area along Dunne Avenue, Bennett Street, and at the Town Park. Drainage is satisfactory except during periods of heavy rain (*Parksley Town Plan*, 2006).

SCHOOLS

Metompkin Elementary School has grades K-5, and is located just southeast of the Town limit on Bennett Street.

NATURAL ENVIRONMENT

Parksley lies within the Chesapeake Bay watershed. The elevation ranges from 30 to 43 feet above sea level, with slopes from 0 – 6%. The Town itself is relatively flat. Parksley is not located within the 100-year floodplain. The soils are a major limiting factor on development due to their unsuitability for septic tanks.

LAND USE LAND COVER

Parksley has a land area of 0.625 square miles or 400 acres. Approximately 30% (Figure 4) of land in Parksley is developed (see Definitions and Acronyms at the beginning of the document for definitions of land use types), with residential land use being the predominant land use category and this being concentrated in the southeast portion of the Town, as seen in Figure 3. Commercial land uses are clustered throughout the Town. Agricultural land use is comprised of three large tracts of farmland located in the outlying areas of town. A substantial portion of agricultural land contains soil types which would allow on-site septic systems, which offers an opportunity for future development. The vacant land present in Town can be developed with alternative (above ground) septic systems (*Parksley Town Plan*, 2006).

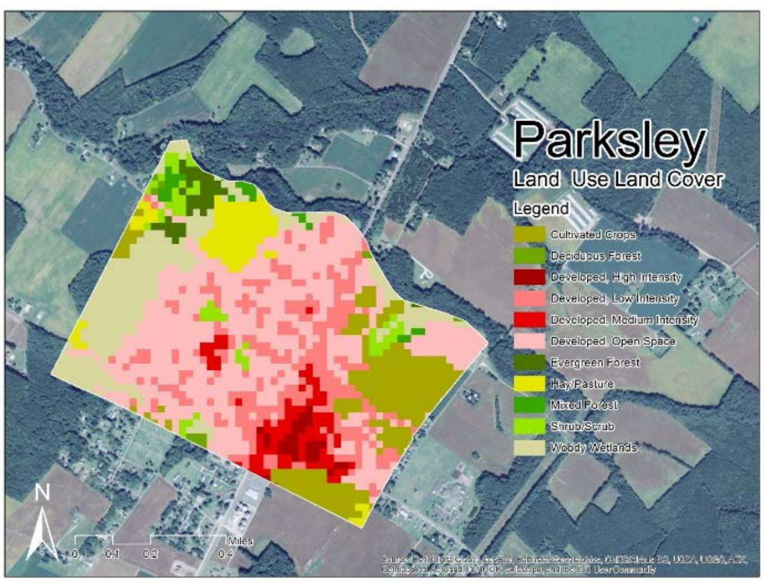


Figure 4: Parksley Land Use Land Cover Map

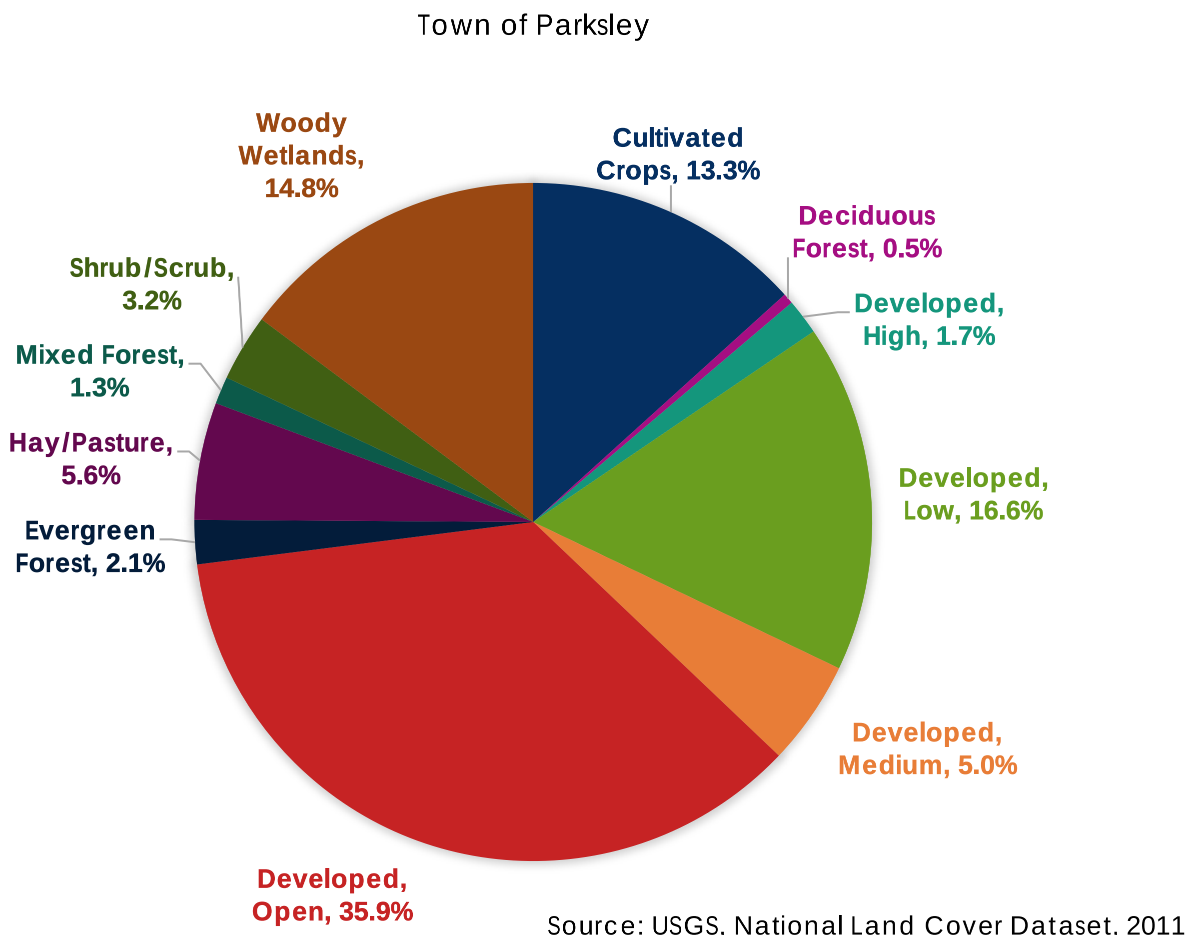


Figure 5: Parksley Land use Land Cover Percentages

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Parksley has participated in the hazard mitigation planning process since 2011. The Town's primary risk is associated with storm water flooding.

Table 6 : Town of Parksley Hazard Mitigation Resources

	Ordinances, Plans, & Publications														Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOODING INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town joined the NFIP on December 22, 2008. The Town has 2 NFIP policies totaling $630,000 in coverage. Neither policies are located in a flood zone, nor have there been any claims filed in the Town (FEMA NFIP Insurance Report, January 2016). This may indicate potential storm water flooding issues within the Town.

HMGP

Parksley has not participated in the HMGP.

HAZARDS PROFILE

Stormwater flooding has the greatest and most frequent impact on the Town.

WIND

No parts of the Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the coast. The Town lies in the 110 – 120 mph design wind zone (Accomack County Building Code).

Most of the residential areas are older and have mature trees in and around the homes. Falling branches or trees may cause damage to structures during a high wind event.

In September 1985, Hurricane Gloria damaged and up-rooted 23 mature trees in Town. Downed trees are hazardous to power lines and can cause extensive power outages. Hurricane Sandy wreaked similar havoc, as seen in Figure 6.

Figure 6: Uprooted tree during Hurricane Sandy. Photo by Denise Bernard

The Parksley Water Tower, Figure 3, is the water source for the Town residents. Wind is the greatest hazard threatening the structure.

COASTAL EROSION

No structures are at immediate risk to coastal erosion.

COASTAL FLOODING

No portions of the Town lie within a Special Flood Hazard Area or within the X zone, which is the 500-year floodplain. The threat of coastal flooding within the Town is considered to be minimal.

STORM WATER FLOODING

Stormwater flooding has the greatest and most frequent impact on the Town. The Town is underlain by some soils that are unsuitable for drainage and rainwater. The *Parksley Comprehensive Plan* indicates that the Town's hydric soils are located along Katy Young Branch to the north and in the western portion of the Town. A secondary hazard from stand water is the potential for mosquito-borne diseases that could impact the health of residents.

The Town maintains the main drainage ditches within the Town limits. Drainage issues are commonly experienced along the boundaries of the Town where the ditches are not maintained as regularly.

A large thunderstorm struck Parksley on September 3, 2003, just prior to Hurricane Isabel. It brought heavy rains that back flooded several homes along Bennett Street on the west side of Town and several stores along Bennett and Dunne streets in the center of Town. It was suspected that clogged ditches and hydric soils in the area were the main factors in the flooding that occurred. Town officials have indicated that the storm water culverts around the Downtown Business District are undersized and have not historically been able to handle heavy rains. Rains from northeasters and hurricanes have historically impacted the Town.

Table 7: Parksley Identified Flooding Locations, Causes, & affected Critical Facilities

	HMP 2006	HMP 2011	HMP 2016
Where is the flooding?	NA	Katy Young Branch to the north and western portion of the Town	Dunn & Adelaide; In front of Jaxon's, Perennial ditch on south side
Cause of Hazard	NA	Significant rain events and inadequately maintained storm water ditches	
Critical Facilities Identified	NA	Downtown Business District	

Figure 7: Parksley Downtown Business District. Photo by Curt Smith

The Downtown Business District, Figure 6, in Parksley is regularly flooded during large rain events because the drainage pipes in this area are undersized. Rainwater commonly becomes backed-up as a result causing flooding in the streets and storefronts.

HAZARDS OF LOCAL SIGNIFICANCE

GROUND WATER CONTAMINATION

The Town faces a threat of ground water contamination from several sources including failed septic systems within the Town, leaks and spills of petroleum based products from underground storage tanks, and major industrial facilities within the area. In Parksley, all residential treatment of wastewater and sewage is done through approximately 341 on-site septic systems within the Town limits. The Town has a central sewer system that was constructed in 2009 that provides wastewater and sewage treatment service to the Downtown Business District. The public water supply and central sewer systems have a secondary power supply in the event of a power outage.

Major ground water withdrawers in the area are Perdue, Byrd Foods, and the Towns of Onancock and Parksley, and Accomack County Nursing Home. Large withdrawals of ground water in the vicinity increase the possibility of well interference, salt water intrusion, and a deterioration of water quality (*Parksley Comprehensive Plan,* 2006).

ICE & SNOW STORMS

A large ice storm impacted the Town in the late 1990s. The ice storm downed tree limbs and power lines and also force local businesses to close for several days. Residents had no electricity for several days.

DROUGHTS

As a result of historic droughts impacting the Town, Parksley has adopted an ordinance regulating water usage during droughts to conserve the Town’s water supply.

TORNADOES

Tornadoes have not historically hit within Town limits, but they have occurred on the outskirts of Town and are a relevant concern.

CRITICAL FACILITIES

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

Table 8: Parksley Critical Facilities

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-owned Facilities								
Parksley Town Office	-	X	X	Wind Stormwater Fire	842	Major Disruption	Yes	Yes
Parksley Public Water Supply and Sewer System	-	X	X	Wind Stormwater	842	Devastating	No	Yes
Parksley Town Park	-	X	X	Trees Wind	842	Inconvenience	No	Yes
Parksley Pavilion (also staging area, recreational area, & farmers market)	-	-	X	Wind Fire Stormwater	842+	Major Disruption	No	Yes
Parksley Police Department	-	X	X	Wind Fire Stormwater	842+	Major Disruption	Yes	Yes
Town garbage truck	-	X	X	Wind Fire Stormwater	842+	Major Disruption	No	Yes
Town Parking Area	-	X	X	Wind Fire Stormwater	842+	Major Disruption	No	Yes
Other Facilities								
Eastern Shore Railway Museum	-	X	X	Wind Fire Stormwater	None, impact would be to economy	Inconvenience	No	Yes
Parksley Fire & Rescue Department	-	X	X	Wind Fire Stormwater	7500+	Devastating	No	Yes
U.S. Post Office	-	-	X	Wind Fire Stormwater	842+	Major Disruption	Yes	Yes
Gas Station	-	-	X	Wind Fire Stormwater	842+	Major Disruption	Yes	Yes
Railroad	-	-	X	Wind Fire Stormwater	842+	Major Disruption	Yes	Yes

FINDINGS

1. The hazards expected to have the greatest impact on the Town are stormwater flooding and high wind events, which have been experienced throughout the Town's history. Other hazards facing the Town are groundwater contamination, ice storms, drought, tornadoes, and mosquito-borne disease.

2. Although no part of the Town lies within any flood zone, due to soil types, topography, and inadequate drainage system, stormwater flooding is the most common hazard experienced by the Town and there are two flood insurance policies in the Town.

3. The Town has identified undersized drainage pipes and repeatedly paved over and thus raised road levels, particularly Dunne Avenue, in the Downtown Business District as the cause of increasing effects of stormwater damages on adjacent buildings and vehicles.

4. Older construction and mature trees in residential areas increase risk from damages from wind and snow events, as branches are likely to come down causing secondary wind/snow damages and power outages.

TOWN OF SAXIS

TOWN PROFILE

Saxis Island juts into Pocomoke Sound and is separated from the rest of Accomack County by Freeschool Marsh. The island was first patented in 1666 and a single community existed on the island as a single farmstead that primarily raised cattle until 1800 when four families inhabited the island. The community grew in size throughout the 1800s and cattle farming declined due to lack of space on the island. It was during this period that seafood became the primary economy. In the 1920s, the causeway connecting the island to the mainland was constructed and a channel was dredged to the harbor allowing for larger boats to access the island. Seafood continues to be the main economy for the Town. Saxis was incorporated as a town in 1959 (*Saxis Town Plan*, 1997).

Figure 1: Saxis Aerial Map

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 that 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. The following sections are intended to provide insight in the make-up and characteristics of the community and how it relates to hazard vulnerability.

DEMOGRAPHICS

The 2010 Census indicates that the Town had a population of 241, which indicates a 10% decrease in population in comparison to the 2014 estimate of 216. The Town has experienced a decline in population since 1960 when the population was 577 (*Saxis Town Plan*, 1997). The median age for residents in Saxis in 2014 was 57.3 (American Community Survey (ACS), 2010 – 2014). This is a population older than the national average, which could indicate a more high risk population during times of emergency.

Table 1: Saxis Demographic Information

	2014***	2013**	2010*	2000****
Population	216	218	241	337
Median Age	57.3	57.8	55.5	47.3
Disability	13	20	NA	NA
Income				
Median Household Income	$30,500	$30,500	$29,545	$18,125
Poverty Level	13.4%	18.3%	17.6%	
Language				
Only English	97.4%	100.0%	NA	99.4%
Other	2.6%		NA	0.6%
Spanish	2.6%		NA	0.6%

* U.S. Census 2010, ** ACS 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Saxis is primarily a community of working watermen and the fisheries industry has provided the economic base for the community since the 19th Century. The fisheries industry is based on soft shell crabs and hard crabs resulting from the soft shell catch. Some clamming and fin fishing also occur. From April to November, peeler crabs are caught in traps, scrapes, pots, and dip nets, held in floats until they shed, and sold as soft crabs (*Saxis Town Plan*, 1997). Although Table 2 indicates a steep 55% decrease in the fisherman workforce since 2010, this is actually the fourth season of improved oyster harvest, so actually the numbers should have increased since 2010 versus decreased. There are more people working in education, health care, and social services than there are in agricultural, forestry, and fishing.

Table 2: Saxis Local Workforce

Civilian Employed Population								
Industry	2014*		2012*		2010*		2000**	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	10	12.3%	15	14.9%	22	20.8%	21	16.2%
Construction	8	9.9%	8	7.9%	5	4.7%	8	6.2%
Manufacturing	8	9.9%	15	14.9%	13	12.3%	5	3.8%
Wholesale trade	8	9.9%	9	8.9%	21	19.8%	9	6.9%
Retail trade	4	4.9%	6	5.9%	2	1.9%	6	4.6%
Transportation and warehousing, and utilities	3	3.7%	3	3.0%	3	2.8%	0	-
Information	0	-	0	-	0	-	2	1.5%
Finance, insurance, real estate, and rentals	4	4.9%	6	5.9%	3	2.8%	3	2.3%
Professional, scientific, waste management	5	6.2%	10	9.9%	9	8.5%	3	2.3%
Educational, health care, social services	13	16.0%	10	9.9%	13	12.3%	0	0.0%
Arts, entertainment, recreation, food	7	8.6%	12	11.9%	8	7.5%	0	0.0%
Public Administration	8	9.9%	4	4.0%	4	3.8%	2	1.5%
Other	3	3.7%	3	3.0%	3	2.8%	4	3.1%
TOTAL CIVILIAN EMPLOYED POPULATION	81	-	101	-	106	-	130	-

Source: *ACS, 2010 – 2014, ** U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Fisheries have long provided the economic base for Saxis. There are seafood companies in Saxis that are concentrated around the harbor, which pack and package crabs and other seafood (*Saxis Town Plan*, 1997). Due to the Town's dependence on seafood, the water quality within Chesapeake Bay is an important factor in the Town's economic sustainability. In the harbor, 72.5% of the 75 slips are used by commercial watermen, but off-season some of those slips are sublet to attract additional new boats. As of July 1, there were 17 on the waiting list for the slips. (Mayor Denise Drewer, personal communication, June 9, 2016)

Many people in the Town are hoping that improvements to the public boat ramp, new restaurant options, the Saxis Island Museum, and potential improved public beach access facilities will open the town to additional visitors and tourism-based businesses (JD Marshall, personal communication, June 9, 2016).

Figure 2: The Harbor at Saxis. Photo by Shannon Alexander.

According to Mayor Drewer, there are now three restaurants, including one snack shack and two seafood restaurants (personal communication, June 9, 2016). The wholesale and manufacturing establishments referenced in Table 3 are assumed to be seafood related.

Table 3: Saxis Business Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Manufacturing	1	1	1
Wholesale Trade	1	1	1
Total, All Establishments	2	2	2
Total Employees	NA	NA	NA

Source: Census Zip Code Business Patterns, 2009, 2011, 2013

BUILT INFRASTRUCTURE

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 evacuate.

HOUSING UNITS

The majority of homes in Town are occupied, but the Town has experienced an increase in the number of homes that were purchased as vacation homes and remain vacant through the majority of the winter months. These properties are at greater risk to damage during the times they are vacant. The majority of housing stock in Saxis is in standard condition, although several houses are not maintained properly and could pose a threat to public health and safety. The Town has their own ordinance and thus the authority to enforce repairs or clearance of dilapidated buildings and has been systematically addressing this issue since the mid-1990's. There are another two homes scheduled for demolition in the next year.

The estimated total number of vacant housing units noted in Table 4 is most likely too high, and is estimated to be closer to twenty. Just less than 50% of the population are seasonal or transient, however they are anticipated to move to Saxis permanently within the next few years (Mayor Denise Drewer, personal communication, June 9, 2016).

Within the Town, a special use permit is required for mobile homes, and home age, electric condition, block foundation, etc. are strictly reviewed and required. There have been no new mobile homes since May of 2008. Because mobile homes are typically more susceptible to damages from winds and flooding, this process of review and permit reduces risks associated with these hazards.

Table 4: Saxis Housing

	2014*	2010**	2000***
Total Housing Units	168	179	193
Occupied	118	117	148
Vacant	50	62	45
Owner-Occupied	98	93	127
Renter-Occupied	20	24	21
Median Housing Value	$103,000	NA	NA

Source: * ACS, 2009 – 2013, ** U.S. Census 2010, *** U.S. Census 2000

TRANSPORTATION

Saxis is connected to U.S. Route 13 by State Route 695, a rural road approximately 11 miles long. Most of the Town's streets are maintained by the Virginia Department of Transportation. Many are not in adequate condition, due to pot holes and regular flooding after rainfall (*Saxis Town Plan*, 1997).

Table 5 reveals that there are fewer households with no vehicle available than there were in 2000; however, ACS estimated that there were 16 residences without vehicles in 2014. This is thought to be an overestimate by Mayor Drewer, which could have been skewed by a higher number of elderly residents in 2010 than there are currently. She believes that there are only four residents without their own vehicle, and that those individuals have family and friends and would not suffer in the case of necessary evacuation (personal communication, June 9, 2016). There is no public transportation that serves the Town. State Route 695 provides the only road access to the Town and portions of the route are often inundated during storm events or astronomically or wind-driven tides. There are about a dozen golf carts, which are allowed on the Town roads. Transportation by water is often utilized; however, there is no ferry service to or from Saxis.

Table 5 : Saxis Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	16	13	23
One	51	77	55
Two	33	52	53
Three or more	18	19	17

Source: * ACS, 2009 – 2013, ** U.S. Census 2000

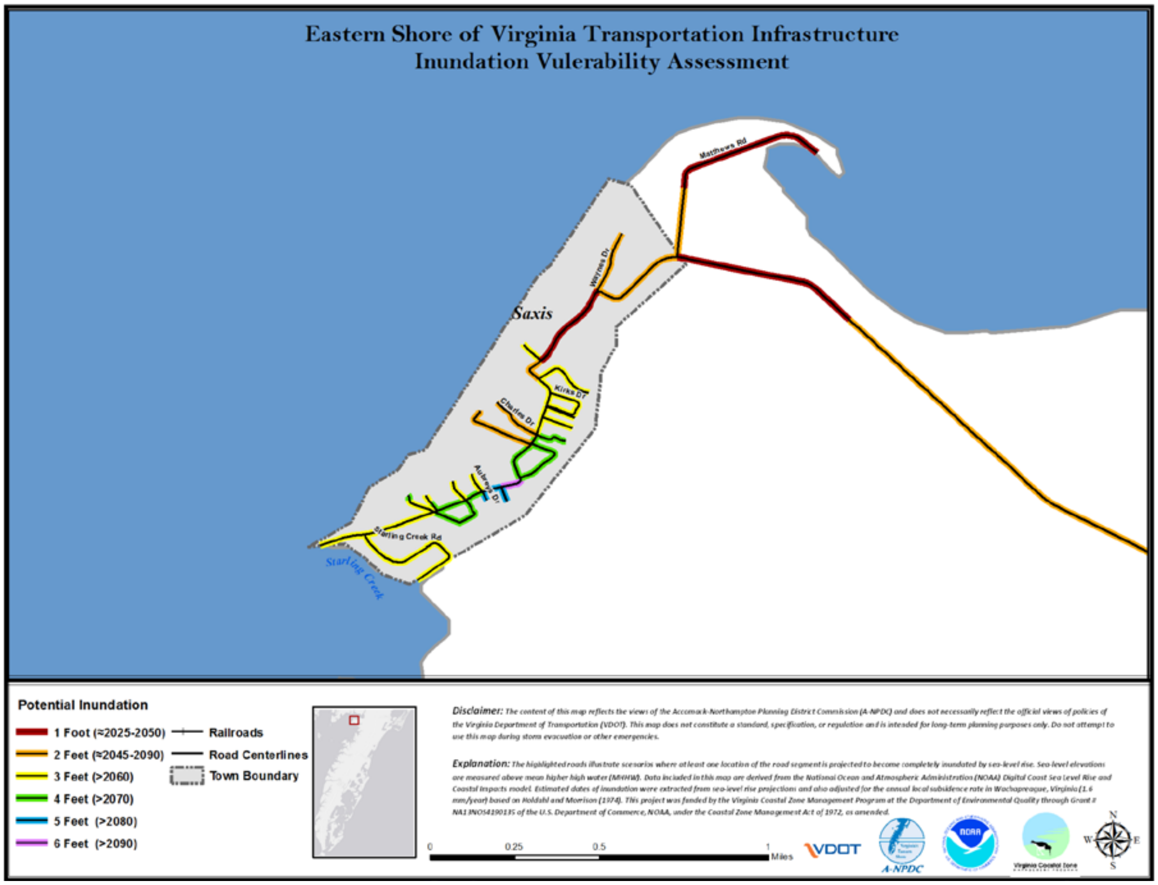


Figure 3: Town of Saxis Transportation Infrastructure Inundation Vulnerability

With only one foot of sea level rise (SLR), it is estimated that the part of State Route 695 will be submerged with one foot of water. This is important to note, as it also reflects that with one foot of flooding about mean high tide, this section of the road would also be inundated, and the remainder of Route 695 leading towards Sanford vulnerable to two feet of SLR or flooding above mean high tide.

COMMUNITY SERVICES AND FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It is important to note what facilities are available in case of a hazard, and it is important to make an inventory of facilities that could be impacted by a hazard. Most of the community facilities within Saxis focus upon the harbor and seafood industry.

PUBLIC SAFETY

Fire protection for the Town is provided by the Saxis Volunteer Fire & Rescue Company, Inc. The fire company also provides ambulance service and includes one ALS ambulance, two engines, one tanker, and one brush unit. The brick building itself, a renovated schoolhouse, has four bays and doubles as the Town Hall of Saxis. Police protection is provided by Accomack County Sheriff's Office, primarily in the evening hours (Mayor Denise Drewer, personal communication, June 9, 2016). There is an intention to utilize the Accomack Sheriff's Office patrol units more, increasing their presence in the Town.

Figure 4 : Saxis' firehouse and Town office are located in a flood zone. Photo by Elaine Meil.

PARKS AND RECREATION

A public harbor and boat launch are located in Town, and two other boat launch facilities are located nearby, outside of Town limits. The Saxis Wildlife Management Area, which borders the eastern half of the Town, offers opportunities for hunting, fishing, and bird watching. There is also a basketball court made available by the Town, and a volleyball court and playground made available on church property (*Saxis Town Plan*, 1997).

Figure 5 : The Saxis Town Pier is located on the western shore of the island. Photo by Curt Smith

The fall of 2016 should bring the completion of the pavilion at the Town Harbor. The large building is to be accompanied by a restroom facility that will be 28 by 28 feet. These improvements will allow for events such as an oyster roast and encourage visitors to the Town. The Town is working to establish Parker's beach park, the beach adjacent to the USACE leased dredge spoil site.

HARBOR

A public harbor was built in 1962 at the south end of Town adjacent to Starling Creek, and funds were reinvested in 2005 to upgrade and maintain the facility. The harbor contains 75 boat slips rented out on a yearly basis for a fee. The harbor is equipped with electricity, lights, a concrete boat ramp, and a working stall with a hoist. About 72.5% of the boat slips are used by commercial boats. While water depths within the harbor appear to be adequate, maintaining the access channel navigability is important (*Transient & Working Waterfront Infrastructure Needs Assessment*, 2013).

The entrance channel and turning basin were authorized by the River and Harbor Act of 30 August 1935. The harbor was designated as a federal Harbor of Refuge by the U.S. Army Corps of Engineers (USACE) in July 1960. The last time that Starlings Creek and the harbor were dredged was in 2015 with Hurricane Sandy funds at a cost of almost $700,000.00 which removed 82,500 cubic yards of sediment (USACE). Dredge spoils were used for beach nourishment and the finer sediments were pumped into the dredge spoil site on the property that the U.S. Army Corps of Engineers leases from the Town.

CULTURAL RESOURCES

Saxis Island Museum was created in 2014 in the larger portion of the same building that hosts the Post Office. Saxis just received state historical designation and is applying for federal designation, which could lead to additional funding for mitigation and resilience projects. There has already been a Federal grant to move into the Crockett Store in the next few years after it is renovated. In Town and along the shoreline, arrowheads are frequently found, particularly following storms and high winds and the associated erosion. To date there have been no surveys to document these findings, but this is a desired project, as it would create additional knowledge about the Native American history in the area.

The Cemetery is a cultural resource in the Town. During Hurricane Floyd in 1999, a few of the graves floated up on the north area of Town. Cemeteries will be at increased risk as sea level continues to rise, increasing frequency and duration of inundation and erosion rates.

WATER SUPPLY AND WASTEWATER

Town residents obtain their water from private wells and dispose of wastewater with private septic systems. Due to Saxis' location near the coast, there is an increased chance of saltwater intrusion into the York-Eastover Aquifer, from which private wells source the resident's water although no impacts have been measured to date. The majority of the developed portions of the Town are on Bojac sandy loam and Munden sandy loam soils, which are considered to be most and fairly suitable, respectively, for development on the Eastern Shore as they drain well, particularly the Bojac.

Public health risks may be encountered during and following coastal flooding events as septic system drainfields are inundated with flood waters. Town applied for USDA grant to obtain their own back hoe for maintenance and will be looking into additional grants for a building to house the back hoe and the mosquito truck that they own already.

SOLID WASTE

Residents are responsible for disposal of their own household waste. The nearest convenience center is in Makemie Park, about 10 miles east of Saxis.

POWER AND COMMUNICATIONS INFRASTRUCTURE

Mobile service in Town can be inconsistent depending on the service provider. There have not been issues with long-time power outages, however, the power lines are suspended along the Saxis Road (Rt. 695), the only road accessing the Town, which is prone to flooding, saturated marsh soils, and the risk of downed power line poles that accompanies these conditions.

The Saxis fire house is the designated staging area following an emergency and has a raised generator.

SCHOOLS

There are no schools in the Town of Saxis. The school age children primarily attend Kegotank Elementary and Saint Paul.

NATURAL ENVIRONMENT

Saxis is situated on a ridge of sand-rich soils on the western perimeter of Freeschool Marsh. It has a 9,000 foot long shoreline including a narrow beach along the Pocomoke Sound. The Town is adjacent to the Saxis Wildlife Management Area to the east and is bound by Starling Creek to the south. The entire Town lies within the Chesapeake Bay Watershed.

LAND USE LAND COVER

The Town of Saxis encompasses 210 acres. The predominant land use is residential. Commercial land uses are mainly concentrated around the harbor. Tidal wetlands are located along the northern half of the shoreline at the northern edge of Town. Wetlands assist in preventing erosion and retain storm water.

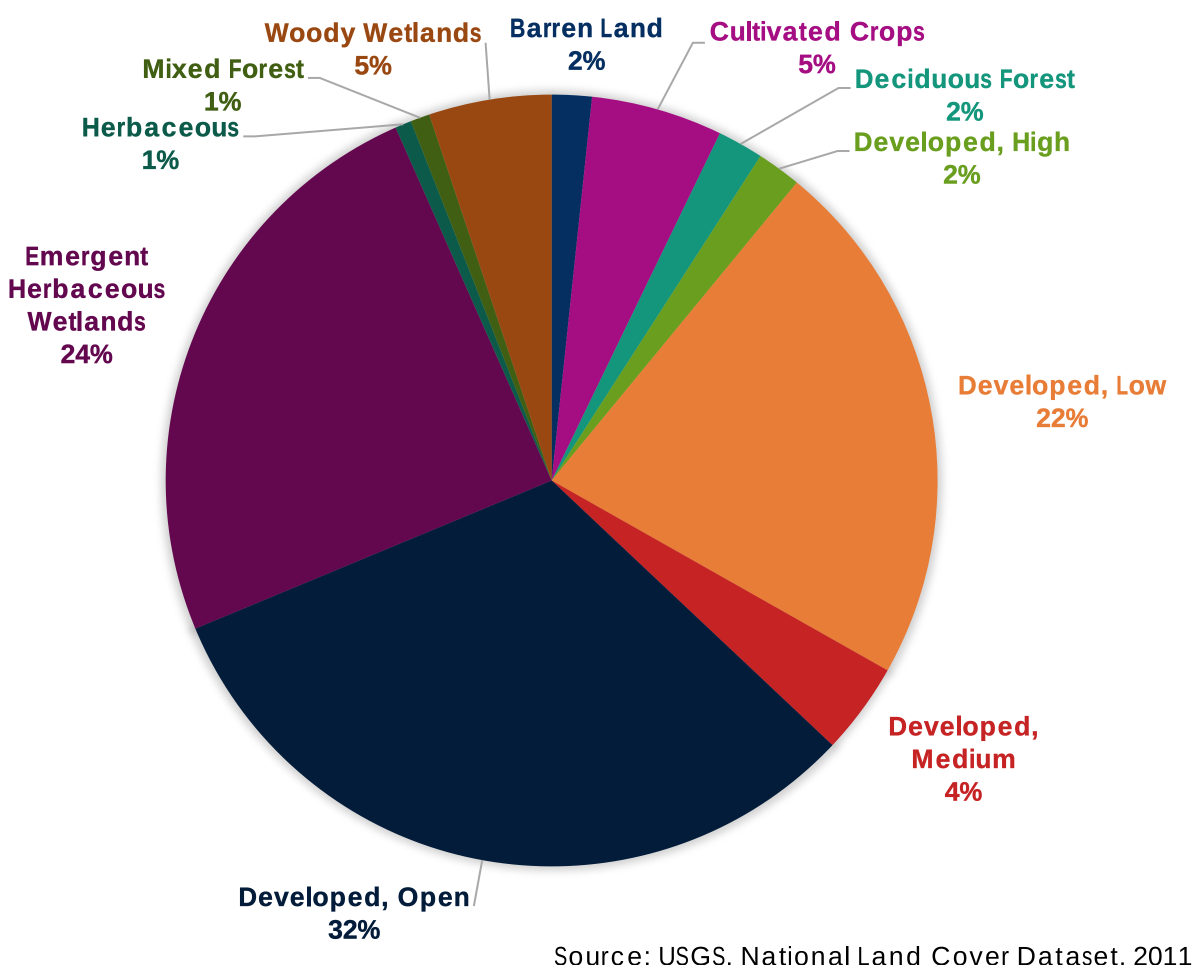


Figure 6 : Saxis Land Use Land Cover Percentages

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

Saxis has participated in the hazard mitigation planning process since 2006. The Town's primary risk is associated with coastal erosion and flooding.

Table 6 : Town of Saxis Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*				*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town joined the NFIP on November 17, 1982. In 2003, Saxis had 13 flood insurance claims since 1982 (*FEMA NFIP Flood Insurance Report*, July 2003). There was one claim in the Town from 2003 to 2011, with the average claim settled being $6,314 (*FEMA NFIP Flood Insurance Report*, May 2011). Between 2011 and 2016 there were 12 claims totaling about $210,000, all of these were probably from damaged incurred during Hurricane Sandy. (Mayor Denise Drewer, personal communication, June 9, 2016).

With the 2015 FIRM, the majority of the Town is still designated to lie within the A zone of the Special Flood Hazard Area (SFHA), meaning that they will be inundated by the 1-percent-annual-chance flood (or 100 year storm) event. However, the base flood elevation (BFE) have increased throughout the Town to a current designation of eight foot BFE, with the very southern and northern parts of Town designated at nine feet. The northern part of Town, although not yet built upon, is already subdivided with over 50 parcels, all of which fall within the 9 foot BFE, some of which have the shoreward portions of the lot in the velocity zones with a ten foot BFE. This is a significant change from the previous FIRM, which indicated only the northern part of Saxis with a nine foot BFE and the developed portion of Town as about evenly proportioned with seven and eight foot BFEs. Therefore, homes that were raised to the previous BFE are often either one or two foot below the new 2015 FIRM BFE. Although their policy premium should not increase this year due to these changes, if a storm event occurs which damages their home and/or contents, then their policy cost will increase the following year. There are four low risk policies; indicating that some property owners maintain insurance despite their lack of requirement to do so. The Town zoning requires homes to be built at two feet above the FEMA BFE.

Table 7: Summary of Saxis' past NFIP participation

	HMP 2006	**HMP 2011**	**HMP 2016**
NFIP (date joined)	November 17, 1982	November 17, 1982	November 17, 1982
Number of Policies		48 policies	49 policies: 1 V-zone, 44 A-zone, 4 other
Total Premium Amount		$34,726	$44,938
Total Coverage Amount		$5,913,000	$6,534,200
Number of Claims (since 1978)	13	14	26
Total Paid (since 1978)		$88,397	$295,928
HMGP	2003 Isabel participation	-	-
CRS Score (1 highest, 10 lowest)	-	-	-

Source: *ESVA Hazard Mitigation Plan*, 2006 and 2011; *FEMA NFIP Insurance Report* 2006, 2011, 2016

HMGP

The Town elevated 16 houses following Hurricane Isabel in 2003 using HMGP funds. This is the only time the Town has participated in the Hazard Mitigation Grant Program.

HAZARD PROFILE

Coastal erosion, coastal flooding, and high winds are the highest threat to the Town. Storm water flooding is primarily tidally dependent and thus considered more of a coastal flooding issue.

WIND

The entire Town is located in the wind borne debris hazard area. This area extends 1-mile inland. For a 1% annual chance storm event, Hazus® estimates that a total of $282,173 in damages could occur in Saxis. Damages from flooding are several magnitudes higher than from wind damage. This lower figure could also reflect the improvements to roofs, windows, etc. The majority of this sum would be from damage to buildings and content, with approximately $60,000 being from losses associated with inventory, relocation, income, rental, and wages. In 2006 the Eastern Shore of Virginia Wind Vulnerability Assessment Assuming, estimated approximately $838,000 in wind damages, but this methodology did not take into account some of the updated data and factors included in the Hazus® calculations.

In addition to wind threats from hurricanes, there is also the potential for Nor'easters, tornados/water spouts, and straight line winds. The Town Zoning does require 120 mph gust zoning standards for new and renovation constructions.

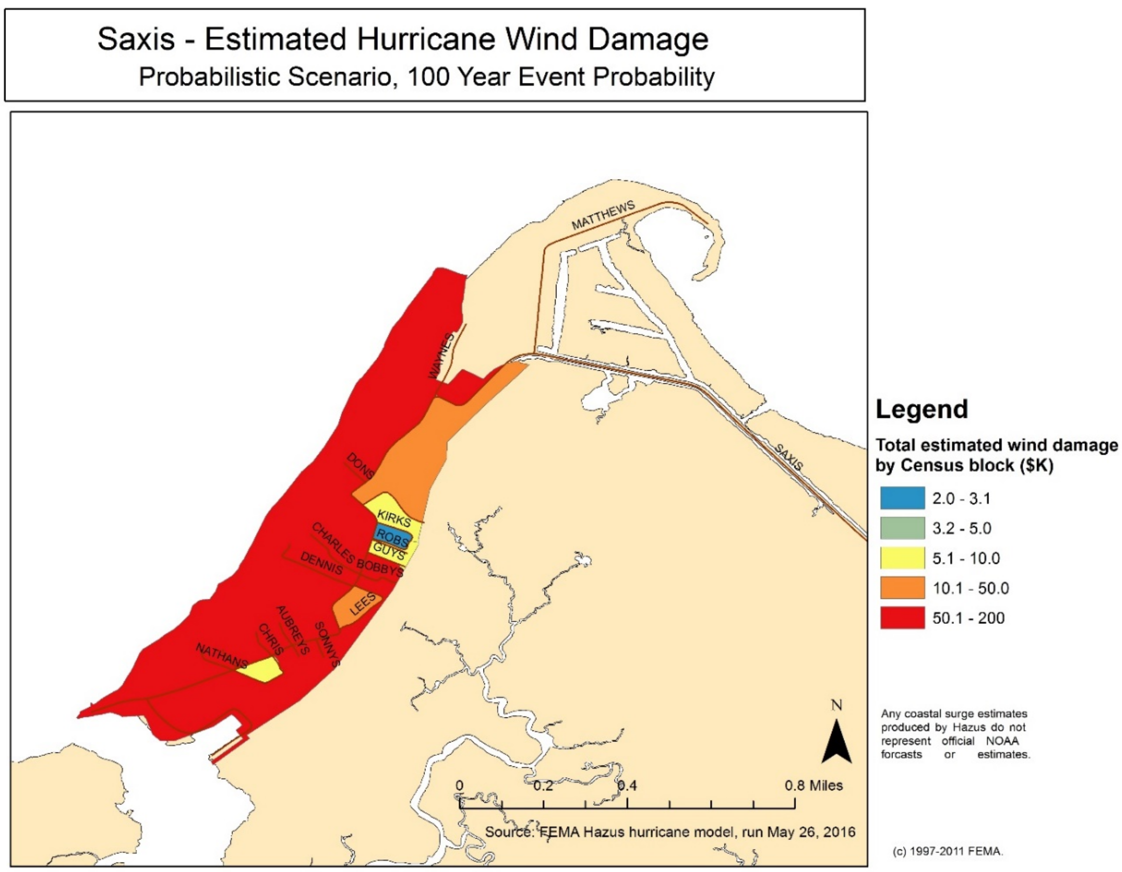


Figure 7: Saxis Estimated Wind Damage by Census Block

COASTAL EROSION

The Town recognizes that it has a serious erosion problem. The Town has been working to resolve the erosion problem since 1972. The average long term erosion rate for Saxis' 9,000 ft long shoreline is 4.9 feet per year (*Saxis Town Plan*, 1997). The Town believes that it is possible that the erosion rate has increased. The Town is only 1,590 feet wide at the widest point. With every bit of erosion, the Town's flood hazard also increases. There are approximately 9 structures in Saxis that are located close to the Bay facing shoreline with little buffer if erosion were to occur in the immediate vicinity of these structures.

The U.S. Army Corps of Engineers (USACE) in Norfolk proposed building a series of seawalls along the western shoreline of the island to restore protective wetlands and in turn, control erosion. The proposal indicated that the Town must match 35% of construction costs, which was $2.3 million. The Town has unsuccessfully explored multiple funding options and does not expect to be able to secure the needed funds to protect their island. During 2015, the USACE did place sand derived from the dredging of Starling Creek along the shoreline adjacent to the dredge spoil basin within Town to mitigate erosion occurring along that portion of the Town.

COASTAL FLOODING

The Flood Insurance Study (FIS) for Saxis identifies that the greatest threat of flood inundation comes from hurricanes. The August 1933 hurricane, September 1936 hurricane, Hurricane Hazel in 1954 and Hurricane Donna in 1960 all caused flooding in the Town (Saxis FIS, 1982). Since this study, the Town has also experienced flooding during Hurricane Floyd 1999, Hurricane Isabel 2003, Nor-Ida 2009, Irene 2011 and Hurricane Sandy 2012.

In 2013 the Town was able to secure funding from the Virginia Port Authority for a 322-foot jetty to protect the Town, namely the harbor, from wave and storm action. During Hurricane Sandy, a year earlier, the Town pier was devastated, as were the many crab shanties that are vital for many residents' livelihoods. Involvement by the Governor allowed for the reconstruction of some of the shanties. In addition, about 60 mature trees were downed during the rain and winds. Mayor Drewer believes that if the jetty had been installed prior to the storm, there probably would have been much less damage (personal communication, June 6, 2016). There has also been a USGS tide gauge installed at the public boat ramp, so more consistent and accurate data will be available.

According to the 2015 FEMA Flood Insurance Rate Map (FIRM), almost the entire Town lies within a Special Flood Hazard Area (SFHA), except for a small ridge and the dredge spoil deposit location on the west side of town that are in the 500 year flood or 0.2% annual chance zone, as revealed by Figure 7 below. Most of the structures lie within an A zone, with Base Flood Elevations ranging from 8 to 9 feet. The Flood Insurance Study for the Town notes that the development within the floodplain is extensive and includes numerous family dwellings, small businesses and seafood related industries. Despite the changes to the FIRM, Mayor Drewer says that they've noticed an increase in frequency of flooding, but that it doesn't commonly affect buildings (personal communications, June 9, 2016).

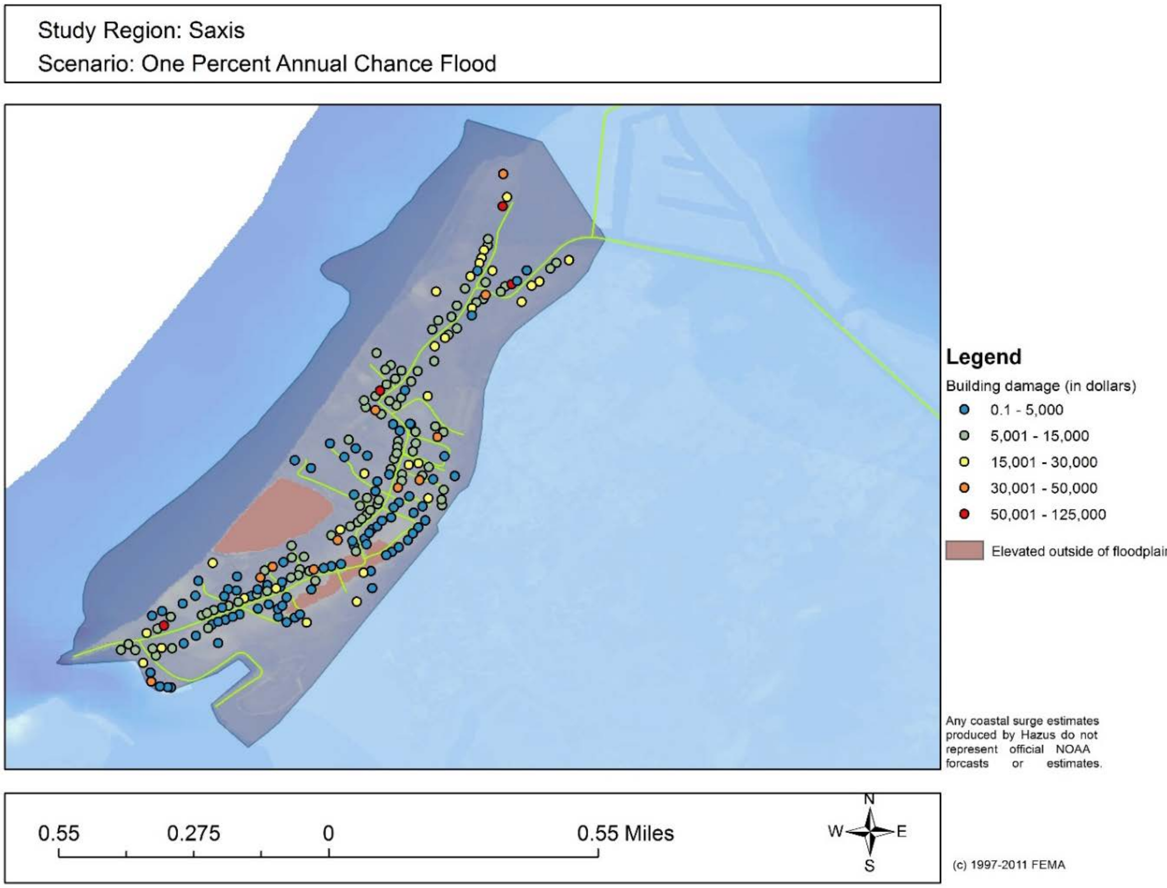


Figure 8 : Saxis Hazus® Predicted Damages During a 1% Annual Chance Flood

The causeway (State Route 695) provides the only vehicular access to Saxis from the mainland. This road regularly experiences coastal flooding during storm events putting residents at great risk. In addition, storm water commonly floods the road in low lying areas near Sanford and Messongo to the east of Town.

Figure 9: View of the causeway leading westward to Saxis. Photo by Curt Smith

Saxis is the highest point of land for approximately 4.4 miles inland. Both the villages of Sanford and Messongo located inland are lower in elevation than Saxis. Sanford is 2.6 miles from Saxis and Messongo is 4 miles from Saxis. The Town serves these areas with its fire station, but would be unable to do so during a flood event.

The harbor at Saxis is a local hub of economic activity. A disastrous flood would adversely affect the Town and surrounding area. Worker productivity would be cut drastically since many persons live and work within the 100-year floodplain. Many employment activities also occur through small businesses and/or self-employment. FEMA notes that small businesses are particularly vulnerable after a disaster with some 30% not surviving (*Planning for Post Disaster Recovery and Reconstruction*, FEMA, 1998).

The fisheries industry is based around the southern end of Saxis near the harbor. This area is classified as an Intensely Developed Area (IDA) according to the requirements of the Chesapeake Bay Preservation Act. It is also zoned commercial-waterfront (C-W). This area is intended to provide space for activities and services relating to the seafood industry (*Saxis Zoning Ordinance*, 1993). This area lies in a regulated flood zone.

Figure 10: Captain E's Hurricane Grill and many fisheries businesses are located in the Intensely Developed Area (IDA) in Saxis. Photo by Shannon Alexander

A small commercial area is located in the center of the Town on Saxis Road. This area previously was classified as Zones A, B and C, but with the 2015 FIRM is now primarily A Zone with a small amount of area in the 0.2% annual chance flood.

In the event of a 100-year or 1% annual chance flood, Hazus® predicts that Saxis would suffer a total of about $4.3 million dollars in damages. This total is a combination of building loss (about $2.3 million), content damages (about $2 million), and inventory loss. There has been an upward trend in the amount of damages that a storm of this magnitude would incur, from the 2006 estimate of $1.6 million and the 2011 estimate of about $2.7 million, which corresponds to the increasing erosion and recurrent flooding rates (*ESVA Hazard Mitigation Plan*, 2006, 2011). However, the 2006 and 2011 estimates were created using a totally different tool and the 2016 is using the new Hazus® model. This rise could also be due to the increased value of many of the properties in the area and because of the change in the FIRM BFE.

STORM WATER FLOODING

Storm water flooding also occurs in the Town. During heavy rains the Town's roads are often flooded (*Saxis Town Plan*, 1997). The Town's drainage ditches empty directly onto the western shore and often become clogged with sand from tides. Ditches in the Town are also commonly filled with debris and invasive plant species such as phragmites. Phragmites, or common reed, can completely overtake a ditch preventing proper drainage and is almost impossible to eradicate. The Town also contends with tidal influence on the drainage system. When tides are high the storm water remains in the ditches until the tide goes out. The County Department of Public Works recently cleaned out one of the main ditches and VDOT cleaned out several additional ditches in early 2016. The drainage is actually efficient so long as trash and yard debris is disposed of properly in order to avoid clogging the ditches. Storm water flooding in the Town is tidally dependent. The Town has applied for a USDA grant for a backhoe to be able to be responsible for their own maintenance (Mayor Denise Drewer, personal communication, June 9, 2016).

HAZARDS OF LOCAL SIGNIFICANCE

WATER QUALITY

Since many people rely on the fisheries industry, fish kills and the declining health of the Chesapeake Bay impact the Town. In July 1999, a fish kill near Saxis caused 500,000 young-of-the-year menhaden to be affected. The cause of this fish kill was low dissolved oxygen in the water linked to the prolonged drought Virginia was experiencing at the time. Town Officials also indicated that residents have been historically impacted by concentrations of the pathogenic bacteria, Listeria monocytogenes, which originated in the Pocomoke River upstream of the island. These water quality hazards represent a threat to the livelihood of residents in Saxis and northern Accomack County.

MOSQUITOS

The Town also has a significant mosquito problem and residents could potentially be at risk to mosquito-borne illnesses such as West Nile virus. In 2012 the Town purchased a mosquito control truck and has implemented a mosquito control abatement program.

SNOW AND ICE STORMS

Winter weather has historically had adverse impacts on the Town's seafood industry. The Town's harbor has historically frozen during extreme cold snaps bringing the seafood-based local economy to a halt. Ice also poses a threat to the causeway and access to the island. Tangier was inaccessible for about a month in both 2012 and 2013, when both the harbor and channel froze over.

CRITICAL FACILITIES

Town officials evaluated the hazards that have or could affect Saxis' critical facilities. The Town's office and fire station are located in the 100-year floodplain. When floodwaters come up, the Town's equipment is moved to the Methodist Church located on the highest point of land in the Town.

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

Table 8 : Saxis Critical Facilities

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-Owned Facilities								
Saxis Volunteer Fire Company		X	X	Flooding Wind Fire	~2,000	Major Disruption	Yes	Yes
Saxis Harbor		X	X	Flooding Erosion Ice	Entire Town and region	Devastating	No	Yes
Saxis Town Pier		X	X	Flooding Erosion Ice Collision Wind	Entire Town and region	Major Disruption	No	Yes

Pavilion			X	Fire, Collision, Wind	Entire Town and region	Major Disruption	No	Yes
Dredge Spoil Basin			X	Erosion, Flood	Entire Town	Devastating	Yes	Yes
Saxis Town Park/Beach			X	Erosion, Flood, Wind	Entire Town and region	Major Disruption	No	Yes
Other Facilities								
Saxis Volunteer Fire Company		X	X	Flooding Wind Fire	~2,000	Major Disruption	Yes	Yes
Saxis Causeway		X	X	Flood Erosion	Entire Town and region	Devastating	No	Yes
Saxis United Methodist Church		X	X	Flooding Wind Fire	300	Devastating	No	Yes
Saxis Island Museum			X	Flood, Wind, Fire	Entire Town and region	Devastating	Yes	Yes
Post Office			X	Flood, Wind, Fire	Entire Town and surrounding areas	Major Disruption	Yes	Yes
USGS Tide Gauge			X	Flood	Entire Town and region	Minor Disruption	No	Yes

FINDINGS.

1. The community appears to have coastal A zones where structures built to previous NFIP requirements can still suffer flood damage in the 100-year flood.

2. Storm water flooding issues are tidal dependent and often related to debris and invasive plant species, such as phragmites, clogging up ditches and drains.

3. Locally, Saxis provides services to the surrounding area and serves as an economic center in northern Accomack County. The Town of Saxis is threatened with erosion although it sits at the highest location in the area. The loss of the harbor, fire station and causeway would adversely impact the entire area including Saxis, Sanford and Messongo.

4. The Town's office and fire station building is located in the 100-year flood plain with a base flood elevation of 8 feet and has been flooded in the past.

5. The Town is experiencing erosion and is actively pursuing funding to construct protective wetlands to mitigate the problem.

6. The Town's residents and FEMA need to document damages sufficiently so that the various flood prone homes can receive mitigation assistance.

7. Structures are being built in the local hazard areas and older structures are being added to and remodeled thereby increasing property at risk.

8. New residents may be unaware of the local hazards and need to be educated on the precautions they need to take in the event of a disaster.

TOWN OF TANGIER

TOWN PROFILE

The Town of Tangier is located on an island in the Chesapeake Bay. Tangier was first settled in 1686 as a farming community. The island at that time was much larger and had woodlands. The community on the island is very resilient, surviving an invasion by the British in 1812 and occupation until 1815, a cholera epidemic in 1866 that caused the island to be evacuated and quarantined for a year, and numerous storms that inundated the island with flood waters. One of these storms, the August 1933 storm, covered the entire island with flood water up to the second story of some buildings. After this flood receded some 500 people, a little over a third of the residents at that time, left the island for good.

Figure 1: Tangier Context and Aerial Maps

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 factors that relate 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. The following sections are intended to provide insight in the make-up and characteristics of the community and how it relates to hazard vulnerability.

DEMOGRAPHICS

Town representatives indicate that the current population is about 475 and that the high 2010 figure is inflated, perhaps from adult children who have never changed their permanent address (Town Council, personal communication, June 16, 2016). At the beginning of the 19th Century, the population of Tangier stood around 1,500. By 1960, the population had dwindled to 876. The median age for residents in Tangier in 2000 was 42.7 years, signifying a population older than the national average. The median age increased to 48.6 in the 2010 census, signifying an aging population and reflects the number of younger residents who may by leaving the Island. The Town experiences a seasonal increase in tourists visiting the island between the months of May and October. Town Manager Renee Tyler estimates that greater than 90% of the current population consists of full-time residents (*ESVA Hazard Mitigation Plan*, 2011).

Table 1: Tangier Demographic Information

	2014***	2013**	2010*	2000****
Population	485	483	727	604
Median Age	54.8	55.7	48.6	42.7
Disability	16	38	NA	NA
Income				
Median Household Income	$38,056	$40,833	$40,556	$26,607
Poverty Level	23.3%	21.3%	28.5%	NA
Language				
Only English	99.2%	99.4%	99.5%	97.9.%
Other	0.8%	0.6%	0.5%	8.1%
Spanish	0.0%	0.0%	0.0%	1.6%
Ind-Euro	0.8%	0.6%	0.5%	0.0%
Asian	0.0%	0.0%	0.0%	0.5%

* U.S. Census 2010, ** ACS 2009 – 2013, *** Annual Estimates of the Residential Population: 2010 – 2014, **** U.S. Census 2000

WORK FORCE

Employment patterns are important to examine for two reasons. It can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. It can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

Due to Tangier being on an island, the majority of people work in seafood, retail, and health services to provide for the citizens. The commercial seafood industry has long provided the economic base for the island community. Over a quarter of Tangier residents are licensed commercial watermen, hauling in seafood valued at $3.4 million in

2011, about 2% of the state landings that year. This represents a decline in watermen, which local representatives attribute to the increases in regulations and fees associated with fishing licenses.

Table 2: Tangier Local Workforce Industry

Civilian Employed Population								
Industry	**2014***		**2012***		**2010***		**2000****	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	55	25.7%	64	27.8%	72	33.6%	55	25.7%
Construction	3	1.4%	0	0.0%	0	0.0%	3	1.4%
Manufacturing	0	0.0%	3	1.3%	14	6.5%	0	-
Wholesale trade	13	6.1%	6	2.6%	12	5.6%	13	6.1%
Retail trade	41	19.2%	38	16.5%	3	1.4%	41	19.2%
Transportation and warehousing, and utilities	27	12.6%	15	6.5%	18	8.4%	27	12.6%
Information	0	0.0%	0	0.0%	0	0.0%	0	-
Finance, insurance, real estate, and rentals	0	0.0%	0	0.0%	0	0.0%	0	-
Professional, scientific, waste management	4	1.9%	2	0.9%	0	0.0%	4	1.9%
Educational, health care, social services	43	20.1%	48	20.9%	28	13.1%	43	20.1%
Arts, entertainment, recreation, food	19	8.9%	20	8.7%	18	8.4%	19	8.9%
Public Administration	7	3.3%	12	5.2%	13	6.1%	7	3.3%
Other	2	0.9%	22	9.6%	40	18.7%	2	0.9%
TOTAL CIVILIAN EMPLOYED POPULATION	214	-	230	-	218	-	214	-

Source: *ACS, 2009 – 2013, **U.S. Census 2000

BUSINESSES

Business data provides basic information used in projecting potential economic losses from business and employment disruption, along with wage losses to employees. It can also serve as an indicator of community recovery resources. Finally, it can help to prioritize restoration of utility and infrastructure functions following a high-intensity hazard.

Fishing grounds in the vicinity of Tangier produce crabs, which are processed on the island. The fishing industry is based on the Atlantic blue crab, although some oystering and fin fishing occur. From April to November, hard crabs are harvested in crab pots placed in local waters. Most of the catch is marketed in Crisfield, Maryland. The soft crab fishery is the most valuable industry, based on revenue, and Tangier is sometimes referred to as the "soft shelled crab capital of the world". Retail and tourism also play an important role for businesses and income on Tangier. Tourists travel to the island by passenger ferryboats from Onancock and Reedville, Virginia, and by way of boat from Crisfield, Maryland. Visits are normally short term, just lasting a single day (*Tangier Town Plan*, 2001). The first aquaculture business began operating on Tangier in 2015. It is possible that this new business type on the island could provide a new source of income for the Town's residents, however, aquaculture is more vulnerable to storm damage than historic fisheries operations.

Table 3: Tangier Business Types

Industry Code Description	Total Establishments		
	2013	2011	2009
Utilities	1	1	1
Wholesale Trade	1	1	1
Retail Trade	2	3	1
Accommodation and Food Services	6	5	6
Other Services (Except Public Admin)	1	1	1
Total, All Establishments	11	11	11
Total Employees	15	18	17

Source: Census Zip Code Business Patterns, 2009, 2011, 2013

BUILT INFRASTRUCTURE

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 towards safety.

Tangier is largely low marshland, so only about one-half of a square mile of the island is habitable and residents have been forced to make maximum use of the land available.

HOUSING UNITS

Knowledge of a community's housing base contributes to hazard and vulnerability analysis by identifying how many homes are at risk.

According to the 2010 U.S. Census, Tangier contains 377 residential units located along the three sand ridges of the island, which are separated by marsh and tidal creeks, and connected by narrow wooden bridges. The lots are generally small with a combination of mobile homes and houses. There are few vacant lots left for development. Some existing homes could be demolished and perhaps rebuilt with newer homes (*Tangier Town Plan*, 2001). The number of vacant homes approximately doubled between 2000 and 2010 meaning that the housing stock on the island may be more vulnerable to impacts from storms in general.

Table 4: Tangier Housing

	2010*	2000**
Total Housing Units	377	270
Occupied	324	244
Vacant	53	26
Owner-Occupied	293	227
Renter-Occupied	31	17
Median Housing Value	NA	NA

* U.S. Census 2010, ** U.S. Census 2000

TRANSPORTATION

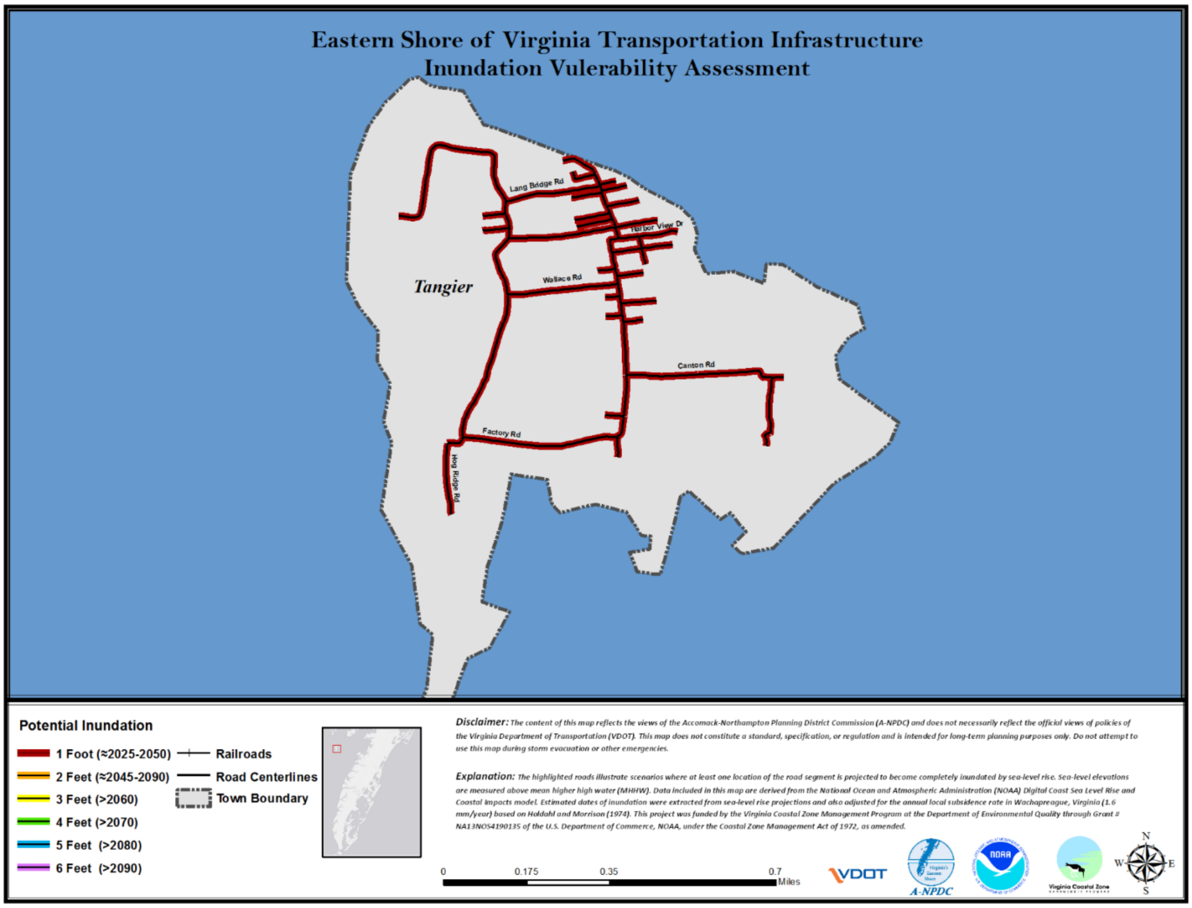
Water transportation is the primary mode of transport between the Town and the mainland. The harbor at Crisfield, Maryland is more heavily traveled than any in Accomack County, however, the Onancock wharf is becoming more popular with the regular, seasonal ferry service. Mail is routed through Crisfield and most residents travel to Crisfield for shopping, business, and entertainment purposes. Residents store over 100 cars in Crisfield's garages and parking lots. Grocery store supplies are brought by boat and large items like mobile homes and building supplies are brought in by barge.

There is an airstrip owned by the Town located on the west side of the island. This airport is the only link the Town has to the mainland when ice covers the bay. The airport has no landing lights, but has been paved recently.

Transportation on the island is by foot, bicycle, golf cart, or motorcycle. Vehicles available to households is typically an indicator of a household's ability to evacuate when necessary, but not for the Town of Tangier. The number, size, and condition of the boats owned would provide more appropriate insight as to the residents' ability to evacuate in the face of an approaching hazard.

The streets are not conducive to regular automobile traffic, although the 2010 census indicated that there were 97 vehicles on the Island. Tangier has 3 miles of narrow roadway (*Tangier Town Plan*, 2001), all of which are susceptible to becoming inundated with a one foot rise in water level above mean higher high tide (*ESVA Transportation Infrastructure Inundation Vulnerability Assessment*, 2015) as shown in Figure 2. There are many golf carts, some high occupancy, on the Island, which can be of aid in quickly moving people and possessions to the harbor when needed (Town Council, personal communications, June 16, 2016).

Figure 2 : Town of Tangier Transportation Infrastructure Inundation Vulnerability



COMMUNITY FACILITIES

Community facilities are facilities required to support the services provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It’s important to note what facilities are available in case of a hazard, and it’s important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

The Tangier Volunteer Fire Department provides fire protection for the Town. The fire alarm is activated by the 911 Operations Center on the Eastern Shore. Equipment includes one mini-pumper, one S-10 pick-up truck, and a Jeep with a pump. The fire company also provides ambulance service with one van-type ambulance. The State of Maryland provides emergency airlift services by helicopter. The Town employs one full-time police officer who is on call 24 hours a day. Tangier also has an agreement with the Virginia Marine Resources Commission (VMRC) whereby the two VMRC officers that live on Tangier can provide back-up response when the permanent officer is away (*Tangier Town Plan*, 2001).

Figure 3: Tangier Firehouse. Photo by Shannon Alexander

MEDICAL SERVICES

The Tangier Health Center was constructed in 2010 in a manner that minimizes impacts from flooding and high winds. The clinic is staffed by a doctor on Tuesdays and Thursdays. Two registered nurses are residents of the Town. A dentist visits the Town monthly, and an optometrist visits six times each year (*Town Council, personal communications, June 16, 2016*).

Figure 4: The Tangier Health Center was constructed in 2010. Photo by Shannon Alexander

PARKS AND RECREATION

There is a neighborhood facility, which provides an area for recreation, two conference rooms, and a kitchen (*Tangier Town Plan*, 2001). Attempts to build a ball field near the school have been unsuccessful due to phragmites encroachment on the designated land and the strict regulations that limit development of marsh wetlands.

HARBOR

The Tangier Channels were authorized by the River and Harbor Act of 2 March 1919 and modified by the P.W.A. Acts of 3 January 1934 and 30 August 1935 and River and Harbor Act of 2 March 1945. The U.S. Army Corps of Engineers (U.S.ACE) maintains channels 8 feet deep, 100 feet wide, and 1,300 feet long in Tangier Sound and also 8 feet deep, 60 feet wide, and 4,800 feet long to an anchorage basin 400 square and 7 feet deep adjacent to the Town.

The Tangier Channels were dredged in 2005 and 2006, when 49,768 cubic yards and 24,904 cubic yards were removed respectively, for a total cost of about $0.9 million. Again in 2011 The Tangier Channel was dredged, when

86,000 cubic yards were removed, for a total cost of just over $1 million. The Tangier Channels were surveyed by the U.S.ACE in their FY2014 are scheduled to be dredged in FY2017. Typically the Channels are dredged by the U.S. ACE at least every 5 years. With new technologies in alternative dredge spoil use, this is something that should be considered in efforts to reduce erosion and improve resiliency.

CULTURAL RESOURCES

The Town was designated as a historic district by the Commonwealth of Virginia in 2015 and has applied for Federal historic designation. The Tangier History Museum, opened in 2007, also operates a small community library, provides free maps, provides the Island's only public restrooms and is responsible for the historical markers that line the streets, allowing visitors to do a sort of self-guided history tour of the Island.

Figure 5: Example of a small cemetery in Tangier. Photo by Shannon Alexander

The location of the former community located on the Uppards has been greatly impacted by erosion in recent years resulting in many cultural resources including graves and artifacts being lost to wave action. There are cemeteries and plots on private property on the main island that should be considered as well.

WATER SUPPLY & WASTEWATER

The Town provides public water and sewage treatment to residents. The water comes from five 1,000 foot artesian wells sourcing the Eocene-aged Potomac Aquifer, which differs from the rest of the Eastern Shore. It is stored in a water tower with a tank capacity of 150,000 gallons, located on the western marsh of the Main Ridge. The Town's water supply is not affected by its own ground water recharge, yet it is still important to protect the resource due to its effect on the ecological diversity of the island (*Tangier Town Plan*, 2001).

The sewage treatment plant serves all the homes and businesses in the Town (*Tangier Town Plan*, 2001). The treatment plant was retrofitted in the last decade and now has solar panels and releases less nitrogen and phosphorus into the Chesapeake Bay. It is located on the western part of the West Ridge, almost due west of the water tower, but outside of the extent of Figure 6.

Figure 6: Aerial view of West Ridge, West Ridge Creek, Main Ridge, and the Mail Channel, featuring the water tower west of the Swain Memorial United Methodist Church and one of the main cemeteries. Photo ©2016 Gordon Campbell/At Altitude Gallery

SOLID WASTE

The disposal of solid waste on Tangier proves to be a problem. The Town operates a waste incinerator for the disposal of most trash that is collected twice a week from homes and businesses. The town incinerator was rehabilitated under the same contract that updated the waste water treatment plant. There is also a town dump located on the northwest side of the island for larger items that can't be put in the incinerator. Barges collect the trash approximately three times a year to bring to the mainland (*Tangier Town Plan*, 2001).

POWER AND COMMUNICATIONS

Electricity is carried to the Island via submerged lines from the Delmarva Peninsula, with an 'extender' located at the south end of the uninhabited Watts Island. In June of 2016 there was construction done. There is one employee of the power company that is a year-round resident.

The microwave tower, built near the water tower, brought cable TV and the Internet to the Island. High speed internet was made available in the spring of 2010.

Figure 7: Electric substation. Photo by Shannon Alexander

SCHOOLS

There is only one school on the island, which serves all grade levels, less than 100 students total. The

Commonwealth does not plan to replace retiring teachers. If teachers are not replaced, alternative means of education must be considered and decided upon.

The Chesapeake Bay Foundation also operates an education facility at Port Isobel to the north of Town.

Figure 8: The Tangier Combined School was elevated in 2006 to mitigate flood damages. Photo by Curt Smith

NATURAL ENVIRONMENT

LAND USE LAND COVER

A large portion of the land area of Tangier consists of marshes. The shoreline is characterized by salt marshes with occasional narrow, sandy beaches. Tangier is relatively uniform in topography. The highest slope in Tangier is 6 feet above sea level. The island is surrounded by tidal waters and cut by tidal creeks and guts (*Tangier Town Plan*, 2001).

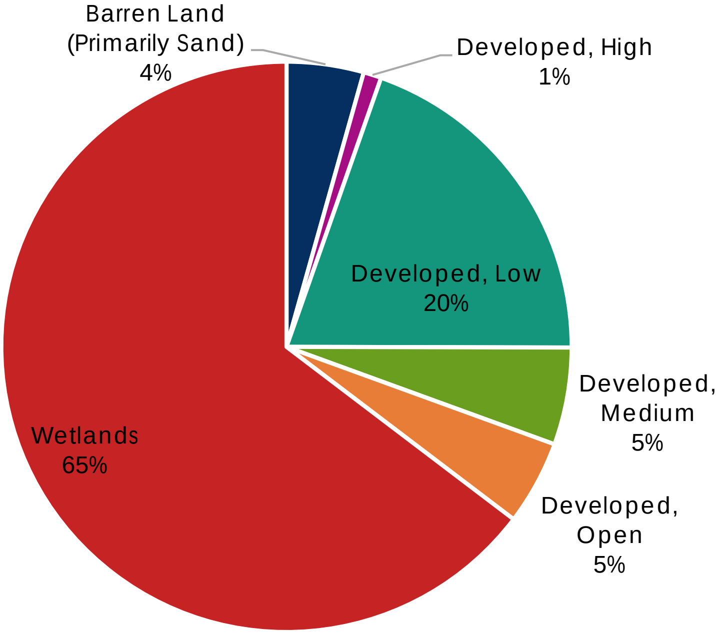


Figure 9: Tangier Land Use Land Cover

Source: USGS. National Land Cover Dataset. 2011

CHESAPEAKE BAY AND WILDLIFE

Tangier is highly dependent on the health of the Chesapeake Bay. The Bay provides more crabs for human consumption than any other water body on Earth. Tangier's fisherman rely on good water quality to provide healthy crabs for the year (*Tangier Town Plan*, 2001).

Tangier supports a variety of wildlife. It attracts a variety of migratory waterfowl, including Canada geese and tundra swans. Non-migratory species include mallards, widgeons, black ducks, and redhead ducks. Black ducks and redhead ducks are of particular importance due to their decline nationally, but strong presence in Tangier. The dynamic nature of the island means that the number of birds and habitat availability fluctuate. There are other species of wildlife including otters and muskrats. The Atlantic Blue Crab is the most important species due to its value as a resource for Tangier fisherman (*Tangier Town Plan*, 2001).

Figure 10: Marsh view from bridge. Photo by Shannon Alexander

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

A summary of the past planning efforts in regards to hazards can be seen below. This section focuses upon a review of what has already been examined and noted in relation to hazard preparedness.

Table 5 : Town of Tangier Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan (updated	Zoning (updated 1992) &/or Subdivision Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committee	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town joined the NFIP on October 15, 1982. From 1982 to 2011 there were 87 total flood insurance claims with an average claim of $10,705. Between May of 2011 and January of 2016, there were there were an additional 11 claims, averaging about $13,348 each. This could be a reflection of an increase in the frequency and intensity of storms, relative sea level rise, and the negative effects of erosion, and can certainly be attributed to damages from Hurricanes Irene and Sandy. There are eleven low risk policies; indicating that some property owners maintain insurance despite their lack of requirement to do so.

According to the new Flood Insurance Rate Maps (FIRM), there are 3.8 mi^2 in the Special Flood Hazard Area (SFHA), and 2.4 mi^2 in the V Zone, both were reduced by 0.1 mi^2 (about 64 acres). The updated 2015 FIRM reveals a net reduction of 29 buildings in the SFHA. The new FIRM thus has more area in the 0.2-percent-annual-chance flood zone and in the X zone (not in any flood zone) than the previous FIRM. The base flood elevation (BFE) for the areas in the A zone are now only 4 feet, where previously many areas were indicated to need a BFE of 5 feet. The indication is that structures need only be built at 4 feet elevation in areas where they were previously required to be built at 5 feet, despite the complaint that some homes regularly flood, even those built at 4 feet elevation (Housing Alliance staff, personal communications, June 13, 2016). The Town uses Accomack County zoning requirements, which as of 2015 require homes to be built at 2 feet above the FEMA BFE, however, FEMA will only pay for homes to be built or raised to the BFE indicated by the FIRM.

Figure 11: Sign indicative of the project that constructed six homes in 2003. Photo by John Aigner

Coastal Barrier Resource Act (CBRA) lands exist within the Town. They are located in the southeast corner of the Town. In addition, there are CBRA lands outside the Town limits that border the corporate boundaries to the south and to the east. After November 16, 1990, flood insurance cannot be purchased from the federal government for any new development or substantial improvement of an existing structure on these lands. Besides the prohibition on purchase of flood insurance other federal monies cannot be expended in this area including; disaster assistance, Community Block Development Grants (CDBG), flood control projects, construction of new federal highways and beach nourishment projects.

Table 6: Summary of Tangier's past NFIP participation

	HMP 2006	HMP 2011	HMP 2016
NFIP (date joined)	October 1, 1982	October 1, 1982	October 1, 1982
Number of Policies		96 policies	78 policies: 0 V-zone, 67 A-zone, 11 other
Total Premium Amount	-	$54,566	$63,852
Total Coverage Amount	-	$10,562,600	$11,100,600
Number of Claims (since 1978)	23	87	98
Total Paid (since 1978)	$194,074	$931,335	$1,078,159
HMGP	21 homes raised	-	-
CRS Score (1 highest, 10 lowest)	-	-	-

Source: *FEMA NFIP Insurance Report* 2006, 2011, 2016

HMGP

The Town has not managed a HMGP grant. Accomack County has used the HMGP to elevate 3 homes on Tangier. Under Disaster Recovery Initiative funds made available following Hurricane Floyd in 1999, the Accomack-Northampton Planning District Commission (A-NPDC) also elevated 6 houses. The Town and A-NPDC elevated 12 homes following flooding from Hurricane Isabel in 2003. No additional projects have been completed, and it is thought to become increasingly difficult for residents to elevate additional homes as the program has become cost prohibitive (Eastern Shore Housing Alliance staff, personal communications, June 13, 2016).

HAZARD PROFILE

WIND

The entire Town is located in the wind-borne debris hazard area. This area extends 1-mile inland. Figure 8 shows that the west coast of the Island is anticipated to bear the brunt of the damages during such a wind event. According to the Hazus® model, a total of about $218,000 in damages to buildings, contents, and inventory would be amassed from winds during a 1-percent-annual-chance event. An additional $36,273 in relocation costs and $26,590 in lost wages and rental income would be accrued, for a total of $282,173 in losses. This is significantly less than the estimates from the previous Hazard Mitigation Plans, but that is due to the methods by which the figures were produced. Figure 6 reveals which areas of the Island are to suffer the most damages financially.

In addition to what is referred to as the 1-percent-annual-chance wind event, there is the additional threat of tornadoes and/or waterspouts.

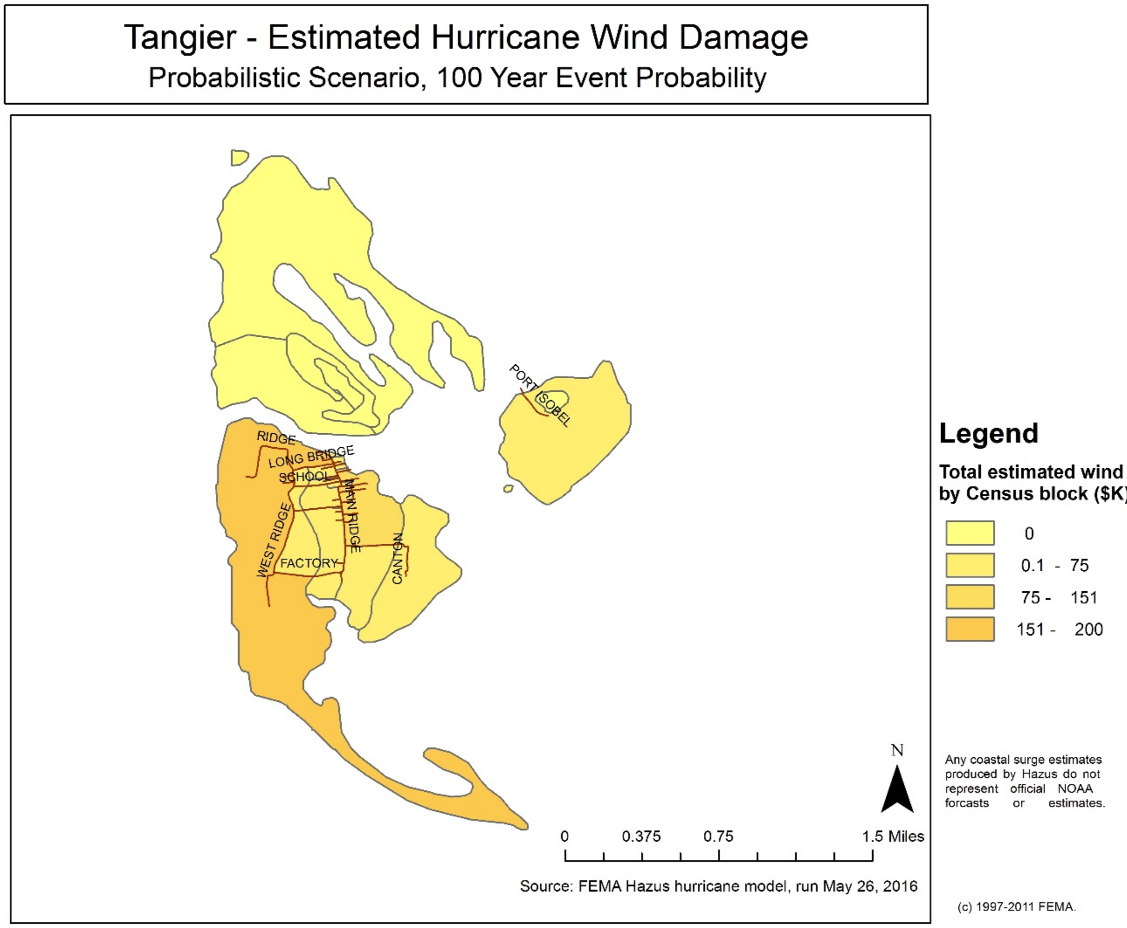


Figure 12: Tangier Estimated Wind Damage by Census Block

COASTAL EROSION

The island has a severe erosion problem. In 1713, grants show that there were approximately 1,170 acres of land. In 1813, a garrison of 1,200 to 1,500 British redcoats and the island's population existed on the island. The 1900 Census showed that the island had 1,064 people and at the time of the 1933 hurricanes the island had a population 1,300 to 1,400. Five former upland ridges have become marshes just since 1850 (Schulte et. al, 2015). One of the ridges, called Canaan, had a roadway until 1923 that connected it with the remaining three developed ridges, but is now separated by Tangier Creek.

Due to increasing rates of land loss, only 33.25% (about 790 acres) of the 1850 island mass is remaining as of 2013 (Schulte et. al, 2015). The results of the 2015 study somewhat align with those of a 2003 study, as they both indicate that the Uppards, the island to the north of the main east-west navigation channel will erode by about 2100. However, the more recent study indicates that in addition to the Uppards, Tangier Island itself will also be inundated by that time, unless remedial actions are taken.

A seawall was built to stabilize the western shoreline of the island, and has prevented significant further erosion from occurring in this area. However, this existing seawall is losing height as rocks are being moved, shifted, and rolled off with repeated storm action. Shoreline erosion, primarily from wind driven waves and ice sheets, was so great on the western side of the island it was threatening to damage the airport runway. It is important to repair this protective asset.

In November 2012, Gov. McDonnel and officials from the U.S.ACE pledged to build a jetty that would protect the Tangier harbor. The feasibility phase was completed by the U.S.ACE in 2012 and indicated a total project cost of less than $45 million, and follows the 1995 design plan. The jetty will protect the mouth of Tangier Creek from further erosion and will extend south from the north shore of the channel on the western side of the island, into the Federal channel, then dogleg southwest about 200 feet, paralleling the channel. Approximately 170 feet of revetment would armor the shoreline at the base of the structure and a small 50-ffoot spur jetty would also be constructed off of the seawall on the south shore adjacent to the North Channel to reduce wave action (U.S.ACE, 2012).

Erosion in Tangier also destroys the Town's natural buffer (trees, shrubs, dunes, etc.) against damages from high wind. If erosion is not mitigated in the future, then the community will be at increasing risks to wind damage as well as flooding damage.

COASTAL FLOODING

The Flood Insurance Study (FIS) for Tangier identifies that the greatest threat of flood inundation comes from hurricanes and northeasters. Development within the Special Flood Hazard Area is extensive and includes numerous wood frame houses and commercial buildings (Tangier FIS). Most of the island is below 4 feet in elevation. The entire island does not lie in the Special Flood Hazard Area, however, much of the remaining land is within the 500-year flood plain. Some structures are built in these areas.

The most vulnerable areas include North Main Street, past the school, on Mailboat Harbor, the south end of Canton Road, South Main Street and homes on West Ridge Road near Big Gut. In 2004, then Mayor Parks estimated that there were 47 homes that were affected by high tides. In a 100-year storm these homes are the most vulnerable to damage.

In addition to a quarter of the Town residents being licensed commercial fishermen, an even larger percentage of the island's workers are employed in the seafood industry (Town Council, personal communications, June 16, 2016). The primary harvest is Atlantic blue crab (Tangier Town Plan, 2001). Tangier watermen also harvest clams and oysters. Large disasters, such as a 1-percent-annual-chance flood, will cut drastically into the Town's profits, the incomes of the residents and the productivity of the workers at the same time making it necessary for the residents to arrange and pay for the repair of damaged homes. Unlike other communities where construction companies are available, Tangier had only 3 individuals employed in construction in 2010 (2010 Census). Additionally, most construction materials need to be shipped to the island.

In September 2003, Hurricane Isabel, although not reaching the Base Flood Elevation, flooded 97 homes and almost wiped out the crabbing industry on Tangier. Some crab houses were completely washed away while others listed into the water. Approximately 34 crab houses, 40%, were destroyed or significantly damaged of an approximate 85 crab houses. These crab houses were located in the southeast of Mailboat Harbor. This was the area where the winds and surge were coming from. Since these buildings are over water they are not eligible for NFIP flood insurance. At that time, the crab houses cost approximately $25-$30 per square foot to rebuild. Commonly, crab houses are typically range in dimension (in feet) from 12 x 12 to 16 x 20. Other watermen sustained losses when their crab pots and crab floats were washed away. These were not insignificant losses since one float costs over $100 and a crab pot runs about $35. A waterman may have 700 crab pots and 30 floats. Crab season runs from April to November with much of the harvest time corresponding to hurricane season.

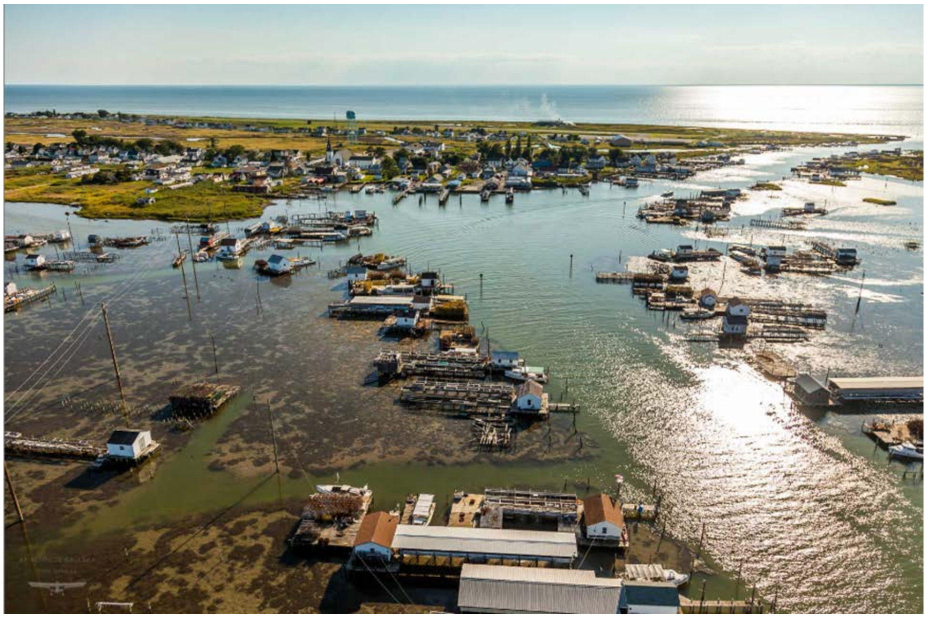


Figure 13: Crab and watermen houses on Tangier can easily be damaged during storms, such as Hurricane Isabel. Photo ©2016 Gordon Campbell/At Altitude Gallery

Besides the crabbing industry, tourism has become a larger part of the local economy of Tangier. The tourism industry is primarily located around Mailboat Harbor and south along Main Street. This industry would also be slow to recover following an intense storm event.

Residential flood losses in the event of a 1-percent-annual-chance flood in the Town were estimated to be approximately $320,000 including building and content damages. This is much less than the estimates of $4 million in 2006 and $4.2 million in 2011 (Eastern Shore of Virginia Coastal Flood Vulnerability Assessment, 2006 & 2011), primarily due to the completely different methods by which the figures were created. The figure for 2016 was created using FEMA's Hazus® model, whereas the previous two years were a system of formulas created locally for use in the Hazard Mitigation Plan. The 2016 NFIP insurance report indicates that a loss of this magnitude would easily be covered by flood insurance.

Town Manager Tyler indicated that historically and generally, residents have only evacuated the island for storms of Category 2 strength or greater. Since the majority of flooding events occur as result of storms of lesser than Category 2 strength, residents that do not evacuate are at greater risk since the Tangier Fire and Rescue Department has limited accessibility around the island during flood conditions. However, with high projected rates of relative sea level rise, it is likely that storms of lower intensity will have higher impacts.

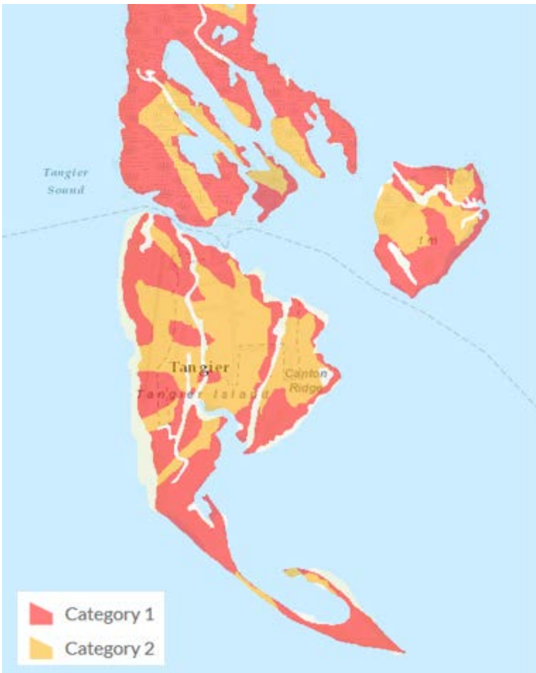


Figure 14: Estimated Hurricane Impacts; Source: Virginia DEM Storm Surge Tool

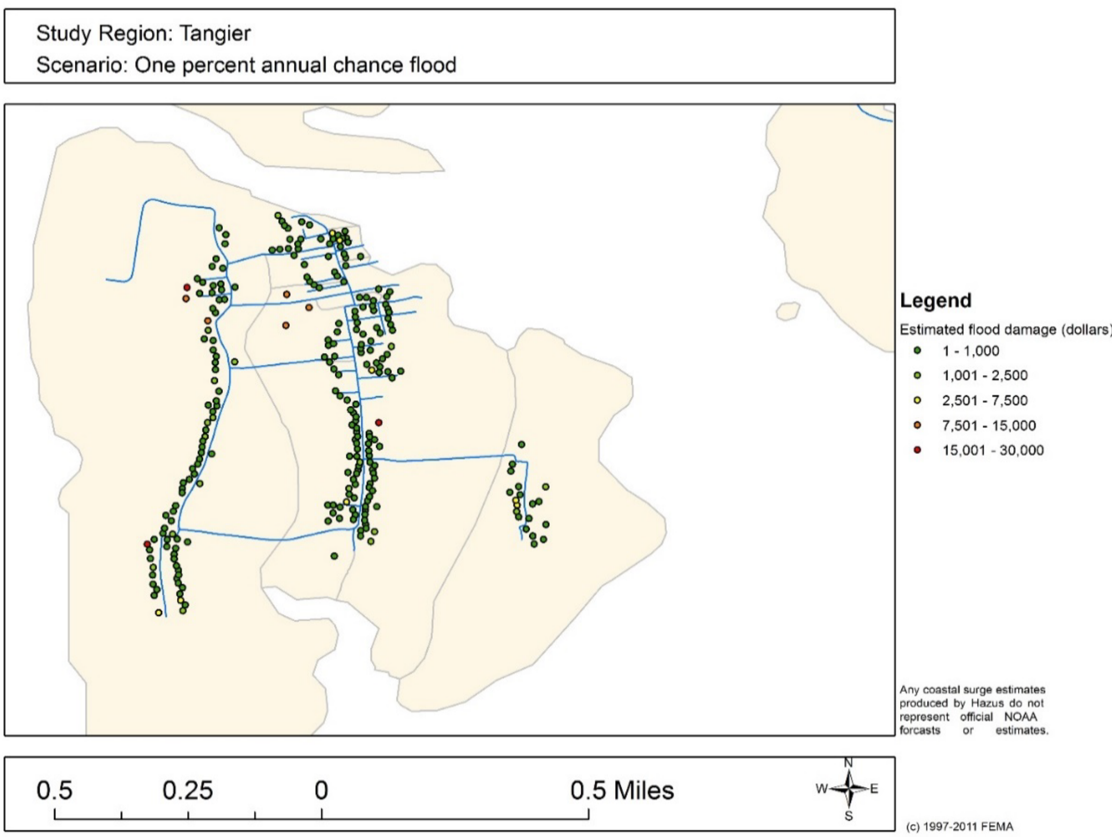


Figure 15: Tangier Hazus® Predicted Damages during a 1% Annual Chance Flood

STORM WATER FLOODING

The island is susceptible to poor drainage due to high water and has localized ponding after storms. Most soils on Tangier Island are highly permeable, and much of the soil underlying the developed areas is hydric. Hydric soils are primarily wet and poorly drained. Currently, there is no storm water management on Tangier (Tangier Town Plan, 2001). In particular, storm water carries pollutants into the wetlands and damages the nurseries of marine life that the Town's economy depends on.

Storm water flooding is tidally dependent, and typically only occurs in tandem with tidal flooding. Pondarosa Road is a recognized problem area. The stretch of Parks Marina Lane and Maine Ridge Road from James Parks Marine to Daley & Son Grocery is also prone to flooding, which is prime commercial area and the area most heavily used by tourism visitors.

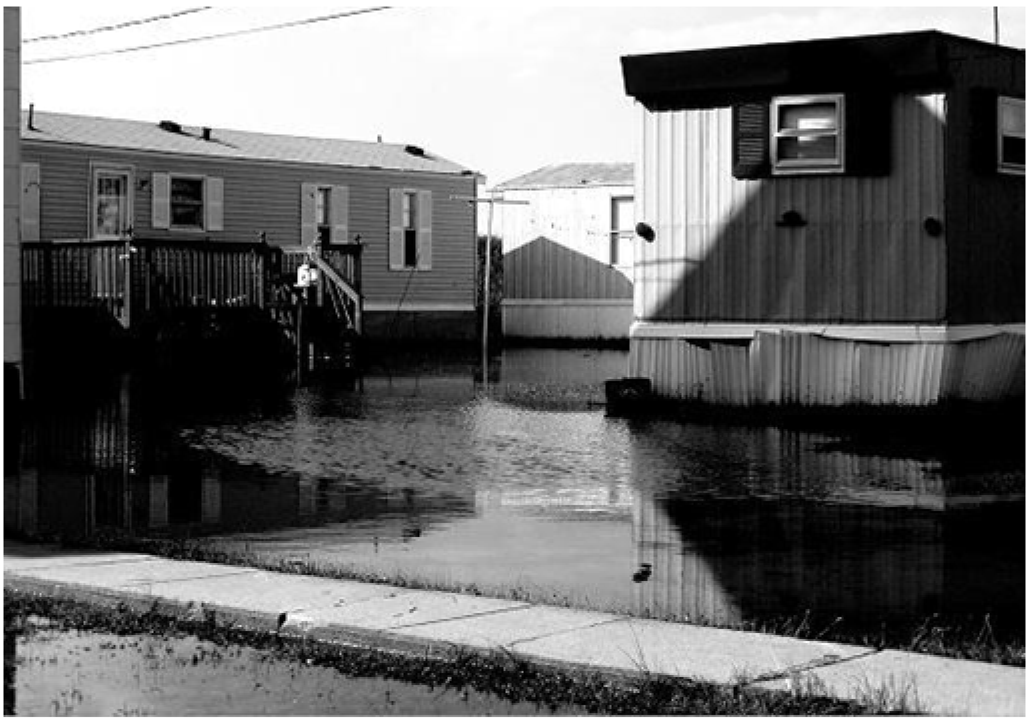


Figure 16: Flood water ponding around homes on Tangier after Hurricane Isabel in September 2003. Photo by Deborah Mills.

HAZARDSOF LOCAL SIGNIFICANCE

Other hazards for Tangier include, but are not limited to: winter weather, water quality, epidemics, fire suppression, and salt spray.

SALT SPRAY

Salt spray and salt air cause damage to local building materials. Over time mortar disintegrates in the air, leaving block foundations essentially dry stacked. The blocks themselves crumble over time with exposure to the salt air.

WINTER WEATHER

Unlike other places on the Eastern Shore winter weather can be devastating to the community as the entire island can become surrounded with ice. Without boat access, supplies on Tangier become limited. In the past, supplies had to be flown to the island and dropped into the marsh for residents to collect to prevent starvation. Since the airport was constructed, some of these problems have been alleviated. In 1977, 20-foot piles of ice collected on the western side of the island causing extensive erosion and damage to the airport runway. Since then, a break water structure has been built to protect the airport from water and ice. This has also helped control Tangier's vulnerability to erosion at this site. These freezes continue to happen unpredictably, as it did in 2003 (Figure 13) and in 2014.

Figure 17: Tangier in February 2003, a Coast Guard cutter came later to break the ice and deliver the mail. Photo by John Aigner

FIRE SUPPRESSION

Fire suppression is a problem if the water supply loses power. The water tank holds approximately one day's water supply and without power from the A&N station there is no means to pump additional water. There are generators at the Tangier substation, but overhead wires supply current to the island and these can come down in high wind events. This substation also powers Smith Island to the north.

WATER QUALITY

Since many people rely on the fisheries industry, fish kills and the declining health of the Chesapeake Bay impact the Town. These water quality hazards represent a threat to the livelihood of residents in Tangier and various coastal communities on the Eastern Shore.

EPIDEMICS

There have been four epidemics on the island. In 1866, a cholera epidemic swept the island. Numerous people died and were quickly buried in their front yards without a marker. The entire island economy was destroyed when the people put down their livestock and evacuated the island. They were unable to return until the following year. In the 1870s, the island was struck with tuberculosis and measles and in the 1880s the island was swept with smallpox. Today such events are less likely due to medical advances, but with any small, isolated community that uses the same water supply and often eats from the same source (Chesapeake Bay seafood), they are still possible and of some concern.

INVASIVE SPECIES

Invasive species that would negatively impact the fisheries would be devastating for the residents of the Town. In addition, invasive species such as the Nutria negatively impact the Town by damaging the marsh vegetation that provides protection from storm surge and erosion.

CRITICAL FACILTIES

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

Three of the critical facilities on the island: the Health Center, Combined School, and History Museum and Interpretive Cultural Center (HMICC), were completed between the original Hazard Mitigation Plan in 2006 and the 2011 update. The Health Center was constructed in 2010 and built in a manner that minimizes impacts from natural hazards, specifically flooding and high winds. The Combined School was elevated above BFE in 2006 to lessen the threat from flooding. The HMICC opened in 2008, serving as the historical and cultural center for residents and visitors of Tangier.

Figure 18: The Tangier History Museum. Photo by Shannon Alexander

Table 7: Critical Town Facilities in Tangier

Facility	HMP 2006	HMP 2011	HMP 2016	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town Owned Facilities								
Tangier Town Office	X	X	X	Flooding Wind	475+	Devastating	Yes	Yes
Tangier Sewage Plant	X	X	X	Flooding Wind	475+	Devastating	No	Yes
Tangier Water Tower	-	-	X	Wind	475+	Devastating	No	Yes
Other Facilities								
Tangier Fire & Rescue Department	X	X	X	Flooding Wind	475+	Devastating	No	Yes
ANEC (power station)	X	X	X	Flooding Wind	475+	Devastating	No	Yes
Tangier Airport	X	X	X	Flooding	475+	Major Disruption	No	Yes
Tangier Combined School	X	X	X	Flooding Wind	475+	Major Disruption	No	Yes
Tangier Museum	-	-	X	Flooding Wind	475+	Major Disruption	Yes	Yes
Tangier Harbor	-	-	X	Flooding Wind	475+	Devastating	No	Yes
Tangier Health Center	X	X	X	Flooding Wind	475+	Major Disruption	No	Yes
Post Office	-	-	X	Flooding Wind	475+	Major Disruption	Yes	Yes
Gym	-	-	X	Flooding Wind	475+	Inconvenience	Yes	Yes

FINDINGS

1. Tangier is unique in our region and nationwide as one of the most at risk communities to erosion, flooding, and wave action.

2. Erosion is the Town's greatest threat and is also aggravating the flooding that occurs on the island. Loss of land on the east side of the Island has worsened flooding. In addition to shoreline stabilization, alternative use of dredge spoil should be considered in efforts to improve resiliency of the Island.

3. Flooding disasters have an extremely adverse effect on the Town's economy and could potentially push it beyond recovery.

4. By its nature, the primary industry on the island, the seafood industry, cannot obtain flood insurance. This will prolong the recovery period needed.

5. The new FIRM lowers the BFE for many buildings, this may be an inaccurate assessment of flood water levels during a 1-percent-annual-chance storm. The result is that homes obtaining assistance through HMGP may not be adequately improved to mitigate the true risk of flooding in the Town.

6. There are a significant number of residents who are uninsured or underinsured from residential flood losses. Not only is insurance cost prohibitive, but there is currently only one private company that offers insurance for homes here.

TOWN OF WACHAPREAGUE

TOWN PROFILE

Wachapreague was originally a Native American fishing village settled by the Matchapungos, a subdivision of the Algonquin Tribe. Nathaniel Bradford first patented the land in 1662 for 1000 acres. The town settlement wasn't developed until the early 1800s. The Town's wharf was used to ship goods to other American cities in 1825. The late 1800s saw a successful fish oil and fertilizer company, and a booming reputation as a tourist destination. The Wachapreague Hotel in 1902 attracted hunters and fisherman from all over the country until it burned down in 1978. Wachapreague has seen a history as a town that capitalized on its location for shopping, natural beauty, and fishing.

Figure 1: Wachapreague Aerial Map

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 factors that relate 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

The population of Wachapreague has remained steady from 2000 to 2014 at just over 200 people (U.S. Census 2000, 2010). Like many towns along the Shore, Wachapreague experiences an increase in transient populations during the warm seasons due to tourism. This is an important aspect in response to emergency situations and mitigating hazards, as larger populations require more response and aid. Also, often visitors do not know where emergency facilities are located and are often less familiar with local weather patterns and hazard potentials. The median household income level indicated for 2014 by the American Community Survey in Table 1 below, is thought to be a low estimate (John Joeckel, personal communication, May 18, 2016).

Table 1: Wachapreague Demographics

	2014***	2013***	2010**	2000*
Population	232	182	232	236
Median Age	63.1	63.2	57.9	55.6
Disability	1	1	0	NA
Income				
Median Household Income	$26,250	$40,625	$54,688	$36,625
Poverty Level	16.4%	17.0%	24.2%	18.0%
Language				
Only English	87.0%	83.0%	92.0%	97.8%
Other	13.0%	17.0%	8.0%	2.2%
Spanish	NA	14.8%	8.0%	0.0%
Ind-Euro	NA	2.2%	0.0%	0.4%
Asian	NA	0.0%	0.0%	1.8%

Source: * US Census 2000, ** US Census 2010, *** American Community Survey 2010 – 2014

WORK FORCE

Employment patterns are important to examine for two reasons. They can help to identify concentrations of people for hazard information dissemination or hazard rescue and evacuation. They can also identify where disruptions in employment and income might occur in the aftermath of a disaster.

The majority of the workforce in Wachapreague work in wholesale, retail, education, or other. If people do not work in the fishing or tourism business than they have to commute outside of the Town to work.

Table 2: Wachapreague Workforce

	Civilian Employed Population					
Industry	2014**		2010*		2000***	
	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	2	2.4%	16	13.6%	3	2.4
Construction	4	4.8%	22	18.6%	11	8.8%
Manufacturing	14	16.9%	4	3.4%	7	5.6%
Wholesale trade	5	6.0%	9	7.6%	8	6.4%
Retail trade	9	10.8%	14	11.9%	13	10.4%
Transportation and warehousing, and utilities	2	2.4%	0	-	17	13.6%
Information	1	1.2%	7	5.9%	0	-
Finance, insurance, real estate, and rentals	2	2.4%	10	8.5%	5	4.0%
Professional, scientific, waste management	7	8.4%	8	6.8%	14	11.2%
Educational, health care, social services	16	19.3%	20	16.9%	20	16.0%
Arts, entertainment, recreation, food	11	13.3%	3	2.5%	14	11.2%
Public Administration	5	6.0%	0	-	13	10.4%
Other	5	6.0%	5	4.2%	0	-
TOTAL CIVILIAN EMPLOYED POPULATION	83	-	118	-	125	-

Source: * American Community Survey, 2010-2014, ** U.S. Census Bureau Center for Economic Studies (OnTheMap), *** U.S. Census 2000

BUSINESSES

Wachapreague's surrounding natural beauty means that most of its economic vitality stems from fishing, hunting, boats, and tourism. Wachapreague has a working waterfront and navigable waterways. This allows the local fishing and recreation facilities of the Town to support a variety of businesses consisting of marinas, tackle shops, restaurants, and lodging services. The Wachapreague Inlet enables access to the Atlantic Ocean and its opportunities for commercial and reactional seafood. The Town's economy is also heavily dependent on tourism. In 2015, there were a reported 24 town business licenses relating to lodging, restaurants, artisan/crafts, tourism, construction services, and commercial seafood enterprises (Town of Wachapreague Comprehensive Plan, 2016).

Table 3: Wachapreague Business Types

Industry Code Description	**Total Establishments**		
	2013	**2011**	**2009**
Construction	1	1	2
Retail Trade	1	1	1
Transportation and warehousing	1	1	1
Professional, Scientific, and Technical Services	1	1	1

Arts, Entertainment, and Recreation	1	1	1
Accommodation and Food Services	2	2	2
Total, All Establishments	7	8	10
Total Employees	65	68	NA

Source: Census Zip Code Business Patterns, 2009, 2011, 2013

BUILT INFRASTRUCTURE

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 towards safety.

HOUSING UNITS

There are a total of 235 housing units in Wachapreague. The vehicles available number reflects upon the 235 occupied housing units. The largest use of housing in the town is for owner occupancy, followed by seasonal, then rental housing. Generally, the Town's housing is in good condition, however, with the decreasing population and increasing seasonal residences, there are housing that are in a poor state of repair (Town of Wachapreague Comprehensive Plan, 2016).

Table 4: Wachapreague Housing

	2014*	2010**	2000***
Total Housing Units	249	230	225
Occupied	112	124	133
Vacant	137	106	92
Owner-Occupied	84	95	107
Renter-Occupied	28	29	26
Median Housing Value	$138,900	NA	NA

Source: * American Community Survey, 2009 – 2013, ** US Census 2010, *** US Census 2000

TRANSPORTATION

Wachapreague has approximately 5.6 miles of state maintained roads, including primary and secondary roads. The primary roads are Route 180 and Route 180 Y. Route 180 connects Wachapreague to U.S. Route 13. Route 180 Y provides an alternate route through Town and connects to Route 624. All other roads are secondary roads. STAR Transit's Green Express, a demand-response van service, serves the Town. With much waterfront activity, playing at the park, walking, fishing, and launching vessels, particularly with the increased population in the summer months, there is a concern about the speed of vehicles entering Town and about sufficient parking (Town of Wachapreague Comprehensive Plan, 2016).

Individuals with personal vehicles can most often more easily remove themselves and their families from harm's way in the case of an emergency. About 5% of the Town residences' are without even a single vehicle.

Table 5: Wachapreague Resident Vehicles

Vehicles Available	2014*	2010*	2000**
None	12	11	12
One	25	42	48

Two	64	57	60
Three or more	12	15	11

Source: * American Community Survey, 2009 – 2013, ** US Census 2000

With only two feet of sea level rise (SLR), it is estimated that Atlantic Avenue, the main waterfront commercial street, will be at least partially inundated with water. This is important to note, as it also indicates that with two feet of flooding at mean high tide, this section of the road would also be inundated. Fortunately for the Town, the majority of the residential area roads will not likely experience flooding unless storm surge or SLR reaches six feet. Much of Wachapreague Road, the main access road to the Town and its evacuation route, is within the floodplain as well, which can be seen in Figure 2.

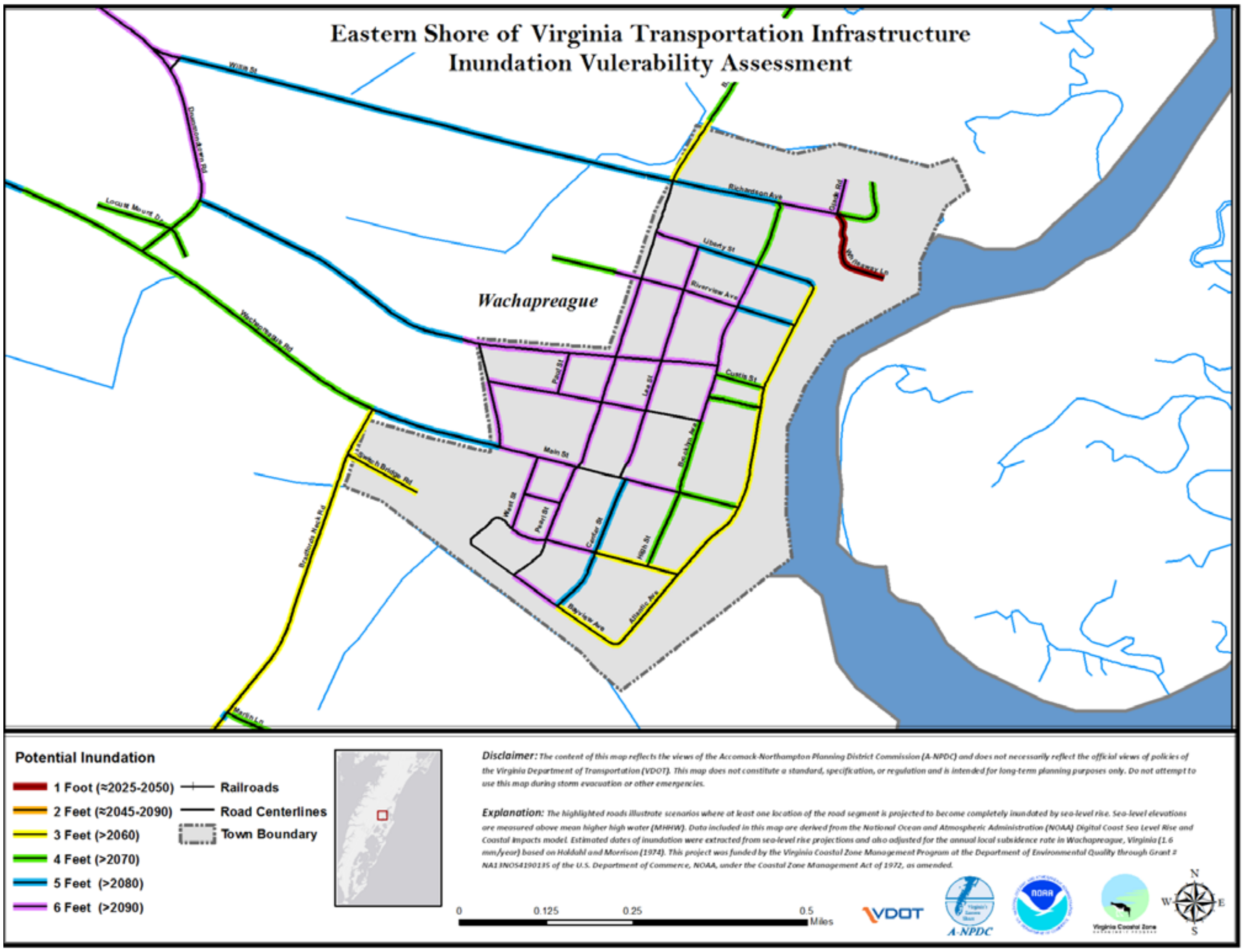


Figure 2: Town of Wachapreague Transportation Infrastructure Inundation Vulnerability

COMMERCIAL AREAS

The commercial center is found along Main Street and Atlantic Avenue. The commercial center consists of lodging, a Post Office, marinas, restaurants, and the Virginia Institute of Marine Science Eastern Shore Laboratory facilities.

The majority of the Town has already been developed. There are remaining undeveloped lots gradually being filled up with new buildings.

Figure 3: Wachapreague Waterfront Commercial Area. Photo by Elaine Meil

COMMUNITY SERVICES AND FACILITIES

Community facilities are facilities required to support the services and functions provided by the Town government or in coordination with other public and private entities. These facilities enhance the overall quality of life for the Town and its citizens. It's important to note what facilities are available in case of a hazard, and it's important to make an inventory of facilities that could be affected by a hazard.

PUBLIC SAFETY

Police protection is provided by Accomack County Sheriff's Office. The Volunteer Fire Company Fire Hall is located at 1 High Street and can be contacted at (757) 787-7818 and serves as the designated Town polling place as well. They provide Fire and other emergency services, however, EMS services are most likely going to be discontinued, and at that time the Painter or Melfa station will provide EMS services. There are no paid firefighting or non-firefighting support personnel employed, but there are about 25 volunteers. The Fire Company has an A.L.S. Ambulance, Engine, Tanker, Brush unit, and a utility/support vehicle. The station features five engine bays to house their fleet of five apparatus, as well as various other amenities.

Figure 4: Wachapreague Volunteer Fire Company.
Photo from The Town of Wachapreague Comprehensive Plan, 2016

WATER SUPPLY AND WASTEWATER

Wachapreague residents rely on private wells for their water supply. There is no central sewerage collection and treatment in the Town. Wastewater is disposal is by septic systems. In addition, residential water supplies can be threatened by failing septic systems. In the past, flooding that has damaged homes and destroyed possessions has also caused failed septic systems (Town of Wachapreague Comprehensive Plan, 2016). Also see the Hazards of Local Significance section in reference to salt water intrusion.

SOLID WASTE DISPOSAL

There is a private service located within the Town. There is a new Accomack County Convenience Center in Grangeville, on Wachapreague Road, just over 2.5 miles from Town.

PARKS AND RECREATION

The 15 acre Powell Memorial Park, has two tennis courts, a baseball field, pet waste station, picnic facilities, and playground equipment, and also serves as the storage location for the Town vehicles. The 1.5 acre Wachapreague Seaside Park, which was completed in December 2010, sits on the parcel on Atlantic Avenue where the historic Wachapreague Hotel once stood and boasts native plants, beneficial in water retention. Nearby, the fairgrounds bring a significant amount of traffic to the Town and the Wachapreague Fireman's Carnival located there provides much of the funds for the Volunteer Fire Company.

Water access is of vital importance for watermen, recreational fishermen, birders, marine research, outdoor enthusiasts, and special events and fishing tournaments such as the Marlin Tournament. In addition to the private Wachapreague Marina, LLC, there is also the Town Marina, which offers free use of the boat ramp for all Wachapreague taxpayers and offers transient and monthly slip rentals for boats up to 44' length over all. This facility provides access to paddle sport enthusiasts as well with a floating dock and as a launch site on the Eastern Shore Seaside Water Trail.

DRAINAGE DITCHES

The Town's drainage system is maintained by VDOT and Accomack County. There needs to be a continued effort to ensure the ditches and culverts are maintained with sufficient frequency. Town residents are concerned about drainage and flooding of streets during storms. There are issues with standing storm water at the intersection of Riverview Avenue and Lee Street and within the Town Park south of the baseball field (Town of Wachapreague Comprehensive Plan, 2016).

POWER AND COMMUNICATIONS INFRASTRUCTURE

Mobile service in the Town is inconsistent and often unreliable.

SCHOOLS

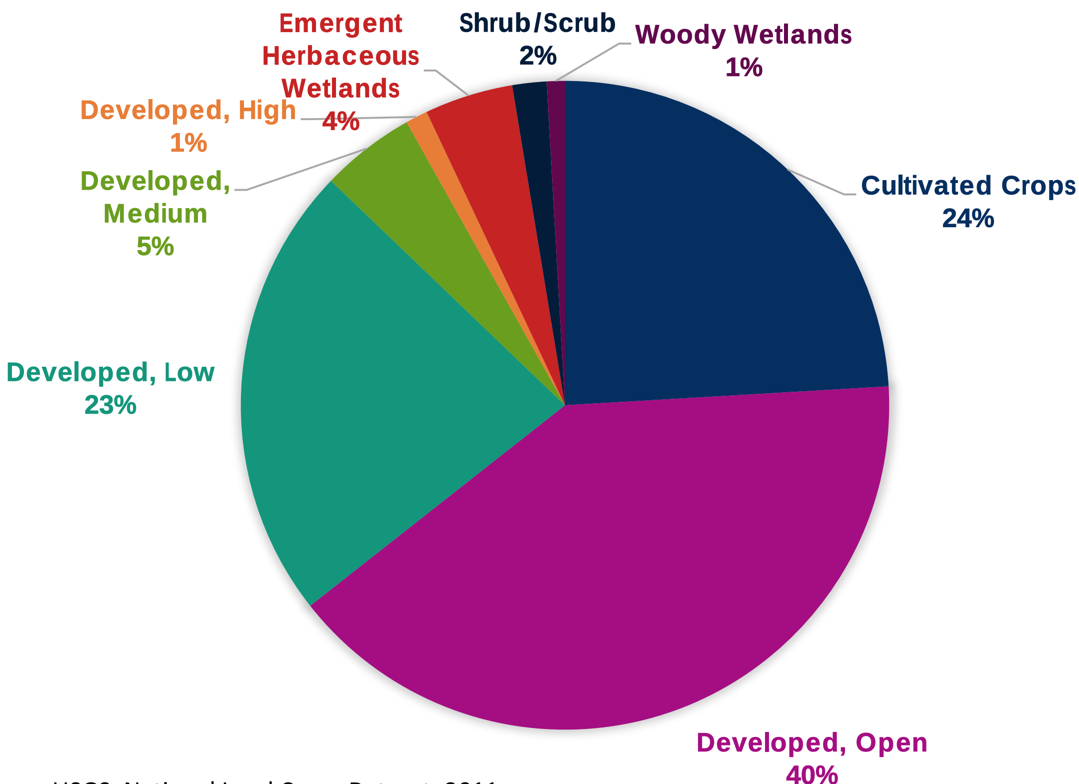
There are no schools within the Town boundaries. The Virginia Institute of Marine Science Eastern Shore Laboratory is located on the northern side of Town and has multiple buildings, including dormitories.

NATURAL ENVIRONMENT

Wachapreague lies within the geological region known as the Coastal Plain. All of the Eastern Shore is included in the Coastal Plain geological region, which is a low-lying region composed of sands, silts, and clay deposited by glacial melt water. Some of the soils in Wachapreague are generally not suited for conventional septic tank drainfields. However, due to alternative on-site wastewater treatment systems, such as mound systems, it is now possible to develop on some of these soils (Town of Wachapreague Comprehensive Plan, 2016).

LAND USE LAND COVER

The majority of Wachapreague's land use is low-density development. Because there is a high amount of green space, there is a low percentage of impermeable surfaces. This, in conjunction with the wetlands and croplands in the Town, is a benefit in mitigating the impacts of storm water and coastal flooding events.



Source: USGS, National Land Cover Dataset, 2011

Figure 5: Wachapreague Land Use Land Cover Percentages

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

The Town has participated in the Hazard Mitigation Planning process since 2006. The Town's primary risk is associated with coastal flooding.

Table 6 : Town of Wachapreague Hazard Mitigation Resources

	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan	Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	All Hazards Preparedness	Emergency Operations Plans	Mutual Aid Agreements/Documents	Neighborhood Emergency Help	Viginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow		Ground Water Committee	Navigable Waterways Committe	Climage Adaptation Working Group	ES Disaster Preparedness Coalition
Local	*				*	*													
County			*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM
& HAZARD MITIGATION GRANT PROGRAM

NFIP

The Town has been a participant in the NFIP program for over 30 years. Every year, there are a few policies for structures that were not located in the 100-year floodplain, which potentially indicates a storm water flooding problem. Most of the Town lies in the 100-year flood plain with the remainder lying in the 500-year floodplain. In 2004, the Town had 35 mortgages and 95 Special Flood Hazard Area policies compared to 51 mortgages and 104 policies in 2010. This indicates that a significant number of residents believe they have a flood problem and are actively trying to protect themselves.

Wachapreague also participates in the voluntary Community Rating System (CRS), which encourages the community to establish sound programs to recognize and encourage floodplain management activities that exceed the minimum NFIP requirements (Town of Wachapreague Comprehensive Plan, 2016). The Town has a rating of 9.

The average insurance amount per policy was $119,686 in 2004, $190,613 in 2011, and is $210,210. The average value of houses in the Town in 2004 was $83,614 and $138,900 in 2014. This may indicate that many of these policyholders carry contents insurance along with their structure insurance. In general, it seems that a significant number of residents and businesses are seeking ways to reduce their flood damage (Mayor J. Joeckel, personal communication, April 18, 2016). In addition, the Town is developing a plan to participate in the Community Rating System, which will improve resiliency and reduce insurance costs for residents and businesses.

Table 7: Wachapreague HMP Participation

	HMP 2006	HMP 2011	HMP 2016
NFIP (date joined)	Joined on September 2, 1982	Joined September 2, 1982	Joined September 2, 1982
Number of Policies	102 policies: 5 V-zone, 90 A-zone, and 7 other policies related to storm water flooding	111 policies: 4 V-zone, 100 A-zone, and 7 other policies related to storm water flooding	88 policies: 1 V-zone, 63 A-zone, and 24 other policies related to storm water flooding
Total Premium Amount	Average amount $119,686	Average amount $190,613	Average amount $234,945
Total Coverage Amount			$20,675,000
Number of Claims (since 1978)	8 claims totaling $5,072	26 claims averaging $14,564	28 claims averaging $14,409
Total Paid (since 1978)	NA	NA	$403,444
HMGP	Applied for funding from Hurricane Isabel to elevate homes and relocate firehouse. Both were pending.	Town received funding to elevate six homes following Hurricane Isabel.	Town received funding to elevate one home in 2012.
CRS Score (1 highest, 10 lowest)	-	-	-

Source: *ESVA Hazard Mitigation Plan*, 2006 and 2011. *FEMA NFIP Insurance Report*, 2003, 2011, 2016

HMGP PARTICIPATION

The Town received funding following Hurricane Isabel in 2003 to elevate six homes that had been impacted during the storm. At the time of writing of this plan, there is one house in the process of being elevated from a 2012 grant.

HAZARD PROFILE

WIND

No parts of Town lie in the wind borne debris hazard area. This area extends 1-mile inland from the barrier islands. The Town lies in the 110-120 mph design wind zone (Building Code). According to the Hazus model, about $36,800 in damages would be sustained from winds from a 100 year probabilistic scenario storm, with the waterfront buildings being the most at risk to higher levels of damages. Most of the residential areas are older and have mature trees in and around the homes. During a high wind event falling branches or trees may damage some structures. During Hurricane Isabel, more trees were downed than in any other event in the past fifteen years.

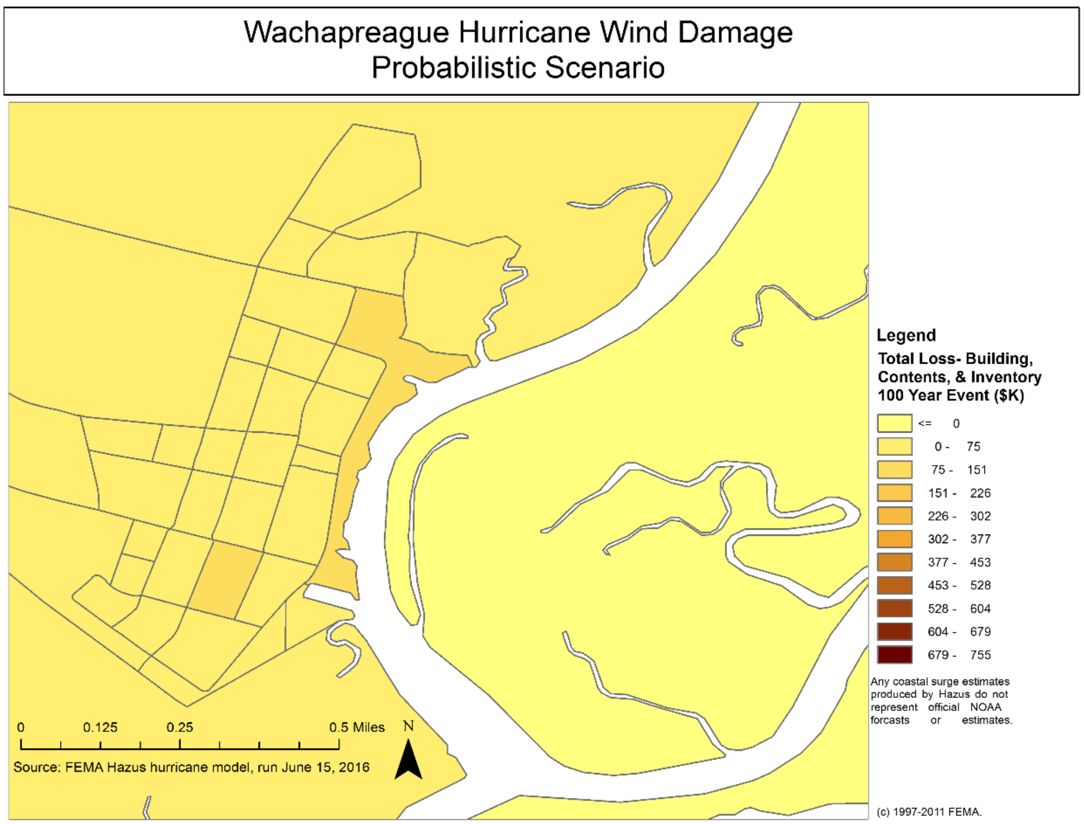


Figure 6 : Wachapreague Estimated Wind Damage by Census Block

Figure 7: High winds from Hurricane Isabel in September 2003 downed trees in Wachapreague including this tree which damaged a car. Photo Dan Bilicki

COASTAL EROSION

No structures appear to be at immediate risk to coastal erosion. The constantly shifting barrier islands, and extensive marshes, have historically protected the Town from the wave energies of the Atlantic Ocean. For Wachapreague, the erosion of Cedar Island is a major concern, as this island provides their primary protection from Atlantic storms. The images in Figure 8 partially reveal the rate and intensity of Cedar Island erosion. This rate has continued to increase, as by the summer of 2016 the entire southern end of Cedar Island, including all land shown in both images in Figure 8, are entirely submerged at all stages of the tide (Town of Wachapreague Comprehensive Plan, 2016 and Robert Hodgson, Town Council, personal communication, November 10, 2016).

Not only are the man-made structures in the Town at increased risk with the loss of the protections that the barrier island afforded, but the marsh is also vulnerable to damages and erosion from increased storm surge exposure. The marsh is vital in reducing flooding risks and as habitat to a variety of commercially valuable harvest species.

There are the remains of a Works Progress Administration earthen protection dike along the east side of Finney Creek and Atlantic Avenue. This was built in summer 1934 in response to the previous year's hurricanes. It has not been maintained and no longer provides much protection from floodwaters. This is, however, Town owned property and the Town is investigating its use as a spoil location site and more importantly an area to build up to serve as a wave break for the Town (John Joeckel, personal communication, April 19, 2016 & Robert Hodgson, Town Council, personal communication, November 10, 2016).

Figure 8: Aerial Comparison Photos for Cedar Island 2006 & 2013. By the summer of 2016, the entire area represented in both photos is entirely under water at all tidal levels. Photo Courtesy of Gordon Campbell, At Altitude Gallery

COASTAL FLOODING

The Flood Insurance Study (FIS) for Wachapreague identifies that the greatest threat of flood inundation comes from northeasters and hurricanes.

The Special Flood Hazard Area (SFHA) boundaries have changed based on new LiDAR-based topographic data, there was a decrease of 0.1 mi^2 and thus 150 buildings. Within the Coastal High Hazard Areas (CHHA) the Town of Wachapreague has two A Zones within the corporate limits where the Base Flood Elevations range from base flood elevation of 7 to 8 feet. The 2015 FIRM shows approximately 91 structures within those zones, see Figure 10. Although the FIRM does not show the V Zone exceeding the immediate shoreline, it is thought that there would be damage from the wave action of floodwaters further inland. This is particularly of concern as the berm or break water opposite the channel from the waterfront has been settling and does not provide the same protection as it did years ago. Additionally, the southern end of Cedar Island has eroded significantly in the last 5 years, vastly increasing the size of Wachapreague Inlet, increasing the vulnerability of the interior mash system and the Town to incoming wave action from the Atlantic during a wind or storm event. Although the Army Corps of Engineers recently announced their intention to complete a beneficial use of dredged material project, this will not be started for at least two years and most likely no physical work will take place for many years.

According to the 2000 Census, 211 (92%) of all houses were built prior to the Town adopting the NFIP ordinance. In the event of a 100-year flood it was estimated in 2006 that the Town would have $6.5 million in building and content loss (Eastern Shore of Virginia Coastal Flood Vulnerability Assessment, 2006). In 2011, it was estimated that the Town could experience $12.5 million in damages, which was nearly a $6 million increase over the previous five years (Eastern Shore of Virginia Coastal Flood Vulnerability Assessment, 2011). An assessment done by Hazus Version 2.2 reveals a total loss of $6.5 million, including building content, inventory, and business interruption for 2016. Over half of that total is from content loss. Although the VIMS construction standards are extremely high, the Hazus model estimates substantial (about 13%) building damage. The loss from inventory and contents of the VIMS facility far exceeds the cost of damages to the buildings, however, and makes up a large portion of the total loss.

Figure 9: The Watchapreague Waterfront Commercial Area during Hurricane Isabel in 2003. Photo by Dan Bilicki

The Hazus model estimates that a total of 476 tons of debris would be generated during such a storm. This is a significant cost to address, as it would require 19 truckloads (at 25 tons/truck) to remove the debris generated by the flood. This debris along the rack line often interferes with vehicular travel and creates a burden on the local residents. Additionally, the model estimates that 28 households will be displaced due to the flood, and that 14 people from these households would seek temporary public shelter.

The Town's fire hall is located in the floodplain as is the commercial center. Wachapreague's economy is based on the businesses centered on the waterfront. There are seven main docking facilities located there: Wachapreague Town Marina, Wachapreague Seaside Marina, Island House Dock, Fisherman's Lodge, Coast Guard Dock, the clam house and the Virginia Institute of Marine Sciences (VIMS) campus. Most other businesses are also located close to Atlantic Avenue. This flood prone area represents most of the commercial activity that occurs in the Town as previously emphasized in Figure 2.

The Town has purchased the parcel where the Wachapreague Hotel was once located and maintained the Wachapreague Seaside Park there since 2010. The parcel's waterfront and central location within the Town made it very desirable for development. Maintaining the parcel as a park eliminates any potential flooding hazards that would be problematic were any development to occur there.

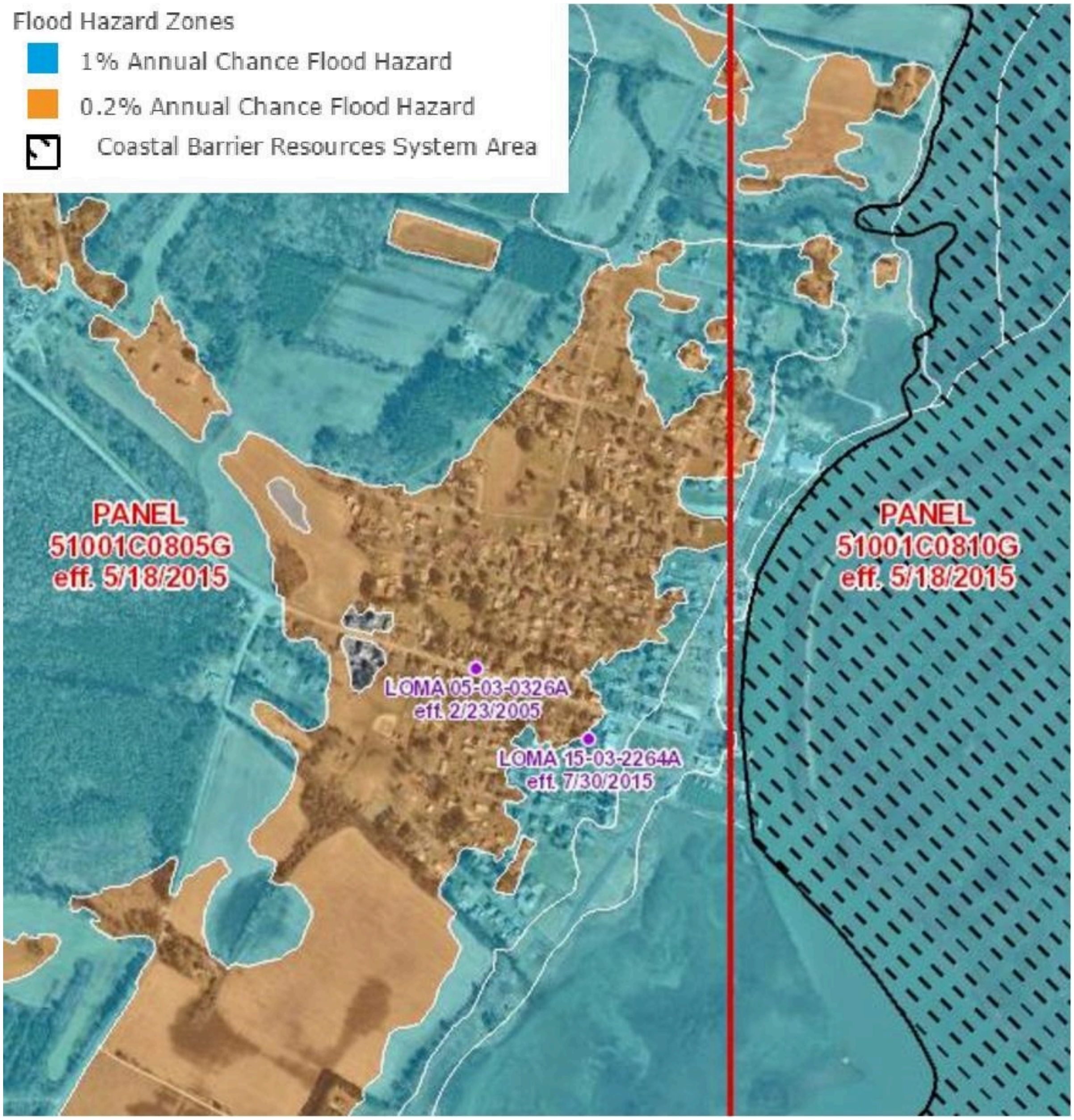


Figure 10: FEMA's National Flood Hazard Layer (effective May 18, 2015) Source: Accomack.mapsdirect.net)

Figure 11: Surge impacting the location of the Seaside Park, marina, and Island House Restaurant during a storm event in October 2005. Photo by Dan Bilicki

Figure 12: Photograph showing the surge from Hurricane Isabel in September 2003 impacting the same area depicted in Figure 11. Photo by Dan Bilicki

STORM WATER FLOODING

The Town is divided into three drainage sheds. One of these runs along the waterfront and expands to include most of the southern portion of the Town. Storm water in this area drains onto Atlantic Avenue and is caught by storm sewers and diverted into Wachapreague Channel and Finney Creek (Wachapreague Town Plan, 1983). The second drainage basin includes most of the remainder of the Town and lies just behind the waterfront drainage basin. This basin has the largest amount of development within it. The lowest point is the intersection of Riverview Avenue and Lee Street. Areas in the Town Park south of the baseball field is also an area that water will sit until it drains into the soil or evaporates. The majority of the soil in the Town sandy loam (fine, Dragston, Magotha, and Bojac), which typically drains well, but generally doesn't hold a significant amount of water. Portions of a third basin are within the Town. The area affected is western pieces of Town centered on Main Street. The water from this area drains west out of the Town. The land south of the ball field holds surface water. Like many coastal areas, tides can have an impact on the storm water flooding, as when tide is high water cannot readily drain.

HAZARDS OF LOCAL SIGNIFICANCE

In addition to the primary four hazards described above, the Town has various other potential threats. These are described below, however, additional hazards may exist.

GROUND WATER CONTAMINATION

Wachapreague's location on the Wachapreague Channel and its direct connection to the Atlantic Ocean causes the Town to be vulnerable to two types of ground water disturbances. Excessive fresh water removal from the waterfront could cause saltwater intrusion. Wells further inland could lead to vertical movement of brackish water found below the lens of potable water (Wachapreague Comprehensive Plan, 2016). Because all of the Town residents rely on wells for their water, this is of high concern.

Figure 13 to the right models a hypothetical withdrawal near the center of the peninsula and the devastating affects that would most likely occur on the Bay and Seaside adjacent coastal areas. Although Wachapreague is just to the south of the area represented in the map, similar effects would occur around the Town if a large withdrawal were to be installed in the area west of the Town.

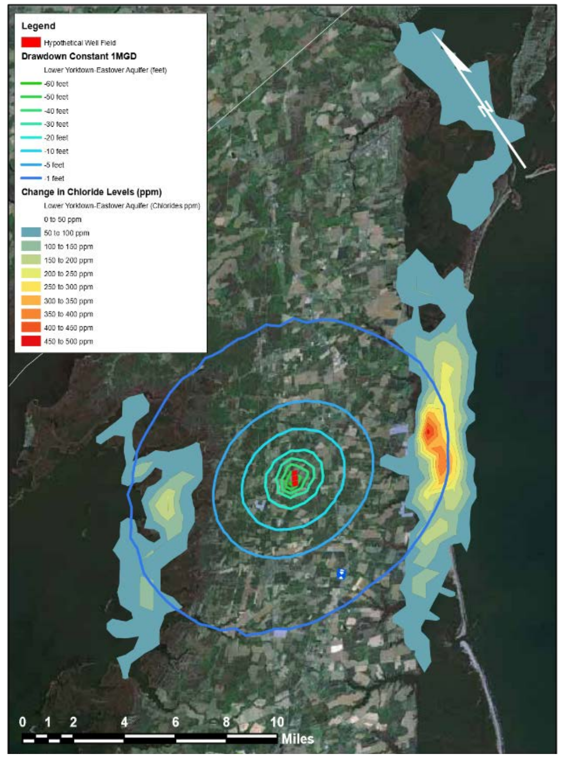


Figure 13: Salt Intrusion (source: ESVA Groundwater Resource Protection and Preservation Plan, 2013)

FIRE

In 1978 the Town's hotel was destroyed in a fire. In 2010 the VIMS Eastern Shore Laboratory's Seaside Hall with a total loss of all the contents. The replacement Seaside Hall was built elevated and to much higher construction standards than the dated destroyed building. Due to the aging housing stock, the risk for fire could be higher due to aging electric wiring.

WATER QUALITY

Since many people rely on the fisheries and aquaculture industries, both commercial and recreational, the health of the seaside bays and the Atlantic Ocean is fiscally and culturally vital. Pollution, nutrients, oxygen levels need to be kept at healthy levels, and monitoring for invasive species and diseases need to be a high priority to prevent damaging fisheries and the scenic coastal ecosystem. Even potential offshore activities such as shipping or oil exploration could threaten the health and livelihood of the community.

HINDERANCES TO WATERWAY NAVIGATION

Shoaling of nearby inlets and channels could negatively impact flushing and water quality in addition to creating a hazard for boaters. As a major access point to the seaside, and with events like the Marlin Tournament, ensuring the safe and easy navigation of channels surrounding the Town is economically imperative. In addition, shoaling and shifting aquatic sediments could have a negative impact on clam and oyster aquaculture, both of high economic importance regionally and to the Commonwealth.

CRITICAL FACILTIIES

The following table lists the critical facilities and their relative importance to the Town. Although lightning is not included as a primary hazard in this Plan, it is important to note that the Town has three tall structures in the Town that are vulnerable to lightning. These are the ferris wheel at the carnival grounds, and two churches.

Table 8: Wachapreague Critical Facilities

Facility	HMP '06	HMP '11	HMP '16	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town-Owned Facilities								
Town Marina	-	-	X	Flooding Wind	100+	Devastating	No	Yes
Dredge Spoil Basin	-	-	X	Erosion	200+	Devastating	No	No
Parks	-	-	X	Flooding, Fire	200+	Major Disruption	No	Yes
Town Vehicles	-	-	X	Flooding Wind Fire	200+	Inconvenience	Yes	Yes
Other Facilities								
Coast Guard Station	-	X	X	Wind	Boaters on the Seaside	Devastating	No	No
Fire Station	-	X	X	Flooding	1000+	Devastating	Yes	Maybe
Churches	-	X	X	Flooding Wind Lightning	50+	Inconvenience	No	Maybe
Commercial Area	-	X	X	Flooding Wind	100+	Devastating	No	No
VIMS Campus and Dock 50'	-	X	X	Flooding Wind	6 – 8	Devastating	No	Maybe
Carnival Grounds	-	X		Flooding Wind Lightning	Supports the fire station, 1000+	Major Disruption	No	No
Post Office	-	-	X	Flooding Wind Lightning	200+	Major Disruption	Yes	Yes

Figure 14: The carnival grounds in Wachapreague are at risk to coastal flooding and were inundated with flood waters from Hurricane Isabel in 2003. High winds and lightning also threaten these structures. Photo by Dan Bilicki

FINDINGS

1. Most structures in the Town are in the 1%-annual-chance floodplain, including its entire commercial area, which does not require a 1%-annual-chance flood to suffer damages. Coastal Flooding is the greatest eminent threat to the Town. Hazus estimates a total loss of $6.5 million, including building content, inventory, and business interruption should this 1%-annual-chance flood event occur.

2. The southern end of Cedar Island has eroded significantly in the last 5 years, vastly increasing the size of Wachapreague Inlet, and thus increasing the vulnerability of the interior mash system and the Town to incoming wave action from the Atlantic during a wind or storm event. In addition the long-ago created berm opposite the channel from the waterfront has been settling and does not provide the same protections. Due to these issues, it is thought that the Town is more susceptible to damage from wave action during a storm event than indicated by the FIRM V Zone.

3. Approximately 92% of all homes were built before the NFIP building code requirements were adopted. After a 1%-annual-chance event there will be significant damage and many structures may trigger the substantial damage regulation that requires the structures to be elevated above the base flood

elevation. Not all structures at risk are insured and those that are insured will not likely receive enough money to comply with these requirements. Currently, Increased Cost of Compliance insurance is included in NFIP flood insurance but the maximum amount is $30,000. This will in most cases not be enough to comply with elevating the older homes in Wachapreague.

4. The local fire station that responds to Wachapreague and the surrounding area is located in the floodplain very close to the waterfront. The firehouse does not require a 1%-annual-chance flood to have water in the buildings. Its lack of elevation means much less significant events imperil the residents of Wachapreague and surrounding areas of Accomack County. The fire house is a cinderblock building that holds up fairly well in floodwaters. This is a major problem since FEMA's Benefit Cost Analysis is solely based on damage to structures and does not take into account the importance of the structure. During flood conditions and in the recovery period, it is more important to have a safe, working fire station than elevating or purchasing a single house, approximately the equivalent in project cost. Yet the Benefit Cost Analysis will make the house look better on paper aiding a single family versus the entire community. It is a failure not to take into account all benefits in the Benefit Cost Analysis.

5. The Town has noted several stormwater flooding problems within its limits.

6. Several Wachapreague residents are proactively trying to protect themselves from flood damage by purchasing flood insurance even though it is not mandatory. These persons make good candidates for other measures to reduce their flood risk.

7. As could be seen in Hurricane Isabel in 2003, mature trees and strong sustained wind can cause massive destruction. Wachapreague, not in the direct path of Isabel, may also be in line for extensive damage from falling branches and trees in a strong wind event. Since so many buildings are in the flood plain in Wachapreague, it is likely that fallen trees will substantially damage structures. If a tree damages a house in this manner then owners will have to meet the NFIP's elevation requirement and usually homeowner's policies will not cover this expense. Although Hazus estimates only $36,800 in damages from a 1%-annual-chance wind event, this value does not take into account any flooding damages.

CHAPTER 27: MITIGATION STRATEGIES DEVELOPMENT

The Eastern Shore Hazard Mitigation Committee met in November, 2004 to discuss the mitigation plan. At that time, members determined the Committee's vision of the Eastern Shore during and after a natural hazard event. In May 2011, the Committee revisited the original vision, updated the status of past strategies, and developed new goals and projects. In June of 2016, the Eastern Shore Hazard Mitigation Steering Committee agreed to maintain the Vision Statement as written and included in the 2011 Plan. The Committee made minor edits to Goals 2, 3, and 4, such that they would be more inclusive.

VISION STATEMENT

As a result of planning and mitigation actions, damage and disruption will be minimized during natural hazard events. Federal and state agencies cooperate with the local government and guide necessary resources to the governments for recovery activities. To the extent possible, residents will be self-sufficient and will have taken responsibility for their own economic and physical protection. Infrastructure smoothly functions throughout the event and the recovery period following.

GOAL DEVELOPMENT

The Committee's goals were informed by several sources of information listed below.

- Eastern Shore Hazard Identification and Risk Assessment (ESHIRA) Findings
- Previous Products from ESHIRA development
- Lessons of other Natural Hazard Events such as Hurricane Floyd, 1999; Hurricane Isabel, 2003; the Twin Northeasters, 1998; winter storms, 2004-2005; Tropical Depression Ernesto, 2006; November Northeaster, 2009; and Hurricane Sandy, 2012.
- Current Initiatives such as the regional Eastern Shore Disaster Preparedness Coalition

IDENTIFIED ISSUES

Several issues confront the Eastern Shore in a time of disaster. Representatives from the localities identified several issues. These are included below.

The Eastern Shore Hazard Identification and Risk Assessment showed that not all residences at risk to flooding have a flood insurance policy on them. In addition, many of those residences that have a policy do not appear to have contents coverage. The most common type of residential flood damage on the Eastern Shore is contents damage.

The Eastern Shore Hazard Identification and Risk Assessment identified numerous areas where storm water flooding occurs. It is not clearly understood what the problem is at all of these sites, and the lack of information hinders drainage and stormwater management projects.

There is a shortage of shelter space during natural hazard events due to a lack of manpower and availability of safe structures to safely operate the shelters.

After the natural hazard event, the counties' limited staff are overwhelmed by administrative requirements for the disaster.

MITIGATION GOALS

The Eastern Shore Hazard Mitigation Committee identified the following goals to work toward. The 2011 Goals 2, 3, and 4 were modified slightly. Goal 2 was expanded to included 'other community partners' and 'planning' and also eliminated the 'commercial' limitation from the 2011 goal. Goal 3 removed the reference to 'residents,' so that businesses, visitors, etc. are also included. Goal 4 removed the word 'natural,' so that anthropogenic hazard events would also be included.

Goal 1 - **Local Governments Guide a Comprehensive Mitigation Program Including Public Education and Ongoing Hazard Assessments.**

Goal 2 - **Residents, Businesses, Local Governments, and Other Community Partners Will Work Together to Minimize Community Disruption Through Planning and Residential and Commercial Mitigation Activities.**

Goal 3 - **Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk.**

Goal 4 - **Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event.**

Goal 5 - **Local Governments Will Make Efforts to Reach Special Needs Populations.**

MITIGATION PROJECT DEVELOPMENT

The Eastern Shore of Virginia Hazard Mitigation Planning Committee collectively identified specific mitigation projects that would benefit the entire region and these projects are included in the table at the end of this chapter. Accomack County, Northampton County, and the Town of Chincoteague developed specific mitigation strategies to address each of the five regional mitigation goals described above. In order to implement the identified strategies, each locality developed mitigation projects specific to their locality. Non-participating towns are currently not eligible for FEMA Hazard Mitigation Assistance grant award funds. Participating towns indicated that mitigation projects included in their respective county's mitigation strategies, when relevant, should also apply to the town.

PROJECT PRIORITIZATION

Prioritization ranking is directly based on the rank of the hazard(s) which it addresses. A ranking of 1 indicates a "highest" level of priority and indicates that the mitigation action would address at least one of the highest ranked hazards (high wind, coastal erosion, coastal flooding, and stormwater flooding). A ranking of 2 indicates "higher" level of priority and indicates that the highest ranked hazard that the mitigation action would address would be one of the medium ranked hazards (well contamination, ice/snow, drought, sewage spills). A ranking of 3 indicates "high" level of priority and indicates that the mitigation action only addresses one or more of the low prioritized hazards (wildfire, HazMat, heat wave, fish kills, BioHazards, invasive environmental disease, earthquake). Because the prioritization of the hazards took into account the potential number of affected structures, impacts, likelihood of success, and availability of implementable mitigation options, this way of ranking the mitigation actions incorporates and carries on these fundamental criteria. Rankings for all of the hazards are found in Table 1 of Chapter 3: Risk Assessment. Also in Chapter 3 (pages 1 and 2), you'll find more information about the criteria for the ranking of the hazards, including the fact that cost-effectiveness was the condition for the 'mitigation options' ranking criteria.

ADOPTION

Adoption Resolutions of this plan are included at the end of the plan in **Appendix E**.

ACCOMACK COUNTY MITIGATION STRATEGIES

Accomack County is the largest county with respect to area and population on the Eastern Shore of Virginia. There are 14 incorporated towns within the County. These towns include: Accomac, the majority of Belle Haven, Bloxom, Chincoteague, Hallwood, Keller, Melfa, Onancock, Onley, Painter, Parksley, Saxis, Tangier, and Wachapreague. The Town of Chincoteague's mitigation projects are found in its own plan section in Chapter 30. The other towns were invited to contribute to the Eastern Shore of Virginia Hazard Identification and Risk Assessment (ESHIRA) and Eastern Shore of Virginia Hazard Mitigation Plan. Representatives from several towns did participate in the ESHIRA development.

PLAN MAINTENANCE

The Emergency Management Coordinator will review the Hazard Mitigation Plan every year prior to the July 1 deadline for the Local Capability Readiness Assessment (LCAR). The Coordinator will evaluate the plan and review progress made during the previous years on the goals and projects in the plan for all of Accomack County and the incorporated towns within the County. The Coordinator will use the LCAR criteria for hazard mitigation to evaluate the hazard mitigation program. Progress will be reflected in the LCAR. The Coordinator will also recommend any revisions to the Board of Supervisors. By July 1, 20120, the Coordinator will assemble a Committee or represent Accomack County on a Committee to update the plan. Towns will have an opportunity to be represented on the Committee. The Committee will work to complete the updates by the fifth year anniversary of the adoption of the plan. During the plan maintenance process, the community will have opportunity, through advertised public hearings, to comment on plan revisions and updates prior to the Board of Supervisors approving them.

Accomack County and the incorporated towns each have a Comprehensive Plan for their respective jurisdiction. The Emergency Management Coordinator will provide input and plan materials to the planning group responsible for updating the Comprehensive Plan and any other relevant planning efforts. During updates of the Comprehensive Plan and other relevant planning efforts, the Hazard Mitigation Plan will be reviewed and appropriate material incorporated into the updates.

See Chapter 2, page 7 and 8 for additional information about plan maintenance and evaluation.

IDENTIFIED MITIGATION GOALS & STRATEGIES – ACCOMACK COUNTY

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program Including Public Education and Ongoing Hazard Assessments

Strategy 1.1 - *Train County staff for mitigation duties.*

Strategy 1.2 – *Promote mitigation programs throughout the County.*

Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities

Strategy 2.1 - *Reduce damages from flooding.*
Strategy 2.2 – *Reduce damages from non-flooding natural disasters, if that type of event occurs.*

Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk

Strategy 3.1 - *Educate the public about their responsibility to respond safely and effectively during a disaster.*

Strategy 3.2 - *Educate the public about their responsibility in reducing and insuring their own risks.*

Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event

Strategy 4.1 - *Maintain safe traffic flow in case of wide scale power loss.*

Strategy 4.2 - *Maintain emergency service functions in case of wide-scale power loss.*

Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations

Strategy 5.1 – *Define and identify special needs populations in the County.*

Strategy 5.2 - *Assure migrant population has access to County emergency response efforts.*

Strategy 5.3 - *Assure Tangier Island residents have access to County emergency response efforts.*

IDENTIFIED MITIGATION PROJECTS – ACCOMACK COUNTY

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program Including Public Education and Ongoing Hazard Assessments

Strategy 1.1 - Train County staff for mitigation duties.
Strategy 1.2 – Promote mitigation programs throughout the County.

Priority Rank	Accomack County – Goal 1: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Set a regional compatibility standard for emergency communications	ALL	ESDPC	2006 / 2006	Funding attained, Pending	Ongoing	
1	Upgrade communications systems and provide for backup in the event of a communication failure	ALL	ESDPC	2006 / 2009	Not Complete	Not Complete	Funding needed
1	Obtain funding for a generator hookup for the Eastern Shore Community College	Flood, Ice & Snow, Wind	Eastern Shore Community College	2006 / Post-declared disaster	Not Complete	Ongoing	Funding needed
1	Research allowed reimbursement under a Presidentially Declared Disaster and offer to train staff to take on emergency response tasks for pay during disaster events	ALL	Accomack Co. Administration	2006 / 2007	Ongoing	Ongoing	
3	Institute a recruitment program for volunteer firefighters. Publicize details on how to volunteer on the County website.	Fire	Accomack Co. Administration	2006 / 2007	Not Complete	Ongoing	
1	Send a letter to the Town of Keller Council recommending the Town join the National Flood Insurance Program so that federal mitigation funds can become available for use within the flood zones in the Town in case of disaster.	Flood	Accomack Co. Building & Zoning (ACB&Z)	2006 / 2007	Not Complete	Not Complete	Lack of Staff
1	Send letters to Town Councils of Accomac, Bloxom, Melfa, Onley, Painter, and Parksley advising the Towns that joining the National Flood Insurance Program will allow residents with stormwater flooding problems to purchase flood insurance.	Flood	AC B&Z	2006 / 2007	Ongoing	Partially Complete	All Towns except Accomac & Painter were informed during the HMP update process

1	Formalize and maintain the Residential Mitigation Project Waiting List	ALL	AC B&Z	2011 / Ongoing	Ongoing	Ongoing	
1	Promote Hazard Mitigation at local community events and meetings.	ALL	Accomack Co. Emergency Management (ACEM)	2011 / Ongoing	Ongoing	Ongoing	
1	Emergency radio communications within the region are to be interoperable.	ALL	ES 911 Commission	2011 / 2011	Funding attained, Pending	Ongoing	
1	Assess and define County staff emergency response responsibilities during disaster events and incorporate these duties into their job descriptions.	ALL	Accomack Co. Administration	2011 / 2012	Not Started	Ongoing	
1	Offer county staff CERT training.	ALL	Accomack Co. Administration	2011 / 2013	Not Started	Ongoing	
Completed Projects							
---	Produce Responder Bilingual Cards with English on back. An example of the type of message to be included is "Do not drink the water."	ALL	Health Dept. and the Eastern Shore Disaster Preparedness Coalition (ESDPC)	2006 / 2006	Complete*	---	
---	Obtain more changeable warning signs	ALL	VDOT	2006 / 2006	Complete	---	
---	Offer county staff free CERT training during office hours in the late afternoon or early morning with the employees using personal time one Saturday to complete the training.	ALL	Accomack Co. Administration	2006 / 2007	Complete	---	

*Spanish Health and Emergency Preparedness informational brochures have been produced and are available to the Hispanic population through a variety of outlets.

Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities

Strategy 2.1 - Reduce damages from flooding.
Strategy 2.2 – Reduce damages from non-flooding natural disasters, if that type of event occurs.

Priority Rank	Accomack County – Goal 2: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Formalize and maintain the Residential Mitigation Project Waiting List	ALL	Accomack Co. Building & Zoning (ACB&Z)	2006 / 2006	Ongoing	Ongoing	
1	Drainage Survey of Nelsonia, north of Fisher Corner and Route 13	Storm Water Flood, Biohazard	VDOT, Accomack Co. Public Works	2006 / 2008	Not Complete	Not Complete	Must coordinate with VDOT
1	After any presidentially declared disaster, manage Residential and Commercial Mitigation Projects that address the most critical damage that has occurred.	ALL	ACB&Z	2006 / Post-declared disaster	Ongoing	Ongoing	
1	Continue a comprehensive drainage plan that identifies specific projects to improve drainage.	Flood	Accomack Co. Public Works, VDOT	2011 / Ongoing	Ongoing	Ongoing	
1	Amend the future land use map and zoning ordinance to direct high density development away from critically eroding shorelines identified as high erosion areas (loss of greater than one foot per year) in the VIMS Shoreline Situation Report for Accomack County.	Erosion	Accomack Co. Planning	2011 / Ongoing	Ongoing	Ongoing	
1	Mitigate public infrastructure against damage caused by natural disasters. For example, hurricane shutters, flood-proofing, etc.	ALL	Accomack Co. Public Works	2011 / Post-declared disaster	Ongoing	Ongoing	
1	Mitigation of flood prone properties (to include, but not limited to acquisition, elevation, relocation, and dry and wet flood proofing of flood prone structures, and mitigation reconstruction for NFIP defined SRL properties only).	Flood	ACB&Z	2011 / Post-declared disaster	Not Started	Ongoing	

3	Develop programs to encourage conservation of barrier islands, marsh land, forested areas, and creek corridors. When consistent with habitat conservation goals, alternatives to fee-simple ownership, such as conservation easements or lease-back agreements should be encouraged to keep property on the tax rolls and in productive use.	Flood, Erosion	Accomack Co. Administration, The Nature Conservancy, Eastern Shore of Virginia Land Trust	2011 / Ongoing	Ongoing	Ongoing	
1	Maintain the Residential Mitigation Project Waiting List	ALL	ACB&Z	2011 / Ongoing	Ongoing	Ongoing	
Completed Projects							
---	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Accomack County Comprehensive Plan.	ALL	Accomack Co. Planning	2011 / During next Comp. Plan update	Not Started	Complete (2014 Amended County Comp Plan)	
---	Amend the future land use map and zoning ordinance to direct high density development away from critically eroding shorelines identified as high erosion areas (loss of greater than one foot per year) in the VIMS Shoreline Situation Report for Accomack County.	Erosion	Accomack Co. Planning	2006 / Ongoing	Complete*	---	
---	Manage a Residential Elevation and Mitigation Project, using benefit-cost analysis provided by FEMA to target structures at risk to flooding.	Flood	Accomack Co., Towns of Onancock, Tangier, Wachapreague, Saxis and Belle Haven	2006 / Post-declared disaster	Complete**	---	
---	In the Town of Belle Haven, dig ditches along King Street near the ESO to improve drainage.	Storm Water Flood, Biohazard	VDOT, Accomack Co. Public Works	2006 / 2008	Complete.	---	
---	Produce a comprehensive drainage plan that identifies specific projects to improve drainage.	Flood	Accomack Co. Public Works	2006 / 2008	Complete	---	

*The Future Land Use Map was updated in 2008. The Zoning Ordinance has not been amended as the County needs the submittal of a rezoning application from the public prior to initiating a rezoning.
** 2011 – 2016 Project Status included in each town's mitigation project list

Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk							
Strategy 3.1 - Educate the public about their responsibility to respond safely and effectively during a disaster. *Strategy 3.2 - Educate the public about their responsibility in reducing and insuring their own risks.*							
Priority Rank	**Accomack County – Goal 3: Description of Projects**	**Hazard(s) Addressed**	**Responsible Department**	**HMP Year / Start Timeline**	**Status as of 2011**	**Status as of 2016**	**Add'l. Info.**
1	Send out information encouraging residents to purchase contents and structure flood insurance to all homes and businesses located in the County's regulated flood zones.	Flood	Accomack Co. Public Safety	2006 / Yearly	Disseminated 2007-2009	Ongoing	Need additional since new 2015 FIRM.
1	Put out an education brochure on tree plantings benefits. Consider using the information developed by VDEM for Hurricane Isabel.	Erosion, Flood	ACEM	2011 / 2012	-	Not Started	Funding
1	Put out an education brochure on benefits from burying property power lines. Consider using the information developed by VDEM for Hurricane Isabel.	Ice & Snow, Wind, Fire	ACEM	2011 / 2012	-	Not Started	Funding
1	Disseminate information encouraging residents and businesses to purchase contents and structure flood insurance.	Flood	ACEM	2011 / 2012	Ongoing	Ongoing	Need additional since new 2015 FIRM.
1	Maintain an Emergency Management website that contains emergency preparedness information for residents and businesses.	ALL	ACEM	2011 / Ongoing	Ongoing	Ongoing	
3	Include details of volunteer opportunities on the County website.	ALL	Accomack Co. Admin.	2011 / 2012	Not Started	Not Started	
1	Produce an emergency preparedness brochure that includes local information to be mailed to residents and businesses.	ALL	ACEM	2011 / 2013	Not Started	Ongoing, Pending Funding	
1	Disseminate information on wind-protection systems (hurricane shutters, etc.) to residents and businesses.	Wind	ACEM	2011 / 2012	Not Started	Not Started	Funding
1	Provide FEMA mitigation-related publications to residents and businesses via the public library.	ALL	ACEM	2011 / 2012	Started	Ongoing	
	Completed Projects						

---	Publish an Annual Press Release about Emergency Preparedness	ALL	Accomack Co. Emergency Management (ACEM)	2006 / Yearly	Complete, Ongoing	---	
---	Investigate the potential for an increased CRS rating to reduce flood insurance premiums.	Flood	Accomack Co. Planning	2006 / 2007	Complete	---	
---	Create a Surge Inundation Map and identify evacuation zones and the nearest shelter for distribution on the County's website and in local schools and libraries	Flood	Accomack Co. Public Safety	2006 / 2006	Complete	---	

Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event

Strategy 4.1 - *Maintain safe traffic flow in case of wide scale power loss.*
Strategy 4.2 - *Maintain emergency service functions in case of wide-scale power loss.*

Priority Rank	Accomack County – Goal 4: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	The following traffic lights should be retrofitted to have backup power installed in order of importance: 1. Four Corners Traffic Light (Rt. 13 and Rt. 179), T's Corner Traffic Light (Rt. 13 and Rt. 175), Traffic Light on Chincoteague Road (Rt. 175) 2. Rt. 13 and Rt. 187 in Nelsonia 3. Rt. 13 & Rt. 180, Wachapreague Rd. 4. Rt. 13 & Madigan Way at Wal-Mart in Onley 5. Rt. 13 & entrance to Food Lion Shopping Center at T's Corner	Ice & Fire, Wind	VDOT	2006 (1-2) 2011 (3-5) / 2007	Pending	Pending	Funding allocation and priorities

1	Obtain funding for a generator hookup for the Eastern Shore Community College.	Ice & Snow, Wind	ESCC	2011 / Post-declared disaster	Not Started	Ongoing	New building will have a commercial generator
1	Encourage implementation of emergency generator power serving public water and wastewater systems.	Ice & Snow, Wind	Accomack Co. Public Works	2011 / 2013	Not Started	Not Started	Funding
Completed Projects							
---	Have all the Accomack County Fire Stations wired for generator hookup.	Ice & Snow, Wind	Accomack Co. Public Safety	2006 / Post-declared disaster	Complete	---	
---	After consultation with the Hazard Mitigation Planning Committee, that included input from the Accomack Sheriff's Office, the following traffic lights were retrofitted to have backup power installed: 1. Rt. 13 and Rt. 176 in Parksley 2. Rt. 13 and Rt. 626 in Melfa 3. Rt. 13 and Rt. 182 in Painter	Ice & Snow, Wind	VDOT	2006 / 2007	Complete	---	

Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations

Strategy 5.1 – *Define and identify special needs populations in the County.*
Strategy 5.2 - *Assure migrant population has access to County emergency response efforts.*
Strategy 5.3 - *Assure Tangier Island residents have access to County emergency response efforts.*

Priority Rank	Accomack County – Goal 5: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Coordinate with Town Staffs to man town shelters	ALL	Accomack Co. Administration	2006 / 2007	Not Complete	Not Complete	Staff
1	Investigate a paid reservist program to man up to 7 emergency shelters.	ALL	Accomack Co. Administration	2006 / 2008	Not Complete	Not Complete	Staff

1	Approach local growers thru the Migrant Council to ask for tax-deductible donations to support and offset sheltering costs for migrants during natural disasters.	ALL	Accomack Co. Administration	2006 / 2008	Not Complete	Not Complete	Staff/ Coordination
1	Provide busing for evacuated Tangiermen from Crisfield, Maryland to shelters in Somerset County or bring them to Accomack County shelters. Prepare Tangier residents before any storms on where and how this system will work.	Flood, Wind, Ice & Snow	Accomack Co. Public Safety	2006 / 2006	Not Complete	Not Complete	Funding/ Coordination
1	Define special needs populations in the County.	ALL	ACEM	2011 / 2012	Not Started	Ongoing	
1	Develop an emergency coordination plan for defined special needs populations in the County.	ALL	ACEM	2011 / 2013	Not Started	Ongoing	
1	Assure that the residents of Tangier Island have access to emergency shelters on the mainland during a disaster.	ALL	ACEM	2011 / Ongoing	Ongoing	Ongoing	
1	Disseminate Spanish language emergency preparedness information to the Hispanic community via camps, churches, Telemon, and other primarily Hispanic outlets.	ALL	ESDPC	2011 / Ongoing	Ongoing	Ongoing	
Completed Projects							
---	Produce County-specific emergency information in Spanish	ALL	ESDPC	2011 / Ongoing	Ongoing	Complete	
---	Develop a plan for sheltering of household pets.	ALL	ACEM	2011 / 2013	Not Started	Complete	
---	Produce County-specific emergency information in Spanish	ALL	Accomack Co. Administration & Public Safety	2006 / 2007	Complete		
---	All public buildings that are slated for renovation or construction will be evaluated for designation of Red Cross Shelter or refuge of last resort status	ALL	Accomack Co. Public Safety	2006 / Ongoing	Complete		
---	Approach local growers thru the Migrant Council to educate them about appropriate measures to take when a disaster is threatening the area while migrants are working.	ALL	Accomack Co. Administration	2006 / 2007	Complete		
---	Provide a mass notification system for relay of emergency information to residents and visitors.	ALL	Accomack Co. Administration	2011 / Post-declared disaster	Not Complete	Complete, Ongoing	CodeRED

IDENTIFIED MITIGATION PROJECTS – ACCOMACK COUNTY TOWNS

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
Bloxom	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Bloxom Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town Plan update	Not Started	Not Started	No Town Plan update yet.
Bloxom	Mitigate against natural disasters.	ALL	Town Staff, Residents	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	
Bloxom	Join the National Flood Insurance Program.	Flood	Town Staff, Coordinator (*if regional position created/funded)	1.1	Post-declared disaster	Not Started	Not Started	Lack of Staff
Bloxom	Retrofit the undersized box culverts in Bloxom to mitigate stormwater flooding.	Storm Water Flood, Biohazard	VDOT	2.1	Post-declared disaster	Not Started	Not Started	VDOT priorities
Bloxom	Promote Hazard Mitigation at local community events and meetings. Acquire or develop materials to cater to the increasing diversity of the population.	ALL	Town & County Staff	3.1, 3.2, 5.1	2011	Not Started	Ongoing	
Bloxom	Regular maintenance of the stormwater drains and the ditches to prevent flooding.	Storm Water Flood, Biohazard	VDOT, Town, Residents	2.1, 4.1	Immediately, 2017	-	Not Started	
Bloxom	Build a staging area (point of distribution), ideally with electric (and generator), water, and minimum commercial equipment (such as microwave, refrigerator, etc.). Ideal location is the Town Square area.	ALL	Town, FEMA	1.2, 4.2	Immediately, 2017	-	Not Started	Funding
Bloxom	Groundwater resources research, particularly to address shallow well concerns.	Well Contamination, Drought	Town, Ground Water Committee	1.2, 3.2	Immediately, 2017	-	Not Started	Funding
Bloxom	Dredge the ditches in order to alleviate stormwater flooding damages and dangers.	Storm Water Flood, Biohazard	VDOT	2.1, 4.1	2011	Started	Complete	-

Hallwood	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Hallwood Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Ongoing	
Hallwood	Mitigate flooding and wind hazards in Hallwood.	Flood	Town, FEMA, Residents	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	
Hallwood	Retrofit the undersized box culverts in Hallwood to mitigate stormwater flooding problems.	Storm Water Flood, Biohazard	VDOT	2.2	Post-declared disaster	Not Started	Not Started	VDOT priorities/ coordination
Hallwood	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1	2011	Not Started	Not Started	
Hallwood	Conduct public education and outreach efforts within Town to raise awareness and promote participation of the NFIP.	Flood	Town Staff, Coordinator (*if regional position created/funded)	3.1	2011	Ongoing	Ongoing	
Hallwood	Provide educational information to residents about the burn permit process.	Fire	Town Staff, County Emergency Management	3.1	2011	Ongoing	Ongoing	
Hallwood	Investigate the use of large drainage ditches as fuel breaks to mitigate wildfires.	Fire, Storm Water Flood	Town Staff, County Emergency Management	2.2	2011	Not Started	Not Started	Lack of Staff, Funding
Hallwood	Encourage water conservation among residents during droughts.	Drought	Town & County Staff	3.2	2011	Ongoing	Ongoing	
Hallwood	Removal of dilapidated structures	Flood, Fire, Wind	Town Council	1.2, 2.1, 2.2	2016	-	Ongoing	
Hallwood	Work with residents to ensure that they are paying the appropriate amount for their NFIP flood insurance policies, since there are residents paying higher than necessary premiums in Town.	Flood	Town Staff, Coordinator (*if regional position created/funded)	3.1	2011	Ongoing	Complete	-
Keller	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Keller Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No Town Plan update yet

Keller	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1	2011	Not Started	Not Started	Lack of Staff
Keller	Join the National Flood Insurance Program.	Flood	Town Staff, Residents, Coordinator (*if regional position created/funded)	1.1	2011	Not Started	Not Started	Lack of Staff, Funding
Keller	Cooperate with Accomack County to implement the Emergency Operations Plan to put residents at less risk during an emergency.	ALL	Town & County Staff	1.1	Post-declared disaster	Ongoing	Ongoing	
Keller	Maintain and ensure adequate drainage ditches to mitigate stormwater flooding problems in Keller.	Storm Water Flood, Biohazard	VDOT, Town must request	2.2	2011	Not Started	Not Started	Staff, VDOT Coordination
Melfa	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Melfa Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	-	Not Started	No Town Plan update yet
Melfa	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1	2016	-	Not Started	Staff
Melfa	Cooperate with Accomack County to implement the Emergency Operations Plan to put residents at less risk during an emergency.	ALL	Town & County Staff	1.1	Post-declared disaster	-	Ongoing	
Melfa	Maintain and ensure adequate drainage ditches to mitigate stormwater flooding problems in Melfa. Install culvert pipes where needed to mitigate stormwater flooding on Woodland Avenue and anywhere else needed.	Storm Water Flood, Biohazard	VDOT, Town must request	2.2	2016	-	Not Started	Staff, VDOT Coordination
Melfa	Construct a pavilion facility with electricity for use as a staging area following a hazard event.	ALL	Town, FEMA	4.2	2016	-	Not Started	Funding
Melfa	Purchase a mobile generator that can be used at any facility (including the pavilion distribution area) during a prolonged power outage.	Wind, Ice & Snow	Town, FEMA	4.2	2016	-	Not Started	Funding
Onancock	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Onancock Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Ongoing	Town Plan update in progress

Onancock	Mitigate the Town's infrastructure against flooding and wind.	Flood, Wind	Town, Residents, FEMA	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	
Onancock	Retrofit Town sewage pump station and manholes to prevent damages from flooding and maintain continuous operation during flood events.	Flood	Town Public Works	4.2	Post-declared disaster	Not Started	Not Started	Funding, Coordination
Onancock	Retrofit the Onancock Town Office, Police Department Office, and Town fuel tank pumps for generator hookups.	ALL	Town, FEMA	4.2	Post-declared disaster	Not Started	Not Started	Funding
Onancock	Purchase portable generator (for fuel tank pumps, etc.)	Flood, Wind, Ice & Snow	Town, FEMA	4.2	2016	-	Not Started	Funding
Onancock	Participate in the Community Rating System (CRS) to create a discount for Town residents.	Flood	Town Staff, Residents, Coordinator (*if regional position created/funded)	1.2, 3.2	2016	-	Not Started	Staffing expertise
Onancock	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1, 5.2	2016	-	Not Started	Lack of outreach materials
Onancock	Cooperation with Accomack County to implement the Emergency Operations Plan to put residents at less risk during an emergency.	ALL	Town & County Staff	1.1	Post-declared disaster	-	Ongoing	
Onley	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Onley Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No Town Plan update yet
Onley	Mitigate the Town's Infrastructure against flooding and wind.	Flood, Wind	Town, Residents, FEMA	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	
Onley	Join the National Flood Insurance Program.	Flood	Town Staff, Residents, Coordinator (*if regional position created/funded)	1.1	2011	Not Started	Not Started	Staffing expertise
Onley	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1	2011	Not Started	Not Started	Lack of outreach

								materials and staff expertise
Onley	Take the necessary actions to satisfy pre-requisites for mitigation funding (i.e. maintain stormwater event log).	Storm Water Flood, Biohazard	Town Public Works	1.1	2011	Not Started	Not Started	
Onley	Cooperate with VDOT to mitigate stormwater drainage in Onley.	Storm Water Flood, Biohazard	VDOT, Town must request	2.1	2011	Not Started	Not Started	Funding, Coordination
Parksley	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Parksley Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No Plan update yet
Parksley	Mitigate against natural disasters.	ALL	Town, Residents, FEMA	2.1, 2.2	2016	-	Ongoing	
Parksley	Retrofit the undersized box culverts in Parksley to mitigate stormwater flooding.	Storm Water Flood, Biohazard	VDOT, Town must request	2.1	2011	Not Started	Not Started	Funding, Coordination
Parksley	Coordinate with VDOT for proper maintenance of roads that need to have the levels lowered.	Storm Water Food, Biohazard	VDOT, Town	2.1	2016	-	Not Started	Funding, Coordination
Parksley	Promote Hazard Mitigation at local community events and meetings. Acquire or develop materials to cater to the increasing diversity of the population.	ALL	Town & County Staff	3.1, 3.2, 5.1	2011	Not Started	Ongoing	
Parksley	Regular maintenance of the stormwater drains and the ditches to prevent flooding.	Storm Water Flood, Biohazard	VDOT, Town must request	2.1, 4.1	2016	-	Not Started	Funding, Coordination
Parksley	Develop multi-lingual emergency plans, preparedness handouts, and evacuation plans.	ALL	Town & County Staff	1.3, 3.2, 5.1, 5.2	2016	-	Not Started	Funding, Staff
Parksley	Backup power for electric substation supplying Parksley and resistors on feeder lines from the substation.	Ice & Snow, Wind	ANEC, County	4.2	2016	-	Not Started	Funding
Parksley	Establish weather station.	Flood, Drought, Heat Wave, Wind, Ice & Snow	NWS, Town must initiate	3.1. 3.2	2016	-	Not Started	Funding

Parksley	Additional street lighting.		Town	1.2	2016	-	Not Started	Funding
Parksley	Retrofit the pavilion roof (staging area and farmers market location) to withstand higher wind conditions.	Wind	Town, FEMA	1.2, 2.2, 4.2	2016	-	Not Started	Funding
Parksley	Acquire generator for the Town Office.	ALL	Town, FEMA	4.2	2016	-	Not Started	Funding
Parksley	Install evacuation signage.	ALL	Town, County, State	3.1	2016	-	Not Started	Funding
Saxis	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Saxis Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No Plan update yet
Saxis	Retrofit the Saxis Town Office and Firehouse to protect against wind and flood hazards.	Wind, Flood	Town, FEMA	2.1, 2.2	Post-declared disaster	Not Started	Not Started	Funding
Saxis	Obtain funding to construct an erosion control structure along the western shoreline of the Town.	Erosion	Town must initiate	2.1	Post-declared disaster	Not Started	Actively Seeking Funding	
Saxis	Retrofit harbor infrastructure to mitigate against wind, coastal erosion and flooding.	Erosion, Flood, Wind	Town must initiate	2.1	Post-declared disaster	Not Started	Actively Seeking Funding	
Saxis	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	3.1	2011	Not Started	Ongoing	
Saxis	Explore CRS	Flood	Town Staff, Coordinator (*if regional position created/funded)	2.1	-	-	Not Started	Staffing expertise
Saxis	Education and outreach to new and transient or seasonal guests or residents.	ALL	Town & County Staff	3.1, 3.2	-	-	Not Started	Lack of materials
Tangier	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Tangier Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No Plan update yet
Tangier	Mitigate erosion, flooding, and wind hazards in Tangier.	Erosion, Flood, Wind	Town, FEMA	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	

Tangier	Retrofit the undersized box culverts in Tangier and have regular maintenance to ensure culverts are not blocked to mitigate stormwater flooding problems.	Storm Water Flood, Biohazard	VDOT, Town must request	2.1	Post-declared disaster	Not Started	Not Started	Funding, Coordination
Tangier	Retrofit critical facilities in Tangier with backup power supplies.	Flood, Wind, Ice & Snow	Town	4.2	2011	Not Started	Ongoing	
Tangier	Obtain funding to purchase an emergency boat for the Tangier Fire Department to better protect residents and structures from fire damage during flood events	Fire, Flood	Town, FEMA	4.2	2011	Not Started	Not Started	Funding
Tangier	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	1.1, 1.2, 3.1, 3.2, 5.1, 5.3	2011	Not Started	Ongoing	
Tangier	Properly maintain and regularly sample the Town wells to ensure safe water supply and a system that is able to cope with a dynamic natural system.	Well Contamination	Town	2.1, 2.2	2016	-	Ongoing	
Tangier	Retrofit the electric line elevated power point on Watts Island, which is currently being negatively impacted by erosion, to ensure continued, uninterrupted power on the Island.	Flood, Erosion, Wind	ANEC	2.1, 2.2, 4.1	2016	-	Ongoing	ANEC willing, permit process challenging
Tangier	Repair and reinforce the sea wall on the western shore of the Island to reduce erosion and protect the airfield.	Erosion, Flood	FEMA, USACE, Town must request	2.1, 2.2, 4.2	2016	-	Ongoing	Working with A-NPDC and others on potential project
Tangier	Create shoreline protection on the eastern shore of the Island.	Erosion, Flood	FEMA, USACE, Town must request	2.1, 2.2	2016	-	Ongoing	Working with A-NPDC and others on potential project
Tangier	Investigate use of sediment (from dredging operations) to address marsh loss.	Erosion, Flood	FEMA, USACE, Town must request	2.1, 2.2	2016	-	Ongoing	Working with A-NPDC and others on potential project
Tangier	Work towards having the health center as the location for an emergency shelter, as it is the best rated against winds, etc.	ALL	Town	2.1, 2.2	2016	-	Not Started	Staff

Tangier	Create and implement a mosquito control plan to prevent potential illnesses such as Zika.	Biohazards	Town	2.1, 3.2	2016	-	Not Started	Funding
Tangier	Work with VDOT on current issues with the roads and on a long-term plan for addressing flooding and SLR.	ALL	VDOT, Town must request	2.1, 2.2, 4.1	2016	-	Not Started	Coordination, VDOT priorities
Wachapreague	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Wachapreague Town Plan.	ALL	Town Staff	2.1, 2.2	During next Town. Plan update	Not Started	Not Started	No plan update yet
Wachapreague	Mitigate the Town's Infrastructure against flooding and wind.	Flood, Wind	Town, FEMA	2.1, 2.2	Post-declared disaster	Ongoing	Ongoing	
Wachapreague	Manage a Residential Elevation and Mitigation Project, using benefit-cost analysis provided by FEMA to target structures at risk to flooding.	Flood	Town	2.1	Post-declared disaster	Ongoing	Ongoing	
Wachapreague	Attain "High Water" and "Flooding" signs to be used primarily along Atlantic Ave. during flood events.	Flood	Town	4.1	Post-declared disaster	Not Started	Ongoing	
Wachapreague	Cooperate with VDOT to mitigate stormwater drainage in Wachapreague.	Storm Water Flood, Biohazard	VDOT, Town must request	2.2	2011	Not Started	Ongoing	
Wachapreague	Conduct public education and outreach efforts within Town to raise awareness and promote participation of the NFIP.	Flood	Town Staff, Coordinator (*if regional position created/funded)	3.1	2011	Ongoing	Ongoing	
Wachapreague	Conduct public education and outreach efforts within Town to raise awareness of hazard mitigation.	ALL	Town & County Staff	3.1	2011	Ongoing	Ongoing	
Wachapreague	Develop and implement a plan to use available funds (from the County perhaps) to start a clean-up of all Town drainage ditches.	Storm Water Flood, Biohazard	VDOT, Town	1.2, 2.1	2016	-	Not Started	
Wachapreague	Encourage Town residents to maintain any ditches connected to their properties.	Storm Water Flood, Biohazard	Town, Residents	3.2	2016	-	Not Started	
Wachapreague	Develop project(s) that would minimize major storm wave damage to the Town's commercial and residential structures by rebuilding the berm/dyke on the east side of the Wachapreague Channel.	Flood, Erosion	FEMA, USACE, Town must request	1.2, 2.1	2016	-	Ongoing	Working with USACE

Wachapreague	Identify and implement program(s) to reduce the loss of marshes and bay grasses and support their enhancement from increased exposure due to the erosion of the southern portion of Cedar Island.	Erosion, Flood	FEMA, USACE, Town must request	1.2, 2.1	2016	-	Ongoing	Working with USACE

NORTHAMPTON COUNTY MITIGATION STRATEGIES

Northampton County is the southernmost county on the Eastern Shore of Virginia. There are 6 towns within the county. These towns include: parts of Belle Haven, Cape Charles, Cheriton, Eastville, Exmore and Nassawadox. The Towns were invited to contribute to the Eastern Shore of Virginia Hazard Identification and Risk Assessment (ESHIRA) and Eastern Shore of Virginia Hazard Mitigation Plan. Representatives from Exmore, Eastville, and Cape Charles participated in the ESHIRA development.

PLAN MAINTENANCE

The Coordinator of Emergency Services will review the Hazard Mitigation Plan every year prior to the July 1 deadline for the Local Capability Readiness Assessment (LCAR). The Coordinator will evaluate the plan and review progress made during the previous years on the goals and projects in the plan. The Coordinator will use the LCAR criteria for hazard mitigation to evaluate the hazard mitigation program. Progress will be reflected in the LCAR. The Coordinator will also recommend any revisions to the Board of Supervisors. By July 1, 2015, the Director of Emergency Services will assemble a Committee or represent Northampton County on a Committee to update the plan. Towns will also have an opportunity to participate in the Plan update. The Committee will work to complete the updates by the fifth year anniversary of the adoption of the plan. The community will have opportunity to comment on plan revisions and updates prior to the Board of Supervisors approving them.

Northampton County and the incorporated Towns have Comprehensive Plans. The Coordinator of Emergency Services will provide input and plan materials to the planning group responsible for updating the County Comprehensive Plan and any other relevant planning efforts, such as the Town's comprehensive planning. During updates of the Comprehensive Plan and other relevant planning efforts, the Hazard Mitigation Plan will be reviewed and appropriate material incorporated into the updates.

See Chapter 2, page 7 and 8 for additional information about plan maintenance and evaluation.

IDENTIFIED MITIGATION GOALS & STRATEGIES – NORTHAMPTON COUNTY

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program Including Public Education and Ongoing Hazard Assessments
Strategy 1.1 - Increase the capacity of Northampton mitigation program through training and coordination with federal, state and local governments.
Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities
Strategy 2.1 - Retrofit housing to reduce risk of coastal flooding. *Strategy 2.2 - Protect new housing by reducing the risk of damage from natural hazards.* *Strategy 2.3 - Retrofit commercial and residential structures to reduce risk of the most critical natural hazard damage.*
Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk
Strategy 3.1 - Increase resident preparedness in the County. *Strategy 3.2 - Educate residents about flood insurance available and encourage participation in the National Flood Insurance Program.*
Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event
Strategy 4.1 - Maintain traffic flow after a natural hazard event. *Strategy 4.2 - Ensure continuity of public water and wastewater systems.* *Strategy 4.3 - Provide for adequate sheltering during an emergency.*
Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations
Strategy 5.1 - Improve communications with special needs residents before and after hazard events.

IDENTIFIED MITIGATION PROJECTS – NORTHAMPTON COUNTY

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program including Public Education and Ongoing Hazard Assessments

Strategy 1.1 - Increase the capacity of Northampton mitigation program through training and coordination with federal, state and local governments.

Priority Rank	Northampton County – Goal 1: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Set a regional compatibility standard for emergency communications	ALL	ESDPC	2006	Funding acquired, pending	Ongoing	
1	Upgrade communications systems and provide for backup in the event of a communication failure, provide for interoperability and redundancy	ALL	ESDPC	2011	Not Started	Ongoing	
1	Hire a Public Safety Director	ALL	North. Co. Admin.	2006 / 2007	Not Complete	Not Complete	Funding
1	Offer County staff free CERT training during office hours in the late afternoon or early morning with the employees using personal time one Saturday to complete the training.	ALL	Northampton Co. Emergency Services	2006 / 2007	Not Started	Not Complete	Funding, Staff
3	Institute a recruitment program for volunteer firefighters. Publicize details on how to volunteer on the County website.	Fire	Northampton Co. Admin.	2006 / 2007	Ongoing	Ongoing	
1	Prepare a letter and package of information to encourage the towns without identified floodzones (~~Nassawadox, Eastville,~~ Cheriton) to join the National Flood Insurance Program allowing residents with storm water flooding problems to purchase flood insurance.	Flood	Northampton Co. Planning & Zoning	2007	Not Started	No longer needed.	This was discussed with all Towns during the HMP process

1	Recommend that the Town of Cape Charles identify potential shelter locations within the town in case the town becomes isolated during an emergency.	ALL	Northampton Co. Emergency Services	2006	Not Started	Not Started	
1	Evaluate and develop a priority list of residential and commercial properties that qualify for the HMGP	Flood	A-NPDC & localities	2011	Ongoing	Ongoing	
Completed Projects							
---	Produce Responder Bilingual Cards with English on back. An example of the type of message to be included is "Do not drink the water."	ALL	Health Department and the Eastern Shore Disaster Preparedness Coalition (ESDPC)	2006 / 2006	Complete*	Complete	
---	Obtain more changeable warning signs	ALL	VDOT	2006 / 2006	Complete	Complete	
---	Create a formal waiting list of residential and commercial projects for the Hazard Mitigation Grant Program.	ALL	Northampton Co. Admin.	2006	Complete	Complete	
---	Upgrade communications systems and provide for backup in the event of a communication failure, provide for interoperability and redundancy	ALL	ESDPC	2006 / 2009	Complete	Ongoing	

*Spanish Health and Emergency Preparedness informational brochures have been produced and are available to the Hispanic population through a variety of outlets.

Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities

Strategy 2.1 - Retrofit housing to reduce risk of coastal flooding.
Strategy 2.2 - Protect new housing by reducing the risk of damage from natural hazards.
Strategy 2.3 - Retrofit commercial and residential structures to reduce risk of the most critical natural hazard damage.

Priority Rank	Northampton County – Goal 2: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	The Town of Exmore has expressed interest in solving their drainage issues in their downtown. Produce a drainage and storm water study of the Town of Exmore's flooding issues in downtown.	Hazmat Incidences, Well Contamination, Storm Water Flood, Biohazard	Mayor of Exmore/Town Manager	2006 / 2016	Not Started	Ongoing	Actively seeking funding and contractor
1	Conduct a drainage survey of areas East and South of Eastville and the Town of Eastville	Storm Water Flood, Biohazard	Northampton Co. Planning & Zoning	2006 / 2008	Ongoing	Ongoing	
1	Conduct a drainage survey of countywide drainage issues; Develop a comprehensive drainage plan that identifies specific projects to improve drainage.	Storm Water Flood, Biohazard	Northampton Co. Planning & Zoning	2006 / 2009	Not Started	Not Started	Funding
1	Maintain a Conservation Preservation Zoning District encompassing coastal areas.	Flood, Erosion, Well Contamination	Northampton Co. Admin.	2006	Ongoing	Ongoing	
1	Enforce the primary dune ordinance.	Flood, Erosion, Well Contamination	Northampton Co. Planning & Zoning	2006	Ongoing	Ongoing	
1	Consider incentives in the zoning ordinance for developers who reserve land or take other measures to preserve both primary and secondary sand dunes.	Flood, Erosion, Well Contamination	Northampton Co. Planning & Zoning	2006 /	Not Started	Not Started	Staff
1	Enforce buffer zone widths set forth in the zoning ordinance along the bayside and seaside waterfront.	Flood, Erosion, Well Contamination	Northampton Co. Planning & Zoning	2006	Ongoing	Ongoing	

1	Revise floodplain management regulations in accordance with new FEMA guidance	ALL	Northampton Co. Planning & Zoning	2011 / 2012	Ongoing	Ongoing	
1	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Northampton County Comprehensive Plan.	ALL	Northampton Co. Planning & Zoning	2011 / During next Comp. Plan update	Not Started	Ongoing; 2013 draft Plan in progress	
1	Mitigation of flood prone properties (to include, but not limited to acquisition, elevation, relocation, and dry and wet flood proofing of flood prone structures, and mitigation reconstruction for NFIP defined SRL properties only).	Flood	Northampton Co. Planning & Zoning, A-NPDC	2011 / Post-declared disaster	Not Started	Not Started	
Completed Projects							
---	Conduct a drainage survey of Cheapside	Storm Water Flood	Northampton Co. Planning & Zoning	2006 / 2007	Complete	Complete	
---	Manage a Residential Mitigation Project		Northampton Co. Emergency Services Coordinator	2006 / Post-declared disaster	Complete	Complete	
---	After any presidential declared disaster, manage Residential and Commercial Mitigation Projects that address the most critical damage that has occurred.	ALL	Northampton Co. Emergency Services Coordinator	2006 / Post-declared disaster	Complete	Complete	
---	Install storm shutters to withstand hurricane winds on the EOC building.	Wind	Northampton Co. Emergency Services Coordinator	2006 / 2009	Complete	Complete	

Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk							
Strategy 3.1 - Increase resident preparedness in the County. *Strategy 3.2 - Educate residents about flood insurance available and encourage participation in the National Flood Insurance Program.*							
Priority Rank	**Northampton County – Goal 3: Description of Projects**	**Hazard(s) Addressed**	**Responsible Department**	**HMP Year / Start Timeline**	**Status as of 2011**	**Status as of 2016**	**Add'l. Info.**
1	Send out information encouraging residents to purchase contents and structure flood insurance to all homes and businesses located in the Count's regulated flood zones.	Flood	Northampton County Planning	2006 / Yearly	Ongoing	Ongoing	
1	Provide preparedness information on the County's website.	ALL	Northampton Co. Emergency Services Coordinator	2006 / 2007	Complete, Ongoing	Complete, Ongoing	EverBridge alert system available
1	Provide updated preparedness information on the County's website to include materials for the Hispanic population.	ALL	Northampton Co. Emergency Services	2011 / 2007	Complete, Ongoing	Complete, Ongoing	
1	Send out information encouraging residents to purchase contents and structure flood insurance to all homes and businesses located in the County's regulated flood zones.	Flood	Northampton County Planning	2011 / Yearly	Not Started	Not Started	
Completed Projects							
---	Investigate whether Northampton should pursue a better CRS rating to reduce flood insurance premiums in the County.	Flood	Northampton Co. Admin.	2006 / 2008	Complete	-	

Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event

Strategy 4.1 - *Maintain traffic flow after a natural hazard event.*

Strategy 4.2 - *Ensure continuity of public water and wastewater systems.*

Strategy 4.3 - *Provide for adequate sheltering during an emergency.*

Priority Rank	Northampton County – Goal 4: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Assess and identify emergency generator power serving public water and wastewater systems for adequacy.	Wind, Ice & Snow, Heatwave	Northampton Co. Public Works Dept.	2011 / 2011	Started	Complete	
1	Retrofit existing emergency shelters against flooding and wind including backup power supplies.	Flood, Wind	Northampton Co. Emergency Services	2011 / 2012	Not Started	Ongoing	
1	Identify and mitigate drainage problems at major intersections along Route 13 in Northampton County.	Storm Water Flood, Biohazards	VDOT	2011 / 2012	Started	Ongoing	
Completed Projects							
---	1. Retrofit three lights for backup power to facilitate traffic movement during a large power outage. 2. The light serving the hospital at Rogers Drive (Rt. 606) and Route 13 in Nassawadox 3. A light at the following intersections, Rt. 13 and Rt. 178 in Belle Haven 4. The light at Stone Road (Rt. 184) and Route 13 serving the Town of Cape Charles.	ALL	VDOT	2006 / 2009	Complete	-	

Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations							
Strategy 5.1 - Improve communications with special needs residents before and after hazard events.							
Priority Rank	**Northampton County – Goal 5: Description of Projects**	**Hazard(s) Addressed**	**Responsible Department**	**HMP Year / Start Timeline**	**Status as of 2011**	**Status as of 2016**	**Add'l. Info.**
1	Work with the Department of Social Services, the Eastern Shore Area Agency on Aging, home health agencies and other organizations to identify special-needs residents and ensure that responsible parties are notified of potentially hazardous situations.	ALL	Northampton Co. Emergency Services	2011	Not Started	Not Started	
1	Establish and maintain a list of seasonal migrant housing locations.	ALL	ESDPC & Northampton Co. Emergency Services	2011	Not Started	Ongoing	
1	Consider plan for sheltering of domestic pets.	ALL	Northampton Co. Emergency Services	2011	Not Started	Still Considering	
Completed Projects							
-	Acquire and implement an updated communications system that can be used for citizen notifications.	ALL	Northampton Co. Emergency Services	2011	Not Started	Complete	

IDENTIFIED MITIGATION PROJECTS – NORTHAMPTON COUNTY TOWNS

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
Cape Charles	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Cape Charles Town Plan.	ALL	Town Planning & Zoning Staff	2.1, 2.2	next Town Plan update	Not Started	Not Started	Lack of Communication
Cape Charles	Mitigate the Town's Infrastructure against flooding and wind.	Flood, Wind	Town Building/Code Enforcement + Planning & Zoning Staff	2.2	Post-Declared Disaster	Ongoing	Ongoing	
Cape Charles	Maintain records of stormwater flooding events.	Storm Water Flood, Biohazard	Town Public Works & Utilities Staff	2.2	2011	Ongoing	Ongoing	
Cape Charles	Take actions to improve Community Rating System ranking in order to decrease residents' flood insurance rates.	Flood	Town Building/Code Enforcement + Planning & Zoning Staff	2.2	2011	Ongoing	Ongoing	
Cape Charles	Mitigate risk to Town water supply by constructing new water tower on south side of Town.	Well Contam., Wind	Town Public Works & Utilities Staff	2.3	Unknown	Not Started	Not Started	Funding
Cape Charles	Implement coastal erosion mitigation actions into the Town's Beach Management Plan.	Erosion	Town Planning & Zoning Staff	2.2	2011	Ongoing	Ongoing	
Cape Charles	Promote Hazard Mitigation at local community events and meetings.	ALL	Town Staff, Manager, & Mayor	1.1, 3.2	2011	Ongoing	Ongoing	
Cape Charles	Educate residents, real estate agents, and lenders about recent changes to flood zones in the Town.	Flood	Town Building/Code Enforcement	1.1, 3.2	2016	-	Not started	Staff

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
			+ Planning & Zoning Staff					
Cheriton	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Cheriton Town Plan	ALL	Town Staff	1.1	During next Town Plan update.	NA	Not Started	No Plan update yet
Cheriton	Cooperate with VDOT to mitigate stormwater drainage in Cheriton.	Storm Water Flood, Biohazards	Town Staff, VDOT	2.2, 4.1	2016	NA	Not Started	Funding, Coordination
Cheriton	Develop and implement a drainage plan to ensure appropriate repairs and regular maintenance to prevent stormwater flooding in the Town.	Storm Water Flood, Biohazards	Town Staff, or contracted entity	2.2, 4.1	2016		Not Started	Staff, Funding, Coordination
Cheriton	Promote Hazard Mitigation at local community events and meetings.	ALL	Town Staff	1.1, 3.1, 3.2	2016	NA	Not Started	Staff Expertise
Cheriton	Equip the Town Hall/Office with a generator.	Wind, Ice & Snow	Town Staff	4.3	2016	NA	Not Started	Funding
Cheriton	Develop and distribute multilingual emergency plan & preparedness handouts/signage.	ALL	Northampton County, Town	3.2, 5.1	2016	NA	Not Started	Coordination with County
Cheriton	Work with VDOT to ensure safety of major intersection at Route 13, which is featured in the VDOT Safety Study of April 2016. Most likely adding an arrow to the traffic light signal.	ALL	Town, VDOT	2.3, 4.1	2016	NA	Not Started	Funding, Coordination
Eastville	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Eastville Town Plan	ALL	Town Staff	2.1, 2.2	During next Town Plan update.	Not Started	Not Started	No Plan update yet
Eastville	Adopt minimum standards such that the Town can participate in the National Flood Insurance Program	Flood	Town Staff	1.1	2011	Not Started	Not Started	Staff Expertise

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
Eastville	Cooperate with VDEQ to ensure adequate water supply and quality.	Well Contam., Drought, Heat Wave	Town Staff, VDEQ	2.2	2011	Started	Started	
Eastville	Upgrade aging water distribution lines in Eastville.	Well Contam., Drought, Biohazards	Town Staff	4.1	2011	Not Started	Not Started	Funding
Eastville	Cooperate with VDOT to mitigate stormwater drainage in Eastville.	Storm Water Flood, Biohazards	Town Staff, VDOT	2.2	2011	Not Started	Not Started	
Eastville	Promote Hazard Mitigation at local community events and meetings.	ALL	Town & County Staff	1.1	2011	Ongoing	Ongoing	
Exmore	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Exmore Town Plan	ALL	Town Manager & Clerk	1.1	2011 / During next Town Plan update.	Not Started	Partially Complete	The 2015 Plan refers to the HMP team and identifies some of the mitigation actions.
Exmore	Conduct public education and outreach efforts within Town to raise awareness and promote participation of the NFIP.	Flood	Town Staff	3.1, 3.2, 5.1	2011	Not Started	Not Started	Staff Expertise
Exmore	Replace the Town's aging public water supply wells.	Well Contam.	Town Staff	2.3, 4.2	2011	Not Started	To be completed in May, 2017	
Exmore	Cooperate with VDOT and the County to mitigate stormwater drainage in Exmore.	Storm Water	Town Staff, VDOT	2.2, 4.1	2011	Not Started	Not Started	Coordination

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
		Flood, Biohazard						
Exmore	Produce a drainage and stormwater study of Exmore's flooding issues in downtown.	Storm Water Flood, Biohazard	Town Staff	2.2, 4.1, 4.2	2011	Not Started	Not Started	Funding, Coordination
Exmore	Upgrade aging water distribution lines in Exmore.	Well Contam.	Town Staff	4.2	2011	Not Started	Not Started	Funding
Exmore	Culvert Hadlock Lane ditch to mitigate erosion.	Erosion, Storm Water Flood, Biohazard	VDOT	2.2, 4.1	2016	Not Started	Not Started	Funding, Coordination
Exmore	Develop emergency plan to utilize treated gray water for fire suppression.	Fire, Well Contam.	Town Staff, County Emergency Management	4.3	2016	Not Started	Not Started	Funding, Staff Expertise
Nassawadox	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Nassawadox Town Plan	ALL	Town Staff	1.1	During next Town Plan update.	-	Not Started	No new plan yet
Nassawadox	Cooperate with VDEQ and others to ensure adequate water supply and quality.	Well Contam.	Town Staff, Riverside, VDEQ, GWC	4.2	2016	-	Not Started	Coordination
Nassawadox	Cooperate with VDOT to mitigate stormwater drainage in Nassawadox.	Storm Water Flood, Biohazard	Town, VDOT	2.2, 4.1	2016	-	Not Started	Coordination
Nassawadox	Develop and implement a drainage plan to ensure appropriate repairs and regular maintenance to prevent stormwater flooding in the Town.	Storm Water	Town, VDOT	2.2, 4.1	2016	-	Not Started	Staff Expertise, Coordination

Town	Action	Hazard(s) Addressed	Responsible Party	Strategy	HMP Year/Start Timeline	2011 Status	2016 Status	Add'l. Info.
		Flood, Biohazard						
Nassawadox	Promote Hazard Mitigation at local community events and meetings.	ALL	Town	1.1, 3.1, 3.2	2016	-	Not Started	Staff
Nassawadox	Replace flat roofing of critical facilities and residential structures with pitched roofs built to (or to exceed) minimum wind standards.	Wind	Town, FEMA	2.1, 2.2, 2.3, 4.3	2016	-	Not Started	Funding
Nassawadox	Develop a location that could serve as the Town Hall and a staging area, equip this building with a generator.	ALL	Town, FEMA	4.3	2016	-	Not Started	Funding

TOWN OF CHINCOTEAGUE MITIGATION STRATEGIES

The Town of Chincoteague, located on Chincoteague Island, lies off of the northeast coast of Accomack County. The town is known as a gateway to Assateague Island National Seashore and the Chincoteague National Wildlife Refuge that has an economy reliant on both its natural resources and seasonal tourism. In addition, the community provides housing and visitor support for the neighboring Wallops Flight Facility. Chincoteague Island's unique location and economy has directed a set of mitigation strategies that specifically address the coastal hazards facing the town.

PLAN MAINTENANCE

The Emergency Management Coordinator will review the Hazard Mitigation Plan every year prior to the July 1 deadline for the Local Capability Readiness Assessment (LCAR). The Coordinator will evaluate the plan and review progress made during the previous years on the goals and projects in the plan. The Coordinator will use the LCAR criteria for hazard mitigation to evaluate the Town's hazard mitigation program. Progress will be reflected in the LCAR. The Coordinator will also recommend any revisions to the Town Council. By July 1, 2015, the Coordinator will assemble a Committee or represent the Town of Chincoteague on a Committee to update the plan. The Committee will work to complete the updates by the end of the calendar year of the fifth anniversary of the adoption of the plan. During the plan maintenance process, the community will have opportunity through advertised public hearings to comment on plan revisions and updates prior to the Town Council approving them.

The Town of Chincoteague has a Town Plan. The Emergency Management Coordinator will provide input and plan materials to the planning group responsible for regular updates to the Town Plan and any other relevant planning documents. During updates of the Town Plan and other relevant planning efforts, the Hazard Mitigation Plan will be reviewed and appropriate material incorporated into the updates.

See Chapter 2, page 7 and 8 for additional information about plan maintenance and evaluation.

IDENTIFIED MITIGATION GOALS & STRATEGIES – TOWN OF CHINCOTEAGUE

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program Including Public Education and Ongoing Hazard Assessments

Strategy 1.1 – Ensure emergency management and government operations can continue during and after a hazard event.

Strategy 1.1 – Complete hazard assessment mapping and Storm Water Master Plan to better inform Town Council decisions and public outreach efforts.

Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities

Strategy 2.1 - Retrofit housing to withstand a 1%-annual-chance flood event.

Strategy 2.2 – Utilize mitigation funds made available following a natural hazard event to retrofit commercial and residential structures to withstand flooding or other hazard events.

Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk

Strategy 3.1 – Promote the benefits of flood insurance from the National Flood Insurance Program.

Strategy 3.2 - Educate residents and businesses on potential hazards.

Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event

Strategy 4.1 – Retrofit the causeway and bridge to maintain connection to the mainland.

Strategy 4.2 - Ensure adequate water resources will be available during and after hazard events.

Strategy 4.3 – Maintain beach access to the Assateague Island National Seashore following hazard events.

Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations

Strategy 5.1 – Identify locations of seasonal housing including mobile homes, campgrounds, etc.

IDENTIFIED MITIGATION PROJECTS – TOWN OF CHINCOTEAGUE

Goal 1 - Local Governments Guide a Comprehensive Mitigation Program including Public Education and Ongoing Hazard Assessments

Strategy 1.1 – Ensure emergency management and government operations can continue during and after a hazard event.

Strategy 1.1 – Complete hazard assessment mapping and Storm Water Master Plan to better inform Town Council decisions and public outreach efforts.

Priority Rank	Town of Chincoteague – Goal 1: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Set a regional compatibility standard for emergency communications	ALL	ESDPC	2006	Funding attained, Pending	Ongoing	
1	Perform GIS mapping project to evaluate incremental flooding issues.	Flood	Chincoteague Planning & Zoning	2012	Not Started	Not Started	Staff Expertise
1	Study and map critical infrastructure including new FEMA wave analysis.	Flood	Chincoteague Planning & Zoning	2013	Not Started, awaiting FEMA map updates	Not Started	Staff Expertise, Coordination
1	Implement the Storm Water Master Plan	Storm Water Flood, Biohazard	Chincoteague Planning & Zoning	2017	-	Ongoing	
1	Investigate potential tertiary locations for a Chincoteague Emergency Operation Center located off the island and in northern Accomack County	ALL	Emergency Services Coordinator	2009	Ongoing	Ongoing	
1	The Causeway: raise, retrofit, or replace with a bridge so that the island is still accessible during flooding events.	Flood	VDOT	2016	-	Not Started	Funding, Coordination
1	Outfit the Community Center for a shelter of last resort.	ALL	Chincoteague Planning & Zoning	2016	-	Not Started	Funding
Completed Projects							
---	Conduct a Phase 2 Storm Water Master Plan to improve drainage infrastructure for the Town and mitigate flooding hazards.	Storm Water Flood, Biohazard	Chincoteague Dept. of Public Works	Ongoing	Phase 1 Complete	Phase 2 Incomplete	Funding, Staff Expertise

---	Produce Responder Bilingual Cards with English on back. An example of the type of message to be included is "Do not drink the water."	ALL	Health Department and the Eastern Shore Disaster Preparedness Coalition (ESDPC)	2006	Complete*		
---	Obtain more changeable warning signs	ALL	VDOT	2006	Complete		
---	Upgrade communications systems and provide for backup in the event of a communication failure	ALL	ESDPC, Tow	2009	Complete		
---	Coordinate studies and maps with Emergency Operations Plan and Comprehensive Plan	ALL	Chincoteague Planning & Zoning	Annually	Ongoing	Ongoing	

*Spanish Health and Emergency Preparedness informational brochures have been produced and are available to the Hispanic population through a variety of outlets.

Goal 2 - Residents, Businesses, Local Governments, and other Community Partners Will Work Independently and Together to Minimize Community Disruption Through Planning and Mitigation Activities

Strategy 2.1 - Retrofit housing to reduce risk of coastal flooding.
Strategy 2.2 – Utilize mitigation funds made available following a natural hazard event to retrofit commercial and residential structures to withstand flooding or other hazard events.

Priority Rank	Town of Chincoteague – Goal 2: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Partner with federal agencies to perform beach nourishment on Assateague Island to mitigate erosion and flooding hazards in Town.	Flood, Erosion	NPS, NFWS, & USACE	Unknown	Not Started	Ongoing	
1	Mitigation of flood prone properties (to include, but not limited to acquisition, elevation, relocation, dry and wet flood proofing of flood prone structures, mitigation reconstruction for NFIP defined Severe Repetitive Loss (SRL) properties only), and drainage infrastructure improvements.	Flood, Erosion, Storm Water Flood	A-NPDC & Chincoteague	Post-declared disaster	Ongoing	Some Complete, Ongoing	
1	Prepare and plan for mitigation of coastal erosion along the southern shoreline of Chincoteague Island	Erosion, Flood	Chincoteague Planning	2012	Not Started	Ongoing	
1	Flood proof commercial buildings along Main Street to mitigate flooding hazards.	Flood	Chincoteague & Main Street Merchant "s Assoc.	2012	Not Started	Not Started	
1	Use hazard mitigation funds to retrofit commercial and residential structures.	Flood	Chincoteague Building & Zoning	Post-declared disaster	Complete, Ongoing	Ongoing	
1	Manage a home elevation project on Chincoteague. Using a cost-benefit analysis, focus on reducing risk to the most vulnerable primary housing.	Flood	Chincoteague Building & Zoning	Post-declared disaster	Not Complete, Ongoing	Ongoing	
4	Increase the safety of residents and visitors on the island by increasing the shoulder and improving sidewalks.	Flood, Fire, Ice & Snow	VDOT	2016	-	Not Started	Transportation during hazard event
Completed Projects							
---	Increase the safety of residents and visitors on the island by replacing the existing bridge.	ALL	VDOT	2006	Complete		

---	Investigate the possibility of shoulders or enlarging pull offs on the causeway to aid traffic control during evacuations.	Flood, Fire, Ice & Snow	VDOT	2008	Complete		
---	Protect new construction by continuing to enforce the building code provisions protecting structures from flooding and wind events.	Flood, Wind, Fire	Chincoteague Building & Zoning	Ongoing	Complete, Ongoing	Ongoing	
---	Incorporate the Eastern Shore of Virginia Hazard Mitigation Plan into the Chincoteague Town Plan.	ALL	Chincoteague Planning	During next Town. Plan update (2015)	Not Started	Complete	

Goal 3 - Local Governments Encourage Self-sufficiency and Personal Responsibility for Managing Risk							
Strategy 3.1 – Promote the benefits of flood insurance from the National Flood Insurance Program. *Strategy 3.2 - Educate residents and businesses on potential hazards.*							
Priority Rank	**Town of Chincoteague County – Goal 3: Description of Projects**	**Hazard(s) Addressed**	**Responsible Department**	**HMP Year / Start Timeline**	**Status as of 2011**	**Status as of 2016**	**Add'l. Info.**
1	Implement a public information campaign on the benefits of flood insurance with a focus on Chincoteague's local needs.	Flood	Chincoteague Administration	Annually	Ongoing	Ongoing	
1	Protect new construction by continuing to enforce the building code provisions protecting structures from flooding and wind events.	Wind, Flood, Fire	Chincoteague Building & Zoning	Ongoing	Ongoing	Ongoing	
Completed Projects							
---	Start a public information campaign on the benefits of flood insurance with a focus on Chincoteague's local needs.	Flood	Chincoteague Administration	2007	Complete, Ongoing	Complete, Ongoing	
---	Review FEMA Region III Coastal Analysis Risk Map and amend Town ordinances, if required.	Flood	Chincoteague Planning	2012	Not Started	Complete; changed the freeboard requirement	
---	Develop and provide residents and businesses with hazard risk assessment maps and response plan. Consider creating in non-English language(s) as well. Distribute to transient population/visitors through chamber and rental companies.	ALL	Chincoteague Planning	2012	Not Started	Ongoing	

Goal 4 - Local Governments Will Work to Ensure That Infrastructure Will Continuously Function During and After a Hazard Event

Strategy 4.1 – Retrofit the causeway and bridge to maintain connection to the mainland.

Strategy 4.2 - Ensure adequate water resources will be available during and after hazard events.

Strategy 4.3 – Maintain beach access to the Assateague Island National Seashore following hazard events.

Priority Rank	Town of Chincoteague – Goal 4: Description of Projects	Hazard(s) Addressed	Responsible Department	HMP Year / Start Timeline	Status as of 2011	Status as of 2016	Add'l. Info.
1	Develop a cooperative agreement between Chincoteague and the National Fish and Wildlife Service and incorporate a short-term response plan to ensure access to the Assateague Island National Seashore following a hazard event	ALL	Chincoteague & NFWS	2011	Started	Ongoing	
1	Perform a storm water infrastructure improvement project on Maddox Boulevard at the traffic circle to reduce frequent flooding of access corridor to National Seashore and Wildlife Refuge	Storm Water Flood, Biohazards	Chincoteague Public Works	2012	Not Started	Not Started	Funding
1	Develop enforceable standards for fill and drainage to mitigate flooding hazards.	Flood, Storm Water Flooding, Biohazards	Chincoteague Administration	2012	Not Started	Not Started	Staff
2	Widen the Route 175 Causeway including expansion of shoulders, construction of an emergency lane/bike lane, and construction of a center safety barrier to maintain a safe corridor.	Flood, Fire, Ice & Snow	VDOT and other state agencies	Unknown	Not Started	Not Started	Funding, Coordination
Completed Projects							
---	1. Obtain and install a generator on the high rise water tower in the Town	ALL	Chincoteague Public Works	2008	Complete		

Goal 5 - Local Governments Will Make Efforts to Reach Special Needs Populations							
Strategy 5.1 – Identify locations of seasonal housing including mobile homes, campgrounds, etc.							
Priority Rank	**Town of Chincoteague – Goal 5: Description of Projects**	**Hazard(s) Addressed**	**Responsible Department**	**HMP Year / Start Timeline**	**Status as of 2011**	**Status as of 2016**	**Add'l. Info.**
1	Identify and map tourist lodging for use in emergency	ALL	Chincoteague & NFWS	2006	Started	Ongoing	
1	Identify locations of special needs populations using newest U.S. Census data and emergency management/response personnel personal knowledge	ALL	Chincoteague Planning & EMS	2011	Not Started	Ongoing	
1	Coordinate special needs assessment into Chincoteague Emergency Operations Plan.	ALL	Chincoteague Planning & EMS	2011	Not Started	Ongoing	
2	Study and propose mitigation actions for increased exposure of special needs populations to coastal erosion and storm surge at south end of Chincoteague Island	Erosion, Flood	Chincoteague Planning & EMS	2011	Not Started	Not Started	Funding, Staff

MITIGATION FUNDING OPTIONS

There are a variety of well-established federal hazard mitigation funding programs available to localities that can be used to implement the future mitigation projects identified in Chapters 28 through 30. In addition, there are other sources of mitigation funding regularly made available through state and federal agencies. These are not included in the following table since the program names, funding amounts, and eligibility criteria commonly vary over time.

Hazard Mitigation Funding Options

Grant Name	Agency	Purpose	Contact
Pre-Disaster Mitigation Program (PDM)	U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)	To provide funding for States and communities for cost effective hazard mitigation activities which complement a comprehensive hazard mitigation program and reduce injuries, loss of life, and damage and destruction of property.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Hazard Mitigation Grant Program (HMGP)	U.S. Department of Homeland Security, FEMA	Provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster declaration.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Flood Mitigation Assistance Program (FMA)	U.S. Department of Homeland Security, FEMA	To help States and communities plan and carry out activities designed to reduce the risk of flood damage to structures insurable under the NFIP.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Homeland Security Grant Program (HSGP)	U.S. Department of Homeland Security, Office of Domestic Preparedness	To enhance the ability of states, territories, urban areas, and local agencies to prevent, deter, respond to, and recover from threats and incidents of terrorism. The HSGP integrates the State Homeland Security Program (SHSP), the Urban Areas Security Initiative (UASI), the Law Enforcement Terrorism Prevention Program (LETPP), the Citizen Corps Program (CCP), the Emergency Management Performance Grants (EMPG), and the Metropolitan Medical Response System (MMRS) Program Grants into a single funding program.	ODP 810 Seventh Street, N.W. Washington, DC 20531 Phone: (800) 368-6498 www.ojp.usdoj.gov/odp/

Grant Name	Agency	Purpose	Contact
Buffer Zone Protection Program (BZPP)	U.S. Department of Homeland Security, Office of Domestic Preparedness	To provide funding for the equipment, management, and administration of actions, to protect, secure, and reduce the vulnerabilities of identified critical infrastructure and key resource (CI/KR) sites.	ODP 810 Seventh Street, N.W. Washington, DC 20531 Phone: (800) 368-6498 www.ojp.usdoj.gov/odp/
Transit Security Grant Program (TSGP)	U.S. Department of Homeland Security, Office of Domestic Preparedness	To provide funding for security and preparedness enhancements for designated transit systems. Funding is allowed for planning, organizational activities, equipment acquisitions, training, exercises, and management and administrative costs	ODP 810 Seventh Street, N.W. Washington, DC 20531 Phone: (800) 368-6498 www.ojp.usdoj.gov/odp/
Public Assistance Program (PA)	U.S. Department of Homeland Security, Federal Emergency Management Agency	To provide supplemental assistance to States, local governments, and certain private nonprofit organizations to alleviate suffering and hardship resulting from major disasters or emergencies declared by the President. Under Section 406, Public Assistance funds may be used to mitigate the impact of future disasters.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Flood Control Works / Emergency Rehabilitation	U.S. Department of Defense, Army Corps of Engineers	To assist in the repair and restoration of public works damaged by flood, extraordinary wind, wave, or water action.	USACE 20 Massachusetts Ave., N.W. Washington, DC 20314 Phone: (202) 761-0001 www.usace.army.mil
Community Development Grant Program (CDBG)	U.S. Department of Housing and Urban Development	To develop viable urban communities by providing decent housing, a suitable living environment, expanding economic opportunities or meeting other community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community where other financial resources are not available. Principally for persons of low and moderate income.	HUD 451 7th Street, S.W. Washington, DC 20410-7000 Phone: (202) 708-3587 www.hud.gov

Grant Name	Agency	Purpose	Contact
Emergency Watershed Protection	U.S. Department of Agriculture, Natural Resource Conservation Service	To provide emergency technical and financial assistance to install or repair structures that reduces runoff and prevents soil erosion to safeguard life and property.	NRCS PO Box 2890 Washington, DC 20013 Phone: (202) 720-3527 www.nrcs.usda.gov
Watershed Protection and Flood Prevention	U.S. Department of Agriculture, Natural Resource Conservation Service	To provide technical and financial assistance in planning and executing works of improvement to protect, develop, and use land and water resources in small watersheds.	NRCS PO Box 2890 Washington, DC 20013 Phone: (202) 720-3527 www.nrcs.usda.gov
Land and Water Conservation Fund Grants	U.S. Department of the Interior, National Park Service	To acquire and develop outdoor recreation areas and facilities for the general public, to meet current and future needs.	NPS PO Box 37127 Washington, DC 20013-7127 Phone: (202) 565-1200 www.nps.gov
Disaster Mitigation and Technical Assistance Grants	U.S. Department of Commerce, Economic Development Administration	To help States and localities to develop and/or implement a variety of disaster mitigation strategies.	EDA Herbert C. Hoover Building Washington DC, 20230 Phone: (800) 345-1222 www.eda.gov
Pre-Disaster Mitigation Loan Program	U.S. Small Business Administration	To make low-interest; fixed-rate loans to eligible small businesses for the purpose of implementing mitigation measures to protect business property from damage that may be caused by future disasters.	SBA 1110 Vermont Avenue, N.W., 9th Floor Washington, DC 20005 Phone: (202) 606-4000 www.sba.gov

Grant Name	Agency	Purpose	Contact
Watershed Surveys and Planning	U.S. Department of Agriculture, Natural Resource Conservation Service	To provide planning assistance to Federal, State, and local agencies for the development of coordinated water and related land resources programs in watersheds and river basins.	NRCS PO Box 2890 Washington, DC 20013 Phone: (202) 720-3527 www.nrcs.usda.gov
National Earthquake Hazards Reduction Program (NEHRP)	U.S. Department of Homeland Security, Federal Emergency Management Agency	To mitigate earthquake losses that can occur in many parts of the nation providing earth science data and assessments essential for warning of imminent damaging earthquakes, land-use planning, engineering design, and emergency preparedness decisions.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Assistance to Firefighters Grant Program	U.S. Department of Homeland Security, Federal Emergency Management Agency, U.S. Fire Administration	Competitively awarded project grants to provide direct assistance, on a competitive basis, to fire departments for the purpose of protecting the health and safety of the public and firefighting personnel against fire and fire-related hazards.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov
Fire Management Assistance Grants	U.S. Department of Homeland Security, Federal Emergency Management Agency, U.S. Fire Administration	To provide project grants and the provision of specialized services for the mitigation, management, and control of fires that threatens such destruction as would constitute a major disaster.	FEMA 500 C Street, S.W. Washington, DC 20472 Phone: (202) 646-4621 www.fema.gov

Grant Name	Agency	Purpose	Contact
Emergency Streambank and Shoreline Protection	U.S. Department of Defense, Army Corps of Engineers	To prevent erosion damages to public facilities by the emergency construction or repair of streambank and shoreline protection works.	USACE 20 Massachusetts Avenue, N.W. Washington, DC 20314 Phone: (202) 761-0001 www.usace.army.mil
Small Flood Control Projects	U.S. Department of Defense, Army Corps of Engineers	To reduce flood damages through small flood control projects not specifically authorized by Congress.	USACE 20 Massachusetts Avenue, N.W. Washington, DC 20314 Phone: (202) 761-0001 www.usace.army.mil
Clean Water Act Section 319 Grants	U.S. Environmental Protection Agency	To implement non-point source programs, including support for non-structural watershed resource restoration activities.	EPA Ariel Rios Building 1200 Pennsylvania Avenue, N.W. Washington, DC 20460 Phone: (202) 272-0167 www.epa.gov

APPENDIX A.

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APPENDIX B.

PROCESS FOR HAZUS RISK ANALYSIS

PRE-MODELING DATA SETS

A-NPDC used the Hazus Multi-Hazard Model (version 2.2, with service pack 02) hurricane wind and the flood hazard modules using data prepared by FEMA Region III and the U.S. Army Corps of Engineers. The user-defined database contains building stock data and attributes for both counties, including such characteristics as building assessment value, year built, footprint location, and zoning classification.

However, the database contains many other fields for which there were no data, and FEMA made assumptions after consulting with ANPDC and county staff based upon the general building and development characteristics. In cases where the data wasn't complete, values were derived from the values of other structures with like land use, building value, year built and neighboring location.

The table below explains the variables used.

Table 1: UDF Analysis for Variables for Risk

UDF Analysis Variables for Risk					
Address	Structure Address	County	County where structure exists	Latitude	Coordinate in Decimal Degrees
Area	Total square footage of structure	DesignLevel	Associated with year built. Value found in CDMS dictionary Appendix C	Longitude	Coordinate in Decimal Degrees
BldgDamageFnId	Derived from the general building stock (GBS) Depth-Damage Function Library. Found at - Analysis/Damage Functions/Buildings/Library - for Structure	ContDamageFnId	Derived from the general building stock (GBS) Depth-Damage Function Library. Analysis/Damage Functions/Buildings/Library - for Contents	InvDamageFnId	Derived from the general building stock (GBS) Depth-Damage Function Library. Analysis/Damage Functions/Buildings/Library - for Inventory
BldgType	Construction material type. Value found in CDMS Dictionary Appendix C	FloodProtection	Presence of flood protection	NumStories	Number of stories
BUPower	Presence of back up Power	FoundationType	Type of foundation. Value found in CDMS Dictionary Appendix C	Occupancy	Hazus value related to land use
City	Municipality	FirstFloorHt	Height of the first floor or lowest adjacent grade. Related to foundation type	Phone	Phone number for owner
Contact	Contact information for property owner	YearBuilt	Year structure was built	ShelterCapacity	Availability to use the structure as a shelter or presence of a shelter
Name	Name of owner	ZipCode	Zip code where structure exists	State	State where structure exists
ContentCost	Value of contents in actual $	Cost	Value of Structure in actual $		

The results were delivered to A-NPDC in three files: two Hazus .hpr files, which contain county-level assessment data, and one Microsoft .mdb files, which contains all of the building stock data. Documentation for the files was also submitted.

The second product group was the depth grids for each county – digital representations of the water depths within the area of the one percent annual chance flood. Taken together – the .hpr files, the .mdb files, and the depth grids – are the inputs required to run the Hazus model.

HAZUS HURRICANE WIND MODEL

Because the Eastern Shore is roughly 70 miles long, hurricanes affect areas of the Shore differently, depending upon their direction of approach, approach speed, circumference, and other factors. So rather than model the entire area as one region, two different regions were created – one for each county – and each was modeled separately. The wind model was run for each county, using the Hazus probabilistic scenario. Model results provided wind speed estimates for the 10, 25, 50, 100, 200, 500, and 1000-year storm return periods. At the December 2, 2015 Steering

Committee meeting, A-NPDC staff chose the 20-year and 100-year scenarios to present in GIS format at meeting, but other scenarios and their associated wind speeds were discussed during the meeting as well.

The table below provides general wind speed ranges for each of the scenarios for each of the counties:

Return period (years)	Accomack County Wind speed –Peak gusts (mph)	Northampton County Wind speed –Peak gusts (mph)
10	43-62	52-56
20	58-73	64-67
50	79-89	80-84
100	90 -100	88-96
200	80-115	98-103
500	106-122	107-115
1000	99-136	114-119

Source: Hazus Multi-Hazard Model, Hurricane Wind module version 2.2, with service pack 02, run separately for each county with user-supplied inventory data and probabilistic scenarios for each run.

The Hazard Mitigation Steering Committee, in consultation with the Planning Council, selected the 100-year return period as the scenario they wished to study, because the wind speeds of the lesser return periods were viewed as similar to routine storms for the Eastern Shore. Because wind results are not available at the town level, county results were clipped to the town level to give an idea of the level of damage at that level.

The Northampton County assessing database does not indicate a building's number of stories, and one assumption made by FEMA in building the county's database was that all buildings were one story. This could lead to an understatement of loss, as roof loss is a major indicator of building, contents, and inventory loss, roof loss is typically higher with two-story structures.

HAZUS FLOOD ANALYSIS

The flood analysis was run for each of the two counties, and for each coastal community, using the one-percent annual chance flood depth grids provided by FEMA.

The regions were easily defined in Hazus for the counties, but defining the municipalities required one extra step. FEMA staff conducted a teleconference training during which Central Data Management System (CDMS) data – the data in FEMA's default national database - were replaced with data from the Accomack and Northampton-specific databases that were prepared by FEMA. This step had to be completed before the municipal regions could be created and the model could be run for municipalities.

BUGS!

There were problems with running Hazus at the town level. Staff noticed that results extended beyond the boundaries of the towns that were being modeled. A request was put in through the FEMA Help Desk for assistance. It appeared that the region was being defined correctly, as the description of the region in the summary report was correct in terms of the geographic size of the towns, and the number of housing units compared favorably to Census numbers. However, when results were mapped, they appeared to be at the Census block group or tract level, and the losses in the summary tables were exaggerated based on what was known to exist in the towns. Unfortunately, this did not come to light until after several towns were run, and inexperience of A-NPDC staff caused staff members to assume the error was their own, and multiple attempts were made to rectify the issue locally. At this point it was not clear if ALL of the results were wrong, or just the building, contents, and inventory results (as opposed to debris, income, etc.) As an interim fix to the problem, staff began using a GIS tool to clip the results to the town boundaries, which at least provided an estimate of the buildings affected, along with an estimate of building, contents, and inventory losses. Other model data were determined to be unreliable without additional information from FEMA.

It took several months to get a response from the FEMA help desk, but it was finally determined that A-NPDC staff had discovered a previously unknown software bug. (According to Help Desk staff, Hazus is not run very often at the small town level). The recommended solution was the one A-NPDC had already employed: clipping results to the town boundaries. However, Help Desk employees did verify that other model results were reliable. The building data, they explained, are point specific and are the only data affected. The income, wages, and rents data are from an econometric model that runs by Census block, and those were mapped and verified as running accurately.

One recommendation was to download the update of Hazus 3.0 and see whether that would fix the problem. However, that course would have required all of the regions to be rebuilt. Both counties' flood models had already been reviewed with the Steering Committee and the Planning Council, and well as wind results, and had been incorporated into report chapters, that it was felt it was too far along to re-start the process with no guarantees the problem would be fixed, and A-NPDC staff had already encountered significant study delays trying to resolve the problem. The decision was made to continue clipping results to town boundaries for coastal towns.

FLOOD RESULTS - COMPARISON TO PREVIOUS HAZARD MITIGATION PLANS AND FEMA REGION III HAZUS MODEL RUN

Other benchmarks exist to which results from the Hazus model runs used in this analysis can be compared. The first is the previous Hazard Mitigation Plan, which produced higher flood loss estimates, and lower wind loss estimates. That plan, and its predecessor, did not use Hazus, but could still be helpful to examine in order to understand differences between the previous plan's estimates and this plan's estimates. The second is a Hazus flood model run undertaken by FEMA Region III for the Eastern Shore area, which produced lower flood loss estimates than the model run used in this Hazard Mitigation Plan.

The table below shows the three in comparison.

Table 2: Discrepancies in Hazus estimates

Loss Estimate Methodology	Accomack	Northampton	Total	Difference from 2016 HMP (Hazus)
Hazus – Flood Model Run for 2016 HMP*	$292,590,000 $293,480,000	$57,000,000 $57,770,000	$349,590,000 $351,250,000	$0
2011 HMP**	$382,963,000	$87,906,000	$470,869,000	+ $121,279,000***
Hazus – Flood Model Run by FEMA	$58,040,000	$2,700,000	$60,740,000	($290,510,000)
Hazus – Wind Model for 2016 HMP+	$37,958,540 $63,170,460	$14,906,990 $22,037,930	$52,865,530 $85,208,390	$0 $0
2011 HMP++	$15,538,000	$16,700,000	$32,238,000	($20,627,530)+++

* Since the 2011 estimate was building and contents only, the 2016 Hazus results are presented for both building and contents first, and then for all damage (building, contents, inventory, and business interruption).

**Includes building and contents losses only. No loss estimate was made for inventory or business interruption.

***Difference is based on building and contents losses only.

+Since the 2011 estimate was for building losses only, the 2016 Hazus results are presented for both building losses only, and then for all losses (building, contents, inventory, and business interruption).

++Includes losses to buildings only.

+++Difference is based on building losses only.

PREVIOUS HAZARD MITIGATION PLANS

Previous hazard mitigation plans utilized loss estimation methodology that was devised specifically for the hazard mitigation plan using local data. In short, the methodology estimated the number of pre-FIRM and post-FIRM buildings, made assumptions about the number of those that were and were not covered by insurance - and in what amount - in order to calculate potential insured and potential uninsured losses. Further assumptions were made about the value of contents and potential uninsured losses were calculated for each locality.

Total estimated losses from the most recent plan completed in 2011 show losses for Accomack County, including incorporated towns, of $382,963,000. Uninsured losses were estimated to be around $240 million. For Northampton County, total losses were estimated at $87,906,000, with about $64 million estimated to be uninsured. While this methodology did include contents losses, it did not include inventory or business interruption loss estimates.

It is worth noting that the Flood Insurance Rate Maps changed in between the time that the 2011 plan and the time that the 2016 plan were completed. The changes resulted in a net reduction of 3,198 buildings in the Special Flood Hazard Areas (both counties), and a net removal of 409 from the velocity zones.

HAZUS FLOOD MODEL RUN BY FEMA REGION III

FEMA Region III ran the Hazus Flood Model (version 2.1) as part of a series of Risk Mapping, Assessing, and Planning (MAP) program information to provide local governments with flood information to help increase resilience to flooding. A refined dataset was used (instead of the Hazus defaults), and they appear to be similar to the datasets developed by FEMA and the Army Corps of Engineers, with the help of the counties, for A-NPDC to use with Hazus, but it is not clear whether they are identical. What does appear to be different is the depth grids, which could be what accounts for the vastly different results.

Through research (when the riskmap3.com website was still active), it appeared that Hurricane Isabel was viewed as the storm of record for Region III, and perhaps depth grids were calibrated using that storm's depths. If that is the case, a general consensus among emergency personnel and planners for the Eastern Shore area is that Isabel was not a storm of record, nor did it approximate a one percent annual chance storm.

However, the storm grid was downloaded from the FEMA map portal, and the flood boundaries seemed compatible with the boundaries of the one percent annual chance flood, although there was some difference in depths between the two, with the grid used for the Risk MAP product showing shallower depths in the locations that were spot checked. Most locations were about 6 inches to one foot shallower than the depth grid provided by FEMA to A-NPDC to run HAZUS for the Hazard Mitigation Plan.

Several phone calls and conversations with Region III FEMA staff did not provide a resolution to the discrepancies between the two model runs. Staff was encourage by FEMA to use the locally-obtained results.

WIND RESULTS – COMPARISON TO 2011 HAZARD MITIGATION PLAN

The 2011 Hazard Mitigation Plan used a methodology that assumed structures within one-mile of the coast would be exposed to 3-second wind gusts of 110 mph. Most building types were assumed to be damaged at 7.5 percent, except for mobile homes, which were assumed to be complete losses.

For the 2016 Hazard Mitigation Plan, the Hurricane Wind Model was run, with a separate run for each county. Hazus has a number of built-in functions that allow the model to account for terrain, building materials, building height, and other factors. As mentioned before, one short-coming of the model's performance in Northampton County is the lack of information in assessing records for the number of stories a building has. In the absence of that information, one story was entered for all Northampton buildings. That could lead to under-estimating losses in towns like Cape Charles where most of the buildings are two-stories.

APPENDIX C.

STORM SURGE METHODOLOGY

ADCIRC is one of two primary models used to forecast storm surge. The other is Sea, Lake and Overland Surges from Hurricanes (SLOSH). The two models work differently: While the SLOSH model uses data from a defined ocean basin, the ADCIRC model pulls data from the western Atlantic and Gulf regions. Both are generally recognized as industry standards for storm surge modeling, but only ADCIRC is accepted by FEMA as meeting National Flood Insurance Program requirements for accuracy (http://www.fema.gov/coastal-numerical-models-meeting-minimum-requirement-national-flood-insurance-program). Additionally, ADCIRC can include full dynamic astronomical tidal forcing, which is necessary for correct simulation of actual events (such as Nor'Ida), and can be coupled with SWAN to account for wave set-up.(John Atkinson, ARCADIS Consulting).

Representatives from National Weather Service and FEMA who participated on the hazard mitigation planning team 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.

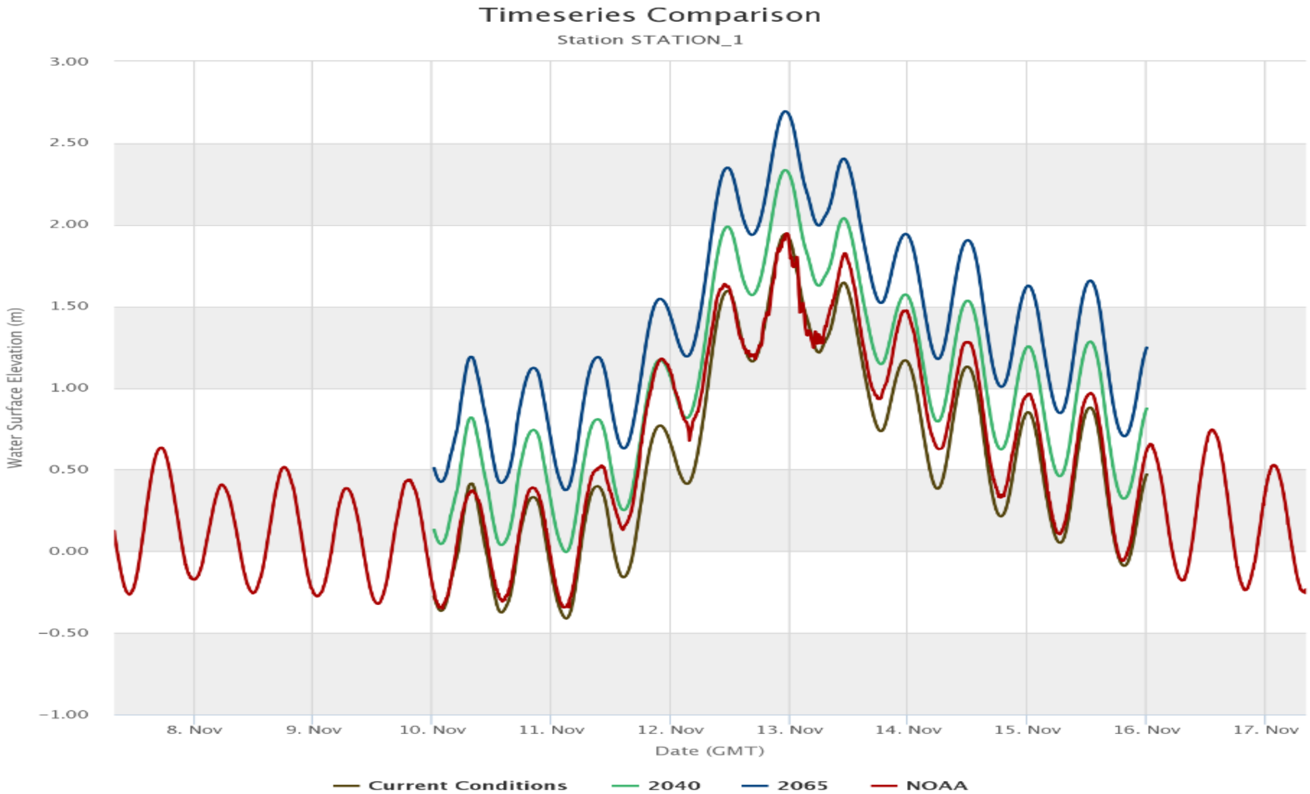

Figure 1: Nor'Ida measured conditions compared to model output for current conditions and sea level rise scenarios

Storm Surge Methodology

The ADCIRC model for the Eastern Shore of Virginia Coastal Resilience Tool was calibrated to Nor'Ida using tidal gauge NOAA_8638610, at Sewell's Point during the Nor'Ida storm of 2009, and comparing to the model output using the Nor'Ida 2040 sea level rise scenario, and 2065 sea level rise scenario (Figure 1). The current conditions and the model output tracked together fairly consistently, with few instances of model-predicted water surface elevation higher than observed water elevation at Sewell's Point. Where the model underperformed was in the tide cycles on either side of the storm's three peak tides, where it underestimated the water level by as much as 0.75'.

APPENDIX D.

This appendix includes the sign in sheets, minutes, and advertisements, when available, for meetings. They are presented in chronological order.

Below is a table indicative of the in-person meetings held with each participating jurisdiction (in addition to emails and phone calls) to present and review their draft chapters, ensuring the accuracy and acquiring first-hand accounts of past hazard events. Some of these were with staff, the mayor, and/or the entire Town Council.

County/Town	Date
Accomack County	July 14, 2016
Northampton County	January 25, 2016
Bloxom	January 25, 2016
Cape Charles	June 8, 2016
Cheriton	January 14, 2016
Chincoteague	January 21, 2016
Eastville	December 7, 2015
Exmore	December 7, 2015
Hallwood	June 2, 2016
Keller	November 4, 2015
Melfa	January 27, 2016
Nassawadox	January 27, 2016
Onancock	June 2, 2016
Onley	February 18, 2016
Parksley	January 14, 2016
Saxis	June 9, 2016
Tangier	June 16, 2016
Wachapreague	May 18, 2016

NOV. 6, 2014 ESHMP KICKOFF MEETING

Sign-In Sheet

Name	Organization	Position	EMAIL	INITIALS
Denise Bendick	Melfa	Mayor	trevdee@verizon.net	
Jim McGowan	The Nature Conservancy	Director, Virginia Coast Reserve	jmcgowan@TNC.org	
uth Boettcher	Virginia Department of Game and Inland Fisheries		Ruth-Boettcher@dgif.virginia.gov	
George Bryan	Hampton Roads Small Business Development Center	Business Counselor	gbryan7600@gmail.com	
R. Scott Callander	Bloxom	Mayor	townofbloxom@verizon.net	
Coleen Charlton	Northampton County Public Schools		ccharlton@ncpsk12.com	
Jane Corson-Lassiter	USDA		Jane.Lassiter@va.usda.gov	
Elizabeth Dodd	Northampton County Chamber of Commerce		chamber@northamptoncountychamber.com	
Eric Dodge	ES Amateur Radio Club		WA2AIC@verizon.net	
Peaches Dodge	ESV Coalition Against Domestic Violence	President	email?	PHD
Denise Drewer	Saxis	Mayor	adrewer@intercom.net	

Carmie ~~Duer~~ Savage	Eastern Shore Soil and Water Conservation ~~Service~~ District		carmie.duer@esswcd.org
Robert Duer	Exmore	Town Manager	rduer@exmore.org
Taylor Dukes	Exmore	Public Works	tdukes@exmore.org
Alvy Dunahoo	ES Amateur Radio Club		WOADD@verizon.net

Name	Organization	Position	EMAIL	INITIALS
David Eder	Eastville	Town Sergeant	deder17@yahoo.com;eastvillepd@esva.net	
James ElcheEberger	Parksley	Mayor	eichelberger@parksley.org	
James Eskridge	Tangier	Mayor	tgitownoffice@yahoo.com	
Paul Ewell	Watermens Museum	Executive Director	pewell@esvawatermen.org	PE
Joe Fehrer	Nature Conservancy	Nassawango Reserve	jfehrer@TNC.org	
Dot Field	Virginia Department of Conservation and Recreation		Dot.Field@dcr.virginia.gov	RF
Tange Francis	Eastern Shore Project Head Start	Executive Director	tfrancis esvaheadstart.or	
Ed Gibb	Nassawadox	Mayor	edgibb@verizon.net	ECO F

Forrest Gladden	Virginia Department of Conservation and Recreation		Forrest.Gladden@dcr.virginia.gov	
Chet Gnagey	Tyson		chet.gnagey@tyson.com	
Nancy Gonzales	Habitat for Humanity	Executive Director	eshabitat@verizon.net	
Greg Hardesty	Cheriton	Council Member	townofcheriton@aol.com	
Harold Higgins	Worcester County, Maryland	Chief Administative Officer		
Charmin Horton	Foodbank of ESVA	Executive Director	chorton@foodbankontine.org	
Amy Howard	VDEM	Hazard Mitigation Coordinator	Amy.Howard@vdem.virginia.gov	
Tina Jerome	USDA		tina.jerome@va.usda.gov	
Joe Joeckel	Wachapreage	Council Member	JJoeckel@seaconsulting.com	

Name	Organization	Position	EMAIL	INITIALS
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Jane Lassiter	USDA		Jane.Lassiter@va.usda.gov	
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Robert Leffel	U. S, Fish and Wildlife Service		Robert_Leffel@fws.gov	
Larry LeMond	Bay Coast Railroad	Vice President	llemond@baycoastrailroad.com	
Robbie Lewis	Virginia Department of Forestry		robbie.lewis@dof.virginia.gov	
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Caroline Massey	NASA		caroline.r.massey@nasa.gov	
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Jack McCambridge	VDOT		John.McCambridge@VDOT.Virginia.gov	
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Moody K Miles	Saxis Island Museum	Director/Chairperson	info@saxisislandmuseum.org	
Mariann Miller	Saxis	Town Clerk	mariann@seaclam.com	
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Dianne Musso	Eastern Shore Area Agency on Aging	Chief Executive Officer	esaaa12@gmail.com

Name	Organization	Position	EMAIL	INITIALS
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Althea Pittman	Center for Independent Living	Executive Director	apittman@vaescil.org	
J. Jackie Poulson	Hallwood	Mayor		
Jon Richardson	Virginia Department of Health		Jon.Richardson@vdh.virginia.gov	[illegible]
~~Brian Richardson~~	~~U. S. Fish and Wildlife Service~~	Supervisory Federal Wildlife Officer	~~matthew b richardson@fws.gov~~	
~~Robin Rich-Coates~~	~~Eastern Shore Community College~~		~~RRich-Coates@es.vccs.edu~~	[illegible]
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Kevin Sfoan	U. S. Fish and Wildlife Service		kevin sloan@fws.gov	[illegible]
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David A. Rogers SP.	Eastern Shore Community College	Chief of Police	drogers@es.vccs.edu	
Curt Smith	A-NPDC			

Conni Morrison A-NPDC

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J. Jackie Poulson	Hallwood	Mayor		
Brian Richardson	U. S. Fish and Wildlife Service	Supervisory Federal Wildlife Officer	matthew b richardson@fws.gov	
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Peaches Dodge	ESV Coalition Against Domestic Violence	President		
Denise Drewer	Saxis	Mayor	adrewer@intercom.net	
Robert Duer	Exmore	Town Manager	rduer@exmore.org	

'Taylor Dukes /ˢ—//	Exmore	Public Works	tdukes@exmore.org
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Dot Field

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Forrest Gladden Recreation

Recreation

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Forrest-

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Chet Gnagey Tyson

Executive Director eshabitat@verizon.net

Nancy Gonzales

Cheriton Council Member townofcheriton@aol.com

Greg Hardesty	Cheriton		
Harold Higgins	Worcester County, Maryland	Chief Administative Officer	
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Larry LeMond	Bay Coast Railroad	Vice President	llemond@baycoastrailroad.com	
Robbie Lewis	Virginia Department of Forestry		robbie.lewis@dof.virginia.gov	

Name	Organization	Position	EMAIL	
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Dr. David Matson	Eastern Shore Health District	Director	David.Matson@vdh.virginia.gov	
Richard Sterrett	Northampton County Social Services	Director	richard.sterrett@dss.virginia.gov	
Susan McAndrews	Riverside Shore Memorial Hospital	Vice President	susan.mcandrews rivhs.com	
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Jack McCambridge	VDOT		John.McCambrid e VDOT.Vir inia. ov	
Jim McGowan	The Nature Conservancy	Director, Virginia Coast Reserve	owan TNC.or	
Ursula Tankard	Virginia Cooperative Extension, Northampton County	Extension Agent	utankard@vt.edu	
Jeremy McLean	Broadwater Academy	Headmaster	jmclean@broadwateracademy.org	
Jeff Terwilliger	Accomack County	Director of Public Safety	[illegible]mack.va.us	
Moody K Miles	Saxis Island Museum	Director/Chairperson	info@saxisislandmuseum.org	
Linda Thomas-Glover	Eastern Shore Community College	President	lglover@es.vccs.edu	
Michael Tolbert	Accomack County Public Schools	Facilities Coordinator	michaelftolbert@accomack.k12.va.us	
Mariann Miller	Saxis	Town Clerk	mariann@seaclam.com	
Chris Truckner	Northampton County Public Schools	Director of Operations	ctruckner@ncpsk12.com	
Laura Vaughan	Barrier Islands Center	Executive Director	barrierislandscenter@live.com	
Josephine Mooney	Eastern Shore of Virginia Resource Conservation and Development Council		esrcdc.projectsdirector@gmail.com	
Richard Wallace	Accomac	Mayor		
Dianne Musso	Eastern Shore Area Agency on Aging	Chief Executive Officer	esaaa.dianne@aol.com	
Bill Neville	Chincoteague	Town Planner	wneville@chincoteague-va.gov	(WR)

EASTERN SH HISTORICAL SOCIETY

TOWN OF CAPE CHALLES

COUNTY OF ACCOMACK

Tom Brockenbrough " "

Jim McGowan The Nature Conservancy

Joel Mitchell NASA/WFF

SECRETARY	WCHELIN@VERIZON.NET	WCH ✓
CODE OFFICIAL	CODEOFFICIAL@CAPECHARLES.ORG	JSB ✓
Acting CODE OFFICIAL	mbowden@co.accomack.va.us	✓
Acting Flood Program Mgr	tbrockenbrough@co.accomack.va.us	TB ✓
Land Protection Manager	jmcgowan@tnc.org	JMcG ✓
Environmental Engr	joel.t.mitchell@nasa.gov	✓

Eastern Shore Hazard Mitigation Plan

Summary of Nov. 6, 2014 Kickoff Meeting

Steering Team Members Present:

Ed Gibb, Town of Nassawadox

Taylor Dukes, Town of Exmore

Greg Hardesty, Town of Cheriton

Joe Joeckel, Town of Wachapreague

Doug Jones, Accomack County

John Outten, Northampton County

Peter Stith, Northampton County

Jeff Terwilliger, Accomack County

VDEM Present:

Amy Howard

Stewart Baker

A-NPDC Staff Present:

Elaine Meil

Connie Morrison

Curtis Smith

Planning Council Members Present:

Ruth Boettcher, Virginia Department of Game and Inland Fisheries

George Bryan, Hampton Roads Small Business Development Center

Coleen Charlton, Northampton County Public Schools

Sheila Corbin, Riverside Shore Memorial Hospital

Jane Corsan-Lassiter, USDA

Eric Dodge, Eastern Shore Amateur Radio Club

Peaches Dodge, Eastern Shore Coalition against Domestic Violence

Paul Ewell, Watermens' Museum

Tange Francis, Eastern Shore Project Head Start

Forrest Gladden, Virginia Department of Conservation and Recreation

Theresa Long, Virginia Cooperative Extension, Accomack County

Dr. David Matson, Eastern Shore District, Virginia Department of Health

Jim McGowan, Nature Conservancy

Beverly Misuna, Riverside Shore Memorial Hospital

Dianne Musso, Eastern Shore Area Agency on Aging

Jackie Phillips, A&N Electric Cooperative

Brian Richardson, U.S. Fish and Wildlife Service

Jon Richardson, Virginia Department of Health

David Rogers, Eastern Shore Community College Chief of Police

Carmie Savage, Eastern Shore Soil and Water Conservation District

Evelyn Shotwell, Chincoteague Chamber of Commerce

Eddie Spencer, Chesapeake Bay Bridge Tunnel

Ursula Tankard, Virginia Cooperative Extension Service, Northampton County

Chris Truckner, Northampton County Public Schools

Call to Order – 11:00 a.m.

Elaine Meil, Accomack-Northampton Planning District Commission (A-NPDC) Executive Director welcomed participants.

Introduction to Hazard Mitigation Planning

Connie Morrison, Regional Planner for A-NPDC, described Hazard Mitigation Planning as a plan of policies and sustained actions to reduce or eliminate the long-term risk to human life and property from hazards that can also prevent damage to unique economic, cultural, and environmental assets.

Communities that participate in hazard mitigation planning, and that adopt the final plan, are eligible for hazard mitigation grants. Some mitigation grants are pre-disaster, but large amounts also become available during disaster recovery. Those localities that choose not to participate hazard mitigation planning will not be eligible for any mitigation funding.

Examples of mitigation actions from the current plan include outreach to increase risk awareness, projects to protect critical facilities, and removal of structures from flood hazard areas.

Eastern Shore Hazard History

Curtis Smith from (A-NPDC) reviewed the Eastern Shore's hazard history. High winds, coastal flooding, and coastal erosion from hurricanes, tropical storms, and nor'easters, constitute the majority of hazards.

Storm records date back to the 1600, but data are lacking regarding the extent of damage for most of the historical storms. What can be said is they occur with some regularity and the category of storm does not necessarily dictate its potential for danger. Storm track, speed, and direction, current ground conditions (i.e. soils that are already saturated from a recent storm), tide cycle, and other factors contribute to its potential to cause harm to people and property.

Other hazards discussed included storm water flooding from brief, high intensity rainfall that exceeds stormwater drainage capacity, blizzards and other ice and snow events, drought, and extreme heat and cold.

Participants were asked to forward information about hazard damage that was not captured in the material presented to Connie Morrison for inclusion in the plan's hazard history.

Dr. David Matson, Director of the Eastern Shore District, Virginia Department of Health, asked the group to consider pandemic pathogen in the list of hazards to prioritize.

Hazard Mitigation Plan Process and Timeline

Amy Howard, Hazard Mitigation Coordinator for VDEM, briefed attendees on federal requirements for hazard mitigation plans.

At their most basic, the plans require jurisdictions to identify hazards and their vulnerabilities to them, and then identify goals, strategies and actions to reduce losses caused by these hazards. It is a systematic approach that involves a broad cross section of stakeholders and the community at large.

The plan not only improves conditions before disasters, but also guides post-disaster recovery. A well-coordinated plan can be integrated into other plans, such as comprehensive plans, housing plans, and transportation plans, and can be implemented through local tools such as county zoning and building ordinances.

Once goals are set and strategies developed, mitigation actions are selected and prioritized. The plan is sent to VDEM and FEMA for approval and local units of government adopt it by resolution. From there, communities work towards meeting their goals, documenting progress, and updating the plan with additional strategies.

Connie Morrison explained the Steering Committee and Planning Council roles. The Steering Committee is made up of representatives of participating county and town governments. They will vote on the contents of the plan, because they are the ones who will have to adopt the plan in the end. The Planning Council is a wide-reaching stakeholder group that will participate throughout the process, offering expertise and experience. Planning Council members will be invited to attend all Steering Committee meetings and will receive all agenda and supporting materials.

It was noted that some Planning Council members will want to be more engaged that others, but there are a few places where their participation will be essential to having confidence that the plan is thorough in its considerations. Each stakeholder can choose the level of participation he or she thinks is appropriate.

A-NPDC staff will provide technical assistance, process management, and accountability for meeting state and federal plan requirements.

The entire process will take about two years to complete from kickoff until adoption by participating local governments.

Steering Committee members were told they would be sent an email to find a date for a December meeting.

Hazard Mitigation – What the Future Might Hold

Past hazard mitigation plans have relied solely on hazard histories as predictors of future probability of reoccurrence. Curt Smith presented considerations of accelerating long-term climatic and geologic changes, as seen in outcomes of warmer oceans and relative sea level rise that could alter the patterns of future hazards.

Data suggest that rates of change and scale of impact will be greater in intensity and severity than in past decades. The hurricane season is expected to become longer. Changes to climate and sea level are expected to affect coastal flooding, stormwater flooding, high winds, and coastal erosion hazards, along with other trends such as ground water use, changes to growing season, and water quality changes.

These are important consideration for mitigation actions taken during periods of accelerated environmental and climatic change. What was expected to be a 20-year fix, could turn out to be only a 10-year solution.

At the conclusion of the presentation, Stewart Baker, Hurricane Program Manager for VDEM, asked A-NPDC, when talking about flooding, to clearly state and define the terms it is using, such as storm surge, inundation, and mean higher high water (MHHW).

Hazard Prioritization

Participants were asked to work together in groups to complete the hazard prioritization worksheets, using the scoring guides and considering the hazard history information, forecasted changes to hazard patterns in the future, and their own knowledge and experience. They were also told they could add to the list of hazards on the worksheet if they thought others should be considered. This information was to be presented to the Steering Committee at its December meeting for its action.

Peaches Dodge, President of the Coalition against Domestic Violence, asked about the applicability of disaster and mitigation planning to the domestic violence shelter. She was offered examples of possible mitigation actions for the shelter and encouraged to continue with both disaster response planning for the shelter and participation in mitigation planning.

The group was dismissed at the end of the prioritization activity, approximately 2 p.m.

Dear Community Member:

Natural disasters affect us all.

The Eastern Shore has seen hurricanes, tornadoes, snow storms, ice storms, wildfires, and nor'easters. Add temperature extremes, high winds, coastal flooding, coastal erosion, and storm water flooding to the possibilities of sewage spills, well contamination, hazmat incidents, and biohazards, and you might think our luck is running out.

Here's some reassurance: we are not relying on luck. Through the Eastern Shore Hazard Mitigation Plan, we are getting ahead of the inevitable hazards, and the result will be a reduction, over time, in exposure to harm.

The Accomack-Northampton Planning District Commission (A-NPDC) has received funding from the Virginia Department of Emergency Management (VDEM), through the Federal Emergency Management Administration (FEMA), to rewrite the Hazard Mitigation Plan which was originally drafted in 2006 and updated in 2011.

The plan identifies policies and actions that can be taken over time to reduce losses from hazards. These actions protect our community - our friends, family, employees, neighbors, business owners, and their property. These actions reduce exposure to risk and curb financial losses.

FEMA requires the plan to be updated every five years. Since there is substantially more data available that at the time of the last update, we have elected to entirely re-write the plan, which is a two-year process. That means we need to start now to have the plans complete and fully adopted by the end of 2016.

Local agencies that participate in creating the plan will be eligible for hazard mitigation grants. Those that don't, will miss out. Northampton and Accomack Counties and 13 of 19 towns participated in 2011. We expect more will participate this time, forming the plan's Steering Committee.

You have been identified as a stakeholder in this process, meaning that you possess knowledge about community assets, vulnerable populations, resources, or other important information that will contribute to developing the plan, the ability to effectively implement the plan, or how it might affect the people you represent.

If we are to have a comprehensive plan that identifies every critical asset, accurately assesses the threats posed by hazards, and how the mitigation measures we proposed affect all of us, we need broad participation from across the Eastern Shore.

We invite you to be a part of the Hazard Mitigation Planning Council, which consists of representatives of business, education, state and federal government agencies, health care, transportation, non-governmental organizations, and individuals who work with vulnerable populations. The Council and Steering Committee together will ensure the plan is thorough in its considerations, complete in its recommendations, and solid in its capacity to mitigate hazards.

Please join us for the plan's kick-off meeting on November 6. Registration opens at 10:30 a.m., with the meeting beginning promptly 11 a.m. and running until 2:00 p.m. At this meeting we will explain the planning process and take the Planning Council and Steering Committee through its first activities: validating and updating an inventory of historical hazard events, identifying future hazards, and rating the likelihood of future occurrences. A complete draft agenda is enclosed.

The Steering Committee will check in with the Planning Council at least two more times during plan development to review, validate, and supplement the steering team's work, each time before taking the Steering Committee's work to the general public. Your time is valuable, and we pledge to make good use of it.

Please give serious consideration to our request for your organization's participation in this civic activity that will strengthen our community and give us something more than luck to rely on before disaster strikes.

Lunch will be served, so please R.S.V.P to Leslie Mason at lmason@a-npdc.org or call 757-787-2936, ext.120 so that we can reserve your spot.

Sincerely,

Elaine Meil
Executive Director

DEC. 3, 2014 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

December 3, 2014

The Eastern Shore Hazard Mitigation Plan Steering Committee met December 3, 2014 in Room 160 of the Workforce Development Building at Eastern Shore Community College in Melfa, Virginia.

Steering Committee Members Present:

Steering Team Members Present:

Mark Bowden, Accomack County

Jeb Brady, Town of Cape Charles

Tom Brockenbrough, Accomack County

Taylor Dukes, Town of Exmore

Robert Duer, Town of Exmore

James Eichelberger, Town of Parksley

Ed Gibb, Town of Nassawadox

Doug Jones, Accomack County

John Outten, Northampton County

Bill Neville, Town of Chincoteage

Peter Stith, Northampton County

VDEM Present:

Amy Howard (via telephone)

A-NPDC Staff Present:

Connie Morrison, Regional Planner

Curtis Smith, Planning Director

Planning Council Members Present:

George Bryan, Hampton Roads Small Business Development Center

Sheila Corbin, Riverside Shore Memorial Hospital

Bill Helin, Eastern Shore of Virginia Historical Society

Jim McGowan, Nature Conservancy

Joel Mitchell, NASA/WFF

Arthur Schwarzchild, University of Virginia

1. Call to Order and Introductions.
   Meeting was called to order at 10:02 by A-NPDC staff person Connie Morrison.

2. Election of Chair and Vice Chair.

Jim Eichelberg, Mayor of Parksley was made chair by consensus, and Peter Stith, Northampton County Long-Range Planner, agreed to serve as Vice-Chair.

3. Nov. 6 Kick-off Meeting Summary and Timeline Review.
   Notes of Nov. 6 kick-off meeting were reviewed, with emphasis on reviewing the process and time frame for the benefit of those who were not present for the kick-off meeting.

4. Meeting Times, Frequency, Structure
   The Steering Committee opted for monthly two-hour meetings wanted to continue to operated similarly to the Dec. 3 meeting that allowed for open participation by all those in attendance for as long as

5. Finalization of Hazard Prioritization Worksheet
   The Steering Committee was presented with a worksheet that compiled all of the hazard prioritization worksheets of participants in the November 6 kick-off meeting. High priority hazards that will be quantified and receive detailed analysis were determined to be high winds, coastal erosion, coastal flooding, and storm water flooding. Medium priority hazards were determined as well contamination, ice and snow, drought, and sewage spills. Hazards assigned low priority were wildfires, hazardous materials incidents (including oil spills, thermo/nuclear incidents, and blast zones), heat wave, fish kills, biological hazards (including human invasive diseases and pandemic pathogens), invasive environmental diseases (including invasive land and water diseases and species), and earthquakes.

6. Wetland Watch Presentation in February
   Wetland watch will make two presentations – one in the afternoon and one in the evening- to the Steering Committee and Planning Council in February to explain the Community Rating System and National Flood Insurance Program. Wetlands Watch is a non-profit that educates the Hampton Roads area on sea level rise. A poll will be sent prior to the next Steering Committee meeting, and the date announced at the January meeting.

7. Local Government Match Timesheets
   Steering Committee members were reminded to complete timesheets so that their time can be converted to a dollar value that is used to match the FEMA grant that is paying for the Hazard Mitigation Plan.

8. Adjourn.
   Meeting adjourned at approximately 11:50 a.m.

9. Next Meeting
   The next meeting is scheduled for January 7, 10 a.m. until noon, Eastern Shore Community College.

JAN. 7, 2015 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

January 7, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met January 7, 2015 in Room 160 of the Workforce Development Building at Eastern Shore Community College in Melfa, Virginia.

Steering Committee Members Present:

Steering Team Members Present:

Mark Bowden, Accomack County

Jeb Brady, Town of Cape Charles

Tom Brockenbrough, Accomack County

Taylor Dukes, Town of Exmore

Robert Duer, Town of Exmore

James Eichelberger, Town of Parksley

Ed Gibb, Town of Nassawadox

John Joeckel, Town of Wachapreague

Doug Jones, Accomack County

John Outten, Northampton County

Bill Neville, Town of Chincoteague

Peter Stith, Northampton County

A-NPDC Staff Present:

Curtis Smith, Planning Director

Connie Morrison, Regional Planner

Planning Council Members Present:

George Bryan, Hampton Roads Small Business Development Center

Trevor Dalee, Coast Guard

Joel Mitchell, NASA/WFF

10. Call to Order and Introductions.
    Meeting was called to order at 10:00.

11. Approval of Minutes.
    Robert Duer moved to approve minutes of December 3, 2014 meeting. Motion was seconded by Eichelberger. Minutes were approved by voice vote.

12. <u>Approval of Agenda.</u>
    Robert Duer moved to approve the agenda. Peter Stith seconded the motion, and the agenda was approved by voice vote.

13. <u>New Business</u>
    Risk Assessment - Critique of 2011 Hazard Mitigation Plan, Coastal Flooding and Sea Level Rise
    Suggestions offered for the next plan included:
    - better explanation of the interconnectivity of hazards (including between coastal erosion and coastal flooding);
    - making it simpler for users to navigate;
    - include subsidence in discussion of sea level rise;
    - place sea level rise discussion in discussion of coastal hazards;
    - needs to address effects of coastal flooding on infrastructure; and
    - address economic impact of getting people back to work

    Risk Assessment – Critical Facilities
    No discussion or action.

    Community Capability Review – Plans, Ordinances, Policies, Actions
    Discussion of plans, ordinances, policies and actions that could interplay with Hazard Mitigation Plan. Some cited were:
    - County and town comprehensive plans
    - Building codes enforced at local levels (counties, Chincoteague, Cape Charles, and Cheriton)
    - Stormwater ordinances (counties)
    - County Emergency Operations Plans and municipal Emergency Management Plans
    - Eastern Shore Hazardous Materials Plan
    - Transportation Plans (Statewide, Regional)
    - Capital Improvements Plans (counties, Cape Charles, Cheriton, Chincoteague, Exmore)
    - Subdivision Ordinances (counties, some towns)
    - Zoning Ordinances (counties, some towns)
    - Floodplain Ordinances (counties, some towns)
    - Water Supply Plans
    - Regional Groundwater Plan
    - Regional Economic Development Strategy

    Statewide Plans
    - Transportation Plan
    - Virginia Outdoors Plan

14. <u>Old Business</u>
    Finalized Hazard Prioritization
    Hazard prioritization approved by consensus, with the following change: the column labeled "probability" will be renamed "likelihood of occurrence."

15. <u>Next Meeting</u>
    The next meeting will be two Community Rating System workshops with Wetlands Watch on February 11. They will take the place of the February monthly meeting.

16. Adjourn.
The meeting adjourned approximately 11:40 a.m.

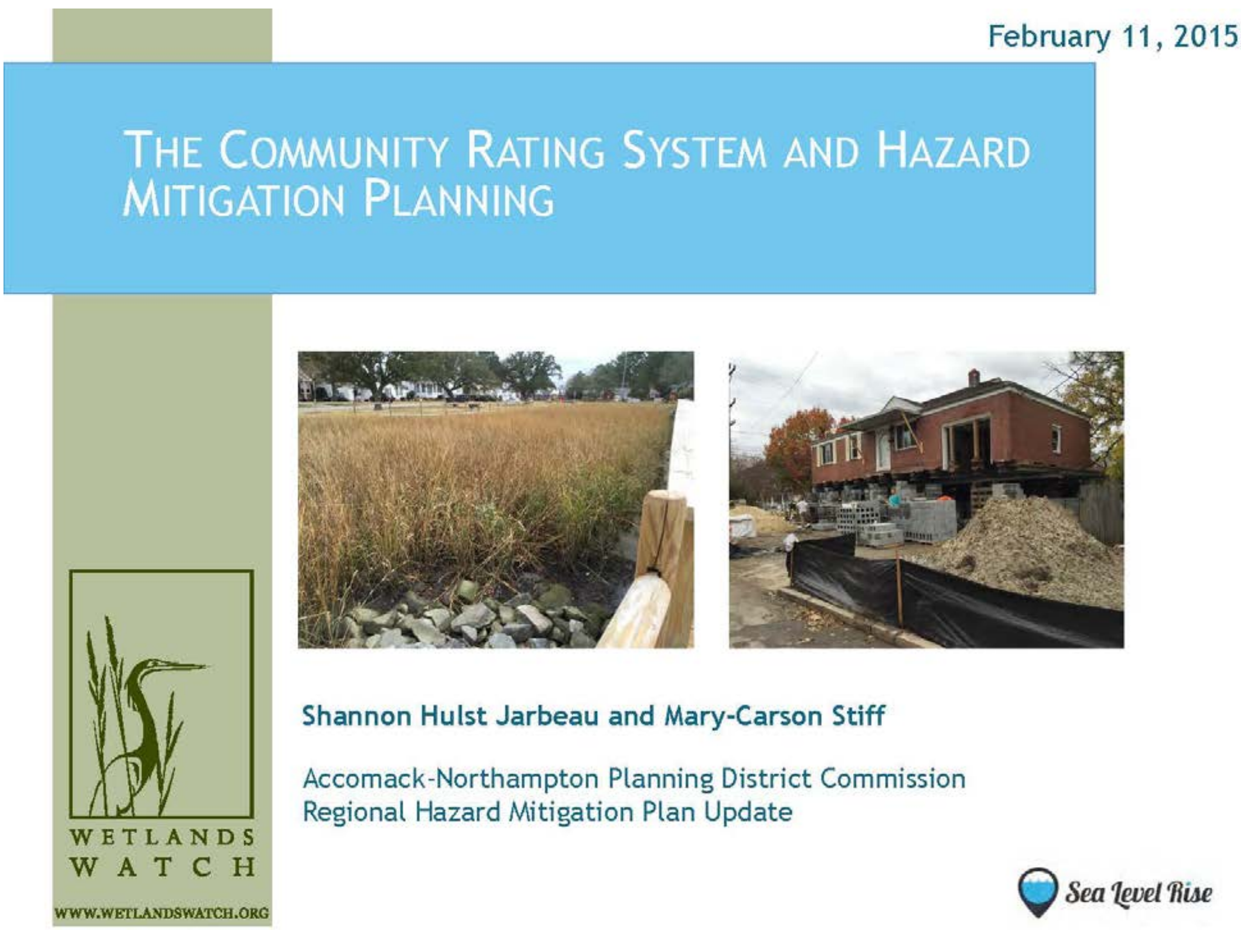
Sign - In
1.7.15

John Soeckel - Town of Wachapreague
✓ ED GIBB - NASSAWADOX
✓ Taylor Dukes - Exmore
Robert G Duer Exmore
Trevor Dalee Coast Guard New
✓ John Outten Northampton County
✓ Joel Mitchell NASA/Wallops Flight Facility
✓ JEB BRADY TOWN OF CAPE CHARLES
✓ Mark Bowden ACCOMACK COUNTY
✓ Tom Brockenbrough Accomack County
✓ Doug Jones Accomack County
✓ Curt Smith A-NPDC

Bill Neville Town of Chincoteague
George Bryan Small Business Devel.
Peter Stith NORTHAMPTON COUNTY
James Eichelberger PARKS

Connie

FEB. 11, 2015 ESHMP & CRS WORKSHOPS



Contact Connie Morrison 757-787-2936, ext. 127 **FOR IMMEDIATE RELEASE**

WorkshopTeaches Communities to Lower Flood Risk

Wetlands Watch to bring flood expertise to Eastern Shore

ACCOMAC— Flooding is one of the greatest threats to the personal and financial safety of Eastern Shore residents, according to a local group appointed to make a plan to address flooding, high winds, erosion and other hazards.

"We can't do anything to stop hurricanes and other storms that bring flooding and high winds, but we can get smarter about the harm they bring, including floods and flood zones, and how to protect ourselves," said Jim Eichelberger, Mayor of Parksley and Chairman of the local-government-appointed Eastern Shore Hazard Mitigation Steering Committee. The committee was established to re-write the plan that evaluates and prioritizes actions to protect life and property before disaster strikes.

Accomack-Northampton Planning District Commission is organizing the work under a grant from the Federal Emergency Management Agency and the Virginia Department of Emergency Management. The commission and two agencies, along with the National Oceanic and Atmospheric Administration, the Virginia Coastal Zone Management Program, and the non-profit Wetlands Watch are co-sponsoring two Feb. 11 workshops for Accomack and Northampton individuals and communities that want to learn more about flooding, flood zones, and floodplain management actions communities can take to potentially lower flood insurance rates.

Shannon Hulst Jarbeau, Certified Floodplain Manager and Assistant Director of Wetlands Watch in Norfolk, Virginia, and Mary-Carson Stiff, JD, also a Certified Floodplain Manager and Assistant Director of Wetlands Watch, are recognized regional experts in the Community Rating System, and will lead both sessions. They will teach participants how communities can work together to lower flood insurance rates, over time, between 5 percent and 45 percent through the Community Rating System, a voluntary program that offers flood insurance discounts in exchange for advanced floodplain management actions at the local level.

Communities opting into the program increase public flood awareness, enhance public safety, reduce damage to private property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. As communities incrementally implement more rigorous program levels, they qualify for greater flood insurance discounts from the National Flood Insurance Program.

"The Community Rating System is an excellent way to encourage localities to improve their resiliency to flooding, protect open space and wetlands, and adapt to sea level rise, while also earning a discount on flood insurance rates and helping their constituents cope with increasing costs," says Jarbeau. "These are all positive outcomes that we hope to help localities achieve."

Jarbeau and Stiff will explain the initial steps communities need to take to qualify for the program, and how to earn credits for further reductions, particularly for actions they are likely already taking.

Session one will be held at VIMS in Wachapreague, 40 Atlantic Ave, on Feb. 11 from 1:30-3:30 p.m. The second session is also Feb. 11, from 6:30–8:30 p.m., at the Northampton County Administration Board Room, Second Floor, 16404 Courthouse Road. Eastville. The same information will be presented at both sessions.

For more information about the workshop or the hazard mitigation plan, please contact Connie Morrison, Accomack-Northampton Planning District Commission, 787-2936, or cmorrison@a-npdc.org.

MAR. 4, 2015 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

March 4, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met March 4, 2015 in auditorium of Eastern Shore Community College in Melfa, Virginia.

Steering Committee Members Present:

Steering Team Members Present:
Mark Bowden, Accomack County
Jeb Brady, Town of Cape Charles
Tom Brockenbrough, Accomack County
James Eichelberger, Town of Parksley
Ed Gibb, Town of Nassawadox
John Joeckel, Town of Wachapreague
Doug Jones, Accomack County
John Outten, Northampton County
Peter Stith, Northampton County

A-NPDC Staff Present:
Connie Morrison, Regional Planner
Curtis Smith, Planning Director

Planning Council Members Present:
Sheila Corbin, Riverside Shore Memorial Hospital
Joel Mitchell, NASA/WFF
Arthur Schwarzchild, University of Virginia

17. <u>Call to Order</u>

The meeting was called to order at approximately 10:10 a.m., after being slightly delayed because it was diverted from the usual meeting space in room 160 of the Workforce Development Building to the Auditorium.

18. Approval of Agenda
    The agenda was approved by consensus.

19. Approval of March 7 Minutes
    The minutes of the March 7, 2014 meeting were approved by consensus.

20. New Business
    a. Federal Flood Risk Management Standards
       Connie told the group about an upcoming meeting sponsored by FEMA about proposed federal flood risk management standards. It was one in a series of meetings around to country to hear reactions to proposals to make federal investments more resistant to sea level rise. This was an information-only item.
    b. Coastal Flooding Chapter Review
       - The team reviewed an early draft of the coastal flooding chapter of the Hazard Mitigation Plan.
       - Joel Mitchell offered to provide estimates of Hurricane Sandy damage to Wallops Flight Facility to add to the table showing past hurricanes and damage amounts.
       - Art Schwarzchild recommended reviewing and incorporating work by Bruce Haydon of the Anheuser-Busch Coastal Research Center for more information regarding storm paths and area of impacts, and also Haydon's research on the impacts of sea level rise on storms.
       - There was a discussion around the estimates of sea level rise used in the report. Connie stated that she used the estimates that were recommended by VIMS in its report to the Legislature, since that was a generally-accepted estimate. The group accepted that approach, but that each town would be able to talk about sea level rise in the way it was comfortable.

21. Old Business
    a. Critical Facilities
       The group decided by consensus to stick closely to the list of critical facilities found in the emergency operations plans when critical facilities are defined in the Hazard Mitigation Plan. Navigation channels are not currently in the plan and it was suggested they be added. There was also a question about whether Coast Guard stations are included. If not, the recommendation was made to add those as well.

    b. Recap of Community Rating System Workshops
       Connie reviewed the February 11 CRS workshops. She reported to the group that during the workshops attendees were told that in order for the future Hazard Mitigation Plan to be fully creditable under the CRS program, those communities wanting to receive credit for the plan need to have representation for every Hazard Mitigation Steering Committee meeting.

Connie spoke with the ISO representative (that's the company that runs the CRS program for FEMA). The representative said it is true that each participating community that wants to receive credit under the CRS should have two designated delegates, and at least one delegate should be present at every meeting. HOWEVER, if one meeting is missed, all is not lost. Of the CRS steps that must be followed, one – AND ONLY ONE – step can be missed, and that would be the missed step, so every other step would have to be scrupulously observed. (NOTE: Connie thought off-hand there were six or seven steps. There are actually 10 CRS steps, and only one can be missed.) Furthermore, this only applies to meetings that are relevant to flooding.

Art Schwarzchild asked for clarification in the administration of CRS. Each entity with land use responsibility can administer its own CRS program, although Curtis Smith clarified that local governments can designate others to administer the program for them. For example, a regional office could be the administering office for all the local governments in an area.

Ed Gibb, Mayor of Nassawadox, expressed frustration with the multiple processes for the CRS, the National Flood Insurance Program, and the Hazard Mitigation Plan, which led to clarification between the requirements and benefits of participating in the CRS, versus the requirements and benefits of participating in the hazard mitigation program.

Connie also asked that communities seeking CRS credit from the Hazard Mitigation Plan to let her know when there are things the Hazard Mitigation Steering Committee needs to do differently in order that they may also qualify for CRS credit. She is using a matrix that compares the two plans, but sometimes there are details in the CRS manual that won't show up in the matrix, and CRS communities are responsible for letting her know when there are extras needed to meet those requirements.

22. Adjourn.
    Meeting adjourned at approximately 11:25 a.m.

23. Next Meeting
    The next meeting is scheduled for April 1, 10 a.m. until noon, Eastern Shore Community College.

MEETING SIGN-IN SHEET

Project:	HAZARD MITIGATION	**Meeting Date:**	MARCH 4, 2015
		Place/Room:	EASTERN SHORE COMMUNITY COLLEGE

Name	Representing	E-Mail
√ John Soeckel	WAchapreague	jsoeckel@seaconsulting.com
√ JEB BRADY	CAPE CHARLES	CODEOFFICIAL@CAPECHARLES.ORG
√ John Outten	Northampton County	joutten@co.northampton.va.us
√ [illegible]	NASSAWADOX	edgibb@verizon.net
√ ART SCHWARZSCHILD	WILLIS WHARF / OYSTER	ARTHUR@VIRGINIA.EDU
√ Tom Brockenbrough	Accomack County	tbrockenbrough@co.accomack.va.us
√ Shelia Corbin	Riverside Shore Memorial	shelia.corbin@rivhs.com
√ Joel Mitchell	NASA/Wallops	Joel.T.Mitchell@nasa.gov
√ Doug Jones	Accomack County EMER. MGMT	DJONES@CO.ACCOMACK.VA.US
√ Jim Eichelberger	Town of Parksley	Eichelberger@Parksley.org
√ Curt Smith	A-NPDC	csmith@a-npdc.org
√ MARK Bowden	ACCOMACK COUNTY	mbowden@co.accomack.va.us
√ Peter Smith	Northampton County	psmith@co.northampton.va.us

Page 1 of 1

MAY 6, 2015 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

May 6, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met May 6, 2015 in classroom 160 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Mark Bowden, Accomack County
Jeb Brady, Town of Cape Charles
Tom Brockenbrough, Accomack County
Robert Duer, Town of Exmore
James Eichelberger, Town of Parksley
John Joeckel, Town of Wachapreague
Doug Jones, Accomack County
John Outten, Northampton County
Peter Stith, Northampton County

A-NPDC Staff Present:
Connie Morrison, Regional Planner
Curtis Smith, Planning Director

Planning Council Members Present:
Jane Corson-Lassiter, USDA-NRCS
Jim McGowan, TNC

24. Call to Order
    Chairman Eichelberger called the meeting to order at 10:04 a.m.

25. Approval of Agenda
    The agenda was approved by voice vote.

26. Approval of March 7 Minutes
    The minutes of the March 7, 2014 meeting were approved by voice vote.

27. New Business
    a. Proposed template for Risk Assessment
       Connie Morrison presented a proposed template to use as a standardized way of reporting the counties' and towns' risk assessments. The content was based on the 2011 plan, and those items that seem to repeat themselves from location to location were incorporated into the template, such as demographic and employment information. She asked the group for other items it would like to see in the template/risk assessment. Examples provided included seasonal populations and vulnerable populations such as mobility impaired and non-English speaking populations.

       Items suggested are shown below (with the acknowledgement that all of the information might not be accessible to the team):

- Locations of disabled individuals who might need assistance getting out in the event of an emergency or disaster
- Locations of individuals reliant on electricity for medical devices
- Locations of businesses and types of businesses (for firefighting/hazmat purposes)
- Concentrations of non-auto owning households
- Concentrations of non-English speaking households

Hazardous materials plans completed by counties will have some of this information.

b. Request for Hazard Mitigation Grant Program Subcommittee
John Aigner requested a subcommittee of five people to help review and prioritize hazard mitigation grant requests for elevating homes. The request is at the behest of Accomack County Administrator Steve Miner, who wants the advisory committee so that there will be a group rather than a single person reviewing and approving projects.

The committee will meet with Mr. Aigner regularly to review the program, and provide advice and guidance on selections. Initially, the group would also propose program policies and guidelines. A draft is already under development, and is based on FEMA regulations and requirements.

Building department and floodplain managers from both counties were asked to giver consideration to serving on the subcommittee. All current projects are in Accomack County, although some applications have been received from Northampton County. Mr. Aigner was to follow up with individuals after the meeting.

c. Coastal Erosion Chapter Review
The team reviewed an early draft of the coastal erosion chapter of the Hazard Mitigation Plan. Suggestions to improve the chapter include:

- Strengthening the focus on mitigation strategies to prevent erosion.
- Include a discussion of the Coastal Zone Management Act and other tools and policies that aid in protecting coastlines and mitigating erosion.

It was agreed to put the Coastal Erosion chapter on a future meeting agenda to allow everyone another opportunity to comment.

d. Meeting reminder: Joint Meeting with Climate Adaptation Working Group on May 12 to review FEMA Flood Risk MAP products.

28. Adjourn.
Meeting adjourned at approximately 11:05 a.m.

29. Next Meeting
The regular monthly meeting is scheduled for June 1, 10 a.m. until noon, Eastern Shore Community College.

MEETING SIGN-IN

Hazard Mitigation	**Meeting Date:**	May 6, 2015
	Place/Room:	ESCC

Name	Representing:	E-Mail
Jim Eichelberger	Parksley	Email: Eichelberger@Parksley.org
Doug Jones	Accomack EM	Email: DJones@Co.Accomack.VA.US
Curt Smith	A-NPDC	Email: csmith@a-npdc.org
Jane Corson-Lassiter	USDA-NRCS	Email: jane.lassiter@va.usda.gov
[illegible]	TNC-VCR	Email:
John Outten	North. Co.	Email: joutten@co.northampton.va.us
Bill Neville	Chincoteague	Email: esvaplan@gmail.com
Peter Stith	Northampton Co	Email: pstith@co.northampton.va.us
		Email:
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MEETING SIGN-IN

Hazard Mitigation	Meeting Date:	May 6, 2015
	Place/Room:	ESCC

Name	Representing:	E-Mail
Robert Duer	EXMORE	Email: rduer@exmore.org
Mark Bowden	ACCOMACK	Email: mbowden@co.accomack.va.us
John Joeckel	Wachapreague	Email: JJoeckel@seaconsulting.com
Tom Brockenbrough	Accomack	Email: tbrockenbrough@co.accomack.va.us
Connie Morrison	A-NPDC	Email:
		Email:
		Email:
		Email:
		Email:
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		Email:
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NOV. 4, 2015 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

November 4, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met Nov. 4, 2015 in classroom 150 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Tom Brockenbrough, Accomack County
Eichelberger, Town of Parksley
Ed Gibb, Town of Nassawadox
Amy Howard, VDEM
John Joeckel, Town of Wachapreague
Doug Jones, Accomack County
John Outten, Northampton County
Peter Stith, Northampton County

A-NPDC Staff Present:
Hillary Essig, Coastal Program Manager James
Elaine Meil, Executive Director
Connie Morrison, Transportation Program Mgr.

30. Call to Order
    Chairman Eichelberger called the meeting to order at 10:02 a.m.

31. Approval of Agenda
    The agenda was approved by unanimous vote.

32. Approval of March 7 Minutes
    May 6 meeting minutes were approved by unanimous vote.

33. Old Business
    a. Review of Revised Template
       Hillary Essig reviews the revised template with the steering committee, highlighting changes since the previous versions, which was reviewed with the committee in May. The newer version was crisper, included additions requested by the Committee in May, including the natural and built environment and public works. The committee had asked to include the following specific information:
       - Locations of disabled individuals who might need assistance getting out in the event of an emergency or disaster
       - Locations of individuals reliant on electricity for medical devices
       - Locations of businesses and types of businesses (for firefighting/hazmat purposes)
       - Concentrations of non-auto owning households
       - Concentrations of non-English speaking households

       Ms. Essig reported that the A and N Electric Co-Op was not able to share information about individuals on dependent on electricity for medical devices because of privacy concerns; nor would they provide information about electrical infrastructure, citing security concerns.

Tom Brockenbrough asked for a completed template for one of the coastal towns participating in the CRS program to share with Cynthia from the Community Rating System Program to see if it captures everything that program requires or would like to see.

John Joeckel asked about the schedule for meeting with towns. Ms. Morrison said she hoped to have most of those first meetings scheduled in November and December, beginning with the communities along the spine, and then moving to the coastal communities.

Doug Jones asked about HAZUS results for the Hurricane model. Ms. Morrison reported she had only recently been able to run the hurricane part of the HAZUS model, and only obtained wind results so far – no storm surge results. Mr. Jones asked which basin the model utilized for storm surge – the Norfolk or the Chesapeake. Ms. Morrison said she did not know; that it might depend on which tracks the selected storms took, but she would find out.

b. <u>HAZUS Model</u>

Ms. Morrison reviewed the HAZUS flood model results with the committee for both counties and Chincoteague, which was the first town for which the model was run.

Ms. Morrison explained that the building valued used in HAZUS were taken directly from both counties' assessing data. The exposure values, however, are not those values, but reflect the full cost to replace buildings, so it is quite a bit higher than the actual assessed value. For Chincoteague, which is the study region, the town's exposure and the scenario exposure, which is what lies within the area expected to be affected by a 100-year, or 1 percent annual chance flood.

Other tables that were highlighted were Table 3, which summarizes expected damage by occupancy under the 100-year flood scenario, and Table 4, which depicts damage by building type. Table 5 indicates that the fire station, police station, and one of the schools would see at least moderate damage, and the fire station and school could expect to see some loss of use.

Ms. Morrison pointed out that debris generation refers to only building debris, and does not take into account vegetative debris. She also pointed out that shelter requirements may vary, depending on time of year.

Table 6 summarizes total losses. Committee members were asked to consider this table and where they might want to note local differences. Business interruption losses were pointed out as one item that require further review, as it could be low in income losses from rental properties. Also business interruption of high season vs. low season. Ms. Morrison said she would check to see whether the model itself could be tweaked to pick the date of the hypothetical storm. For example, for agricultural losses, it allows the user to input the date, but she was not sure if it affects other types of economic loss. Amy Howard asked whether peak hurricane and peak tourism season are the same. Ms. Morrison said they are not.

c. Review of Regional Hazard Mitigation Projects
Ms. Essig reviewed progress on the regional Hazard Mitigation with the committee. Several of these were assigned to the Eastern Shore Disaster Preparedness Coalition. Ms. Essig said she would check with the community college to see whether they obtained the generator hook-up. Ms. Howard reported that if the community college had not acquired the generator, it just missed a funding opportunity with VDEM.

Ms. Morrison offered to send a link for mitigation best practices to the committee.

d. Additional Comments on Coastal Erosion Chapter
Ms. Morrison explained that the hazard chapters are meant to explain the hazards themselves: what causes them, what is their extent, and what is imperiled by them.

She asked Steering Committee members asked for additional comments (the committee had reviewed in May and asked for it come back). She also said that all comments had not yet been incorporated because she wants to get all comments on the table and discussed before making all of the changes, because sometimes there are differences that are best worked out at the committee meetings.

Mr. Joeckel said he did not think the chapter emphasizes enough the erosion that is happening on Cedar Island because of the effect it has on the salt marshes and ultimately the increased risk he believes that poses to the residents of the town of Chincoteague. Mr. Brockenbrough reminded Ms. Morrison that he sent comments about waterways shoaling over.

34. Information Items

a. Ms. Essig reported on a Historic Resources Study to be conducted by the Department of Historic Resources with post-Sandy funding on the Eastern Shore. The study will catalog historic resources within the floodplain, including infrastructure, buildings, and historic settings. Ms. Howard added that an area can be historic, even if the buildings are not, and that historic buildings can add greatly to the cost of building elevations.
b. Ms. Morrison asked whether either county planned to offer comments on FEMA's Damage Assessment Operations Manual. No one knew of plans for either county to submit comments.
c. Mr. Jones commented that he expects the Assistance to Firefighters Grant program to be opened shortly.
d. Mr. commented on the hurricane evacuation route study that was about to be re-done. It will take a couple of years, and this time the Eastern Shore will be considered with the rest of Virginia, instead of being part of the Delmarva region.

35. Adjourn.
    Meeting adjourned at approximately 11:58 a.m.

36. Next Meeting
    The regular monthly meeting is scheduled for Dec. 2, 10 a.m. until noon, Eastern Shore Community College.

    A recording of this meeting can be found at:
    http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_11042015070310924_1069495.mp3

MEETING SIGN-IN

Hazard Mitigation	Meeting Date:	November 4, 2015
	Place/Room:	ESCC

Name	Representing:	E-Mail (if changed or new)
Doug Jones	Accomack County	Email (if changed)
Jim Eichelberger	Parksley	Email (if changed) Eichelberger@Parksley.org
John Soeckel	WACMA League	Email (if changed) jsoeckel@seo-consulting.com
John Outten	Northampton Co.	Email (if changed)
Peter Smith	Northampton	Email (if changed)
Tom Brockenbrough	Accomack Co	Email (if changed)
ED GIBB	NASSAWADOX	Email (if changed)
Amy Howard	VDEM	Email (if changed)
		Email (if changed)
		Email (if changed)
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FEB. 3, 2016 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

February 3, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met Feb. 3, 2015 in classroom 160 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Tom Brockenbrough, Accomack County
Ed Gibb, Town of Nassawadox
Jim Eichelberger, Town of Parksley
John Joeckel, Town of Wachapreague
Doug Jones, Accomack County
John Outten, Northampton County
John Pavlik, Town of Onley

A-NPDC Staff Present:
Shannon Alexander, Coastal Programs Manager
Connie Morrison, Transportation Program Mgr.
Curtis Smith, Planning Director

Planning Council Members Present:
Bill Sammler, NWS Wakefield, via telephone
Evelyn Shotwell, Chincoteague Chamber of Commerce
Stewart Baker, VDEM

37. Call to Order
    Chairman Eichelberger called the meeting to order at 10:04 a.m.

38. Approval of Agenda
    The agenda was approved by unanimous consent.

39. Approval of Dec. 2 Minutes
    Chairman Eichelberger made a correction to the minutes to add Chris Bruce of The Nature Conservancy as present at the Dec. 2 meeting by telephone.

40. New Business
    a. Storm Surge Analysis
       Ms. Morrison called attention to the storm track/flood depth maps that were sent out prior to the meeting. She reminded the team that it had agreed to use the Nor'Ida storm as its baseline, and asked for a seaside and bayside storm in each of the moderate and high intensity categories. However, after the storm tracks were obtained, she added one storm each in the moderate and high categories for the cross-peninsula storms because they produced higher inundation, and the group had said it wanted to look at worst case scenarios.

       But before getting too far into the discussion, she suggested that the group agree on some terminology, and called their attention to a graphic from NOAA describing storm surge and storm tide. The inundation modeling was done based on mean tide level, so depending on when a storm hit during the tide cycle, the actual inundation depth could be plus or minus as much as 2 or 2.5'. A call was made to Chris Bruce to clarify that the flood depths on the map were adjusted to show flood depths above ground level.

The model that was used for the scenarios was ADCIRC with SWAN. The ADCIRC model does not use basins, but rather pulls in data from the western Atlantic and Gulf regions. Mr. Baker said that none of the preparedness agencies use ADCIRC, even though it is out there and available. They all use SLOSH. ADCIRC is resource intensive and cannot be run in a short turnaround.

Mr. Joeckel pointed out that the model does not account for wave action. So far, he said, they have not experienced a true storm surge, but rather, high tide with four to six-foot waves pounding the waterfront, and that is what causes the damage in Wachapreague.

The ADCIRG model used in the Coastal Resilience Tool also adds the SWAN model, which models wave action, but only insofar as waves push flood waters farther inland. It does not account for the vertical action of waves.

Mr. Floyd said Storm Track 4 is like Floyd (1999). He said that the highest surge probably occurred on the bayside on the back side of the storm. Without having storm details, don't have how the storm played out.

Mr. Baker said that although Storm Track 5 is a little closer to the shoreline, it is similar to Hurricane Gloria in 1985, which was a strong Category 2 or a weak Category 3 hurricane. Mr. Baker said that where there are other historic storms that are similar to those we are using in our analysis, or where the impacts are similar, that we should call those out to make them more relatable to readers of the document.

Mr. Sammler suggested some cautions with the use of these storms. First, he said, there are no probabilities associated with any given storm. Cross-peninsula storms have least likelihood of occurrence, but will create the worst-case scenarios, especially for the seaside.

Mr. Smith asked Mr. Sammler if he had suggestions for incorporating the storm information into the plan. Other areas have used primarily SLOSH data. Mr. Sammler suggested laying out context or concerns raised during today's discussions: not comprehensive scenarios, different results than standard SLOSH model, and the less likelihood of cross-peninsula storms. If this is done, this data can still be used in the plan.

Mr. Sammler said he didn't know of a single location on the ocean side where water was 9.4' above ground level during Nor'Ida. It probably was not over four or five feet, and ADCIRC does have a history of overestimating storm surge in a tropical frame work.

As a result of conversation with the group, the group decided to eliminate scenario 13. The following changes will be made to the remaining maps:

- Add details of the size and speed of the storm, and the wind speed.
- Change color ramp on the depth scale to more easily distinguish the different depths.
- Change title to reflect flood depth above ground level.

More information will be explained in the text about wave action, and its effects, bearing in mind the effects the salt marsh has on negating wave action

b. Coastal Resilience Tool

Ms. Morrison introduced the Coastal Resilience Tool and briefly explained how it relates to the individual storms the Steering Team is reviewing. The tool provides a composite view of the worst impact of all the medium intensity storms, and does the same for all of the high intensity storms (some of which are not in the set of storms under review by the team). It uses Nor'Ida as a baseline storm for comparison purposes.

The Coastal Resilience tool also allows individuals to look at what those storms might look like under various future sea level rise scenarios. Ms. Morrison encouraged those in attendance to sign up for the Feb. 11 and 12 Coastal Resilience classes.

c. Regional Hazard Mitigation Chapter

Ms. Morrison asked the group what should be included in the regional chapter, in addition to regional resources. The Eastern Shore Disaster Preparedness Coalition was mentioned. Mr. Smith mentioned that we are using templates across localities, and asked whether the group is good with us using the same template for the regional chapter. He said in the past, the plan has contained regional actions and strategies, but we have not had regional assessments of risk in the past (county only). The team agreed to try the template format at first. There was some concern about how detailed the critical infrastructure lists would be, and what would be helpful. Doug Jones suggested it might be helpful to have a list of all critical infrastructure by category of facility.

41. Adjourn.

Meeting adjourned at approximately 11:38 a.m.

42. Next Meeting

The regular monthly meeting is scheduled for March 2, 10 a.m. until noon, Eastern Shore Community College.

A recording of this meeting can be found at:
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_02032016070521944_1088993.mp3

MEETING SIGN-IN

Hazard Mitigation	**Meeting Date:**	Feb 3, 2016
	Place/Room:	ESCC

Name	Representing:	E-Mail (if changed or new)
Jim Eichelberger	Town of Parksley	Email (if changed)
Connie Morrison	A-NPDC	Email (if changed)
Matthew C Pavlik	Town of Onley	Email (if changed)
Stewart Baker	VDEM	Email (if changed)
John Joeckel	W Chincoteague	Email (if changed)
Doug Jones	ACEMA	Email (if changed)
Tom Brockenbrough	Accomack	Email (if changed)
John Outten	Northampton Co	Email (if changed)
Curt Smith	A-NPDC	Email (if changed)
[illegible]	NASSAWADOX	Email (if changed)
Evelyn Shotwell	Chin. Chamber	Email (if changed)
Shannon Alexander	A-NPDC	Email (if changed)
		Email (if changed)
Bill Sammler via phone		Email (if changed)
		Email (if changed)
		Email (if changed)
		Email (if changed)
		Email (if changed)

MAR. 2, 2016 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

March 2, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met March 2, 2015 in the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia. [note: nothing has been done beyond this point.]

Steering Team Members Present:
Tom Brockenbrough, Accomack County
Jim Eichelberger, Town of Parksley
Ed Gibb, Nassawadox
John Joeckel, Town of Wachapreague
Doug Jones, Accomack County
Peter Stith, Northampton County

A-NPDC Staff Present:
Shannon Alexander, Coastal Programs Manager
Connie Morrison, Transportation Program Mgr.

Planning Council Members Present:
Stewart Baker, VDEM
Paul Moye, USACE (via teleconference)

43. Call to Order
    Chairman Eichelberger called the meeting to order at 10:04 a.m.

44. Approval of Agenda
    The agenda was approved by unanimous consent.

45. Approval of Feb. 3 Minutes
    Minutes for the Feb. 3 meeting were approved by unanimous consent.

46. Old Business
    a. Storm Surge Mapping
       The group reviewed changes to the storm surge maps that were made since the last meeting.

       Mr. Brockenbrough asked about projecting the storms over a different background other than aerials. Ms. Morrison said that she had tried various backgrounds, but the surge depths did not show up as well those she had tried, especially over the marshes. Another thing she wanted to point out to the group was that flood depths are hard to see in some places at this scale because they appear way up the creeks. The example she gave was Storm Track 2, which has depths up to 11 feet. It is hard to spot those depths on the map because they only show up when zoomed way in on the end of those creeks.

The committee had requested details about the storms' headings, wind speeds, and other data, which were provided, but Ms. Morrison did not know the point in the storm that those data represented. Mr. Baker added that the storms tend to speed up and weaken when they hit Virginia's latitude because they are continuing over land.

After discussion, the following map changes were suggested:

- A zoom-in on each of the storm tracks for coastal towns so towns can see how their vulnerabilities change.
- A different background for the Regional section so it will be less cluttered.
- One foot increments under 10', then in 2' increments with a consistent scale on all of the maps.
- Cut off the storm surge at the state line.

The group discussed how to best examine vulnerable populations, sources of information, and the reliability of each. It was not felt that looking at things like low income population would be useful at this scale. Mr. Brockenbrough said the U. S. Census Bureau's American Community Survey is only available at the block group level, and that level obscures trends. Limited English Proficiency, low income, and housing values were all discussed. The suggestion was made to just map the vulnerable areas. Ms. Morrison said the group was charged with identifying populations that might have difficulty removing themselves from harm's way or receiving information. Staff would continue to look for ways to convey this information.

b. Storm Surge Modeling
Ms. Morrison explained a write-up of storm surge modeling that she put together comparing the ADCIRC and SLOSH models. With the Committee's approval, she would like to include the write-up in the Regional section of the Hazard Mitigation Plan, and asked Committee members to convey comments to her.

c. Regional Hazard Mitigation Chapter
Ms. Morrison reported that she had planned to have the committee review the first draft of the Regional chapter, but she had not finished drafting it yet.

47. Information Items

The 2015 SAFER Application Grant period and the FY 2016 Pre-Disaster Hazard Mitigation Grants and Flood Mitigation Assistance Grant Programs were brought the attention of committee members.

48. Committee Member Comments

Mr. Gibb said he had a chance to read over the storm surge modeling section, and his suggestion was to keep the storm surge maps the same size, and if anything needed to be adjusted to make room for the commentary on each scenario, then it should be the map of the storm track and wind field that appears under the storm data.

Mr. Moye asked whether computed storm tides are available at specific locations, and whether they could be displayed with water surface elevations referenced to NAVD, suggesting this would be useful to readers, either on a map or in a table. Readers could reference it back to the Flood Insurance Study to get an idea of flood probability. Ms. Morrison agreed to check on the availability of this data. Mr. Moye also agreed that zoomed-in maps with 1/2’ and 1’ flooding maps with building footprints for towns would be helpful.

49. Adjourn.

Meeting adjourned at approximately 10:53 a.m.

50. Next Meeting

The regular monthly meeting is scheduled for April 6, 10 a.m. until noon, Eastern Shore Community College.

A recording of this meeting can be found at:
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_03022016070310435_1087607.mp3

MEETING SIGN-IN

Hazard Mitigation	Meeting Date: ~~Feb 3, 2016~~ March 2
	Place/Room: ESCC

Name	Representing:	E-Mail (if changed or new)
Jim Eichelberger	Parksley	Email (if changed) Eichelberger@Parksley.org
Ed [illegible]	NASSAWADOX	Email (if changed)
Tom Brockenbrough	Accomack	Email (if changed)
[illegible]		Email (if changed)
Shannon Alexander	A-NPDC	Email (if changed)
Stewart Baker	VDEM	Email (if changed)
John Soeckel	WAC/Inframanager	Email (if changed)
Peter Smith	NHCO	Email (if changed)
Connie Morrison	ANPDC	Email (if changed)
		Email (if changed)
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MAY 4, 2016 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

May 4, 2015

The Eastern Shore Hazard Mitigation Plan Steering Committee met May 4, 2015 in Room 150 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Jeb Brady, Cape Charles
Tom Brockenbrough, Accomack County
Ed Gibb, Nassawadox
John Joeckel, Town of Wachapreague (via teleconference)
Ron Marney, Town of Chincoteague
John Outten, Northampton County
Bryan Rush, Town of Chincoteague
Peter Stith, Northampton County

A-NPDC Staff Present:
Shannon Alexander, Coastal Programs Manager
Connie Morrison, Transportation Program Mgr.
Curt Smith, Director of Planning

Planning Council Members Present:
George Bryant, Small Business Development Center
Amy Howard, VDEM (via teleconference)

51. <u>Call to Order</u>
    Vice Chairman Peter Stith called the meeting to order in the absence of Chairman Eichelberger at 10:03 a.m.

52. <u>Approval of Agenda</u>
    The agenda was approved by unanimous consent.

53. <u>Approval of March 2 Minutes</u>
    Minutes for the March 2 meeting were approved by unanimous vote.

54. <u>New Business</u>
    a. <u>Regional Chapter</u>
       The Committee reviewed the Regional Chapter and provided a number of edits. Among the high-level comments were:

       - Make maps and graphics larger so that they are more readable.
       - Be sure to keep focus at the regional level.
       - Acknowledge the effects of seasonal employment and population changes.
       - Add ferry service to the transportation section.

- Add and electrical transmission section.
- Add a section for broadband.
- Look for NFIP numbers that reflect a full year since the new maps have been in place.
- Move much of the storm modeling information out of the coastal flooding section and bring back in more of the scenario discussion and the scenarios themselves.
- Sources were recommend for some of the medium and low-priority hazards so that those hazards could have a couple of paragraphs written about them.
- Items were provided for inclusion on critical infrastructure chart.

b. Storm Water Chapter

Suggestions were made for improving the storm water section. Edits for that chapter include:

- Mention of seasonal high water table.
- Zoom in on LIDAR graphic to show more Carolina Bays.
- Keep table of storm water flooding location (for possible mitigation actions)

55. Information Items

Household hazardous waste will be collected on May 7 at Birdsnest, Grangeville, and Horntown convenience centers from 10 a.m. until 2 p.m.

56. Adjourn

Meeting adjourned at 11:55 a.m.

57. Next Meeting

The regular monthly meeting is scheduled for June 1, 10 a.m. until noon, Eastern Shore Community College.

Recordings for this meeting can be found at:
May 4, 2016 HM Meeting Part 1
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_05042016071528476_1067115.mp3
May 4, 2016 HM Meeting, Part 2
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_05042016073404248_1067187.mp3
May 4, 2016 HM Meeting, Part 3
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_05042016075500992_1067213.mp3
(Note: Due to difficulties with the conference call line, there are multiple recordings associated with this meeting)

MEETING SIGN-IN

Hazard Mitigation	Meeting Date: May 4, 2016
	Place/Room: ESCC

Name	Representing:	E-Mail (if changed or new)
Ron Marney	Town of Chincoteague	Email (if changed) rmarney@chincoteague-va.gov
Bryan Rush	Town of Chincoteague	Email (if changed) brush@chincoteague-va.gov
Shannon Alexander	ANPDC	Email (if changed)
[illegible]	Town of Nassawadox	Email (if changed)
Curt Smith	A-NPDC	Email (if changed)
Tom Brockenbrough	Accomack Co	Email (if changed)
John Cutler	Northampton CO	Email (if changed)
John Jeckel	Wach. (joined by phone)	Email (if changed)
Amy Howard	VDEM (joined by phone)	Email (if changed)
[illegible] Smith	NASCO	Email (if changed)
George Boyden	SBPC	Email (if changed)
Jeb Brady	Town of Cape Charles	Email (if changed)
Connie Morrison	ANPDC	Email (if changed)
		Email (if changed)
		Email (if changed)
		Email (if changed)
		Email (if changed)
		Email (if changed)

JUN. 1, 2016 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

June 1, 2016

The Eastern Shore Hazard Mitigation Plan Steering Committee met May 4, 2015 in Room 150 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Peter Stith, Northampton County
John Joeckel, Town of Wachapreague
Ed Gibb, Nassawadox
David A. Rogers Sr., ESCC
Robert Mears, ESCC
Mark Bowden, Accomack County

A-NPDC Staff Present:
Shannon Alexander, Coastal Programs Manager
Connie Morrison, Transportation Program Mgr.
Curt Smith, Director of Planning

Planning Council Members Present:
George Bryant, Small Business Development Center

58. Call to Order
Vice Chairman Peter Stith called the meeting to order in the absence of Chairman Eichelberger at 10:02 a.m.

59. Approval of Agenda
The agenda was approved by unanimous consent.

60. Approval of May 4 Minutes
Committee Member Gibbs moved to approve the minutes for the May 4 meeting. The motion, seconded by Vice Chairman Stith, carried unanimously.

61. New Business
    a. Regional Hazard Mitigation Goals and Actions
    The Committee reviewed the Regional Chapter and provided a number of edits. Among the high-level comments were:

    Agree on maintaining Vision Statement as it was written and included in the 2011 Plan.

    Edits to the 2011 Mitigation Goals:
    - Goal 1: None.
    - Goal 2: Residents, Businesses, ~~and~~ Local Governments, *and other community partners* will work *together* to minimize community disruption through *planning* and ~~commercial~~ mitigation activities.

- Goal 3: Local governments encourage self-sufficiency ~~among residents~~ and personal responsibility for managing ~~their own~~ risk. *(This way businesses, visitors, etc. are also included.)*
- Goal 4: Local governments will work to ensure that infrastructure will continuously function during and after a ~~natural~~ hazard event. *(To also include anthropogenic events, such as oil spill, etc.)*
- Goal 5: None.

Committee Members updated the status as of 2016 column in the regional mitigation projects table and agreed upon additional projects to be included in the 2016 Plan.

62. <u>Information Items</u>

None.

63. <u>Adjourn</u>

Meeting adjourned at 11:55 a.m.

64. <u>Next Meeting</u>

The regular monthly meeting is scheduled for July 6, 10 a.m. until noon, Eastern Shore Community College.

Recordings for this meeting can be found at:
June 1, 2016 HM Meeting
http://rec001.freeconferencecalling.com/mp3/1240690/182321/LA3488_06012016070342820_1061757.mp3

MEETING SIGN-IN

Hazard Mitigation	Meeting Date: June 1, 2016
	Place/Room: ESCC

Name	Representing:	E-Mail (if changed or new)
John Joeckel	Wachapreague	Email (if changed)
David A. Rogers SR.	ESCC	Email (if changed) drogers@es.vccs.edu
Robert Mears	ESCC	Email (if changed) bmears@es.vccs.edu
S Alexander	ANPDC	Email (if changed)
Peter Stith	NHCo	Email (if changed)
MARK Bowden	ACCOMACK CO	Email (if changed)
Curt Smith	ANPDC	Email (if changed)
[illegible]	NASSAWADOX	Email (if changed)
Connie Morrison	ANPDC	Email (if changed)
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AUG. 3, 2016 ESHMP STEERING COMMITTEE MEETING

Minutes of the Eastern Shore Hazard Mitigation Plan Steering Committee

August 3, 2016

The Eastern Shore Hazard Mitigation Plan Steering Committee met August 3, 2016 in Room 160 of the Workforce Development Building of Eastern Shore Community College in Melfa, Virginia.

Steering Team Members Present:
Doug Jones, Accomack County
Tom Brockenbrough, Accomack County
Chairman Jim Eichelberger, Town of Parksley
Robert Hodgson, Town of Wachapreague
John Outten, Northampton County

A-NPDC Staff Present:
Shannon Alexander, Coastal Resources Program Manager

65. Call to Order
    Chairman Eichelberger called the meeting to order at 10:02 a.m.

66. Approval of Agenda
    The agenda was approved by unanimous consent.

67. Approval of June 1 Minutes
    As no members whom were present June 1 were present, action on this item was postponed until next the Committee meets.

68. Old Business
    a. Regional Chapter Review:
       Committee Member Tom Brockenbrough supplied feedback on the draft of the Regional Chapter, specifically pointing out what seem to be erroneous figures concerning the workforce.

69. New Business
    a. Ranking Hazard Mitigation Action:
       The Committee reviewed the mitigation actions and updated staff on the status of the actions. There were several edits to the wording for some of the actions. Committee Members discussed criteria for ranking and reached consensus on the criteria and the ranking of each of the actions which have not yet been started. The Committee Members request that a copy of the updated table be included with the meeting minutes for greater Committee review and approval. Attached.

b. Staff presented recent opportunity to have FEMA representatives offer training to coincide with the rollout of the final draft of the new Hazard Mitigation. This will be in November.

70. Information Items
    a. Staff presented the Residential Hurricane Wind Retrofit Fact Sheet
    b. Staff presented update from the Regional Housing Alliance concerning their intention to apply for funding to elevate 10 homes in the region.
    c. Staff presented 2 web sites offering potentially useful tools for planning:
        i. https://coast.noaa.gov/ccapatlas/
        ii. http://ssrf.climatecentral.org/

71. Adjourn

Meeting adjourned at 12:09 p.m.

72. Next Meeting

There is no regular monthly meeting scheduled at this time. A November training will serve as an official meeting of the Hazard Mitigation Steering Committee and will be held at the Eastern Shore Community College.

MEETING SIGN-IN

Hazard Mitigation	Meeting Date: August 3, 2016
	Place/Room: ESCC

Name	Representing:	E-Mail (if changed or new)
S Alexander	ANEC	Email (if changed)
Doug Jones	Accomack EM	Email (if changed)
Tom Brockenbrough	Accomack Co	Email (if changed)
Jim Eichelberger	Parksley	Email (if changed)
Robert L Hodgson	Wachapreague	Email (if changed)
John Outten	Northampton Co	Email (if changed)
		Email (if changed)
		Email (if changed)
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DEC. 6, 2016 ESHMP RESILIENCE WORKSHOP

Accomack-Northampton Planning District Commission Resilience Workshop

The Hermitage on the Eastern Shore, 23610 North Street, Onancock, VA 23417
December 1, 2016
Agenda

3:00 PM: Sign In

3:10 PM: Welcome and Introductions

3:20 PM: Making Resilient Connections: NFIP, Hazard Mitigation, Risk MAP, and Agency Programs

An overview of resiliency and its connection to the National Flood Insurance Program (NFIP), hazard mitigation, Risk Mapping, Assessment and Planning (Risk MAP) program, and State and Federal agencies will help set the course for the workshop.

3:40 PM: Using Non-Regulatory Flood Risk Products

Flood Risk Products greatly help assess, visualize, and communicate local flood risk. This presentation will focus on the new tools available for Accomack-Northampton PDC communities and how they can be used to support risk reduction, including the following:

- Support Floodplain Management, Hazard Mitigation Assistance grants, and Community Rating System activities;
- Enhance emergency and community planning by illustrating the most severely impacted areas;
- Assist with response and recovery planning and resource distribution;
- Inform flood risk reduction actions, such as advocating for higher building code requirements or the use of flood-resilient designs and construction materials;
- Inform decision makers where to prioritize mitigation activities and resources;
- Help visually communicate flood risk to the public; and
- Improve risk communication and outreach.

4:00 PM: Break

4:10 PM: Making the Case for Mitigation

This session will provide communities with talking points, tools, and resources to capture the cumulative effects of mitigation, its economic impacts, and promote the value of mitigation to decision makers and other audiences in the current reality of competing priorities and fiscal constraint.

4:30 PM: Implementation Techniques and Tools

Tools to support community mitigation efforts of all sizes.

5:00 PM: Next Steps and Conclusion

Reg Status	Pay Status	Last Name	First Name	Email Address	Reg Date
REGISTERED	NA	Brockenbrough	Tom	tbrockenbrough@co.accomack.va.us	11/02/2016 11:51 AM EDT
REGISTERED	NA	Corbin	Shelia	shelia.corbin@rivhs.com	11/02/2016 01:11 PM EDT
REGISTERED	NA	Isdell	Chris	christopher.isdell@vdot.virginia.gov	11/03/2016 09:50 AM EDT
REGISTERED	NA	Schwenk	Barbara	bschwenk@a-npdc.org	11/03/2016 04:56 PM EDT
REGISTERED	NA	Hruska	Tom	tom.hruska@verizon.net	11/04/2016 06:16 AM EDT
REGISTERED	NA	Sedjat	MiMi	lsedjat@escsb.org	11/04/2016 10:11 AM EDT
REGISTERED	NA	Francis	Tange	tfrancis@esvaheadstart.org	11/04/2016 10:27 AM EDT
REGISTERED	NA	Horton	Charmin	chorton@foodbankonline.org	11/04/2016 10:41 AM EDT
REGISTERED	NA	Cropper	Garey	gareycropper@msn.com	11/04/2016 08:08 PM EDT
REGISTERED	NA	Eichelberger	James	eichelberger@parksley.org	11/06/2016 06:16 PM EST
REGISTERED	NA	Cousineau	Vanessa	elnessa2002@yahoo.com	11/07/2016 12:43 PM EST
REGISTERED	NA	Leonard	Arthur	5leonards@verizon.net	11/17/2016 09:54 PM EST
REGISTERED	NA	Smith	Curt	csmith@a-npdc.org	11/18/2016 05:20 PM EST
REGISTERED	NA	Jones	Doug	djones@co.accomack.va.us	11/21/2016 10:16 AM EST
REGISTERED	NA	Kerbin	Bill	wkerbin@onancock.com	11/22/2016 08:17 AM EST
REGISTERED	NA	Tremblay	Kristen	ktremblay@co.accomack.va.us	11/22/2016 03:25 PM EST
REGISTERED	NA	Aigner	John	jaigner@a-npdc.org	11/29/2016 07:26 AM EST
REGISTERED	NA	Gunnells	David	david.gunnells@dcr.virginia.gov	11/29/2016 03:50 PM EST
REGISTERED	NA	Prosise	William	prosises@aol.com	11/30/2016 08:13 AM EST

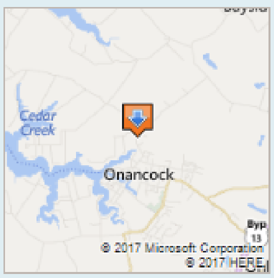
When

Thursday December 1, 2016 from 3:00 PM to 5:00 PM EST

Add to Calendar

Where

The Hermitage in Onancock, Social Hall
23610 North St.
Onancock, VA 23417



Driving Directions

Contact

Shannon Alexander
Accomack-Northampton Planning District Commission
757-787-2936 x115
salexander@a-npdc.org

Hazard Mitigation Tools & Training

Please take advantage of the opportunity to hear from representatives from A-NPDC, FEMA, DCR, VDEM, and the Army Corps! Learn tools & techniques that you can use to make your community more resilient and prepared.

Resilient communities have the ability to "bounce back" from hazardous events, successfully respond to stressors, and adapt well to change. What does this mean for the communities on the Eastern Shore? During this interactive workshop, participants will discuss priorities that will inform how communities can respond to hazardous events, review tools and resources for communities to assess risk and promote mitigation efforts, and identify actions to spur future activities or projects to build resilience and reduce risk.

Representatives from FEMA, VDEM, A-NPDC, and the U.S. Army Corps will be presenting and available for questions and consultation.

Training Opportunity (Registration Required)
3:00 PM: Sign In
3:10 PM: Welcome and Introductions
3:20 PM: Making Resilient Connections: Tools You Can Use
3:40 PM: Using Non-Regulatory Flood Risk Products
4:00 PM: Break
4:10 PM: Making the Case for Mitigation
4:30 PM: Implementation Techniques and Tools
5:00 PM: Adjourn

Open House (Registration Not Required)
6:00 - 8:00 PM A-NPDC Hazard Mitigation Plan Open House
with presentations from A-NPDC and FEMA 6:30 - 7:00 PM.
We look forward to seeing you on December 1! Please do not hesitate to contact Shannon Alexander by phone or email with any questions.

Register Now!

DEC. 6, 2016 ESHMP PUBLIC OPEN HOUSE

Accomack-Northampton Planning District Commission
Hazard Mitigation Plan Open House
The Hermitage on the Eastern Shore, 23610 North Street, Onancock, VA 23417
December 1, 2016
6:00 – 8:00 PM
Agenda

Welcome!

Please visit stations to learn more about the National Flood Insurance Program (NFIP), hazard mitigation, the Accomack-Northampton PDC Hazard Mitigation Plan Risk Mapping, Assessment and Planning (Risk MAP) program, and State and Federal agencies. The following information stations will be available:

- **Hazard Mitigation for Property Owners and Renters:** This station provides tools to support individual and community mitigation efforts of all sizes.

- **Mapping Tools:** Visit this station to view Risk MAP Non-Regulatory Flood Risk Products, Flood Insurance Rate Maps, and the local Coastal Resilience website. Printers are available to print individual maps of locations that interest you. If you would like to view information after the meeting visit:
  - Map Service Center – msc.fema.gov
  - Coastal Resilience – maps.coastalresilience.org/virginia/

- **Accomack-Northampton PDC Hazard Mitigation Plan:** The Hazard Mitigation Plan is in the process of being updated for approval and local adoption in 2017. Visit this station to review and comment on the draft plan. View the plan in more detail after the meeting at:
  - www.a-npdc.org/accomack-northampton-planning-district-commission/coastal-resources/hazard-mitigation-planning/

We will have two brief presentations starting at 6:30 PM

- **Value of Mitigation from the Individual to the National Level:** This presentation by the Federal Emergency Management Agency will engage attendees with opportunities for mitigation from their own property to the Nation.

Hazard Mitigation Plan Overview and Request for Comments: The Accomack-Northampton Planning District Commission will provide an overview of the plan and kick-off the public comment period.

Accomack-Northampton PDC
Open House Sign-In Sheet
December 1, 2016

Name	Jurisdiction/Organization	Phone	Email
Dary Jones	Accomack EM		DJONES@Co.Accomack.VA.US
Tom Brockenbrough	Accomack County		Tbrockenbrough@co.accomack.Va.us
John Grant	Accomack County		j.grant.2012@gmail.com
Jenny Gehman	gehman.jennyg@gmail.com		
Donna Spady	Accomack CO.		Spady@NetzerO.Net
Sarah Bowen	Resilience Action Partners		sbowen@mbakerintl.com
Charley Banks	VA DCR		charley.banks@dcr.virginia.gov
Darlene Messina	FEMA FPMI		
David Smith	Acc Co Painter		eswoodman@gmail.com
Mari Radford	FEMA R3		

Paul Moye USACE

Zane Hadzick FEMA R3 zane.hadzick@fema.dhs.gov


HAZARD MITIGATION PLAN
OPEN HOUSE, PLUS FREE
TOOLS & TRAINING FROM FEMA
BE PREPARED!
DEC
1
Hazard Mitigation Plan, Tools & Training
Public · Workshop · Hosted by Accomack-Northampton Planning District Commission
Going
Thursday, December 1, 2016 at 6 PM - 8 PM
about 3 months ago
23610 North St, Onancock, VA 23417-2024, United States
Show Map
About
Discussion

Contact Shannon Alexander 757-787-2936, ext. 115 **FOR IMMEDIATE RELEASE**

Open House Provides Resources for Residents and Communities to Lower Risk During Hazard Events

FEMA, DCR, and USACE bring their expertise to Eastern Shore

ACCOMAC— For the last two years residents from the Eastern Shore have worked together to make a plan to address flooding, high winds, erosion and other hazards that face our peninsula.

"We can't do anything to stop hurricanes and other storms that bring flooding and high winds, but we can get smarter about the harm they bring, including floods and flood zones, and how to protect ourselves," said Jim Eichelberger, Mayor of Parksley and Chairman of the local-government-appointed Eastern Shore Hazard Mitigation Steering Committee. The committee was established to re-write the plan that evaluates and prioritizes actions to protect life and property before disaster strikes.

Accomack-Northampton Planning District Commission is organizing the work under a grant from the Federal Emergency Management Agency and the Virginia Department of Emergency Management. The commission and two agencies, along with the National Oceanic and Atmospheric Administration, the Virginia Coastal Zone Management Program, and the non-profit Wetlands Watch are co-sponsoring two Feb. 11 workshops for Accomack and

Northampton individuals and communities that want to learn more about flooding, flood zones, and floodplain management actions communities can take to potentially lower flood insurance rates.

Charley Banks, the Certified Floodplain Manager and NFIP Coordinator for the Commonwealth, will be present.

USACE

Communities opting into the program increase public flood awareness, enhance public safety, reduce damage to private property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. As communities incrementally implement more rigorous program levels, they qualify for greater flood insurance discounts from the National Flood Insurance Program.

For more information about the open house or the hazard mitigation plan, please contact Shannon Alexander, Accomack-Northampton Planning District Commission, 787-2936 x115, or salexander@a-npdc.org.

APPENDIX E.

Resolutions of adoption of this Eastern Shore Hazard Mitigation Plan by all participating jurisdictions.

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
COUNTY OF ACCOMACK, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including Accomack County; and

WHEREAS, the efforts of the Accomack County, Eastern Shore of Virginia Hazard Mitigation Planning Committee members and the Accomack-Northampton Planning District Commission have resulted in the development of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Accomack, Virginia, that the sections pertaining to Accomack County in the Eastern Shore Hazard Mitigation Plan dated April, 2017 is hereby approved and adopted for the County of Accomack, Virginia.

Mike Mason, Acting Administrator
Accomack County

4/19/17
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
COUNTY OF NORTHAMPTON, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including Northampton County; and

WHEREAS, the efforts of the Northampton County, Eastern Shore of Virginia Hazard Mitigation Planning Committee members and the Accomack-Northampton Planning District Commission have resulted in the development of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Board of Supervisors of the County of Northampton, Virginia, that the sections pertaining to Northampton County in the Eastern Shore Hazard Mitigation Plan dated April, 2017 is hereby approved and adopted for the County of Northampton, Virginia.

John Andrzejewski

John Andrzejewski,
Acting County Administrator
Northampton County

May 9, 2017

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF BLOXOM, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Bloxom; and

WHEREAS, the efforts of the Town of Bloxom, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Bloxom, Virginia, that the sections pertaining to Bloxom in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Bloxom, Virginia.

R. Scott Callander

R. Scott Callander, Mayor
Town of Bloxom

23 MAY 2017
Date

RESOLUTION 20170420C

2016 EASTERN SHORE OF VIRGINIA HAZARD MITIGATION PLAN TOWN OF CAPE CHARLES, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Cape Charles; and

WHEREAS, the efforts of the Town of Cape Charles, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Cape Charles, Virginia, that the sections pertaining to Cape Charles in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Cape Charles, Virginia.

****

Adopted by the Town Council of the Town of Cape Charles, April 20, 2017

By: George R. Proto
Mayor

ATTEST:

Libby Hume
Town Clerk

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF CHERITON, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Cheriton; and

WHEREAS, the efforts of the Town of Cheriton, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Cheriton, Virginia, that the sections pertaining to Cheriton in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Cheriton, Virginia.

Joe Habel, Mayor
Town of Cheriton

04/26/2017
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF CHINCOTEAGUE, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Chincoteague; and

WHEREAS, the efforts of the Town of Chincoteague, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Chincoteague, Virginia, that the sections pertaining to Chincoteague in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Chincoteague, Virginia.

John A. Leonard

J. Arthur Leonard, Mayor
Town of Chincoteague

4/20/2017

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF EASTVILLE, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Eastville; and

WHEREAS, the efforts of the Town of Eastville, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Eastville, Virginia, that the sections pertaining to Eastville in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Eastville, Virginia.

Jim Sturgis, Mayor
Town of Eastville

April 18, 2017
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF EXMORE, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Exmore; and

WHEREAS, the efforts of the Town of Exmore, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Exmore, Virginia, that the sections pertaining to Exmore in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Exmore, Virginia.

Douglas W. Greer, Mayor
Town of Exmore

5/1/17
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF HALLWOOD, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Hallwood; and

WHEREAS, the efforts of the Town of Hallwood, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Hallwood, Virginia, that the sections pertaining to Hallwood in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Hallwood, Virginia.

J. Jackie Poulson

J. Jackie Poulson, Mayor
Town of Hallwood

5/8/17

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF KELLER, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Keller; and

WHEREAS, the efforts of the Town of Keller, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Keller, Virginia, that the sections pertaining to Keller in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Keller, Virginia.

Pat Nottingham

Pat Nottingham, Mayor
Town of Keller

5-3-17

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF NASSAWADOX, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Nassawadox; and

WHEREAS, the efforts of the Town of Nassawadox, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Nassawadox, Virginia, that the sections pertaining to Nassawadox in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Nassawadox, Virginia.

Patsy Stith

Patsy Stith, Vice Mayor
Town of Nassawadox

April 24, 2017

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF ONANCOCK, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Onancock; and

WHEREAS, the efforts of the Town of Onancock, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Onancock, Virginia, that the sections pertaining to Onancock in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Onancock, Virginia.

____
~~Russell Jones~~, Vice Mayor Fletcher Fosque
Town of Onancock

April 24, 2017
____
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF ONLEY, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Onley; and

WHEREAS, the efforts of the Town of Onley, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Onley, Virginia, that the sections pertaining to Onley in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Onley, Virginia.

Jack Pierson

Jack J. Pierson, Mayor
Town of Onley

June 5, 2017
Date

RESOLUTION
2017 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF PARKSLEY, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Parksley; and

WHEREAS, the efforts of the Town of Parksley, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Parksley, Virginia, that the sections pertaining to Parksley in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Parksley, Virginia.

J. Eichelberger, Mayor
Town of Parksley

April 10, 2017

Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF SAXIS, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Saxis; and

WHEREAS, the efforts of the Town of Saxis, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Saxis, Virginia, that the sections pertaining to Saxis in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Saxis, Virginia.

Denise Drewer, Mayor

Denise Drewer, Mayor
Town of Saxis

May 1st 2017
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF TANGIER, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Tangier; and

WHEREAS, the efforts of the Town of Tangier, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Tangier, Virginia, that the sections pertaining to Tangier in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Tangier, Virginia.

James Eskridge, Mayor
Town of Tangier

April 10, 2017
Date

RESOLUTION
2016 EASTERN SHORE OF VIRGINIA
HAZARD MITIGATION PLAN
TOWN OF WACHAPREAGUE, VIRGINIA

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments develop and adopt natural hazard mitigation plans in order to receive certain federal assistance; and

WHEREAS, an Eastern Shore Hazard Mitigation Planning Committee comprised of members of the business community and non-profit organizations, and local officials was convened in order to study the County's risks from and vulnerabilities to natural hazard, and to make recommendations on mitigating the effects of such hazard on the County; and

WHEREAS, the Accomack-Northampton Planning District Commission updated a regional Hazard Mitigation Plan including the Town of Wachapreague; and

WHEREAS, the efforts of the Town of Wachapreague, the Eastern Shore of Virginia Hazard Mitigation Steering Committee members, and the Accomack-Northampton Planning District Commission have resulted in an update of a regional Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED by the Town of Wachapreague, Virginia, that the sections pertaining to Wachapreague in the Eastern Shore Hazard Mitigation Plan dated April 2017, is hereby approved and adopted for the Town of Wachapreague, Virginia.

Fred Janci, Mayor
Town of Wachapreague

4/11/2017
Date