

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 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

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 be 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

Eastern Shore Hazard Mitigation Plan 2016

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).

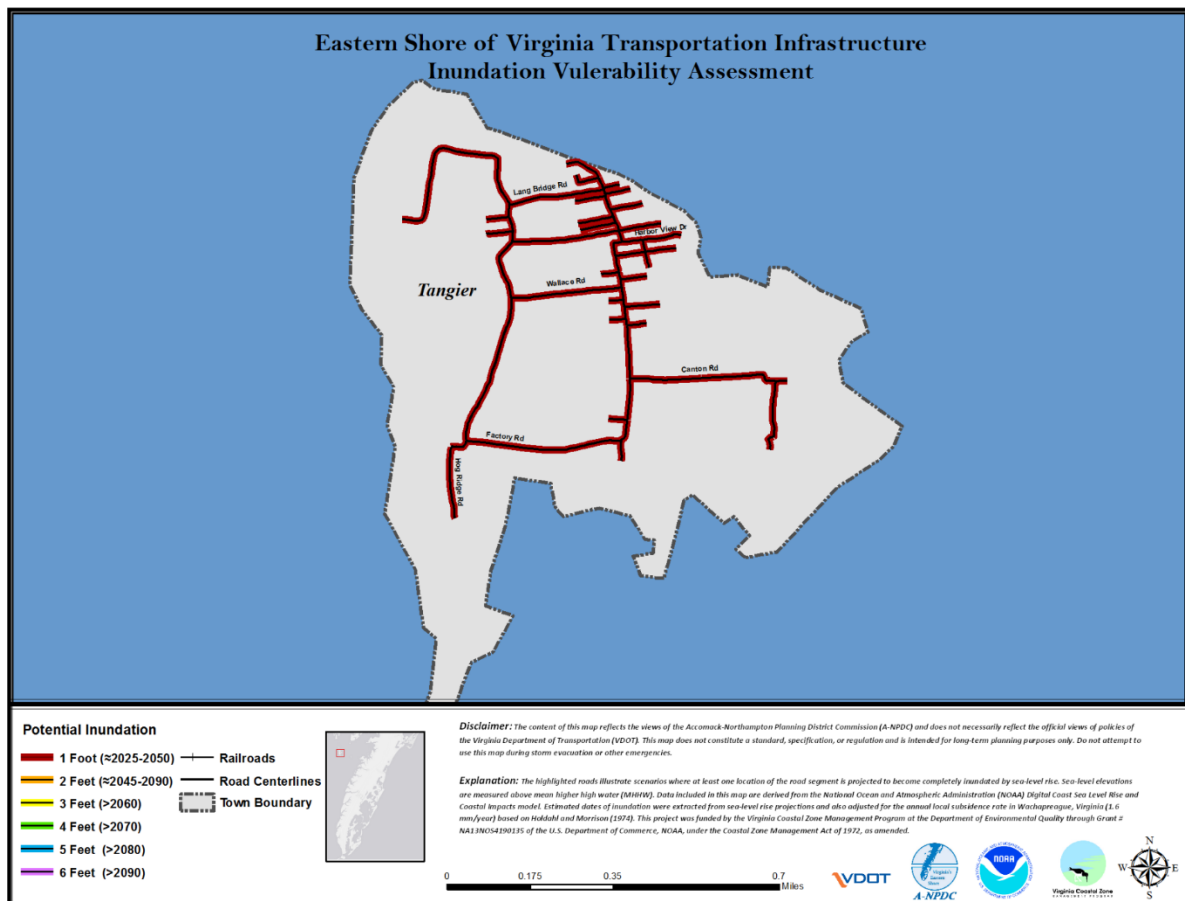


Figure 2 : Town of Tangier Transportation Infrastructure Inundation Vulnerability

COMMUNITY FACILITIES

Community facilities are the structure and services provided by the government. These facilities include schools, water and sewer, waste disposal, public safety, recreational facilities, and some medical services.

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.

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.

*Figure 5: Example of a small cemetery in Tangier.
Photo by Shannon Alexander*

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

Town of Tangier

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*).

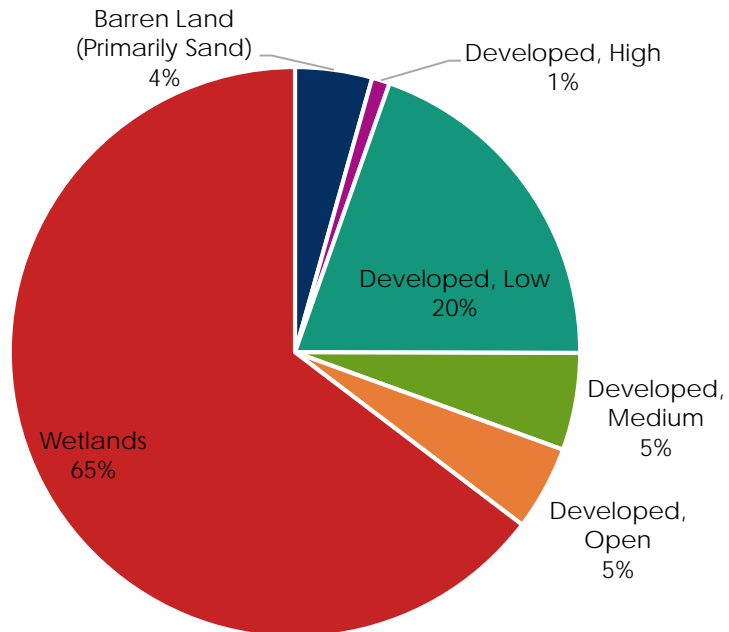


Figure 9: Tangier Land Use Land Cover

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					
	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	Virginia Hurricane Evacuation	Oil & HazMat Response Plan; HazMat Commodity Flow	Ground Water Committee	Navigable Waterways Committee	Climate 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 mi² in the Special Flood Hazard Area (SFHA), and 2.4 mi² in the V Zone, both were reduced by 0.1 mi² (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.

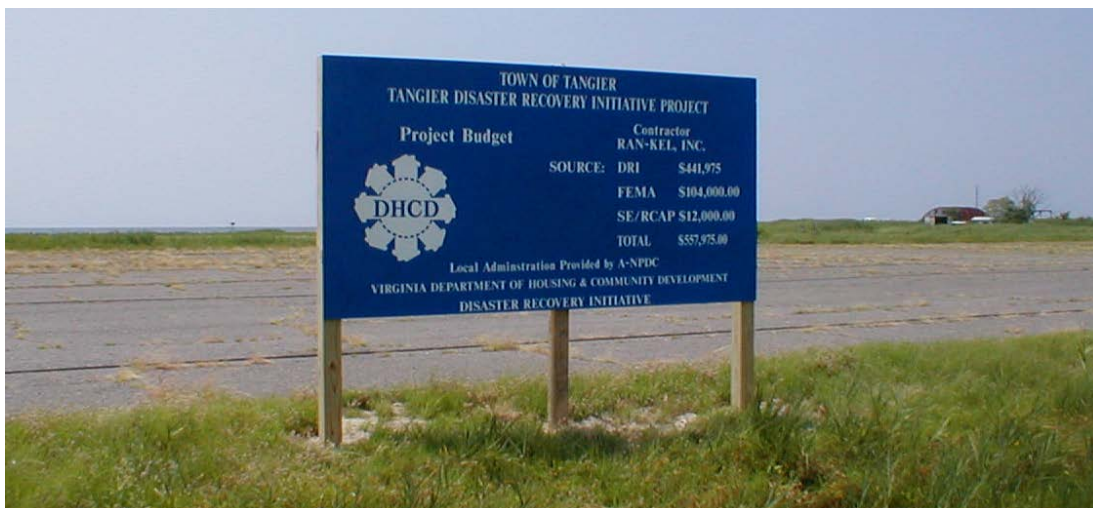


Figure 11: Sign indicative of the project that constructed six homes in 2003.

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.

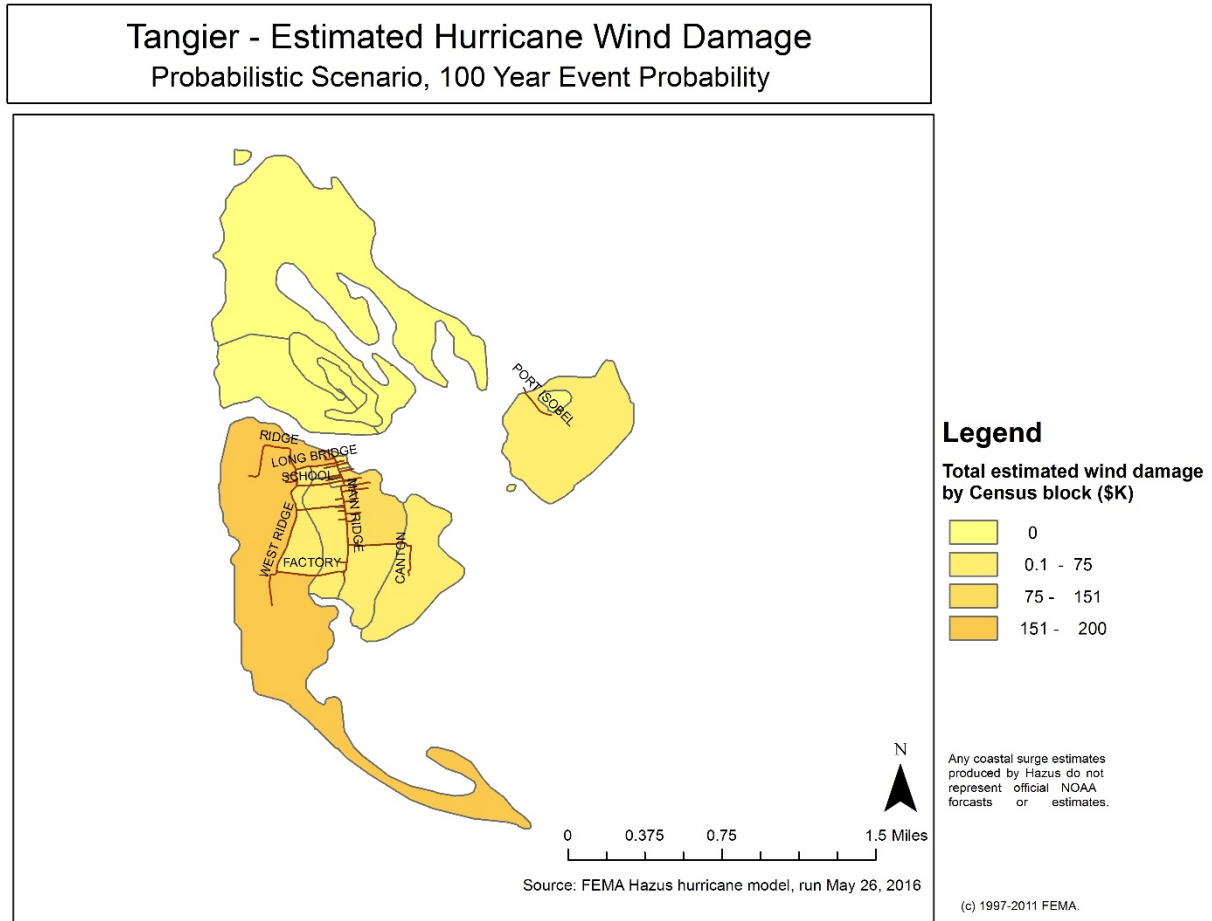


Figure 12: Tangier Estimated Wind Damage by Census Block

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. McDonnell 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-foot 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.

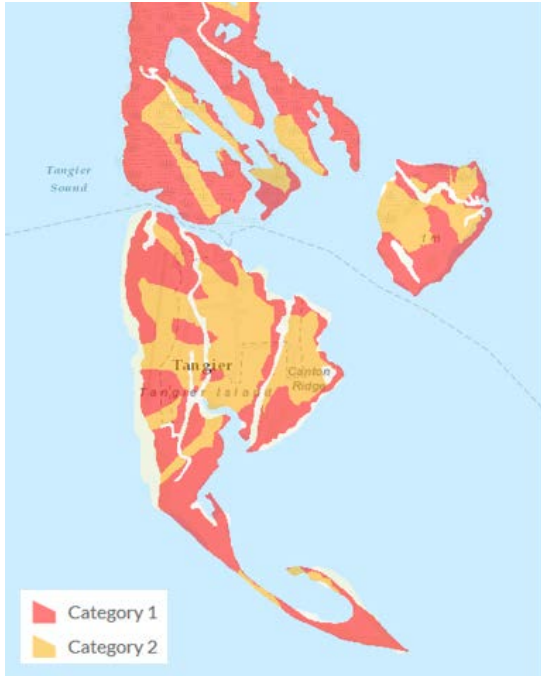


Figure 14: Estimated Hurricane Impacts; Source: Virginia DEM Storm Surge Tool

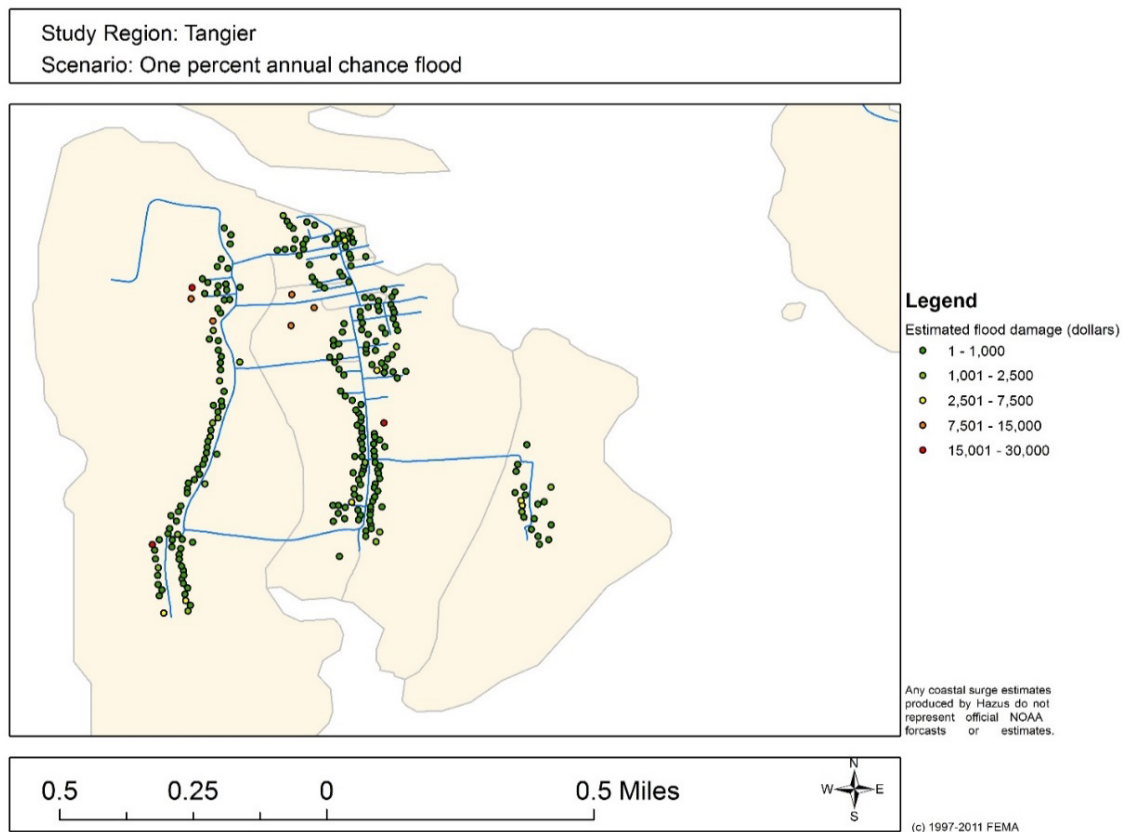


Figure 15: Tangier Hazus® Predicted Damages during a 1% Annual Chance Flood

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. Ponderosa 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.

OTHER HAZARDS

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 FACILITIES

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.