CHAPTER 22: 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. At that time, the island was much larger and had woodlands. The community 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.

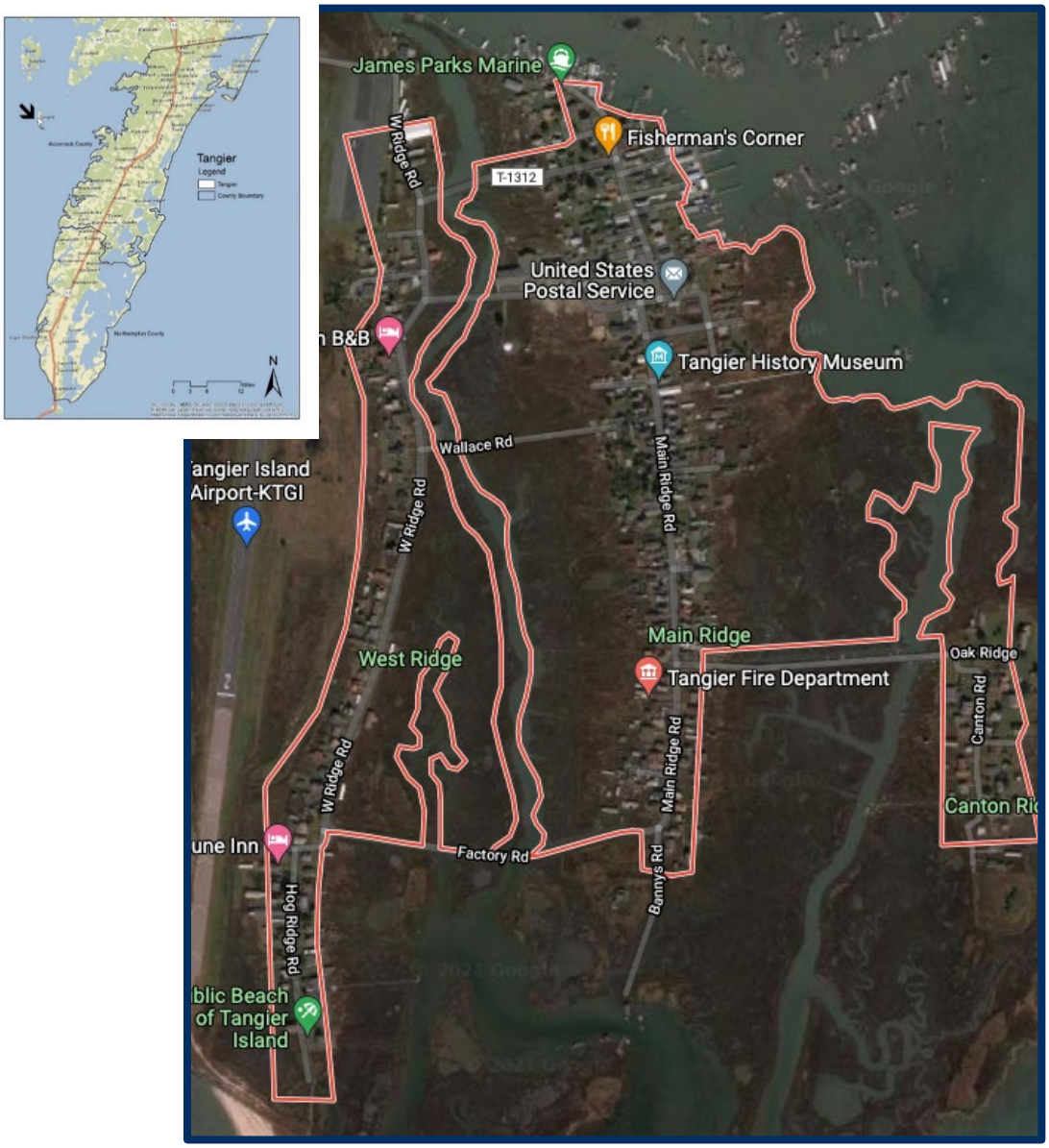


Figure 1: Tangier Context and Google Map

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. 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

In 2019, the American Community Survey five-year estimates indicate that the population in Tangier was 506, an increase from 2014 and 2013. Town officials agree that the population is currently around 500 (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). 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, which increased to 48.6 in the 2010 census, and again in the ACS 2019 estimates to 52.3, signifying an aging population and the number of younger residents who may be leaving the Island. In 2019, 31.4% of Tangier's population was over the age of 65. The Town experiences a seasonal increase in tourists visiting the Island between the months of May and October. It is estimated that about 5-10% of the population is seasonal (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

No parts of the population in Tangier speak a language other than English; therefore, everyone would be able to access important safety information regarding hazards.

Table 1: Tangier Demographic Information

	2020	2014**	2013***	2010****	2000*****
Population	436	485	483	727	604
Median Age	52.3*	54.8	55.7	48.6	42.7
Disability	87*	16	38	NA	NA
Income					
Median Household Income	$41,806*	$38,056	$40,833	$40,556	$26,607
Poverty Level	17.2%*	23.3%	21.3%	28.5%	NA
Language					
Only English	100.0%*	99.2%	99.4%	99.5%	97.9.%
Other	0.0%*	0.8%	0.6%	0.5%	2.1%
Spanish	0.0%*	0.0%	0.0%	0.0%	1.6%
Ind-Euro	0.0%*	0.8%	0.6%	0.5%	0.0%
Asian	0.0%*	0.0%	0.0%	0.0%	0.5%
Other	0.0%*	0.0%	0.0%	0.0%	0.0%

Source: U.S. Census 2020, *ACS, 2014-2019, **Annual Estimates of the Residential Population: 2010 – 2014, ***ACS, 2009-2013, ****U.S. Census 2010, *****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 the workforce is employed in the seafood/fishing industry. Other industries that dominate the workforce in Tangier are education and health care and transportation and warehousing and utilities. The workforce has been steadily increasing since the 2000 Census. 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 (*Eastern Shore Hazard Mitigation Plan*, 2016). This represents a decline in watermen, which local representatives attribute to the increases in regulations and fees associated with fishing licenses. There have been five watermen lost in just the past year and a half (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). The increase of workforce in the transportation and warehouse industry can likely be attributed to an increase in tug boaters and marine merchants, and may be switching from the fishing/aquaculture fields (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

Table 2: Tangier Local Workforce Industry

Civilian Employed Population										
Industry	**2019***		**2014****		**2012****		**2010****		**2000*****	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Agriculture, forestry, fishing/hunting, or mining	59	23.8%	55	25.7%	64	27.8%	72	33.6%	55	25.7%
Construction	0	0.0%	3	1.4%	0	0.0%	0	0.0%	3	1.4%
Manufacturing	0	0.0%	0	0.0%	3	1.3%	14	6.5%	0	0.0%
Wholesale trade	11	4.4%	13	6.1%	6	2.6%	12	5.6%	13	6.1%
Retail trade	7	2.8%	41	19.2%	38	16.5%	3	1.4%	41	19.2%
Transportation and warehousing, and utilities	50	20.2%	27	12.6%	15	6.5%	18	8.4%	27	12.6%
Information	0	0.0%	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%	0	0.0%	0	0.0%
Professional, scientific, waste management	10	4.0%	4	1.9%	2	0.9%	0	0.0%	4	1.9%
Educational, health care, social services	56	22.6%	43	20.1%	48	20.9%	28	13.1%	43	20.1%
Arts, entertainment, recreation, food	28	11.3%	19	8.9%	20	8.7%	18	8.4%	19	8.9%
Public Administration	21	8.5%	7	3.3%	12	5.2%	13	6.1%	7	3.3%
Other	6	2.4%	2	0.9%	22	9.6%	40	18.7%	2	0.9%
TOTAL CIVILIAN EMPLOYED POPULATION	248	-	214	-	230	-	218	-	214	-

Source: *ACS, 2014-2019, **ACS, 2009-2014, ***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.

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 also 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 (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). 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.

There are also two Bed and Breakfasts, rental properties, several restaurants (although only one is open year-round) and ice creams shops, a museum, health centers, A&N Electric, and a marine supply store. The Town has issued 52 business licenses for 2021 (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

Table 3: Tangier Business Establishment Types

Industry Code Description	Total Establishments			
	2021	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	~15	11	11	11
Total Employees	-	15	18	17

Source: Personal Communications, Laurie Thomas, Town Manager, April 29, 2021; Census Zip Code Business Patterns, 2009, 2011, 2013

BUILT INFRASTRUCTURE

§201.6(d)(3) 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 2019 American Community Survey five-year estimates, Tangier contains 276 residential units. Data from the 2010 Census is likely an overestimate (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). These units are 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 (*Town of Tangier Comprehensive Plan*, 2001). In the last two years, there have been approximately five demolitions of derelict buildings on the Island. The number of vacant homes approximately doubled between 2000 and 2010 and is still increasing as of 2019 (ACS 2019), meaning that the housing stock on the Island may be more vulnerable to impacts from storms in general. An increase in vacant units is likely due to units being used as seasonal or second homes.

Table 4: Tangier Housing

	2019*	2010**	2000***
Total Housing Units	276	377	270
Occupied	214	324	244
Vacant	62	53	26
Owner-Occupied	196	293	227
Renter-Occupied	18	31	17
Median Housing Value	$89,700	NA	NA

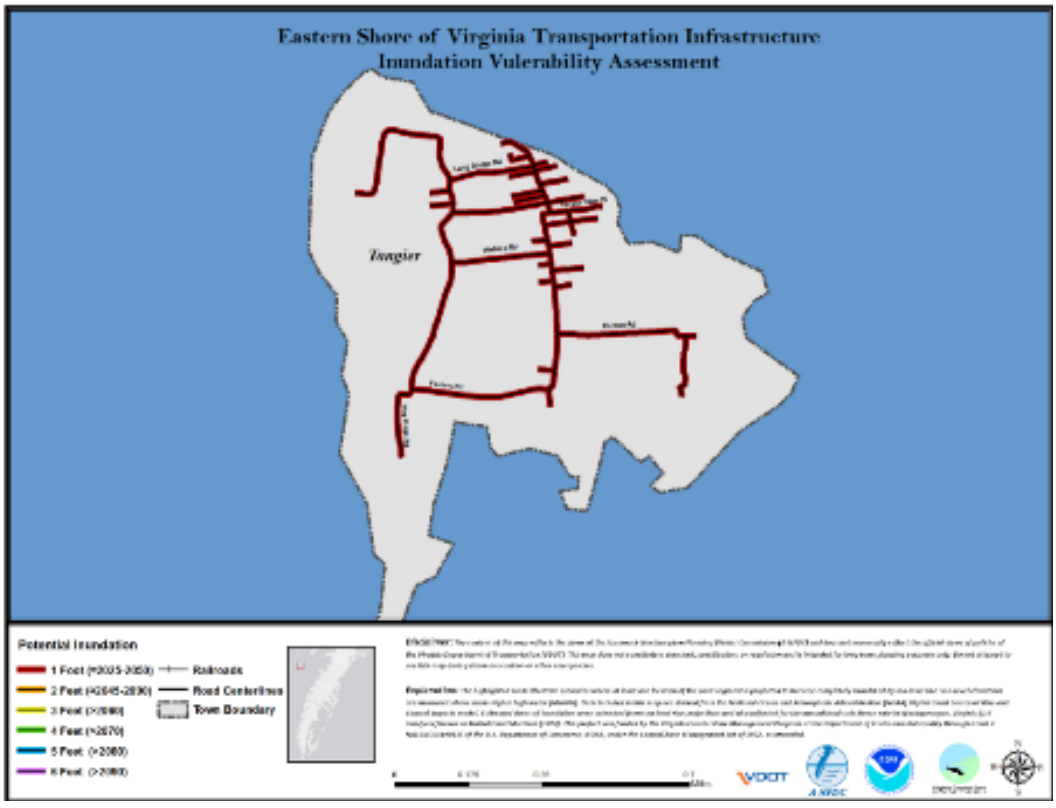
Source: *ACS, 2014-2019, **U.S. Census 2010, ***U.S. Census 2000

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. There are three other seasonal ferry services to and from the Town as well (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). 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, such as 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 it has been paved recently.

Figure 2: Town of Tangier Transportation Infrastructure Inundation Vulnerability



Transportation on the island is by foot, bicycle, golf cart, 4-wheeler, ATV, or motorcycle. Vehicles available to households is typically an indicator of a household's ability to evacuate, but not for the Town of Tangier. The number, size, and condition of the boats owned would provide a more appropriate insight as to the residents' ability to evacuate in the face of an approaching hazard, as the majority of residents have their own boats (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

The streets are not conducive to regular automobile traffic, although the 2019 ACS estimates indicated that there were 77 vehicles on the Island. Tangier has 3 miles of narrow roadway (*Town of Tangier Comprehensive Plan*, 2001), all of which are susceptible to becoming inundated with a one-foot rise in water level above mean 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 (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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. The Fire Department has 20-25 volunteer firefighters and one paid part-time EMT. 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 ambulance and a John Deere equipped with a stretcher when the ambulance cannot fit down narrow lanes (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

The State of Maryland provides emergency airlift services by helicopter. The Town is actively seeking one full-time police officer to be on call 24 hours a day. Tangier also has an agreement with the Virginia Marine Resources Commission (VMRC) whereby the one VMRC officer that lives on Tangier can provide back-up response in the absence of a permanent officer (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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. There are two registered nurses that are residents of the Town and a full-time nurse practitioner. A dentist visits the Town regularly and an optometrist visits six times each year (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

Figure 4: The Tangier Health Center - Constructed in 2010. Photo by Shannon Alexander

PARKS AND RECREATION

There is a neighborhood facility near the airport which provides an area for recreation, two conference rooms, and a kitchen. A baseball field was completed in 2018 for use by the school and community residents (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 (USACE) maintains channels 8-foot-deep, 100-foot-wide, and 1,300-foot-long in Tangier Sound and also 8-foot-deep, 60-foot-wide, and 4,800-foot-long to an anchorage basin 400-square-foot and 7-foot-deep adjacent to the Town.

There have been several dredging projects to ensure the safe navigation of vessels into the harbor. Typically, the Channels are dredged by the USACE at least every five years. With new technologies in alternative dredge spoil use, this is something that should be considered in efforts to reduce erosion and improve resiliency. A contract was issued in 2020 to construct a 685-foot-long stone jetty at the northern end of the seawall and the southern end of the Uppards to protect the harbor and increase navigability in the Channel. (See Coastal Erosion Section)

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, open in 2007, also operates a small community library, provides free maps, contains public restrooms, and is responsible for the historical markers that line the streets, allowing visitors to do a self-guided history tour of the Island.

The Town is looking into opening public restrooms year-round due to all others being closed in the off-season and on Sundays (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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.

A public beach with a foot bridge is also located in Town at the end of West Ridge past the Jetty and B&B (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 (*Town of Tangier Comprehensive Plan*, 2001).

The sewage treatment plant serves all the homes and businesses in the Town (*Town of Tangier Comprehensive 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 or more times a year to bring to the mainland (*Town of Tangier Comprehensive Plan*, 2001; Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 are two employees of the power company that are year-round residents (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

Figure 7: Electric substation. Photo by Shannon Alexander

The microwave tower, built near the water tower, brought Dish Direct and internet to the Island. High speed internet was made available in the Spring of 2010.

The Town is in the process of having broadband connected to the island. This will be beneficial in several ways, as VMRC is doing away with paper notices and will be completing all work online. Once the cables are run and climbers complete the antennae, it is estimated to take one to two weeks for all residents to be hooked up (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

SCHOOLS

There is only one school on the Island which serves approximately 60 students total in all grade levels. 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

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 with the highest elevation less than 6 feet above sea level and slopes effectively 0% (*Town of Tangier Comprehensive Plan*, 2001). The Island is comprised of beaches, marshes, and three sand ridges and is surrounded by tidal waters and cut by tidal creeks and guts.

LAND USE LAND COVER

The majority of Tangier is low marshland and very little of the Island is habitable. Nearly all development is located on the three sand ridges, Main Ridge, West Ridge, and Canton Ridge. Canton Ridge is the eastern-most ridge and is entirely residential, while West Ridge is primarily residential (*Town of Tangier Comprehensive Plan*, 2001). Nearly all commercial development and some residential development is located on Main Ridge. Soils along West Ridge are poorly drained and typically have severe limitations when it comes to development.

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 (*Town of Tangier Comprehensive Plan*, 2001). Tangier's fishermen rely on good water quality to provide healthy crabs for the year. 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 their 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 fishermen (*Town of Tangier Comprehensive Plan*, 2001).

Figure 9: Marsh view from bridge. Photo by Shannon Alexander

HAZARD PREPAREDNESS & COMMUNITY CAPABILITIES

PREVIOUS HAZARD MITIGATION PLANS

§201.6(b)(3), §201.6(c)(3), §201.6(d)(3) 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. The Town began participating in the hazard mitigation planning process in 2006. The Town's comprehensive plan was last updated in 2001.

Table 5 : Town of Tangier Hazard Mitigation Resources

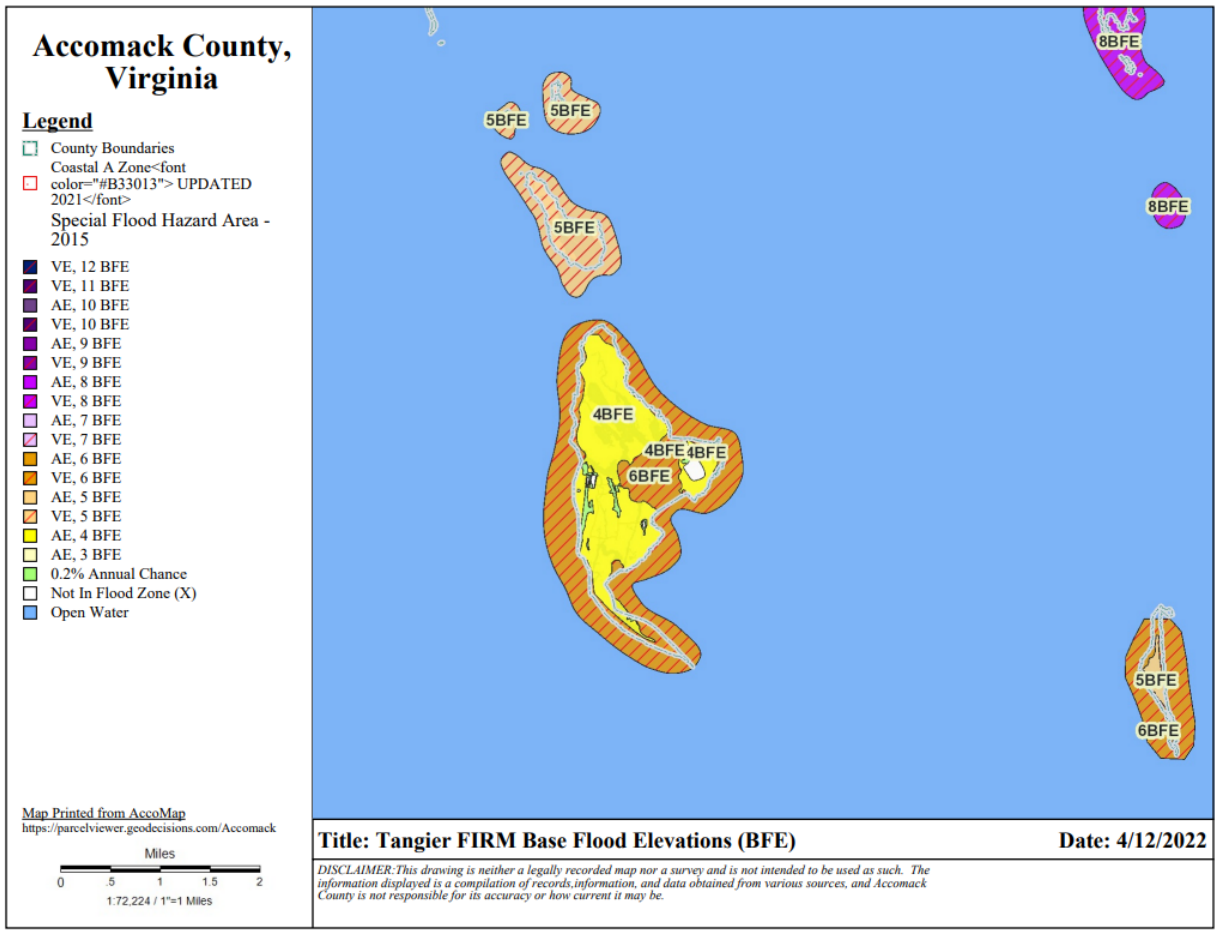
	Ordinances, Plans, & Publications															Resources, Committees			
Authority	Building Code	Chesapeake Bay Act	SWMP	Hazard Mitigation Plan	Comprehensive Plan (updated	Zoning (updated 1992) &/or Subdivision Ordinance	Storm Water Regulations	Transportation Infrastructure Inundation Vulnerability Report	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	Climate Adaptation Working Group	ES Disaster Preparedness Coalition
Local					*	*													
County	*		*																
Regional				*				*	*	*	*			*		*	*	*	*
State		*					*						*						
Federal		*																	

NATIONAL FLOOD INSURANCE PROGRAM & HAZARD MITIGATION GRANT PROGRAM

NFIP

§201.6(c)(2)(ii), §201.6(c)(3)(ii), §201.6(d)(3) The Town joined the NFIP on October 15, 1982. There are 49 policies with 107 claims for the Town. Between May of 2011 and January of 2016, 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. More information on repetitive loss properties, NFIP policies and claims, and the CRS program can be found in Chapter 6: Coastal Flooding and Chapter 9: The Region.

Figure 10: Town of Tangier FIRM Base Flood Elevation (BFE)



According to the 2015 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. 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. There are still a few houses prone to flooding that are waiting to be raised (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 and are located in the southeast corner. 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 that cannot be expended in this area include: disaster assistance, Community Block Development Grants (CDBG), flood control projects, construction of new federal highways, and beach nourishment projects.

HMGP

The Town has not managed a grant under the HMGP. 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 (Personal communications, Eastern Shore Housing Alliance Staff, June 13, 2016).

HAZARD PROFILE

§201.6(c)(2)(i), §201.6(c)(2)(ii), §201.6(d)(3) Coastal erosion has the greatest and most frequent impact on the Town.

PANDEMIC RESPONSE AND READINESS

The Town of Tangier was affected by the COVID-19 Pandemic in several ways and implemented policies and changes to help combat the virus.

Tangier Combined School immediately shut down on March 13 and seniors graduated at the airport located on the Island. The 2020-2021 school year consisted of two virtual days. Churches shut down, resulting in the temporary absence of the local foodbank, located in the Town's Sunday School building. The Town switched to virtual meetings and followed state mandates regarding masks, social distancing, indoor dining, etc. Ferries transporting residents and visitors to and from the Island had limited capacity or did not run at all. Seasonal ferry trips began late in the summer. Those with limited capacity also made the same number of trips, therefore limiting access to the Island for visitors. CARES Act and other federal funding was spent to help the community. The first round of funding was put towards small businesses and waterman grants. The second round was used to purchase additional masks, sanitizer, cleaning supplies, and anything else that may have been needed (Personal communications, Laure Thomas, Town Manager, April 29, 2021).

WIND

§201.6(c)(2)(i), §201.6(c)(2)(ii), §201.6(d)(3) The entire Town is located in the wind-borne debris hazard area. This area extends one mile inland. Figure 11 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, 3% of the estimated losses is related to business interruption from winds during a 1-percent-annual-chance event. Figure 11 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 that occur from time to time (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 Town'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 and eroding at an annual rate of 15 feet (www.virginiaplaces.org).

Due to increasing rates of land loss, only 33.25% (about 790 acres) of the 1850 island mass is remained as of 2013 (Schulte et. al, 2015). By 2017, 22 more acres were lost (www.phys.org). 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. It is estimated that 75% of the land mass in 1850 disappeared by 2015 and less than 10% of the remaining land above water is currently habitable (www.virginiaplaces.org).

A seawall was built to stabilize the western shoreline of the Island and has prevented significant further erosion from occurring in this area; however, due to repeated storm action, the seawall has a history of accruing damage and needing repair, with the most recent repairs occurring in October 2020. The wall now sits at approximately 580-590 feet (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). Shoreline erosion, primarily from wind driven waves and ice sheets, was so great on the western side of the Island that it was threatening to damage the airport runway. It is important to maintain this protective asset and complete needed repairs as quickly as possible.

After Hurricane Sandy in 2012, Governor McDonnel and officials from the USACE pledged to build a jetty to reduce erosion and increase navigability in the Tangier North Channel. The feasibility phase was completed by the USACE in 2012 and indicated a total project cost of less than $4.5 million and follows the 1995 design plan. The jetty protects 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 (USACE, 2012). In May of 2020, a contract was issued for $2.9 million to construct a 685-foot-long stone jetty at the entrance of the Tangier Island Federal Navigation Channel, located on the western side of the Island (www.nao.usace.army.mil). The new jetty provides an added layer of protection from wave action in the channel and where vital crab-processing facilities and fishing vessels are located. Limiting wave action helps to reduce the risk of damage to these facilities and vessels during storms.

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. In 2011, the Tangier Channel was dredged again, when 86,000 cubic yards were removed, for a total cost of just over $1 million. The Tangier Channels were surveyed by the USACE in their FY2014 and were scheduled to be dredged in FY2017; however, this did not happen. Typically, the Channels are dredged by the USACE 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.

Due to unsafe navigable conditions, there was emergency dredging at the mouth of the harbor by the Virginia Port Authority in October of 2020. A one-time dredging waiver for the USACE to dredge in May of 2021 was issued. By October 2021, dredging of the entire mouth and channel is scheduled to be completed (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

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 an increased risk from wind damage as well as flooding damage. In October of 2021, the Department of Forestry and the Town of Tangier will be planting trees and shrubbery near the jetty and the beach in order to help mitigate future erosion. There are also plans to plant additional trees and shrubs once the area behind the jetty has been filled in (Personal communications, Laurie Thomas, Town Manager, April 29, 2021).

COASTAL FLOODING

The Flood Insurance Study (FIS) for Tangier identifies that the greatest threat of flood inundation comes from hurricanes and nor'easters. 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 Ridge Road, past the school, on Mailboat Harbor, the south end of Canton Road, South Main Ridge Road, 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. Today, that number has likely increased. In a 100-year storm these homes are the most vulnerable to damage.

In addition to nearly 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 (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). The primary harvest is Atlantic blue crab (*Town of Tangier Comprehensive Plan*, 2001), but 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, while 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 did not have any individuals employed in construction in 2019 (ACS 2014-2019). 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. Out of 85 crab houses, approximately 34, or 40%, were destroyed or significantly damaged. 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 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, whereas 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 a large portion of the harvest time corresponding along with hurricane season.

Figure 12: Crab and watermen houses on Tangier can easily be damaged during storms, such as Hurricane Isabel. Photo ©2016 Gordon Campbell/At Altitude Gallery

Other than the crabbing industry, tourism has also become a larger part of the local economy of Tangier. The tourism industry is primarily located around Mailboat Harbor and south along Main Ridge Road. 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 would be significant to include direct building losses and business interruptions. The Hazus® model estimates that a total of 9,343 tons of debris will be generated in a 1-percent-annual-chance flood event. Approximately 374 truckloads would be needed to

remove the debris. The Eastern Shore of Virginia Coastal Flood Vulnerability Assessment in 2011 estimated $4.2 million in building damages.

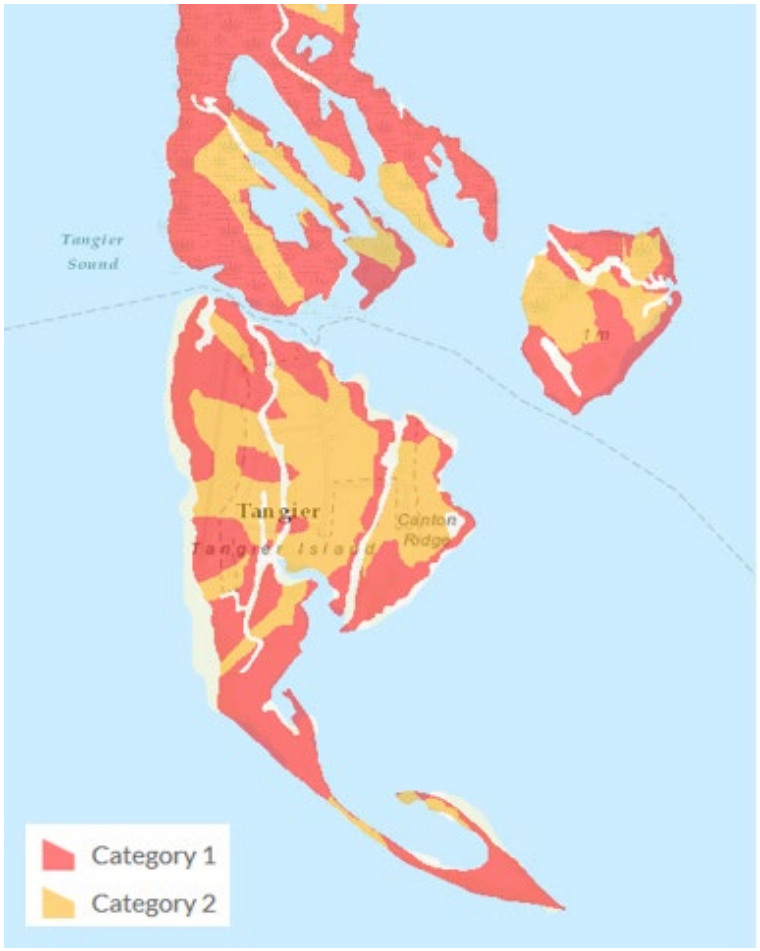
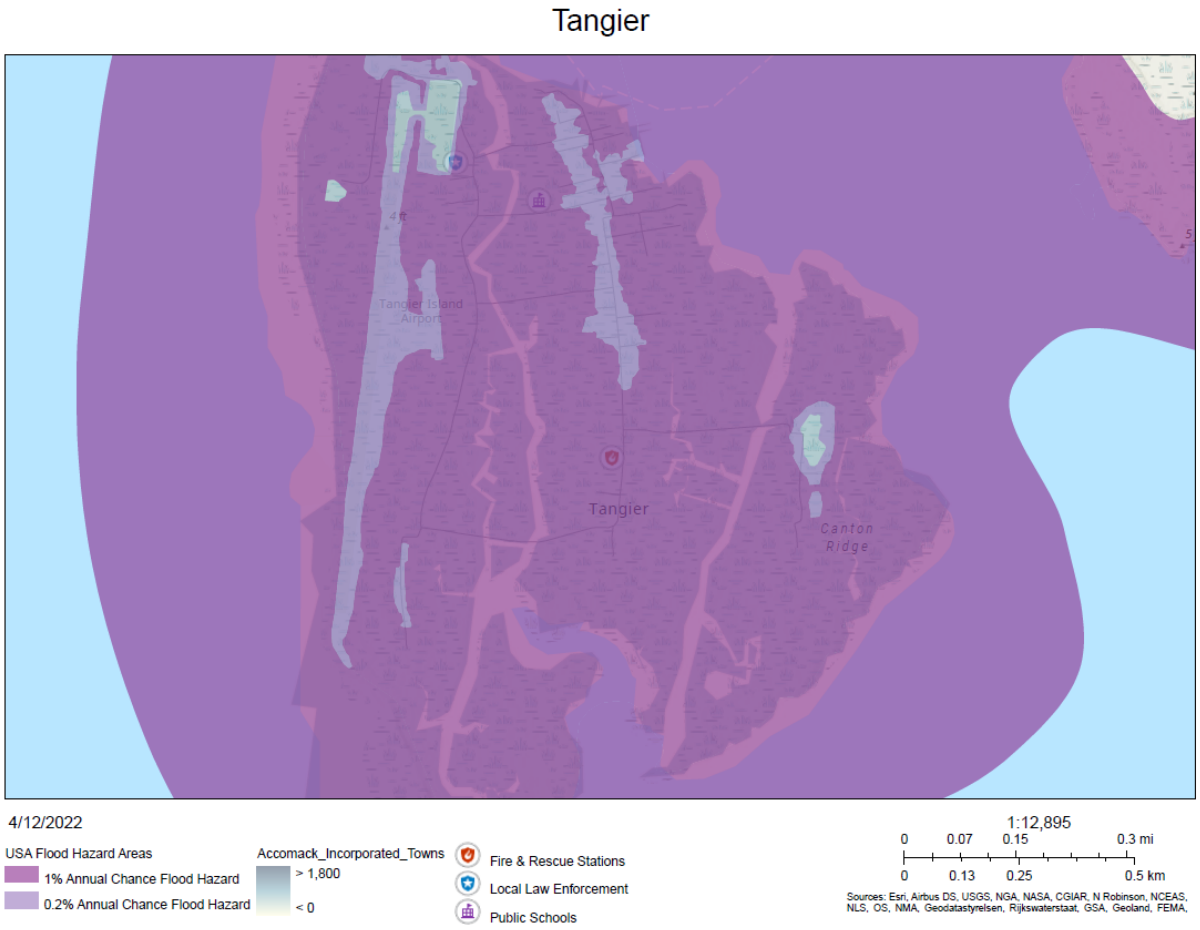


Figure 13: Estimated Hurricane Impacts; Source: Virginia DEM Storm Surge Tool

In 2016, it was indicated that historically and generally, residents have only evacuated the Island for storms of Category 2 strength or greater (Personal communications, Renee Tyler, Town Manager, June 16, 2016). 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 other than an off-road ATV; however, with high projected rates of relative sea level rise, it is likely that storms of lower intensity will have higher impacts.

Figure 14: Town of Tangier Flood Hazards to Infrastructure

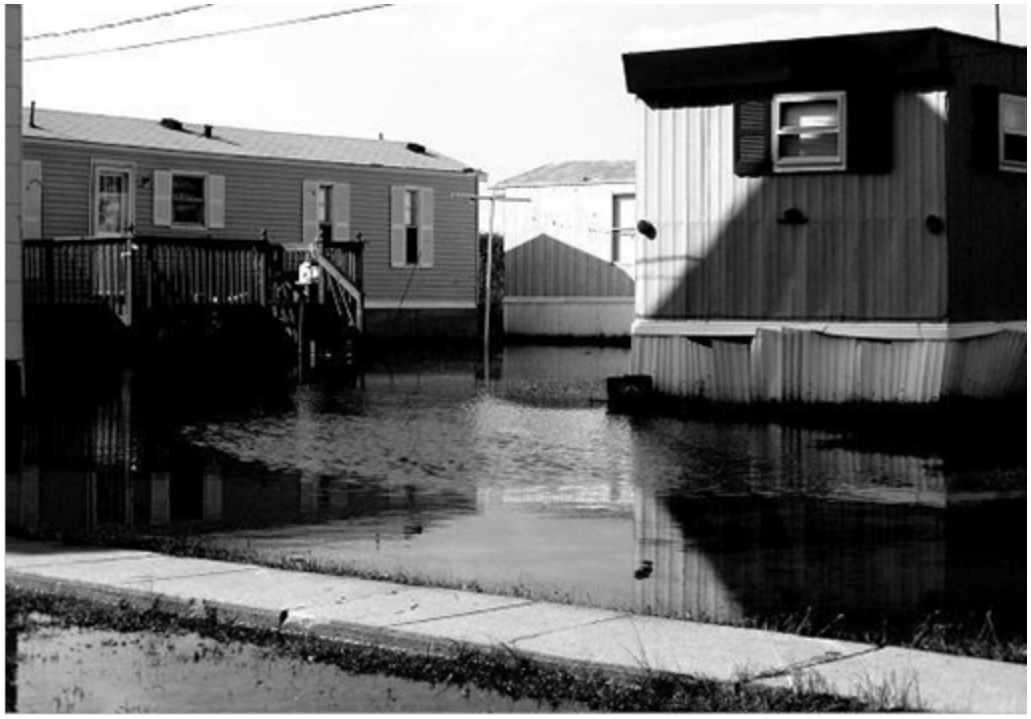


STORM WATER FLOODING

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 (*Town of Tangier Comprehensive 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 Main 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 15: Flood water ponding around homes on Tangier after Hurricane Isabel in September 2003. Photo by Deborah Mills



HAZARDS OF LOCAL SIGNIFICANCE

Other hazards for Tangier Island 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. In January of 2019, water distribution pipes froze and burst, causing 150,000 gallons of water from the water tower to drain out. Residents collected seawater in order to flush toilets and the fire hydrants were left dry for nearly three weeks (www.virginiaplaces.org). These freezes continue to happen unpredictably, as it did in 2003 (Figure 15) and in 2014.

Figure 16: 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. 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 five epidemics on Tangier 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. In the 1880s, it 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, as seen with the recent COVID-19 outbreak.

In March of 2019, the COVID-19 pandemic struck. The Town of Tangier managed to not have a single positive COVID-19 test for eight months. In November of 2019, the first Town resident tested positive and the virus quickly spread throughout the Town, resulting in two deaths (Personal communications, Laurie Thomas, Town Manager, April 29, 2021). The positivity rate was nearly triple that of the national rate and was likely even higher, as several symptomatic residents self-quarantined and were never tested. Tangier immediately took action and put in place strict mask mandates and social distancing rules. Tangier Combined School, both churches, and nearly all businesses temporarily closed while residents quarantined to combat the spread of the virus.

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, Tangier 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 17: The Tangier History Museum. Photo by Shannon Alexander

Table 6: Town of Tangier Critical Facilities

Facility	HMP 2006	HMP 2011	HMP 2016	HMP 2021	Hazards	No of People Affected	Loss potential	Relocation Potential	Retrofit Potential
Town Owned Facilities									
Tangier Town Office	X	X	X	X	Erosion Flooding Wind	506+	Devastating	Yes	Yes
Tangier Sewage Plant	X	X	X	X	Erosion Flooding Wind	506+	Devastating	No	Yes
Tangier Water Tower	-	-	X	X	Erosion Wind	506+	Devastating	No	Yes
Other Facilities (Not Town-Owned)									
Tangier Fire & Rescue Department	X	X	X	X	Erosion Flooding Wind	506+	Devastating	No	Yes
ANEC (power station)	X	X	X	X	Erosion Flooding Wind	506+	Devastating	No	Yes
Tangier Airport	X	X	X	X	Erosion Flooding	506+	Major Disruption	No	Yes
Tangier Combined School	X	X	X	X	Erosion Flooding Wind	506+	Major Disruption	No	Yes
Tangier Museum	-	-	X	X	Erosion Flooding Wind	506+	Major Disruption	Yes	Yes
Tangier Harbor	-	-	X	X	Erosion Flooding Wind	506+	Devastating	No	Yes
Tangier Health Center	X	X	X	X	Erosion Flooding Wind	506+	Major Disruption	No	Yes
Post Office	-	-	X	X	Erosion Flooding Wind	506+	Major Disruption	Yes	Yes
Gym	-	-	X	X	Erosion Flooding Wind	506+	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. A new jetty was constructed to help protect the harbor. In addition to shoreline stabilization, regular dredging of the channels and maintenance of the seawall should be considered in efforts to improve resiliency of the Island. The Town, with the help from the Department of Forestry, intends to plant trees and shrubbery around the jetty to further mitigate erosion.

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 2015 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.

7. Freezing conditions on the Island can affect the seafood industry and prevents the delivery of essential items to Island residents.