ESRI/ NAEP Virtual Webinar

November 16, 2021

Maryland Department Of Transportation

State Highway Administration

Incorporating Risk and Resilience with GIS at MDOT

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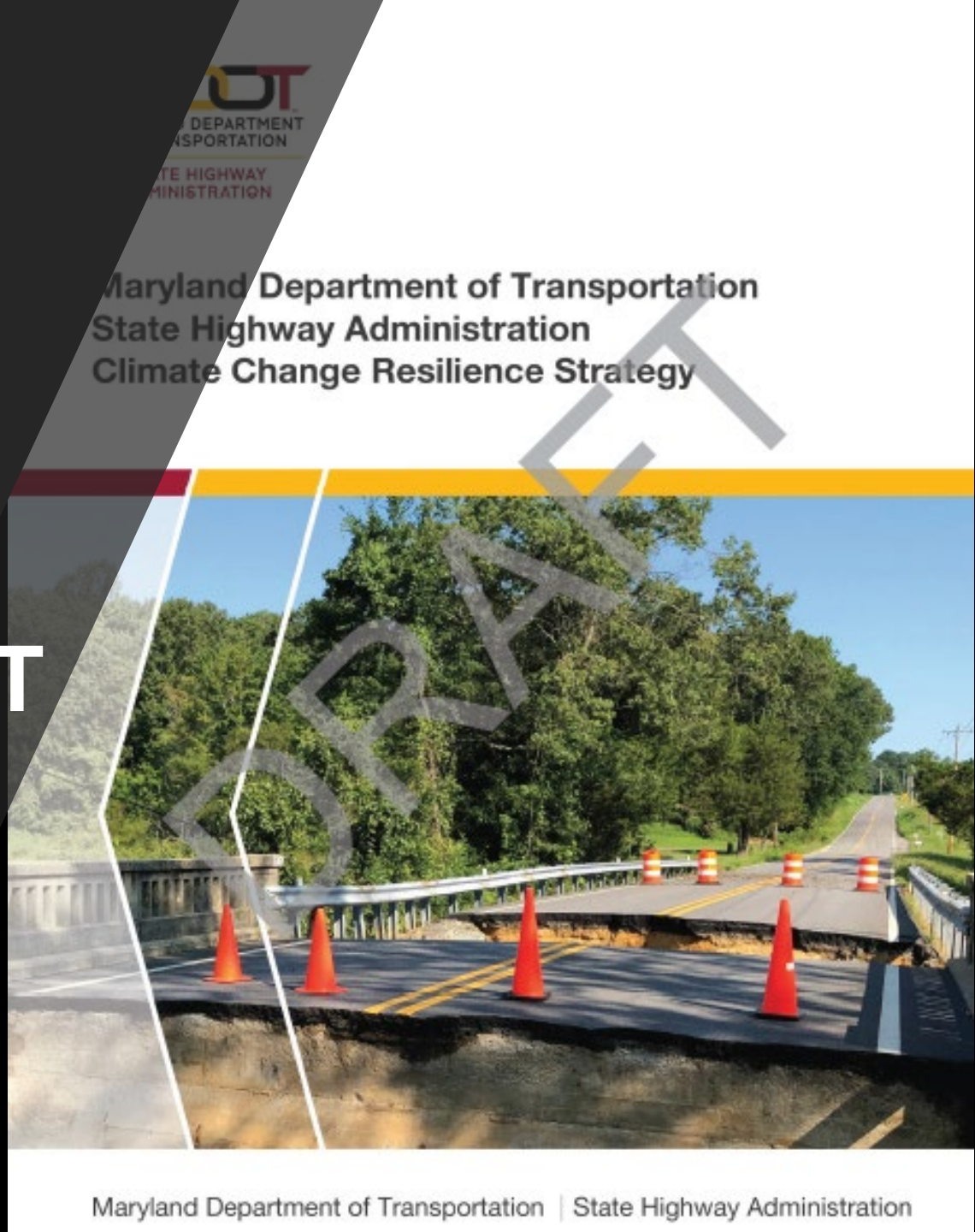

MDOT SHA Transportation infrastructure at risk to Extreme Weather and Climate Change including, increased flooding related to rising sea levels, increases in the occurrence of heavy precipitation events, and increased rainfall intensity:

- **Coastal areas**: Expected to experience dramatic increases in tidal flooding.
  - 0.8-1.6 ft sea level rise from 2000 to 2050; 2-4 ft through 2100
- **Inland**: Projected 11-18% increase in the amount of rain associated with the 10% annual chance 24-hr precipitation event (around Baltimore)

CLIMATE CHANGE IN MARYLAND

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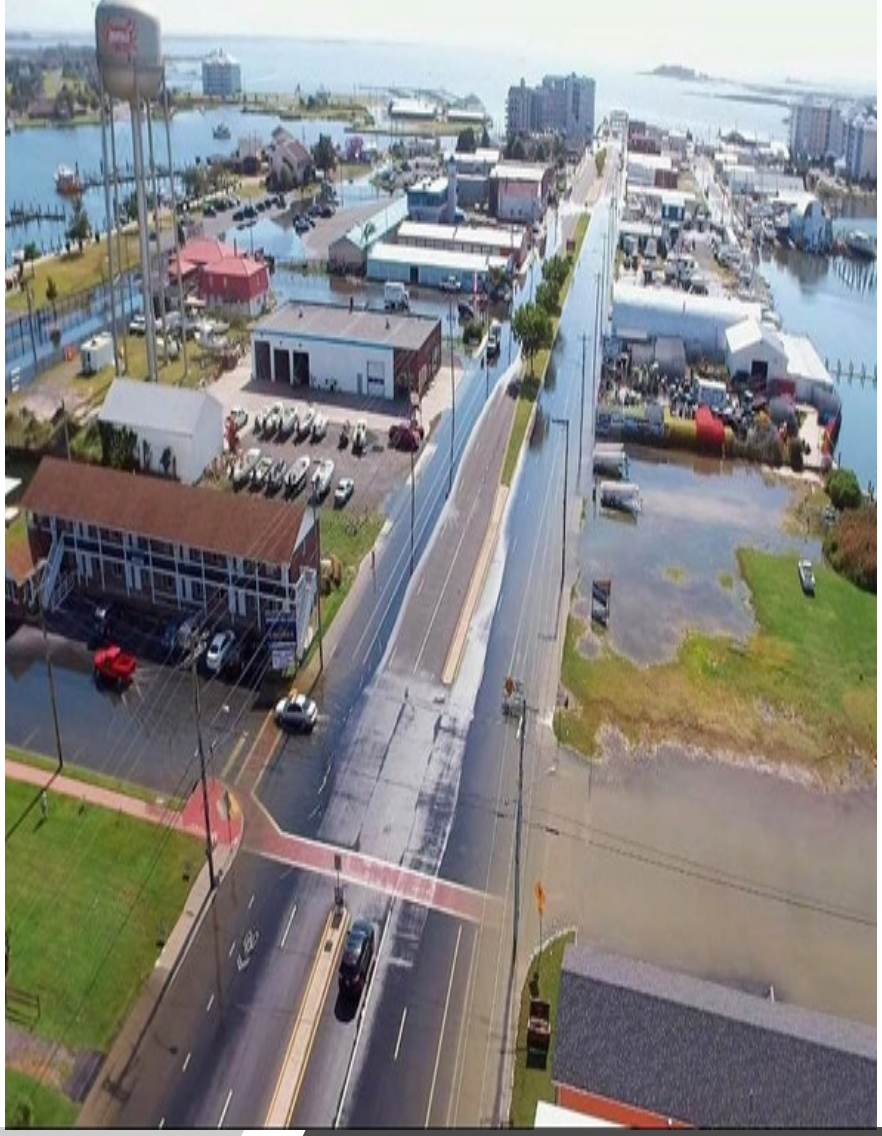
- MDOT SHA Climate Risk and Resiliency Program
  - Facilitates compliance with State and Federal requirements
  - Develops data and tools
  - Coordinates with stakeholders to implement processes and policies that minimize climates risks and optimize the maintenance of our assets

- State and federal policymakers are increasingly requiring MDOT SHA to take action, including:
  - “Coast Smart” siting & design criteria for new construction of structures or highway facilities.
  - Federal Regulation 25 CFR parts 515 and 667
  - 2015 Fixing America’s Surface Transportation (FAST) Act



MDOT SHA Climate Risk and Resilience Program

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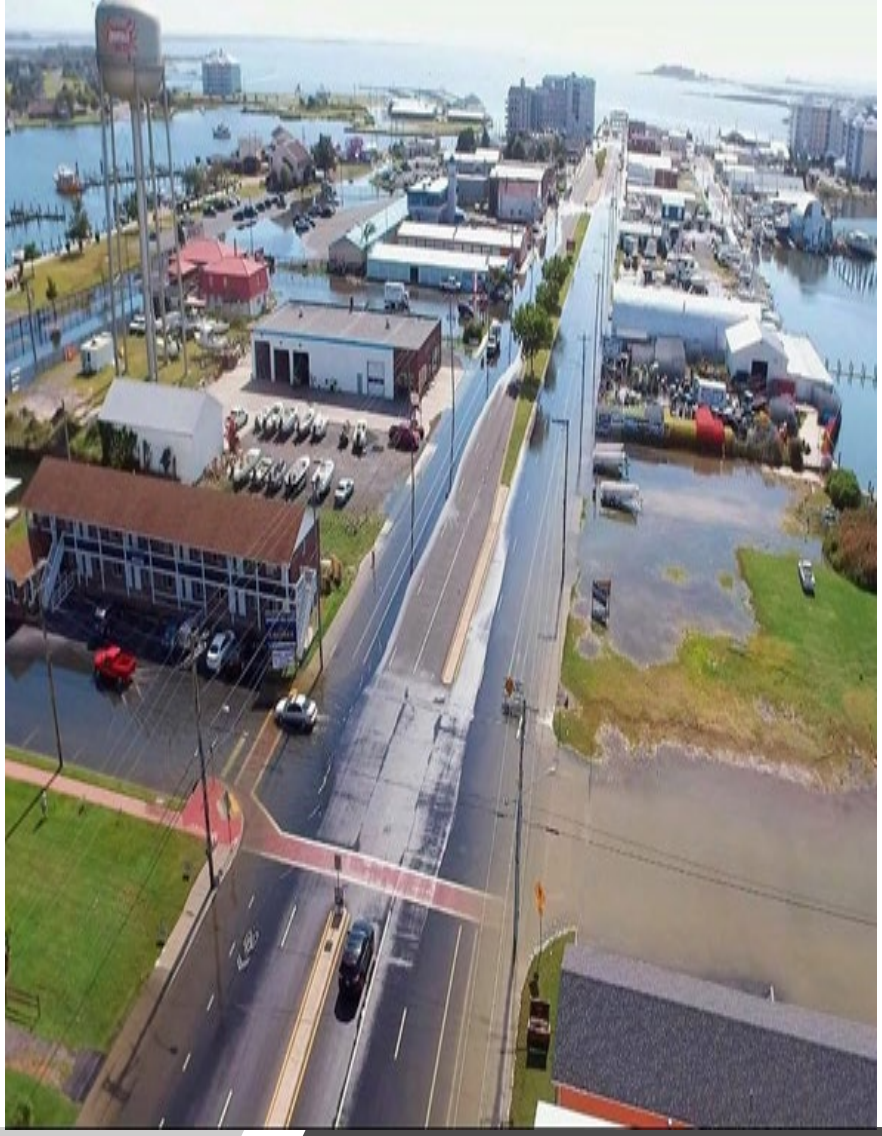
- Vulnerability Assessments
  - Bridge Vulnerability
  - Roadway Vulnerability
  - Corridor Vulnerability Pilot

- Transportation Network Criticality using GIS methodology



MDOT SHA Analyses

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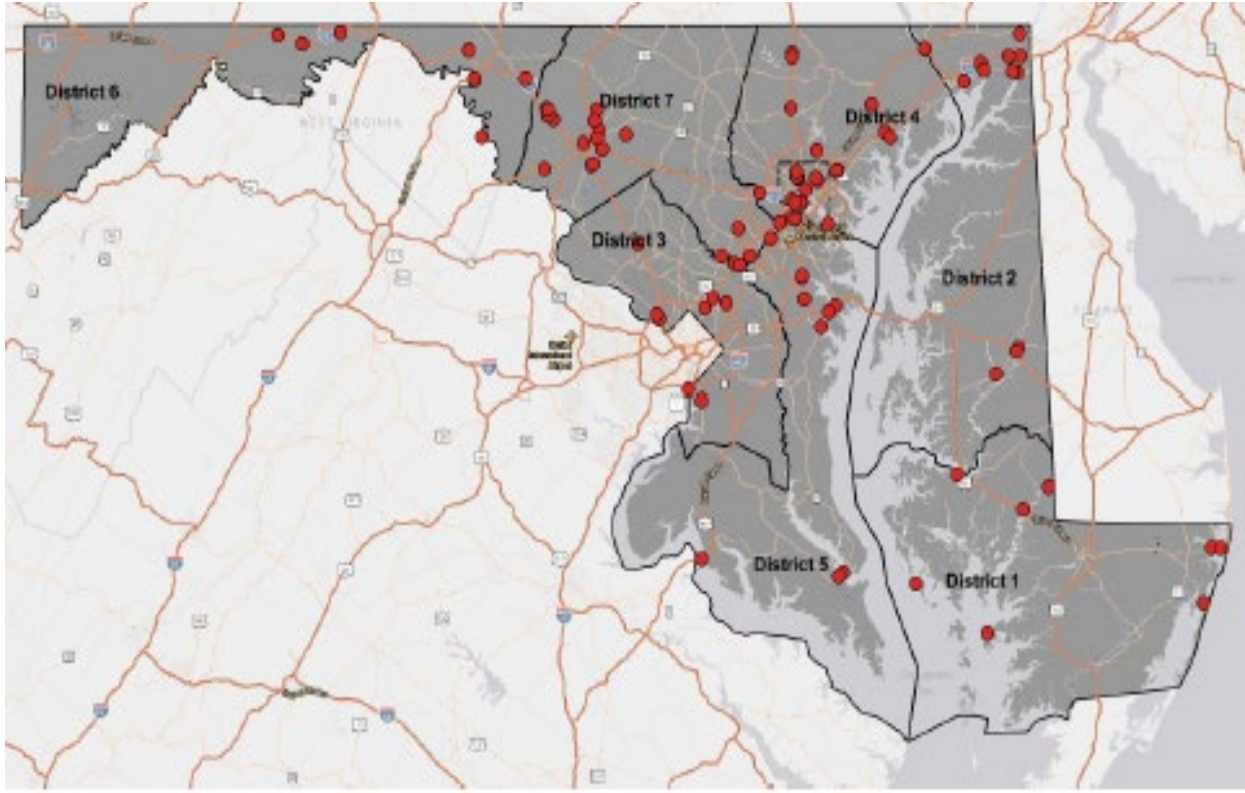
- 33 of 8,588 structures evaluated are highly vulnerable to sea level change.
- 172 of 8,588 structures evaluated are highly vulnerable to storm surge.
- 102 of 8,588 structures evaluated are highly vulnerable to precipitation change.
- Assets with high vulnerability to sea level change and storm surge are concentrated in Districts on the eastern shore of Maryland and on the bay.
- Assets with high vulnerability to precipitation change are spread across all Districts, with the highest concentration in Districts inland.



Bridge Vulnerability Assessment using VAST Tool

BRIDGE VULNERABILITY ASSESSMENT

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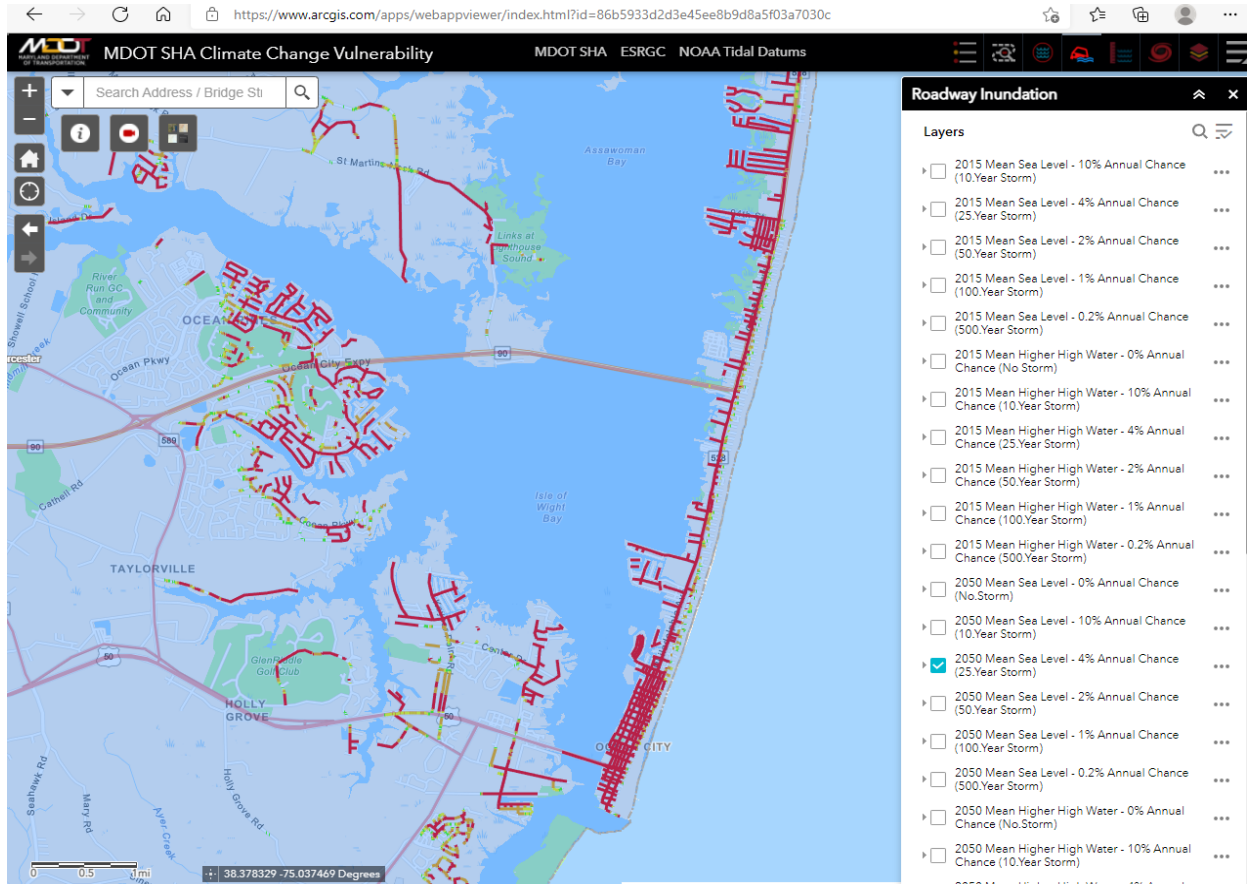
- Nearly 100 miles of roadway is expected to be permanently inundated by 2050, mostly in Dorchester and Somerset counties.
- The numbers are even higher if you look at the amount of roadway that would be flooded at high tide (aka Mean Higher High Water). There, we go from nearly 5 miles flooded at high tide today statewide, to over 290 miles by 2050. That's a nearly **60-fold increase**

Roadway Vulnerability Assessment – Hazard Vulnerability Index (HVI)



ROADWAY VULNERABILITY ASSESSMENT

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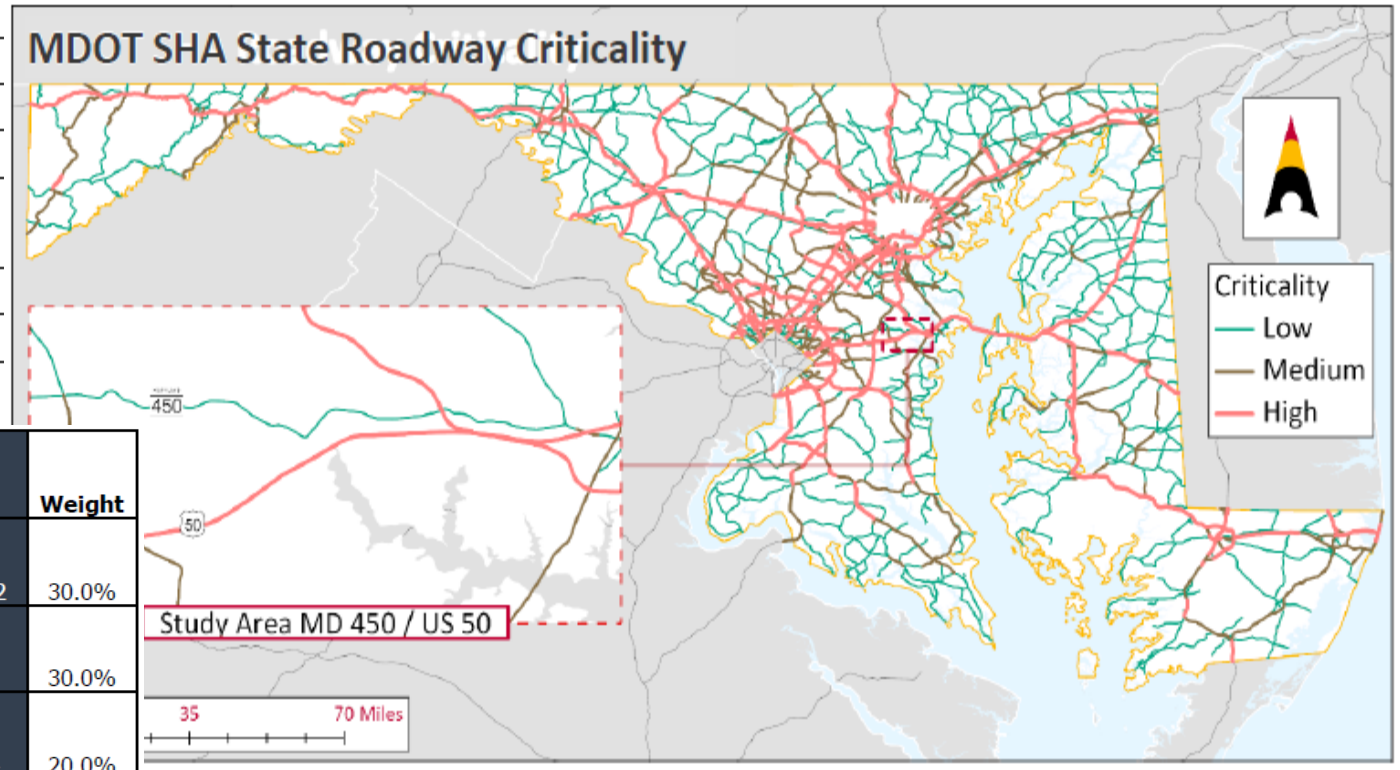
Criticality Criteria	Criticality Factor
Use and Operational	AADT
	AASHTO Functional Class
	Access to public transportation
Socioeconomic	Freight tonnage /Freight Revenue
	Tourism Revenue
	Significant tourism destinations
Health and Safety	Proximity to hospitals, Emergency operations
	Social Vulnerability Index (SOVI)
	Underserved population accessibility



	1 Very Low Impact	2 Low Impact	3 Moderate Impact	4 High Impact	5 Very High Impact	Weight
AADT	0 – 3,624	3,625 – 9,310	9,311 – 19,101	9,312 – 38,271	38,272- 267,232	30.0%
Functional Class	Minor Collector	Major Collector	Minor Arterial	Major Arterial	Interstate	30.0%
Freight Tonnage (1,000 tons)	0	1 - 102	103 -712	713 – 7,688	7,689 – 69,064	20.0%
SoVI	(-6.55) - (-5.66)	(-5.65) - (-3.06)	(-3.05) - (-1.91)	(-1.40) - (0.44)	(0.45) - (3.97)	10.0%
Redundancy	13 - 24	9 - 12	7 - 8	5 - 6	1 - 4	10.0%

Corridor Risk Assessment and Criticality

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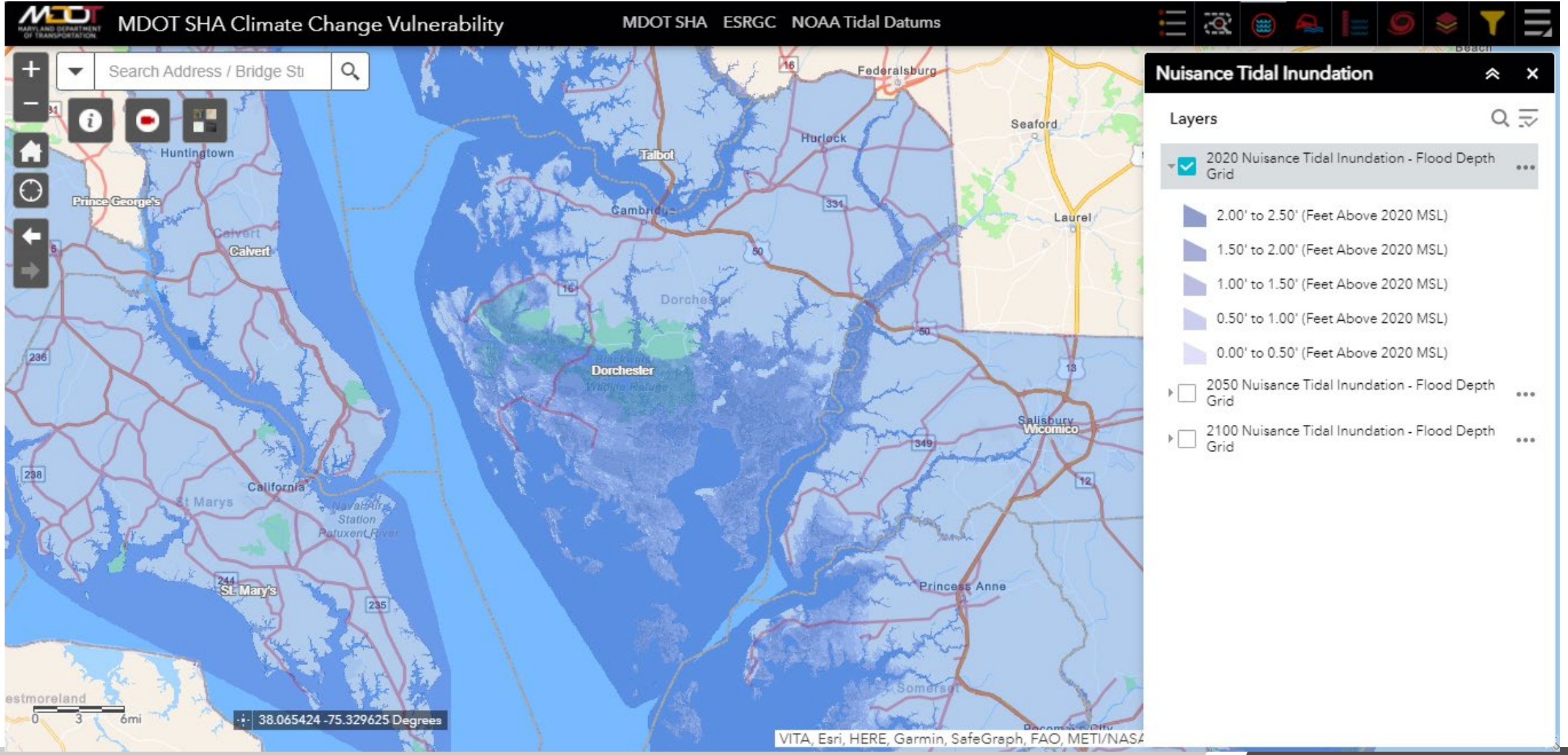

CLIMATE CHANGE VULNERABILITY VIEWER

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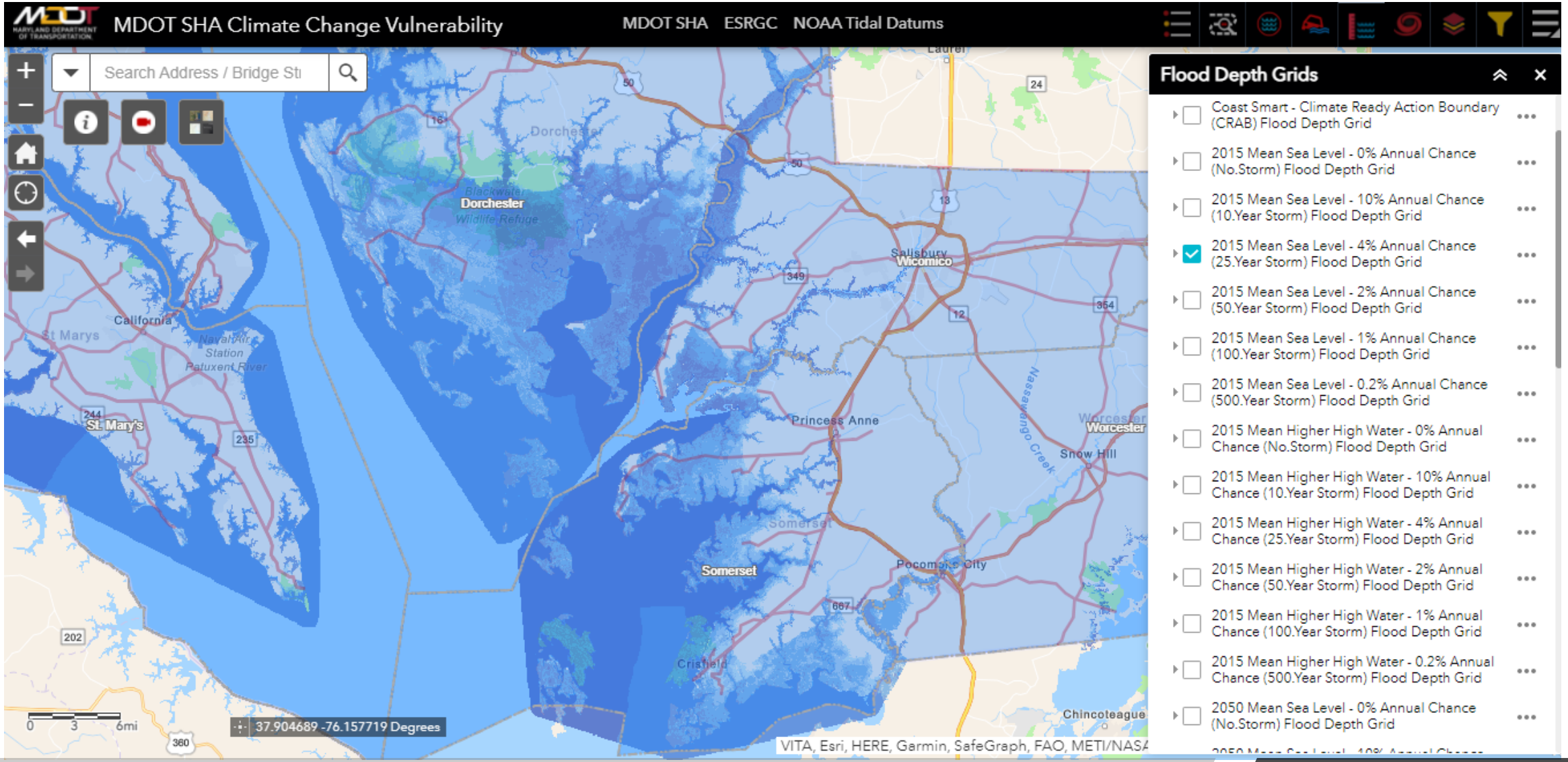

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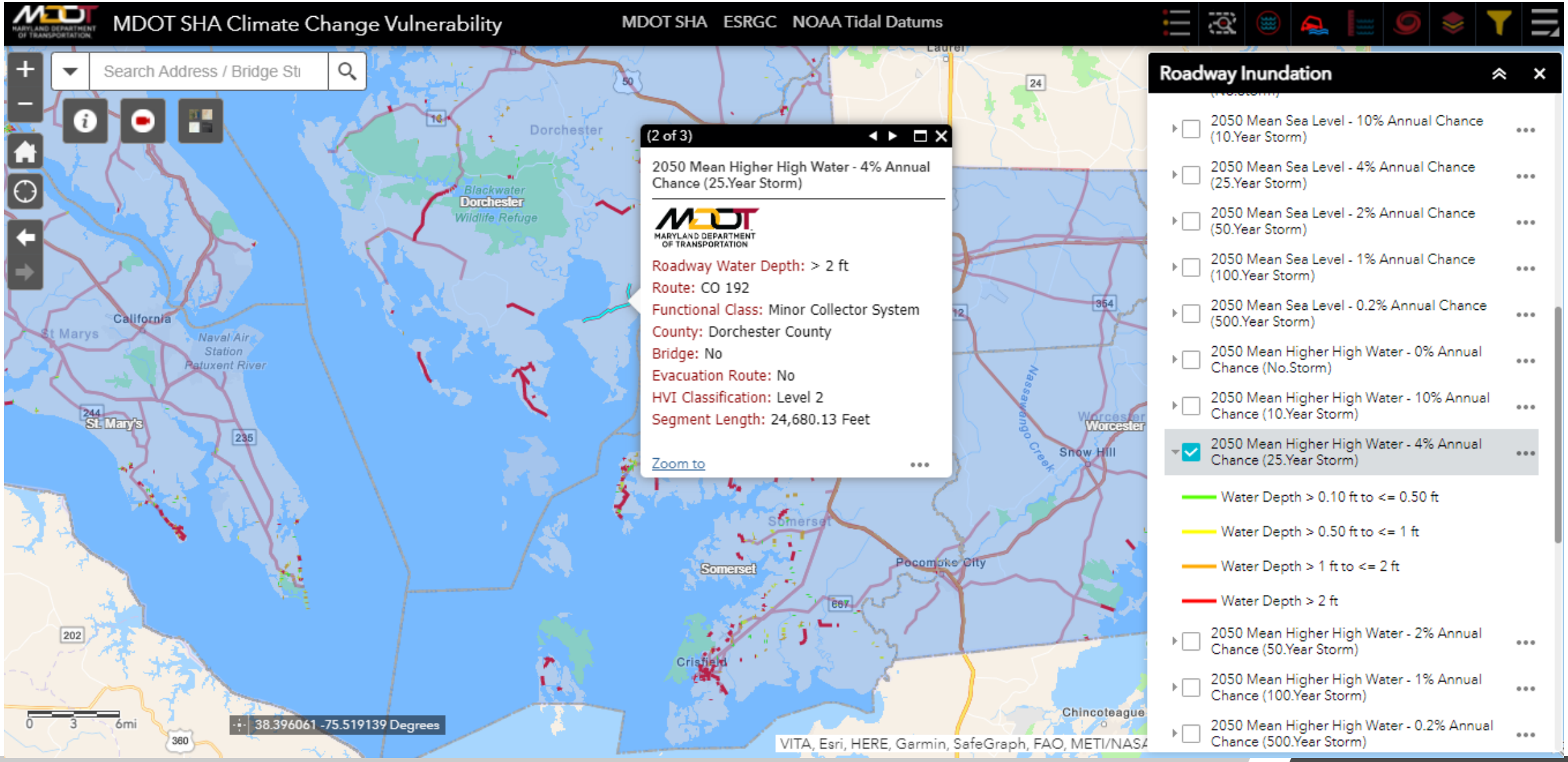

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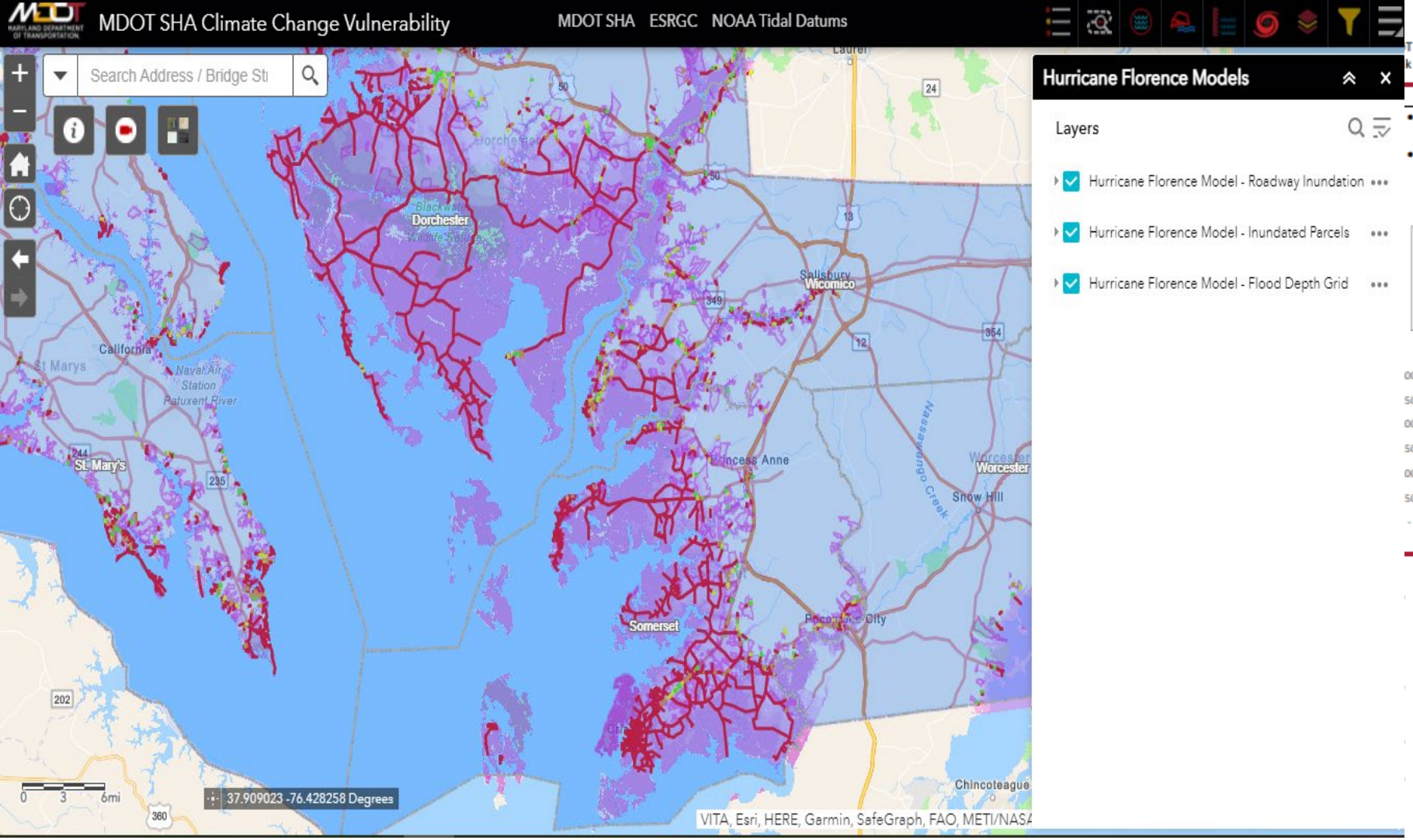


Key Findings for Roadway Inundation

T SHA has modeled roadway inundation under various flooding scenarios to pre-emptively identify k roads to aid decision-making.

Across Scenarios

- Flooding is expected to become **more frequent and extensive** over time due to sea level change (see table).
- The **vast majority** of flood risks across all scenarios are **on County maintained roads.**

Total Miles of Roadway Flooded

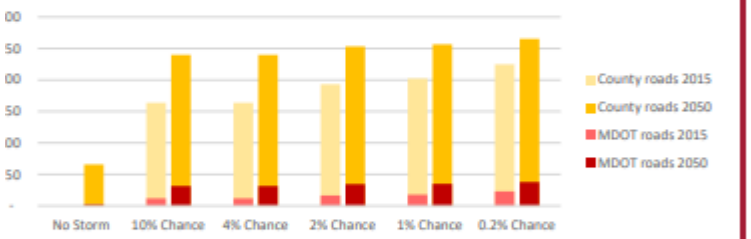
Storm Event Annual Exceedance	2015	2050	% Change
No Storm	0	67.6	-
10% (10-YR)	175.5	271.4	55%
4% (25-YR)	175.5	271.4	55%
2% (50-YR)	209.6	287.7	37%
1% (100-YR)	220.1	291.4	32%
0.2% (500-YR)	247.8	303.0	22%

Top Risks: 25-Year Storm (Map)

104.7 miles of roads are potentially exposed to a 25-year flood event by 2050 (ranging from moderate to high flood risk). **89.0 miles are County maintained roads.**

The one roadway segment with high risk of at least two feet of flooding during a 25-year storm event by 2050 is **MD 355.**

Total miles inundated under various flooding scenarios, by road ownership: 2015 vs 2050



Potential Climate Risk and Resilience Next Steps

Expand local, regional, and state agency partnerships to develop a plan to reduce flood risk to critical infrastructure (e.g., asset-specific strategies, land use planning strategies, or watershed/coastal management strategies).

Conduct studies (e.g., risk analysis, vulnerability assessments) to understand the root cause of repeat flooding at specific locations.

Use flood risk data to enhance emergency management planning efforts (e.g., detour routes).

Track flooding impacts and associated costs. Identify criteria (e.g., frequency of flooding impacts) to indicate the need for transitioning from maintenance and emergency response to capital improvement.

Additional Information:

- Additional data and maps area available in the **MDOT SHA Climate Change Viewer** at: https://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=86b5933d2d3e45ee8b9d8a5f03a7030c
- Eastern Shore Regional GIS Cooperative, Hazard Vulnerability Index Data Products. https://geoservices.salisbury.edu/arcgis/rest/
- Eastern Shore Regional GIS Cooperative, 2016. GIS Data Products to Support Climate Change Adaptation Planning: Dorchester County, Maryland. https://www.esrgc.org/data/flooding (go to Sea Level Change drop down and select desired County)

CLIMATE CHANGE VULNERABILITY VIEWER

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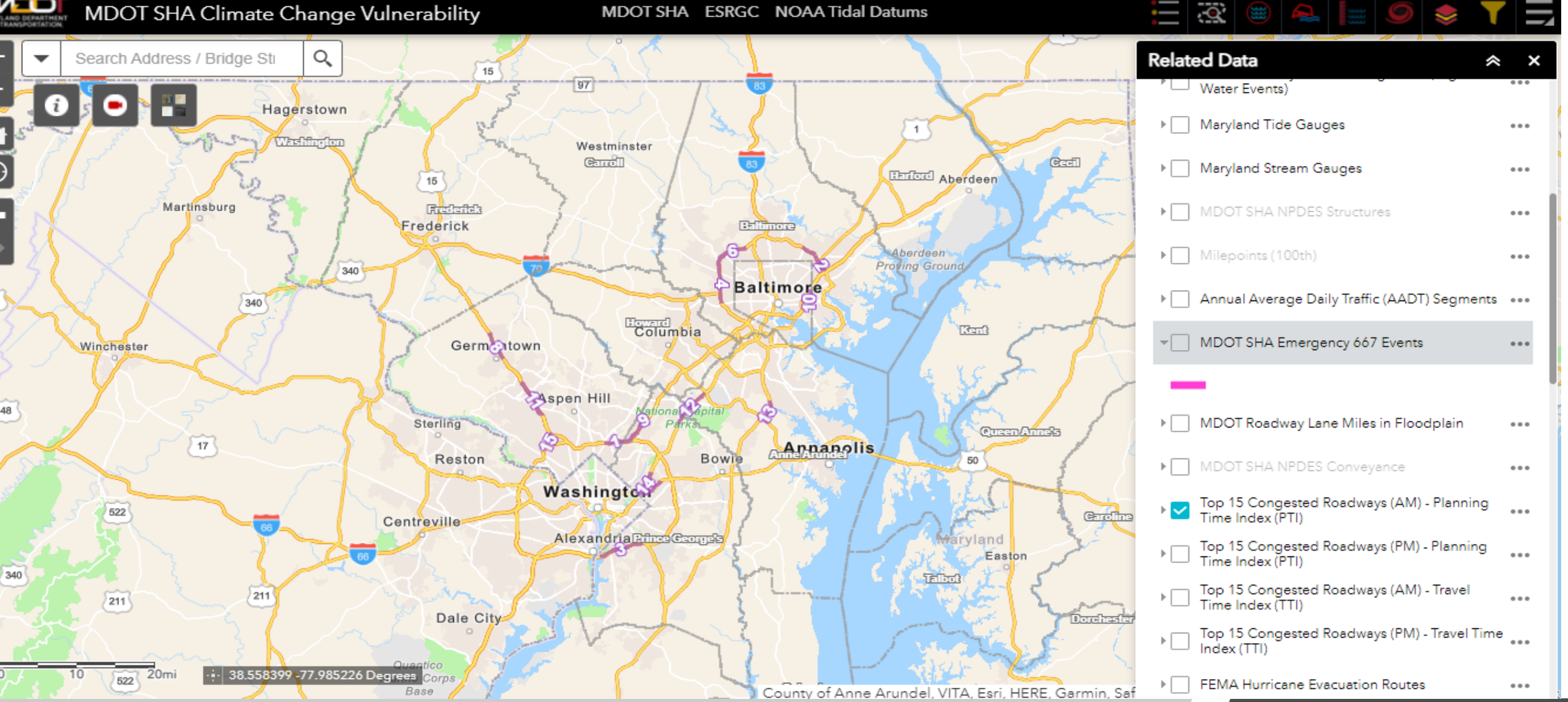

CLIMATE CHANGE VULNERABILITY VIEWER

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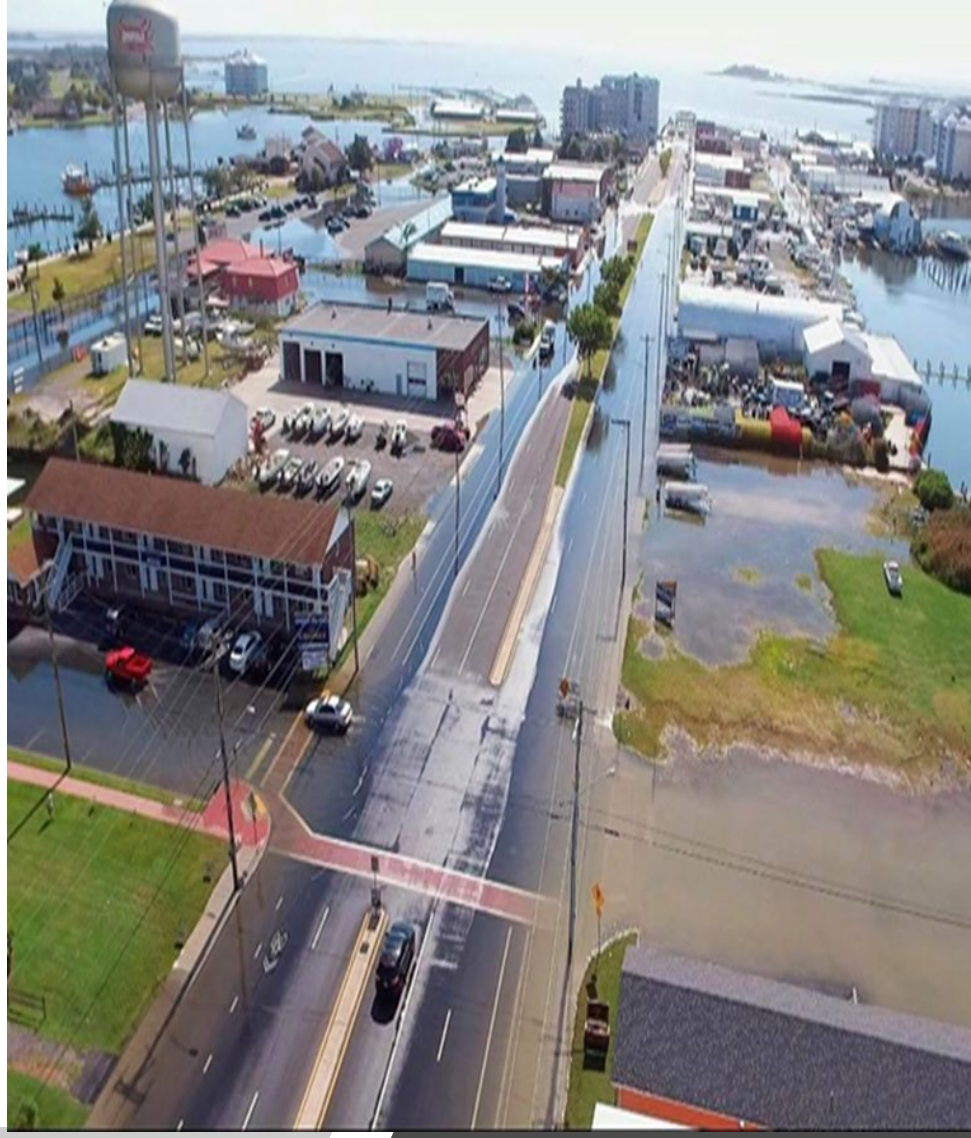

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