

Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment (TIIVA)

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To utilize best-available data in order to assess the long-term vulnerability of inundation on regional transportation infrastructure.

## Answering key long-term planning questions:

 <u>Where?</u> → VDOT Road Centerline data & NOAA Sea Level Rise/Coastal Flooding Model (uses highresolution LiDAR)

• How is access to communities impacted?

• <u>When?</u> → VA sea-level projections (*VIMS Recurrent Flooding Study, 2013*)

Study conducted in partnership with VDOT

First regional study of its kind in Virginia



### Where will inundation occur?

### **VDOT Road Centerline Data**

- Road network divided into segments from intersection to intersection
- Segments checked by ANPDC staff to verify accuracy compared to LiDAR data
- Separate datasets utilized during consideration of bridges and culverts

### NOAA Sea Level Rise Model

- Inundation levels from 0-6 feet in one foot increments
- Inundation levels measured above MHHW for 1983-2001
- Does not consider:
  - Astronomical or meteorological tides
  - Stormwater back-flooding
  - Storm surge
  - Groundwater conditions
  - Erosion/accretion
  - Land subsidence
  - Assumes no construction



### Where will inundation occur?



<u>Oft.</u> •Current MHHW conditions (light green) •No segments inundated •Bridge segment postprocessed by ANPDC staff <u>1 ft.</u> ments inu

•2 segments inundated (highlighted red)
•Segment north of bridge initially shown as inundated prior to post-processing by ANPDC staff <u>2 ft.</u>
Same 2 segments from 1 ft. scenario inundated (red)
2 new segments inundated (green)

# 

## How is access to communities impacted?

### <u>A-NPDC Staff:</u>

- 1. Worked with County staff to develop list of communities and critical facilities to be assessed
- 2. Identified number of access routes
- 3. Assessed accessibility under inundation scenarios from 1-6 ft.:
  - <u>Not Impacted</u>
  - <u>Access to Community Limited (at least</u> one access route inundated) and <50% of roads in community inundated)
  - <u>Disconnected/Inaccessible</u> (all access routes inundated and <50% of roads in community inundated)
  - <u>Majority of Roads Inundated (>50% of</u> roads in community inundated)



## 

## When is this projected to occur?

## VA Sea-level Projections:

- Includes measurements from 1992-2009 and projections to 2100
- Based on 2014 National Climate Assessment curves
- Adjusted for the annual local subsidence rate in Wachapreague (1.6 mm/yr) based on Holdahl & Morrison 1974 study
- VIMS recommends using high curve

Ranges of dates for the highest, high, and low curves were used based on consensus recommendation of ESVA Climate Adaptation Working Group.



# Regional Maps



2.5

#### Potential Inundation

- 1 Foot (≈2025-2050) → Railroads 2 Feet (≈2045-2090) → Road Centerlines 3 Feet (>2060) 4 Feet (>2070)
- 5 Feet (>2080)
- 6 Feet (>2090)



Disclaimer: The context of this may reflects the siews of the Accumuck-Barthampton Planning District Commission (A-BPEC) and does not necessarily reflect the official siews of policies of the Virginia Department of Transportation (PDOT). This may does not constitute a standard, specification, or regulation and is intended for iong-term planning parposes only. Do not attempt to use this may during stars accumulates are able emergencies.

Explanation: The highlighted roads illustrate scenarios where at least one location of the road segment is projected to become completely insudated by see-level rise. See-level elevations are measured above mean higher high water (MINTM). Data included in this may are derived from the National Ocum and Atmospheric Administration (NCAA) Option Cost is an level Rise and Coantal Impacts model. Estimated dates of invadations were extracted from rea-level rise projected in adjusted for the annual local analytic rise in Webaprengue, Virginia (L.B. mar/pear) based on Holdell and Morrise (1997). This project was fauded by the Virginia Coantal Tace Minargement Program at the Department of Environmental Gaulty through Grant # NA1 MOS4190135 of the 0.5. Department of Constrance, NDA4, under the Coastal Tace Minargement Act of 1972, as anomalist.





- Potential Inundation
- 1 Foot (≈2025-2050) → Railroads
- 2 Feet (≈2045-2090) ----- Road Centerlines
- 4 Feet (>2070)
- 5 Feet (>2080)



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#### Potential Inundation

1 Foot (≈2025-2050) → Railroads 2 Feet (≈2045-2090) Road Centerlines 3 Feet (>2060) 4 Feet (>2070) 5 Feet (>2080) 6 Feet (>2090)

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#### Potential Inundation

= 6 Feet (>2090)

1 Foot (≈2025-2050) → Railroads
 2 Feet (≈2045-2090) Road Centerlines
 3 Feet (>2060)
 4 Feet (>2070)
 5 Feet (>2080)

![](_page_10_Picture_3.jpeg)

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- Potential Inundation
- I Foot (≈2025-2050) → Railroads
- ----- 2 Feet (≈2045-2090) ----- Road Centerlines
- 4 Feet (>2070)
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#### Potential Inundation

1 Foot (≈2025-2050) → Railroads 2 Feet (≈2045-2090) Road Centerlines 3 Feet (>2060) 4 Feet (>2070) 5 Feet (>2080) 6 Feet (>2090)

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## Town Maps

![](_page_14_Figure_0.jpeg)

8.0

#### Potential Inundation

![](_page_14_Figure_2.jpeg)

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Explanation: The highlighted roads illustrate scenarios where at least one location of the road segment is projected to become completely inundated by sea-level rise. Sea-level elevations are measured above mean higher high water (MMHW). Data included in this map are derived from the National Ocean and Atmospheric Administration (NOAA) Digital Coast Sea Level Rise and Coastal Impacts model. Estimated dates of hundration were extracted from sea-level rive projected to a doubted for the annual local subsidence rate in Wochopreague, Virginia (1.6 mm/year) based on Holdrah and Morrison (1974). This project was funded by the Virginia Coastal Zene Managament Program at the Department of Environmental Quality through Grant # NA13NO3+190135 of the U.S. Department of Commerce, NOAA, and rive Coastal Zene Managament Act of 1972, in annoted.

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VDOT

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2 Feet (≈2040-2070) - 6 Feet (> 2085)

- Road Centerlines

3 Feet (≈2055-2100) ----- Railroads

4 Feet (> 2065)

![](_page_16_Figure_0.jpeg)

![](_page_17_Figure_0.jpeg)

0.5

![](_page_17_Figure_1.jpeg)

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VDOT

A-NPDC

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![](_page_19_Figure_0.jpeg)

0.25

#### Potential Inundation

1 Foot (≈2025-2050) → Railroads 2 Feet (≈2045-2090) Road Centerlines 3 Feet (>2060) Town Boundary 4 Feet (>2070) 5 Feet (>2080) 6 Feet (>2090)

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A-NPDC

Community Accessibility Maps

![](_page_21_Figure_0.jpeg)

![](_page_22_Figure_0.jpeg)

![](_page_23_Figure_0.jpeg)

![](_page_24_Figure_0.jpeg)

![](_page_25_Figure_0.jpeg)

![](_page_26_Figure_0.jpeg)

		Accon	<u>nack Count</u>	<u>y</u>				
	# of							
Community/Critical Facility	Access	1 feet	2 feet	3 feet	4 feet	5 feet	6 feet	
	Routes	(≈2025-2040)	(≈2040-2070)	(≈2055-2100)	(>2065)	(>2075)	(>2085)	
Assawoman	3	, ,	, , , , , , , , , , , , , , , , , , , ,	, í	- ` <i>` '</i>	, í	, <i>,</i>	
Baileys Neck	1							
Battle Point/Baylys Neck	1							
Belle Haven	4							
Bell Neck	1							Leaend
Bloxom	4							
Captains Cove	3							Community
Cashville	2							Community
Cedar View	1							Access Not
Chincoteague	1							11000331100
Chincoteague Nat. Wildlife Refuge	1							<i>Impacted</i>
Crystal Beach	1							<b>T</b>
East Point	1							
Davis Wharf	1							Access to
Deep Creek	1							<b>C</b>
Gladding Landing	1							Community
Greenbackville	2							Limited
Guard Shore	1							Linueu
Guilford	3							
Hacksneck	1							
Harborton	1							Disconnected
Hopkins	1							
Henry's Point	1							/Inaccessible
Locustville	2							
Mount Nebo	3							
Nandua Bay	1							
NASA Wallops Flight Facility - Main Base	2							мајотну ој
NASA Wallops Flight Facility - Mid-	1							Roade
Atlantic Regional Spaceport	-							Nouus
North Chesconessex	1							Inundated
Pitts Creek Landing	1							
Poplar Cove	1							
Sanford	2							
Saxis	1							
Schooner Bay	1							
Tangier	0							
Trails End	1							
Quinby/Upshurs Neck	3							
Wachapreague	4							

								Communitu
	Continuanting							
	# of		Inundation	Access Not				
Community/Critical Facility	Access Routes	1 feet (≈2025-2040)	2 feet (≈2040-2070)	3 feet (≈2055-2100)	4 feet (>2065)	5 feet (>2075)	6 feet (>2085)	Impacted
Arlington Plantation	1							
Bayford	1							Access to
Cape Charles	2							
Cherrystone	1							Community
Church Neck	1							Limited
Clearview	1							Lintted
Franktown	4							
Johnsons Cove/Old Neck	1							<b>D</b> <sup>1</sup> ( <b>1</b>
Oyster	2							Disconnected
The Peacefuls	2							/Inaccessible
Red Bank	1							/ Indecessione
Vaucluse Shores	1							
Webbs Island	1							
Willis Wharf	2							Majority of
Wise Point Landing - ESVA NWR	1							Roads
								Inundated

<u>Legend</u>

### Sea Level Scenarios Above Current MHHW

Jurisdiction	Total Miles of Roads	1 foot (≈2025-2040)		2 feet (≈2040-2070)		3 feet (≈2055-2100)		4 feet (>2065)		5 feet (>2075)		6 feet (>2085)	
		Total Miles Inundated	% of Total in Jurisdiction										
Eastern Shore of Virginia	1516	33	2.2%	131	8.6%	209	13.8%	270	17.8%	319	21.0%	371	24.5%
Accomack County	1014	31	3.1%	115	11.3%	183	18.0%	236	23.3%	275	27.1%	316	31.2%
Town of Belle Haven	7	0	0.0%	0	0.0%	0	0.0%	0.11	1.6%	0.11	1.6%	0.32	4.6%
Town of Chincoteague	60	4	6.7%	38	63.3%	56	93.3%	60	100.0%	60	100.0%	60	100.0%
Town of Onancock	13	0	0.0%	0.43	3.3%	0.79	6.1%	1	7.7%	1	7.7%	1	7.7%
Town of Savis	4	0.25	6.3%	1	25.0%	2	50.0%	Д	100.0%	4	100.0%	4	100.0%

langier													
Town of Wachapreague	5	0.12	2.4%	0.12	2.4%	0.88	17.6%	2	40.0%	2	40.0%	5	100.0%
Northampton County	502	2	0.4%	16	3.2%	26	5.2%	34	6.8%	44	8.8%	55	11.0%
Town of Cape Charles	28	0	0.0%	0	0.0%	0	0.0%	0.2	0.7%	6	21.4%	8	28.6%

4

100.0%

4

100.0%

4

100.0%

4

100.0%

100.0%

4

Town of

4

4

100.0%

## Lessons Learned

![](_page_30_Picture_1.jpeg)

- VDOT's current engineering and planning horizons do not extend beyond 22 years for roads and 50 years for bridges
- Considering flooding, sea-level rise and inundation is currently not a widely used practice by VDOT
- VDOT has no policy for determining which roads will continue to be maintained based off the number of properties served by a road
- The Eastern Shore will be competing for funding to re-engineer roads with many other localities in Virginia

## Next Steps

- Report published February 2015
- Incorporate findings into 6-Year Transportation Plan and Long-Range Transportation Plan
- Continue working with VDOT to identify strategic plan for implementing necessary engineering work to mitigate inundation
- Distribute report and publish maps on VCZM Coastal GEMS portal and TNC's Coastal Resilience portal

![](_page_31_Picture_5.jpeg)