

Low-Lying Roads Project

Fall 2021- June 2023

Project funded by:
Municipal Vulnerability Preparedness Program
Economic Development Administration

Purpose and Objectives of Workshop

- **Review flood projections and impacts on roadways for the town under future scenarios**
- **Discuss vulnerable low-lying roads or other transportation infrastructure**
- **Prepare the town to address priority road segments for design and permitting**

Agenda

- Project Overview
- Vulnerability and Risk Assessment
- Results of Low-Lying Roads Screening
- Discussion/Breakout Groups
- Next Steps



Low-Lying Roads



10
TOWNS

Barnstable	Orleans
Bourne	Sandwich
Brewster	Truro
Dennis	Wellfleet
Eastham	Yarmouth

Flooding vulnerability assessment of low-lying roads and transportation infrastructure

Support municipal road segment prioritization

Identify range of potential design solutions, costs

Work performed by Cape Cod Commission and Woods Hole Group

HAZARD
Storms, SLR
& Flooding

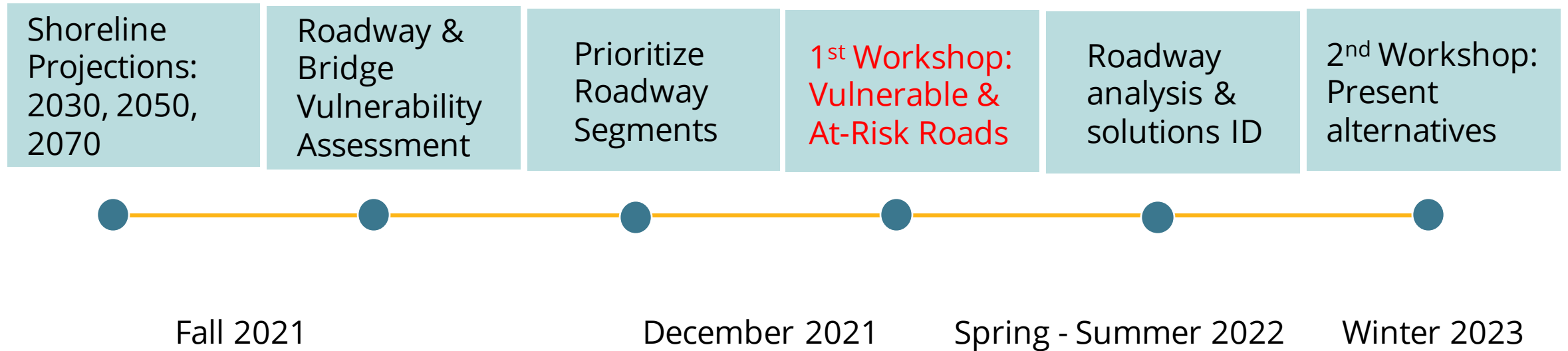


Adaptation Strategies



- | Green Infrastructure, or Nature-based Solutions
- | Gray Infrastructure, or Traditional Engineering Structures
- | Other approaches – Managed Retreat, Abandonment

PROJECT TIMELINE & ELEMENTS



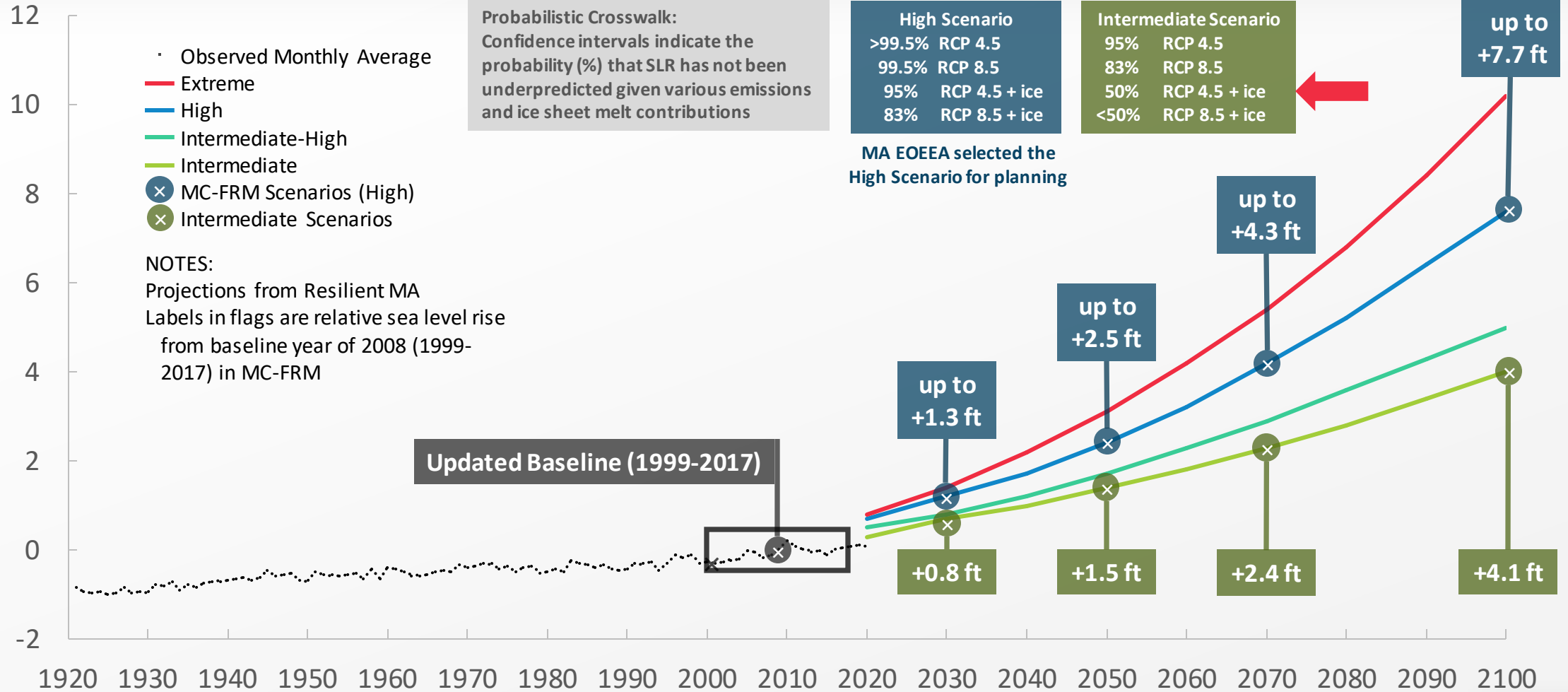
Questions?

- Workshop Purpose or Objectives
- Low Lying Roads project
 - Key components
 - Vulnerability Assessment - Identify Potential Sites
 - Public Outreach and Engagement
 - Roadway Feasibility and Alternative Solutions
 - Solutions Identification
 - Timeline

MA EOEEA Probabilistic Sea Level Rise Projections

MC-FRM NORTH (DeConto & Kopp, 2017)

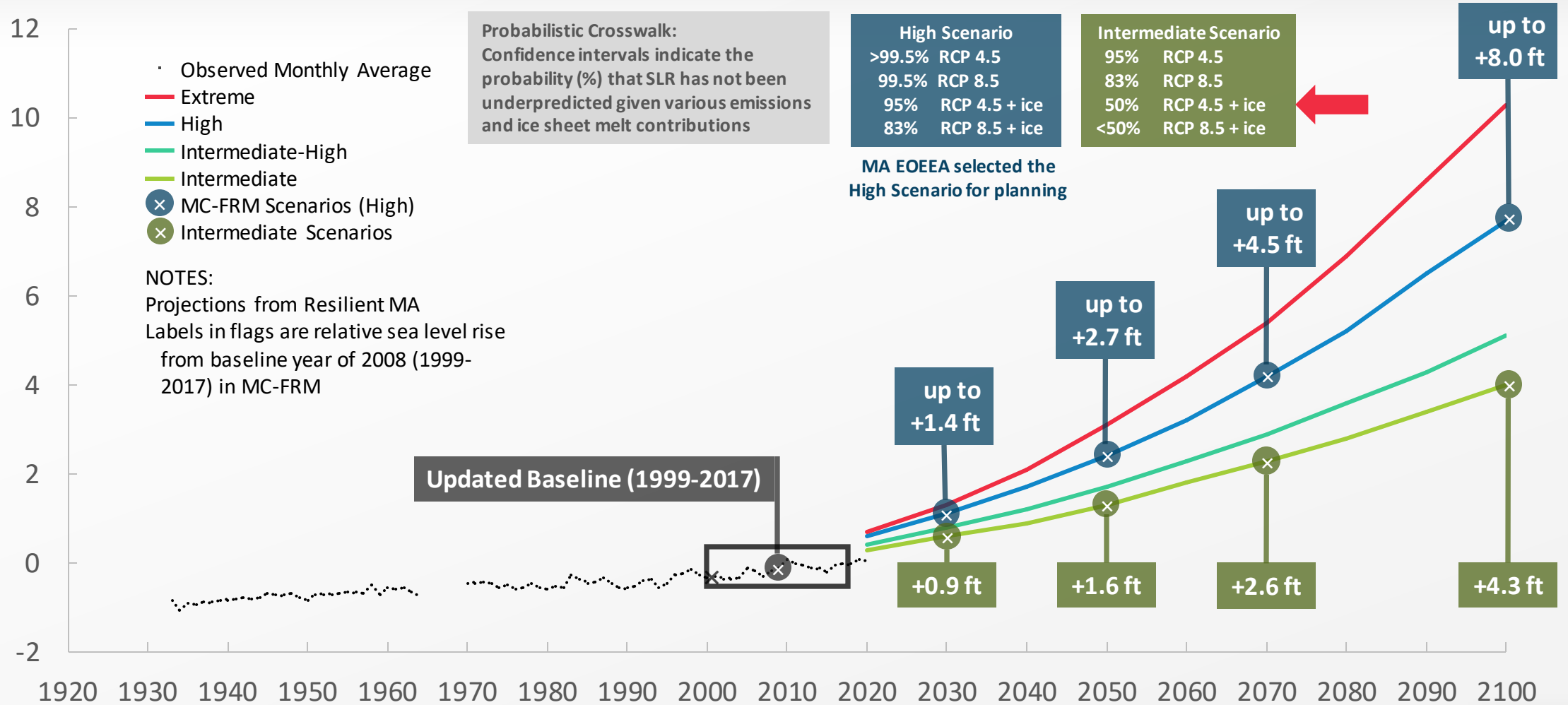
Relative Mean Sea Level (feet NAVD88)



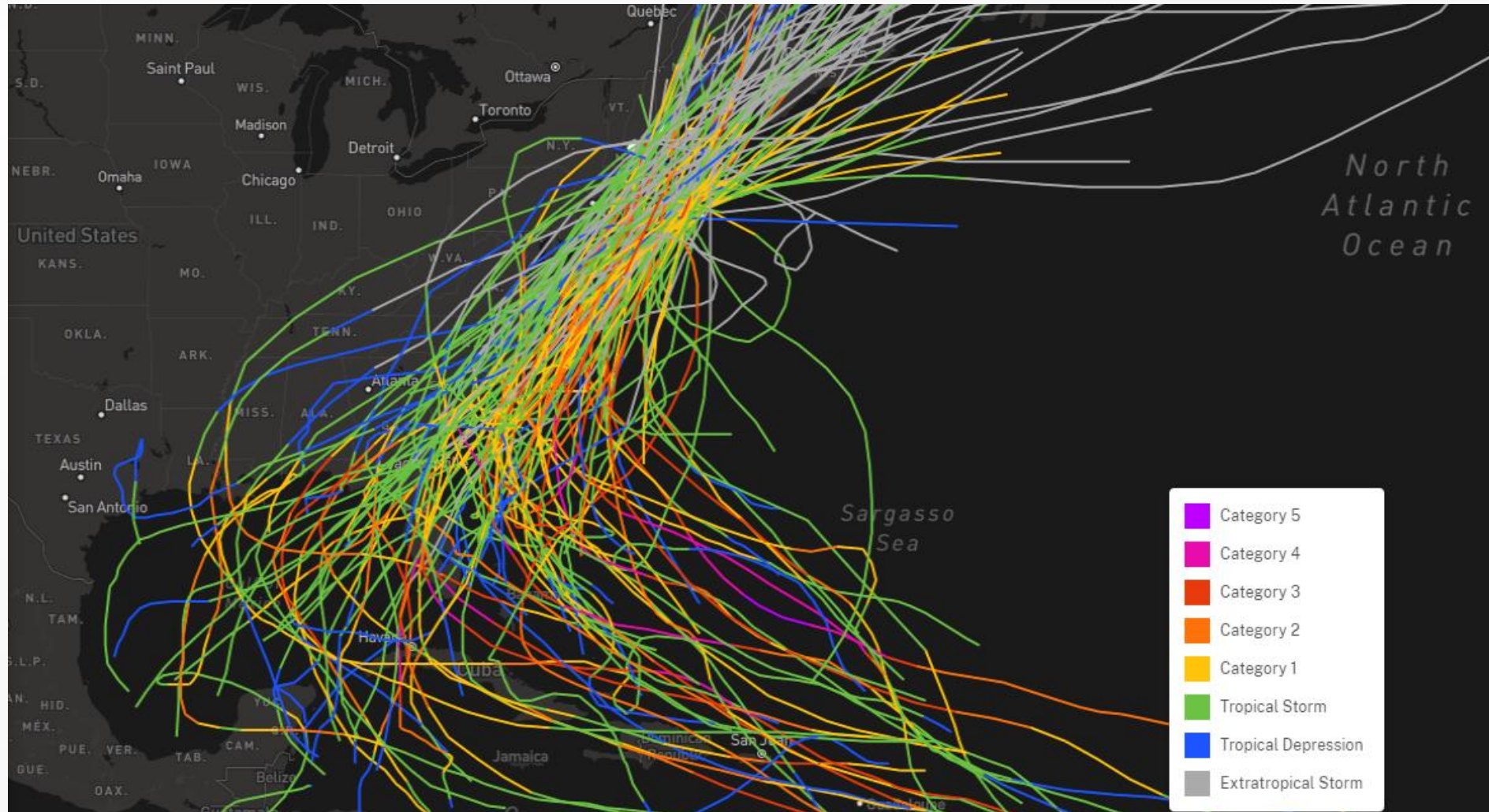
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MC-FRM SOUTH (DeConto & Kopp, 2017)

Relative Mean Sea Level (feet NAVD88)



Tropical / Extra-tropical Storms



NOAA National Ocean Service

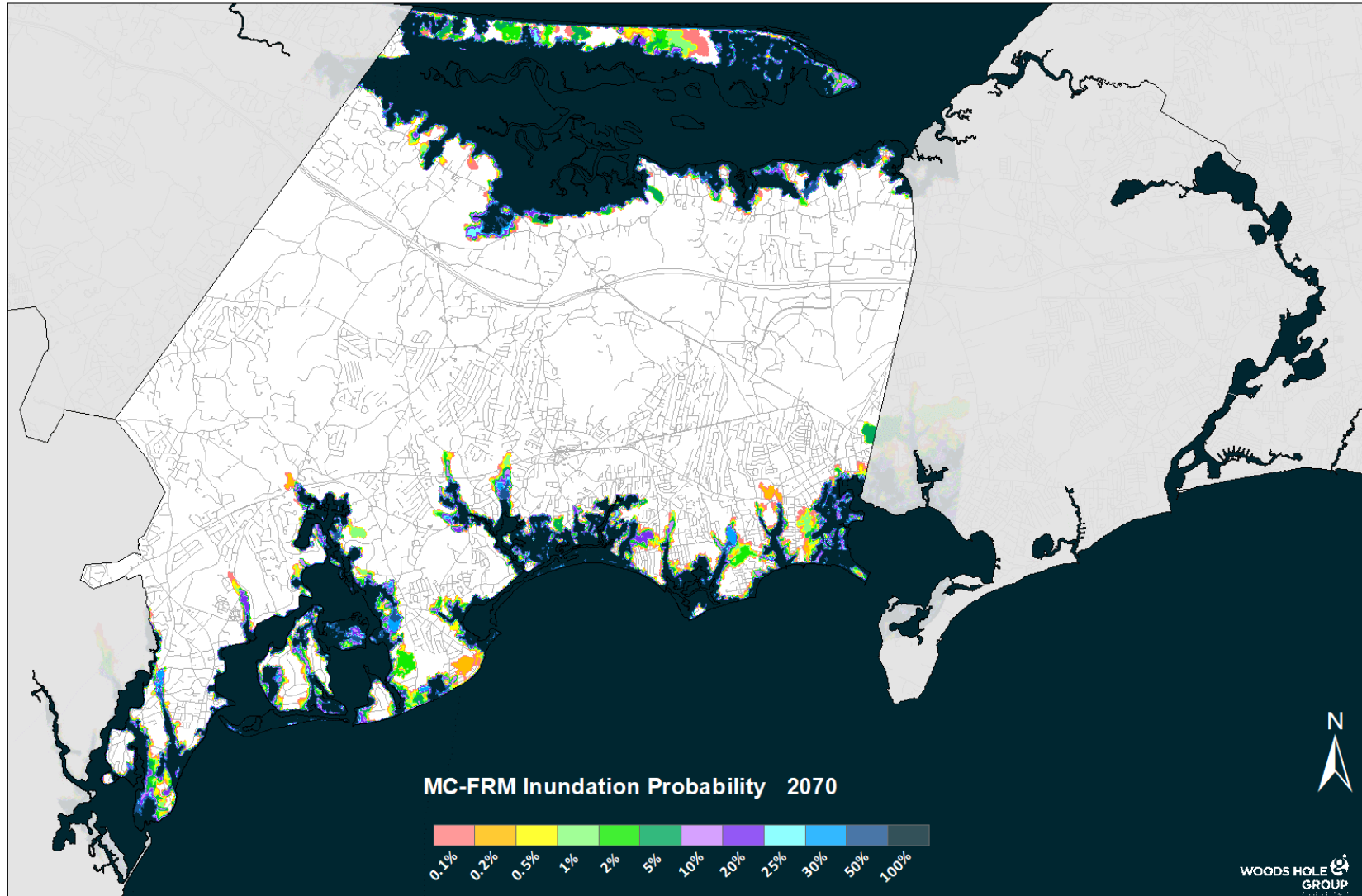
Massachusetts Coast Flood Risk Model (MC-FRM)



MC-FRM Resolution - Barnstable



MC-FRM Coastal Flood Exceedance Probability – Barnstable



Massachusetts Coast Flood Risk Model

SUMMARY

Hydrodynamically modeled projections

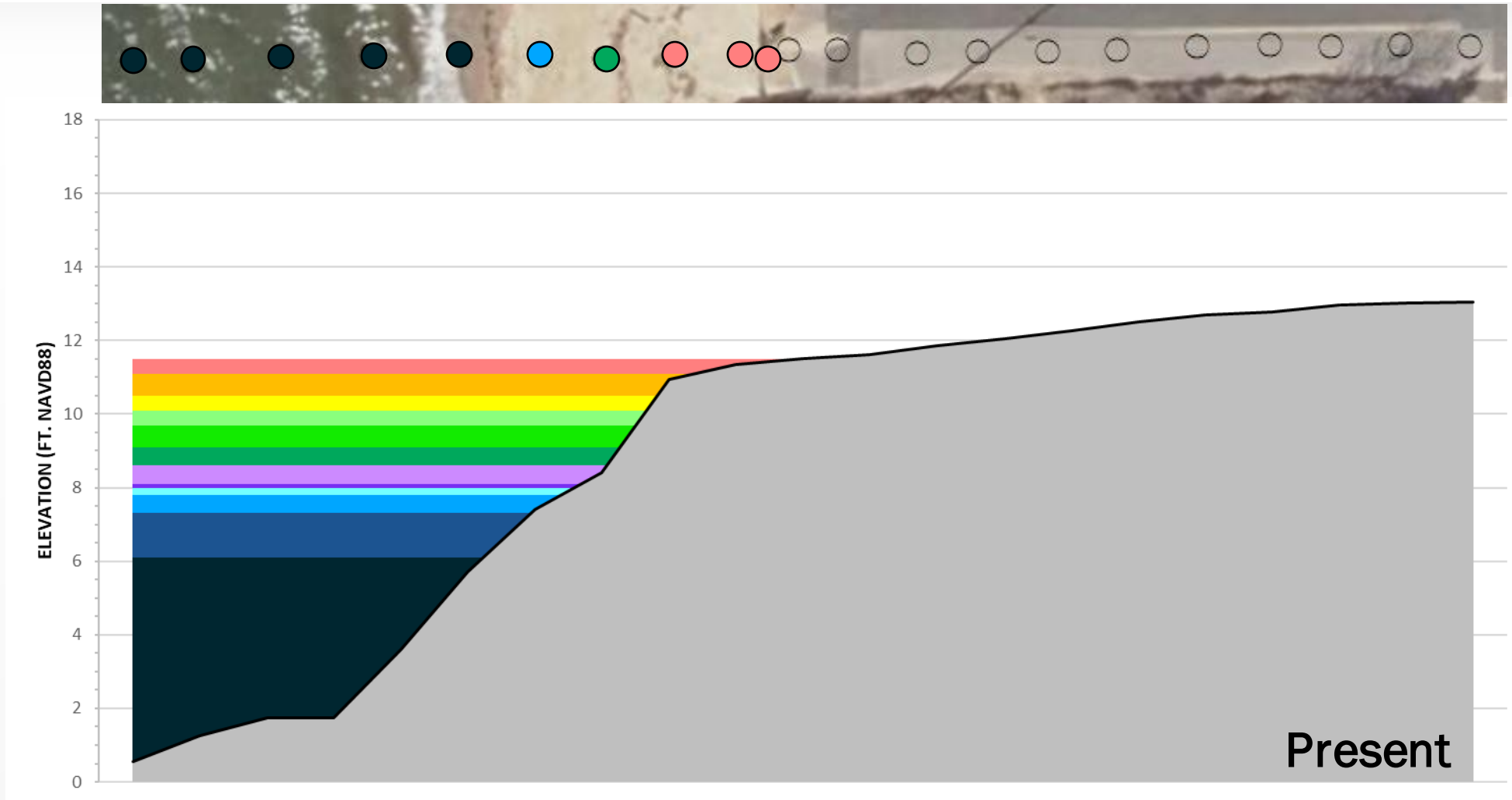
Sea level rise and storm surge – combined

Annual chance of flooding under 2030/2050/2070 climate conditions

QUESTIONS?



Cape Cod Low Lying Roads Vulnerability Assessment Methods



COASTAL FLOOD EXCEEDANCE PROBABILITY

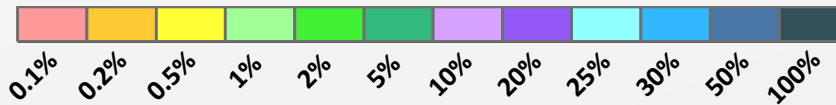


Cape Cod Low Lying Roads Vulnerability Assessment Methods



2030

COASTAL FLOOD EXCEEDANCE PROBABILITY

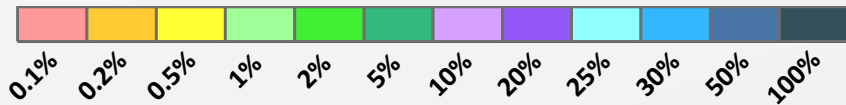


Cape Cod Low Lying Roads Vulnerability Assessment Methods



2050

COASTAL FLOOD EXCEEDANCE PROBABILITY

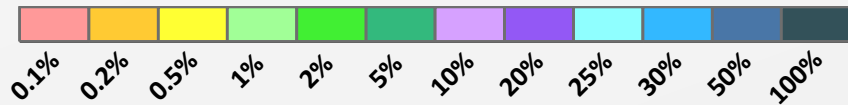


Cape Cod Low Lying Roads Vulnerability Assessment Methods

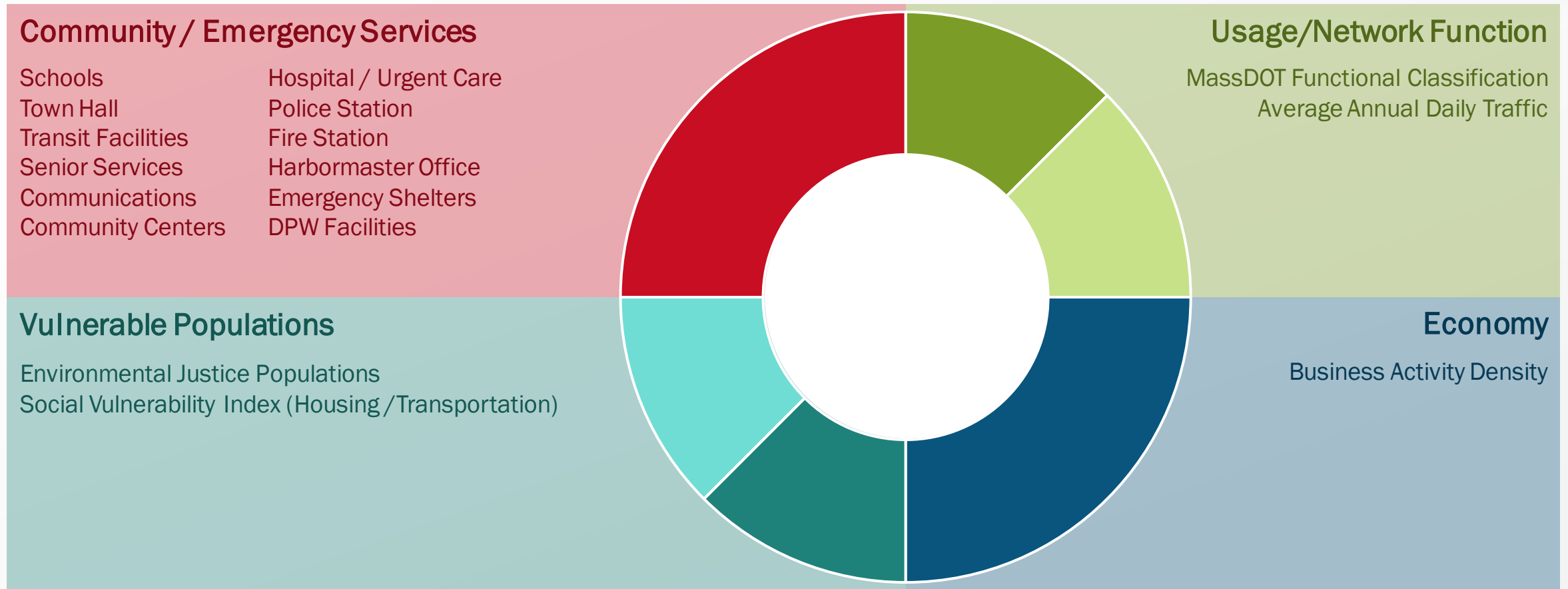


2070

COASTAL FLOOD EXCEEDANCE PROBABILITY

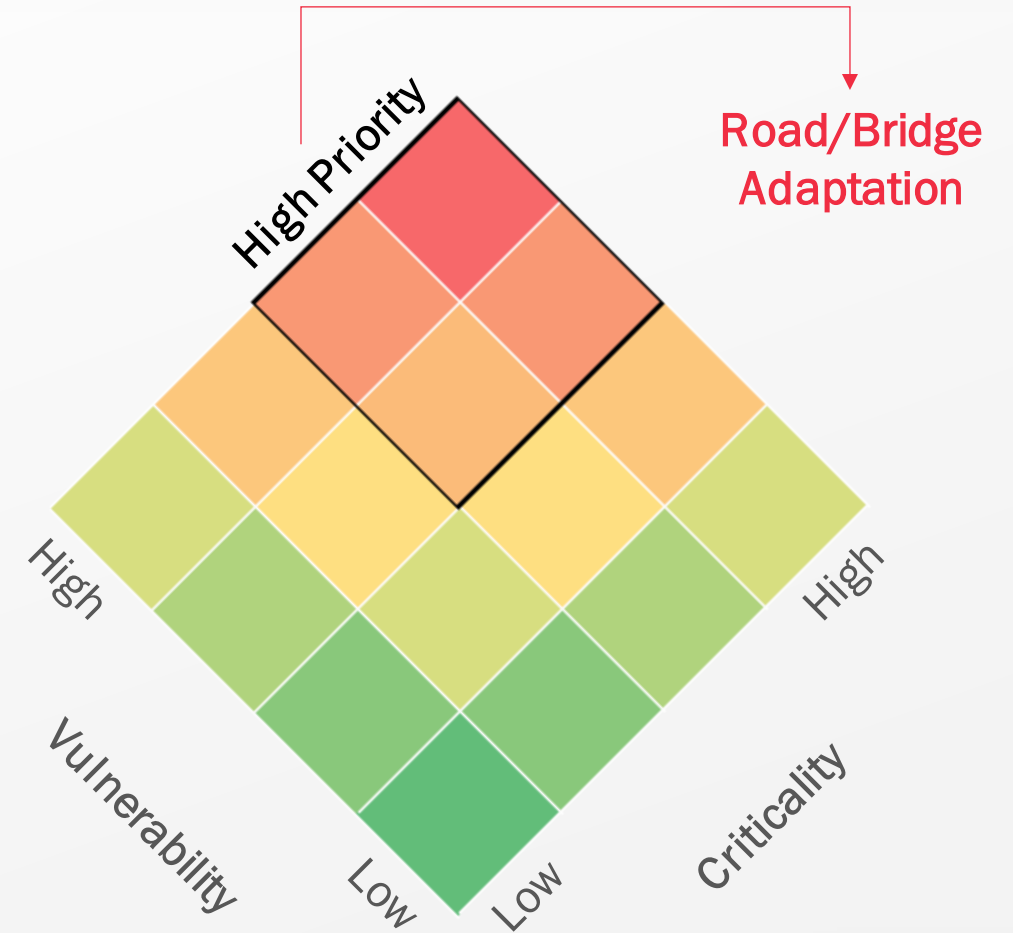


Cape Cod Low Lying Roads Criticality Scoring Framework

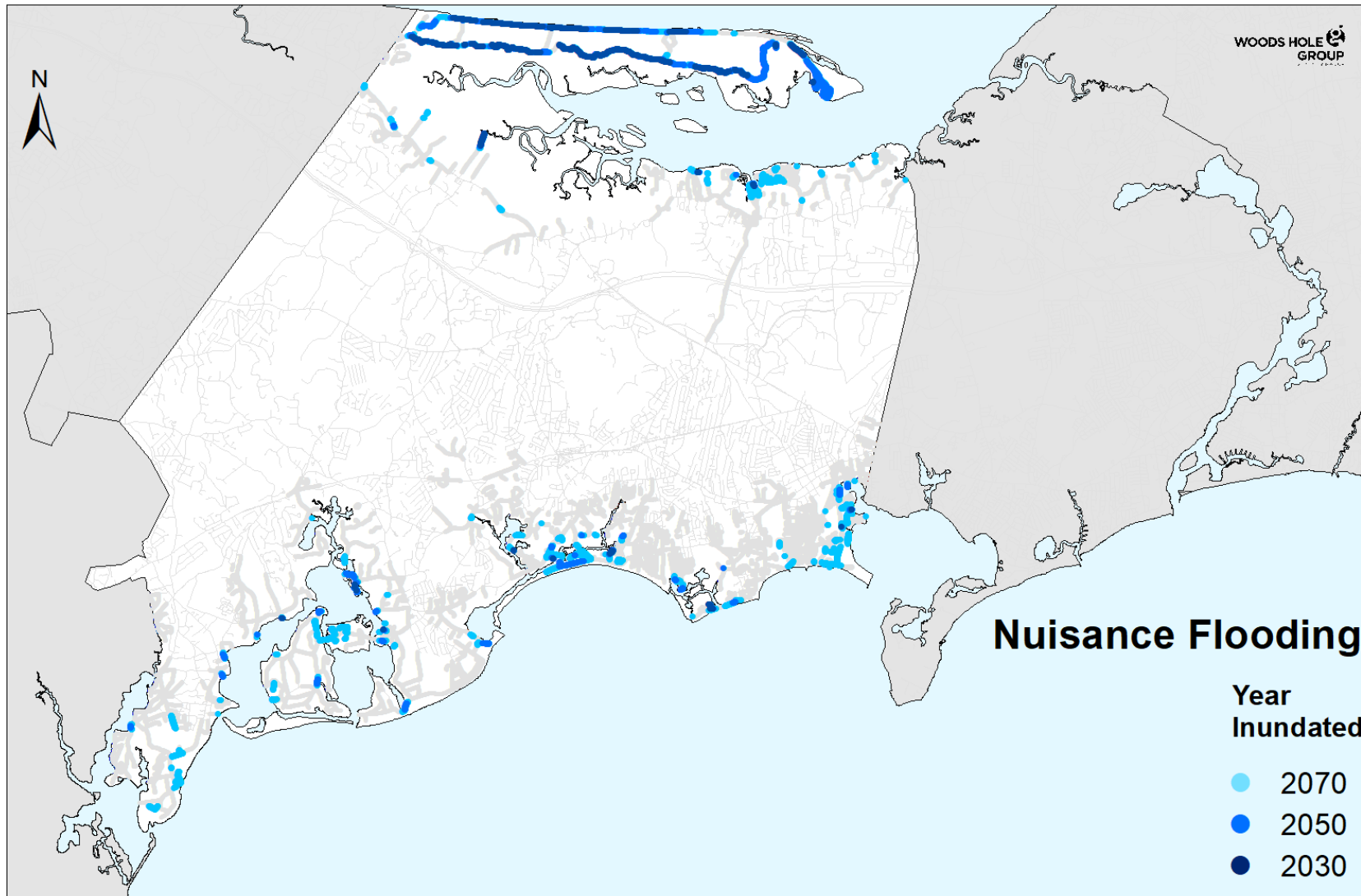


Cape Cod Low Lying Roads Risk Assessment Approach

1. Extract roadway/bridge critical elevations (CEs)
 - › From LiDAR at 20m interval along surface
2. Compile 2030/2050/2070 MC-FRM water surface elevations (WSEs)
 - › 0.1%, 0.2%, 0.5%, 1%, 2%, 5%, 10%, 20%, 100%
3. Compare CEs to WSEs to determine vulnerability
 - › Highest probability WSE exceeding CE
4. Score road segment criticality
 - › Usage/Network Function
 - › Economy
 - › Vulnerable Populations
 - › Community and Emergency Services
5. $\text{Probability} * \text{Criticality} = \text{Risk}$
6. Prioritize high-risk road segments for community consideration



Low Lying Roads Nuisance Flooding (Barnstable)



Road Miles 2030

5.8/168.7

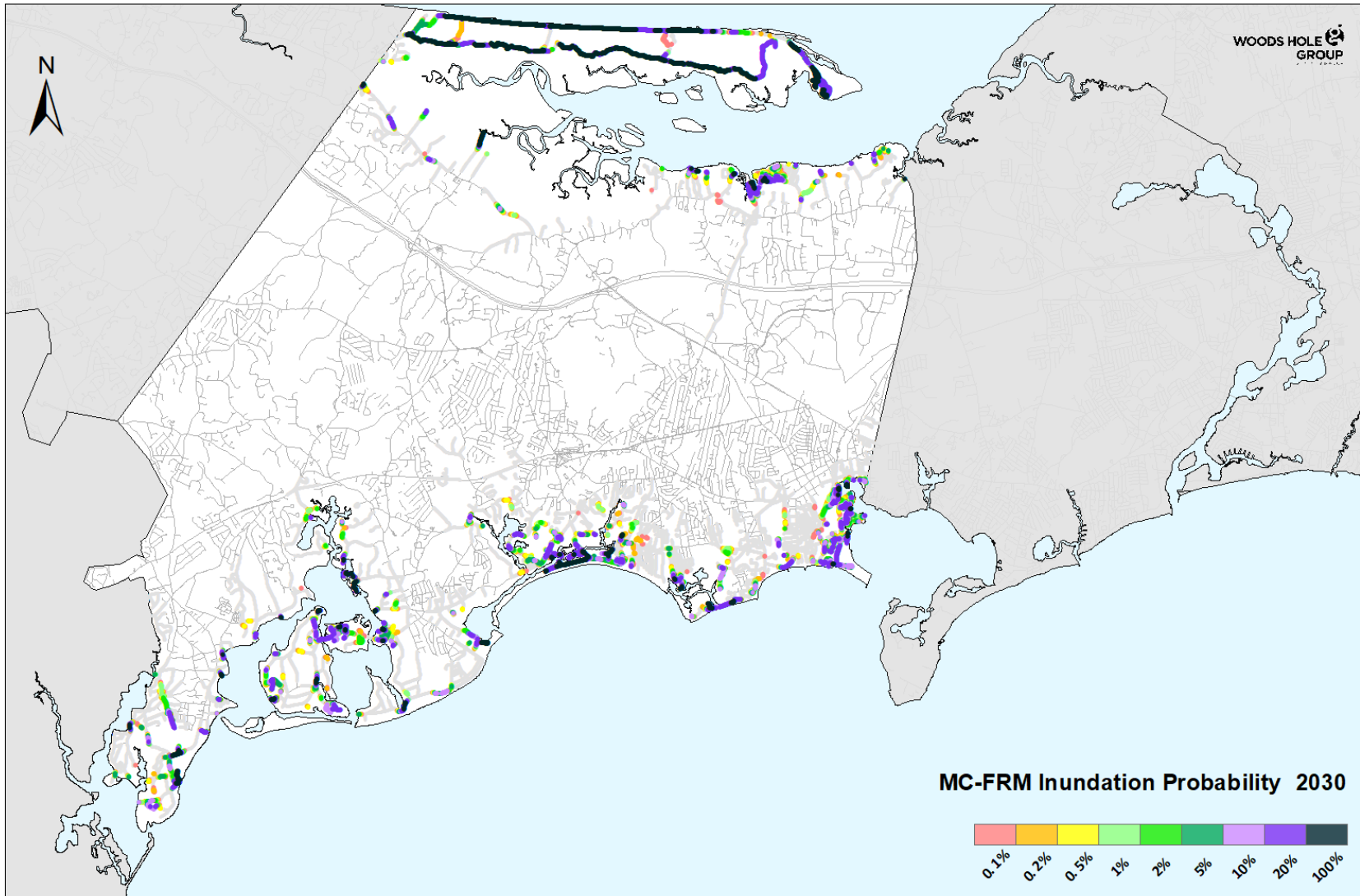
Road Miles 2050

11.3/168.7

Road Miles 2070

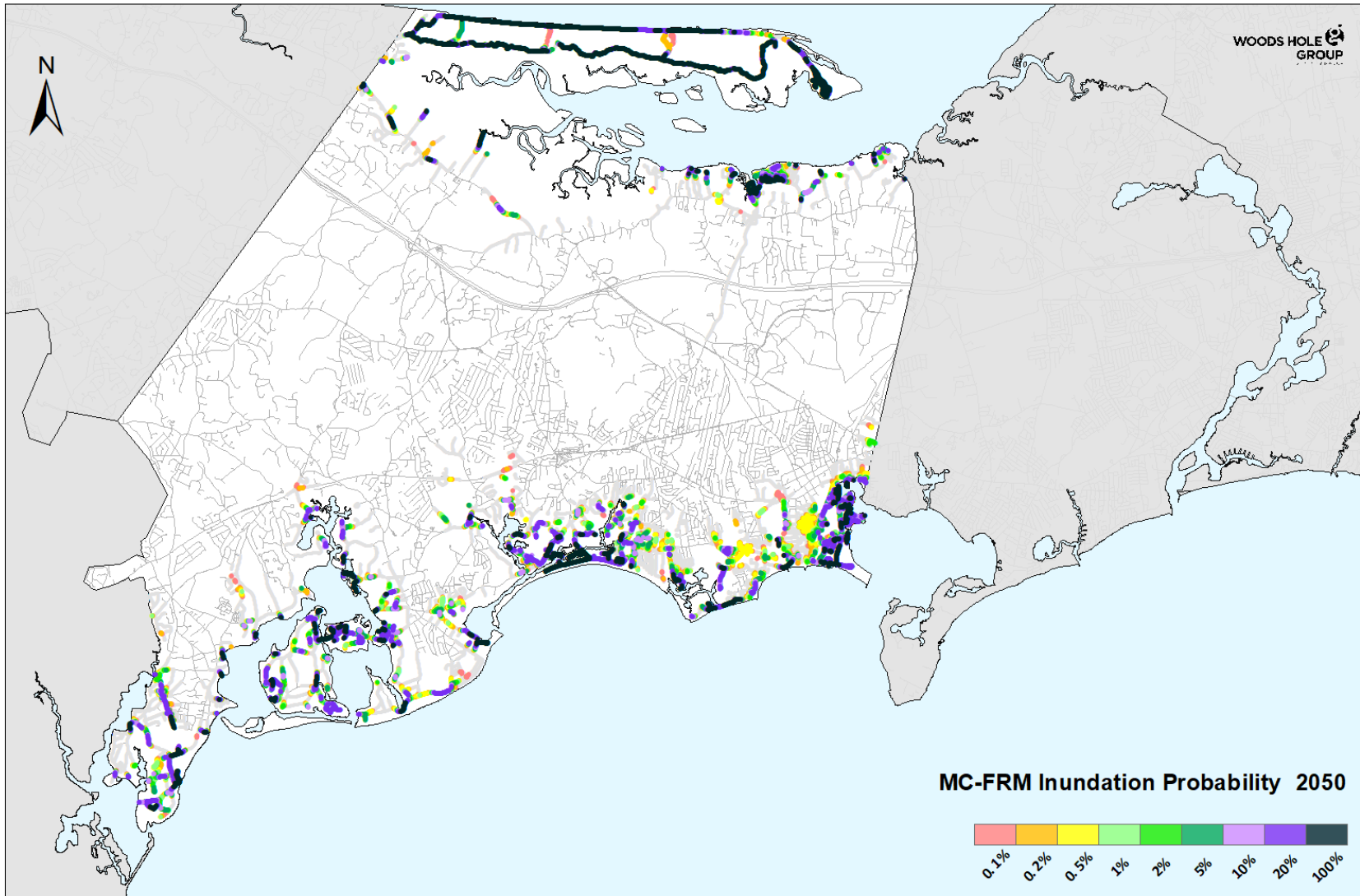
22.0/168.7

Low Lying Roads 2030 Inundation Probability (Barnstable)



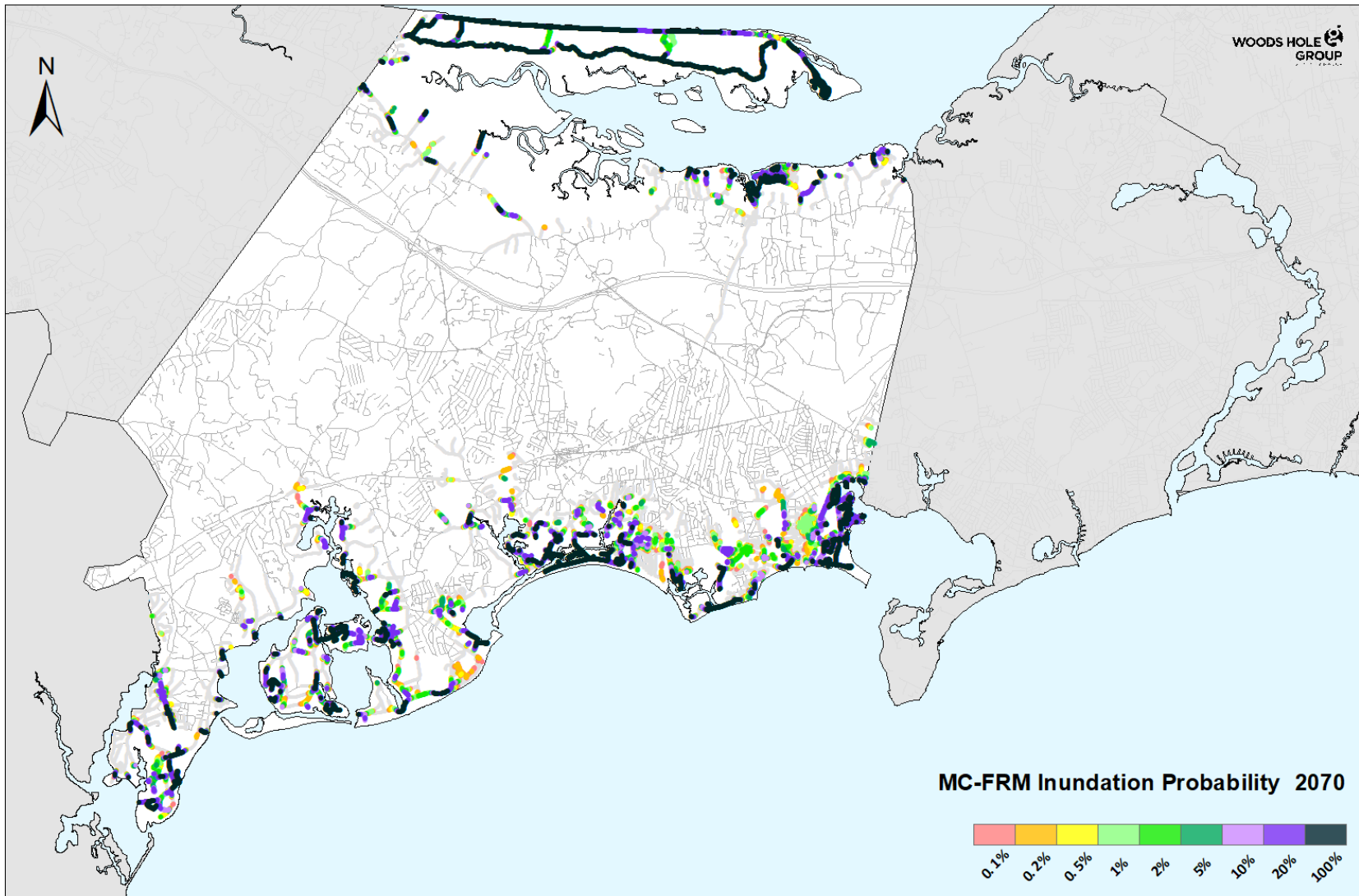
%	Road miles
0.1	46.1
0.2	43.2
0.5	39.8
1	36.8
2	33.5
5	29.4
10	25.4
20	21.1
100	9.9

Low Lying Roads 2050 Inundation Probability (Barnstable)



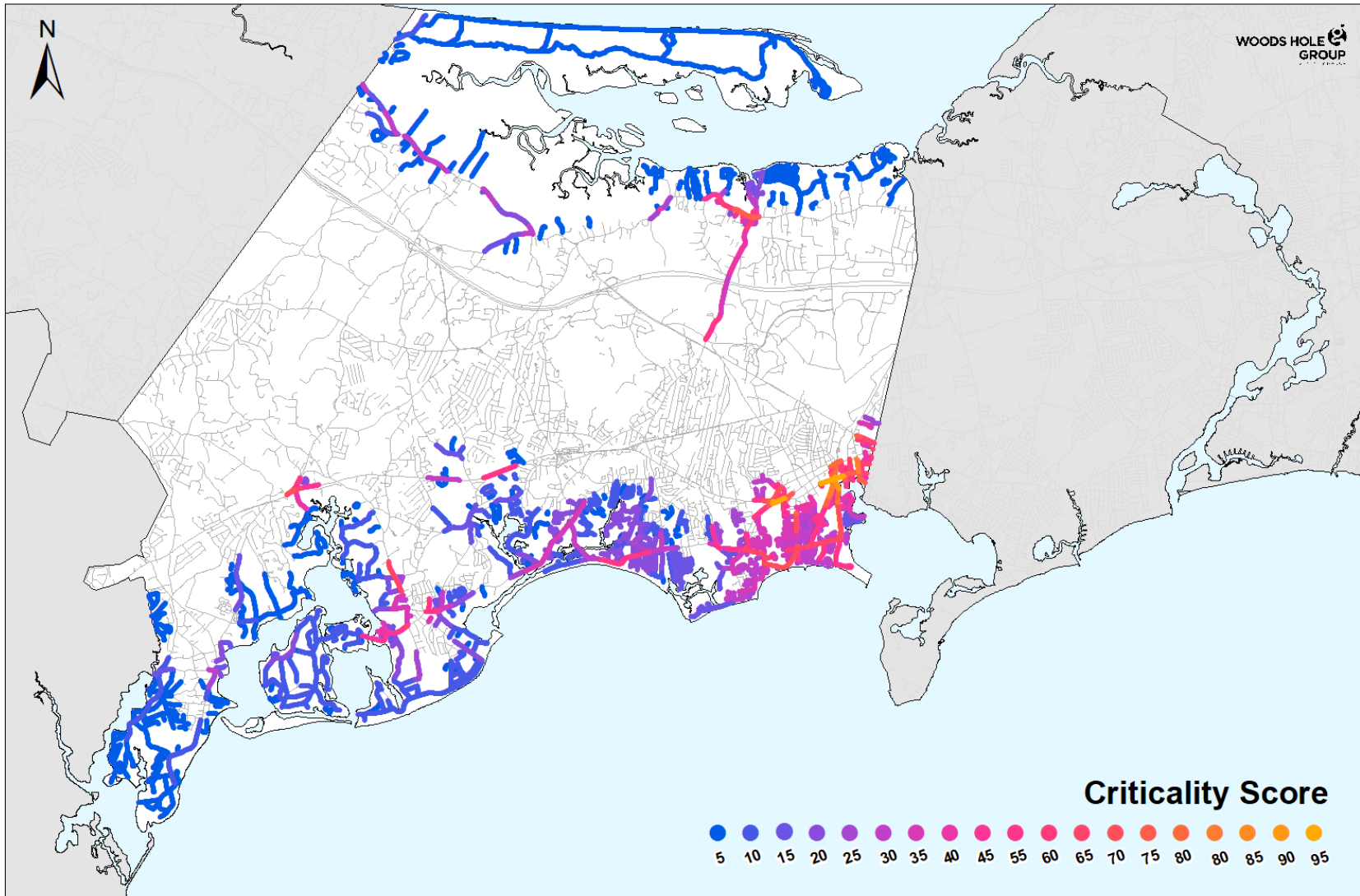
%	Road miles
0.1	78.0
0.2	73.8
0.5	66.9
1	59.2
2	54.2
5	47.6
10	41.4
20	35.6
100	19.4

Low Lying Roads 2070 Inundation Probability (Barnstable)

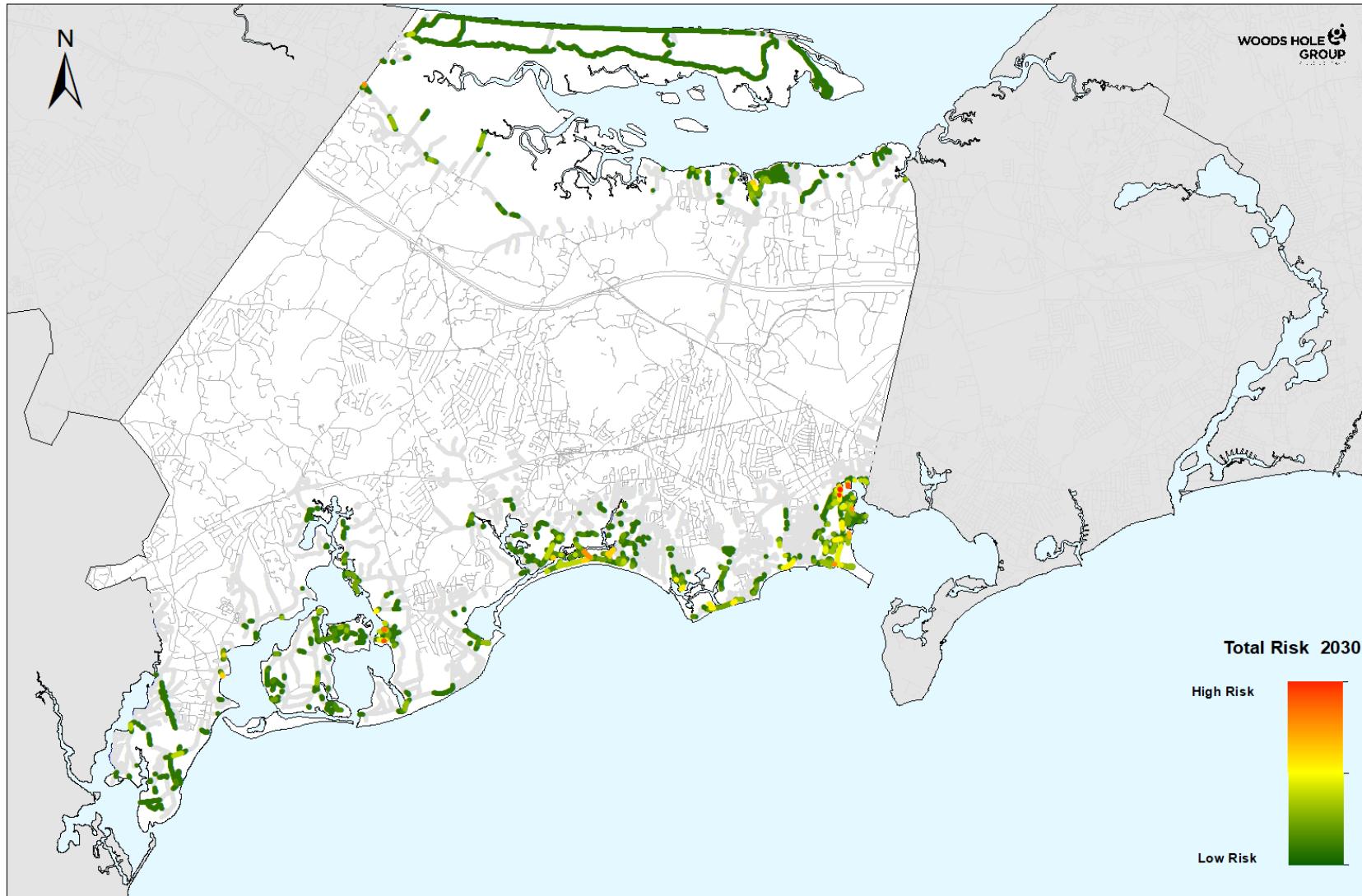


%	Road miles
0.1	85.9
0.2	82.1
0.5	75.4
1	69.8
2	62.9
5	55.8
10	50.1
20	44.3
100	29.0

Low Lying Roads Criticality Scoring (Barnstable)



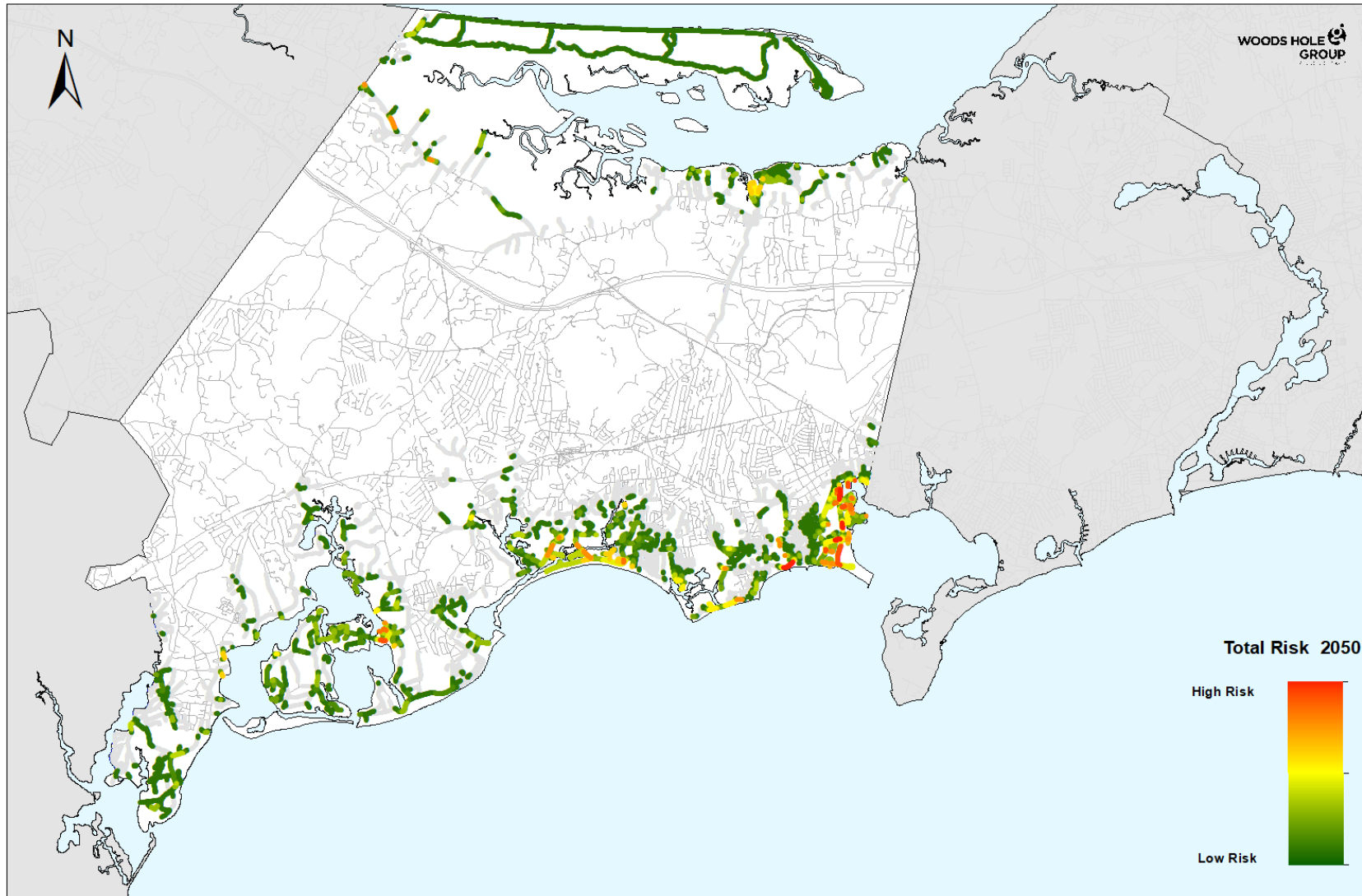
Low Lying Roads 2030 Risk Results (Barnstable)



High Risk Road Segments

- Ocean St
- Pleasant St
- Bridge St (Osterville/Little Island)
- West Bay Rd
- Craigville Beach Rd

Low Lying Roads 2050 Risk Results (Barnstable)

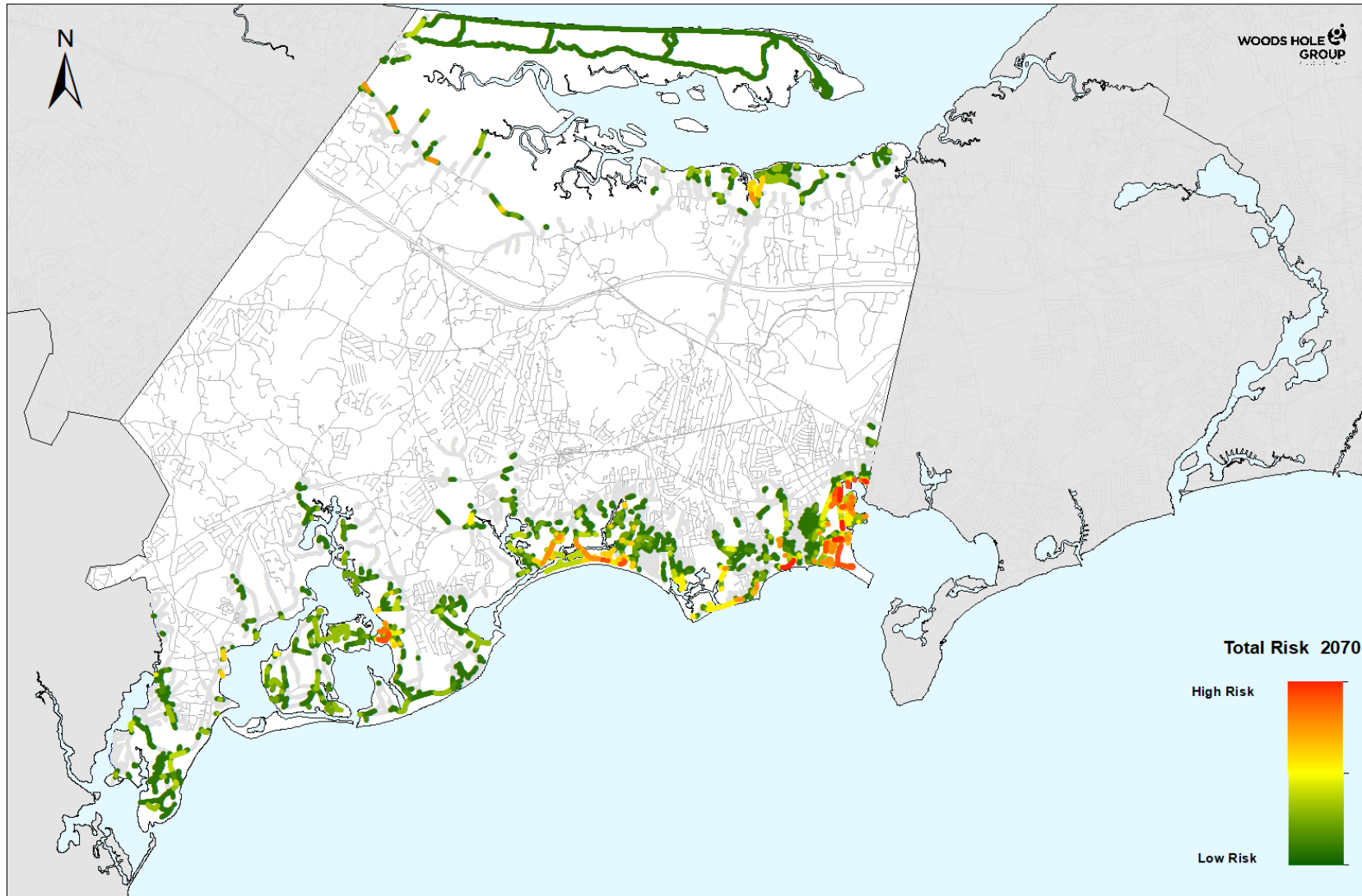


High Risk Road Segments

- Ocean St
- Pleasant St
- Bridge St (Osterville/Little Island)
- West Bay Rd
- Craigville Beach Rd

- Ocean St (Snow's Creek)
- Ocean Ave (Stewarts Creek)
- Gosnold St
- Ocean St (Kalmus)
- Estey Ave

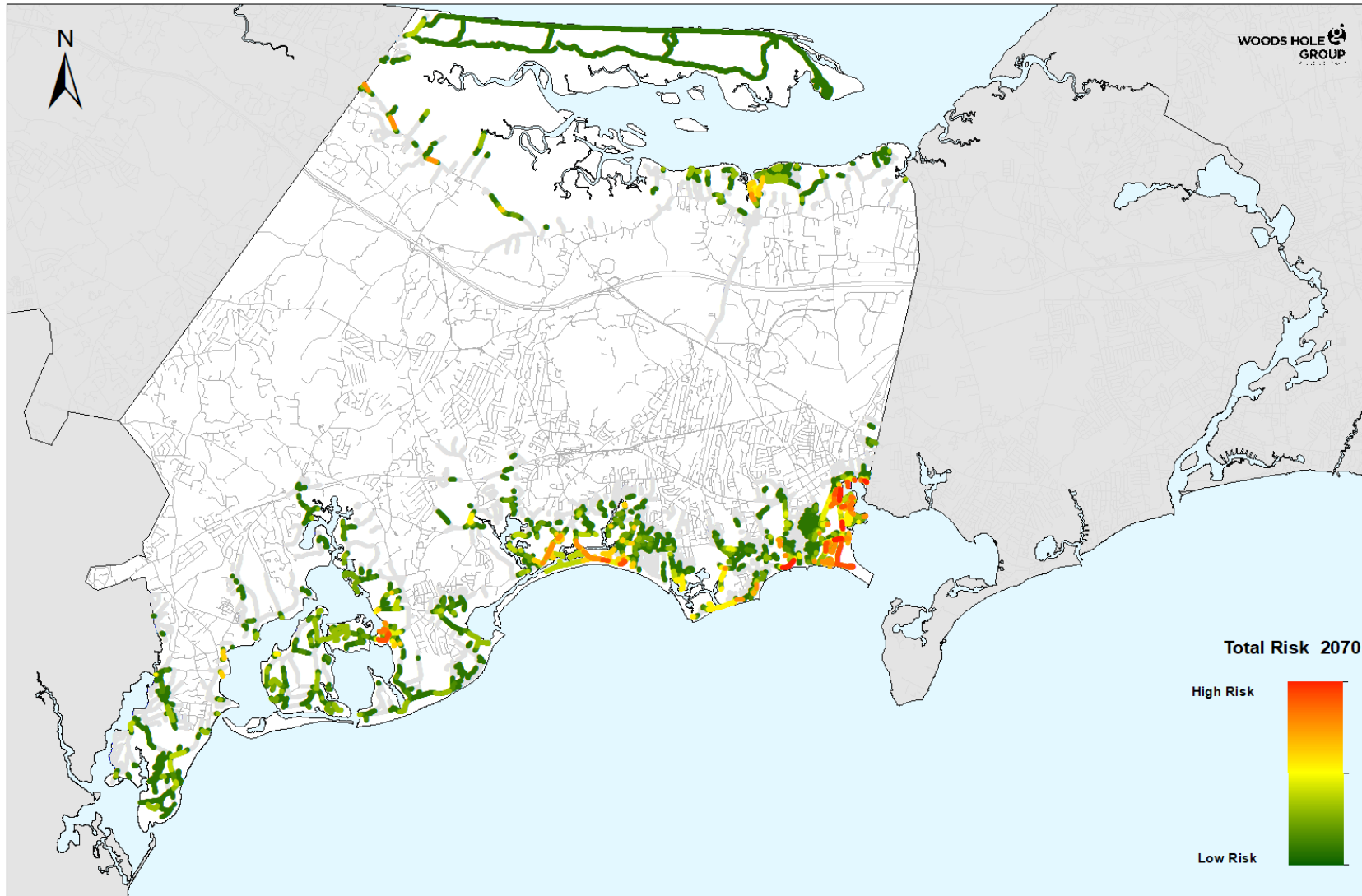
Low Lying Roads 2070 Risk Results (Barnstable)



High Risk Road Segments

- Ocean St
 - Pleasant St
 - Bridge St (Osterville/Little Island)
 - West Bay Rd
 - Craigville Beach Rd
-
- Ocean St (Snow's Creek)
 - Ocean Ave (Stewarts Creek)
 - Gosnold St
 - Ocean St (Kalmus)
 - Estey Ave
-
- Willow St & Quinlan Way

Low Lying Roads 2070 Risk Results (Barnstable)



Other Vulnerable Road Segments

- Dale Ave & Squaw Island Rd
- South Main St
- East Bay Rd
- Sea View Ave
- Millway
- Rte 6A (Scorton Creek)*
- Bridge St (Osterville Grand Island)
- Commerce Rd
- Rte 6A (Smith Creek)*
- Rte 6A (Boat Cove Creek)*
- Rte 6A (Bridge Creek)*
- Main St (Rushy Marsh Pond)

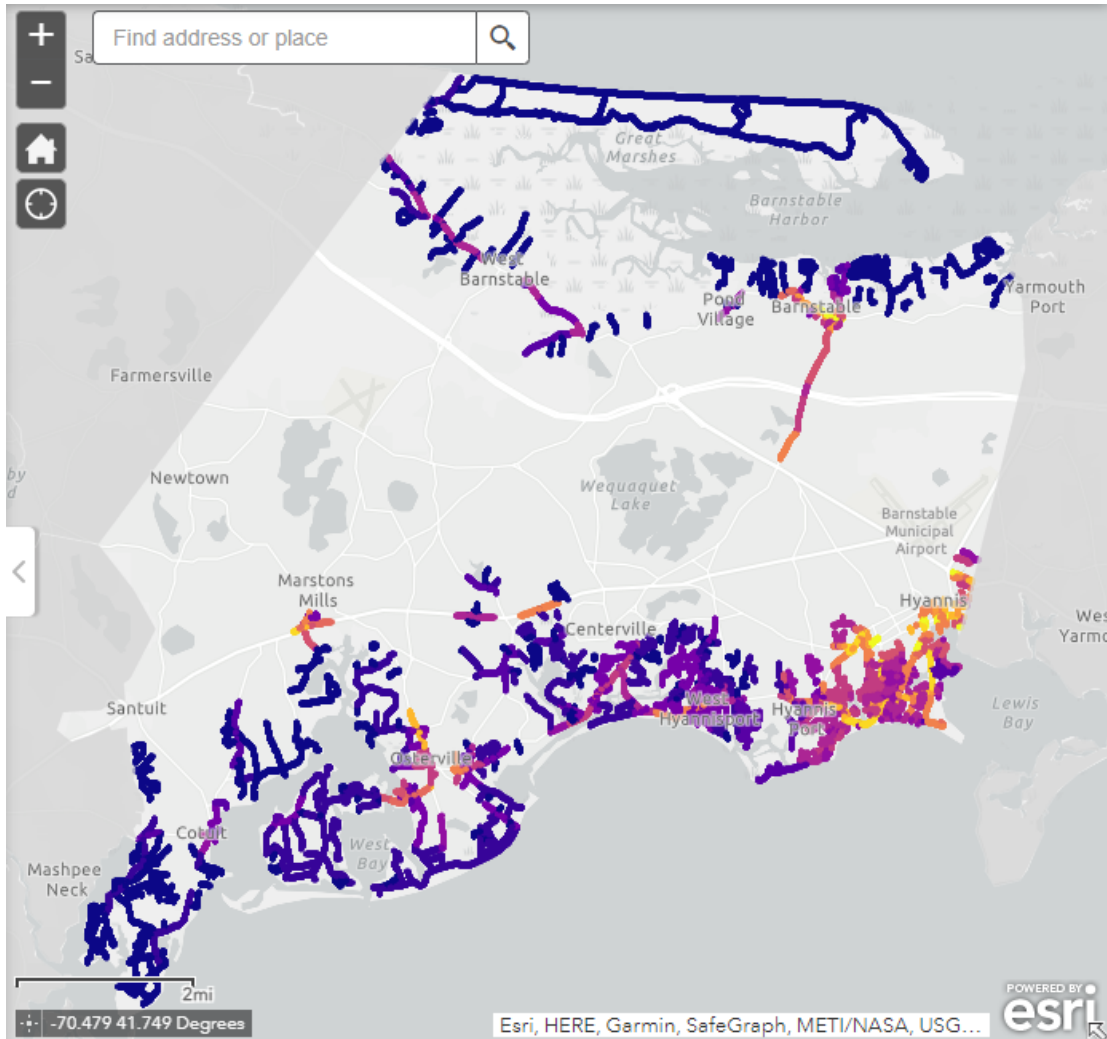
Summary of High Priority Road Segments (Barnstable)

Name	Length (ft)	Description	Segment Storm Probability (%)			Nuisance Length (ft)		
			2030	2050	2070	2030	2050	2070
A Ocean St	1300	Adjacent to Hyannis Harbor	0-100	2-100	10-100	0	280	740
B Pleasant St	940	Adjacent to Hyannis Harbor Park	0.1-100	5-100	10-100	0	200	300
C Bridge St (Osterville and Little Island)	2100	Access to Three Bays and Little Island	0-100	2-100	10-100	0	140	500
D West Bay Rd	420	Access to North/West Bay waterfront	2-100	20-100	100	40	120	260
E Craigville Beach Rd	4500	Access to Craigville Beach	0-100	2-100	10-100	0	0	1100
F Ocean St (Snow's Creek)	860	Culvert over Snow's Creek adjacent to JFK Memorial	0-20	2-100	10-100	0	0	380
G Ocean Ave (Stewarts Creek)	1340	Culvert over Stewarts Creek	0.1-20	10-100	20-100	0	0	420
H Gosnold St	1220	West of Ocean Street	0-20	10-100	10-100	0	0	400
I Ocean St (Kalmus)	2480	Access to Kalmus Park Beach	0-20	2-100	10-100	0	0	1620
J Estey Ave	860	Access to neighborhood	0-20	2-100	10-100	0	0	260
K Willow St & Quinlan Way	800	Hyannis Harbor and Cape Cod Hospital area	0.1-10	5-20	10-100	0	0	0
L Dale Ave & Squaw Island Rd	2760	Access to Hyannis Point and Squaw Island	0.5-100	5-100	20-100	0	200	1760
M South Main St	2700	Access to Centerville River neighborhoods	0-20	2-100	5-100	0	100	860
N East Bay Rd	2740	Access to Dowes Beach	0.2-100	5-100	20-100	0	560	1200
O Sea View Ave	1360	Access to Wianno Head	0-100	2-100	10-100	0	360	840
P Millway	2320	Access to Barnstable Harbor and Millway Beach	0.2-100	2-100	20-100	0	0	1360
Q Rte 6A (Scorton Creek)*	720	Route 6A low lying segment at Sandwich Town Line	0-100	1-100	5-100	0	0	60
R Bridge St (Osterville Grand Island)	3040	Access to Oyster Harbors	0-20	2-100	10-100	0	0	1120
S Commerce Rd	1800	Access for neighborhood north of Maraspin Creek	0.1-100	2-100	10-100	0	0	1380
T Rte 6A (Smith Creek)*	920	Route 6A low lying segment	0.1-20	2-100	10-100	0	120	500
U Rte 6A (Boat Cove Creek)*	620	Route 6A low lying segment with culvert	0.5-20	5-100	20-100	0	0	140
V Rte 6A (Bridge Creek)*	720	Route 6A low lying segment with culvert	0.2-10	2-20	20-100	0	0	260
W Main St (Rushy Marsh Pond)	1060	Access for neighborhood at Meadow Point	0.1-100	5-100	20-100	0	0	820

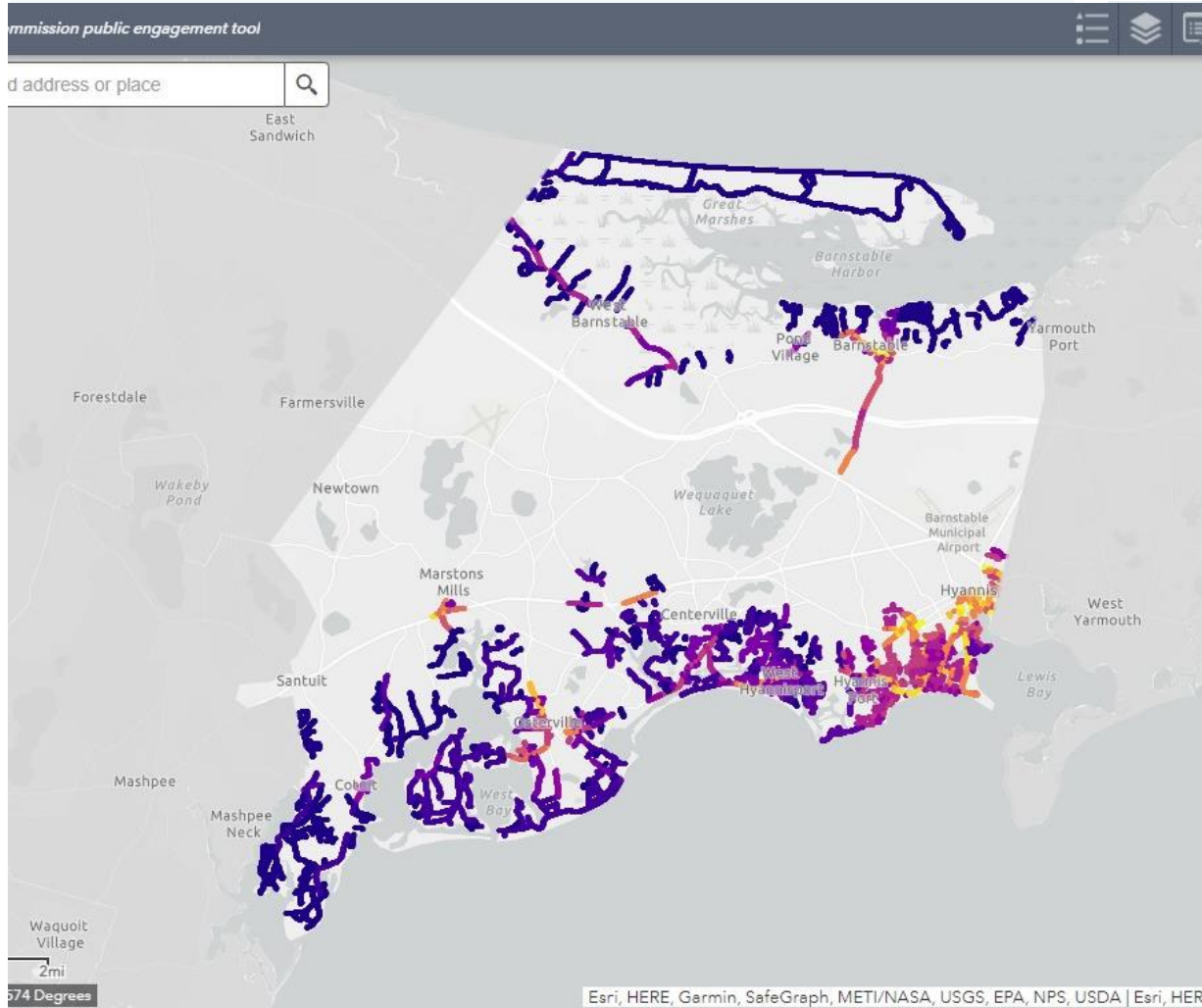
* = MassDOT roadway

LOW LYING ROADS

Group Discussion



**DISCUSSION
ORIENTATION**



DISCUSSION QUESTIONS

1. Are there roads that we missed?
2. How would you prioritize these roads – what local knowledge or concerns can you bring to the discussion?
3. What are the high-priority road segments?

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C	Bridge St (Osterville and Little Island)	2100	Access to Three Bays and Little Island	0-100	2-100	10-100	0	140	500
D	West Bay Rd	420	Access to North/West Bay waterfront	2-100	20-100	100	40	120	260
E	Craigville Beach Rd	4500	Access to Craigville Beach	0-100	2-100	10-100	0	0	1100
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Breakout Groups

Breakout Group Discussion

GETTING STARTED

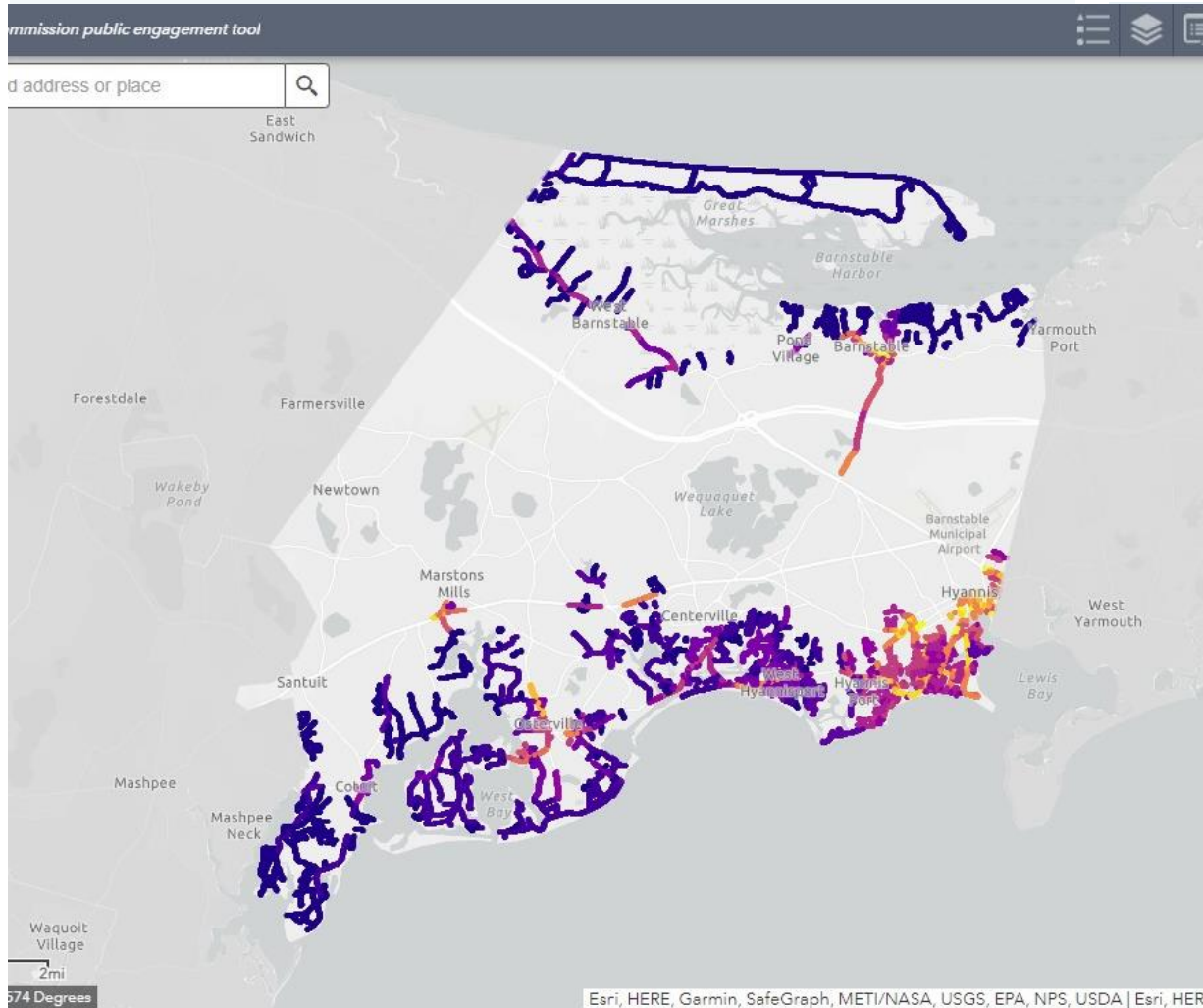
- Introductions
- Clarifying Questions

CONSIDERATIONS...

1. Are there roads that we missed?
2. How would you prioritize these roads – what local knowledge or concerns can you bring to the discussion?
3. What are the high-priority road segments?

LOW LYING ROADS

Summary: Vulnerability and Risk Analysis



- MC FRM
 - Data: SLR, Storms, Tides, Elevations
 - Flood projections 2030, 2050, 2070
- Road network vulnerable to flooding
- Criticality of road network to community
- Risk = probability x criticality

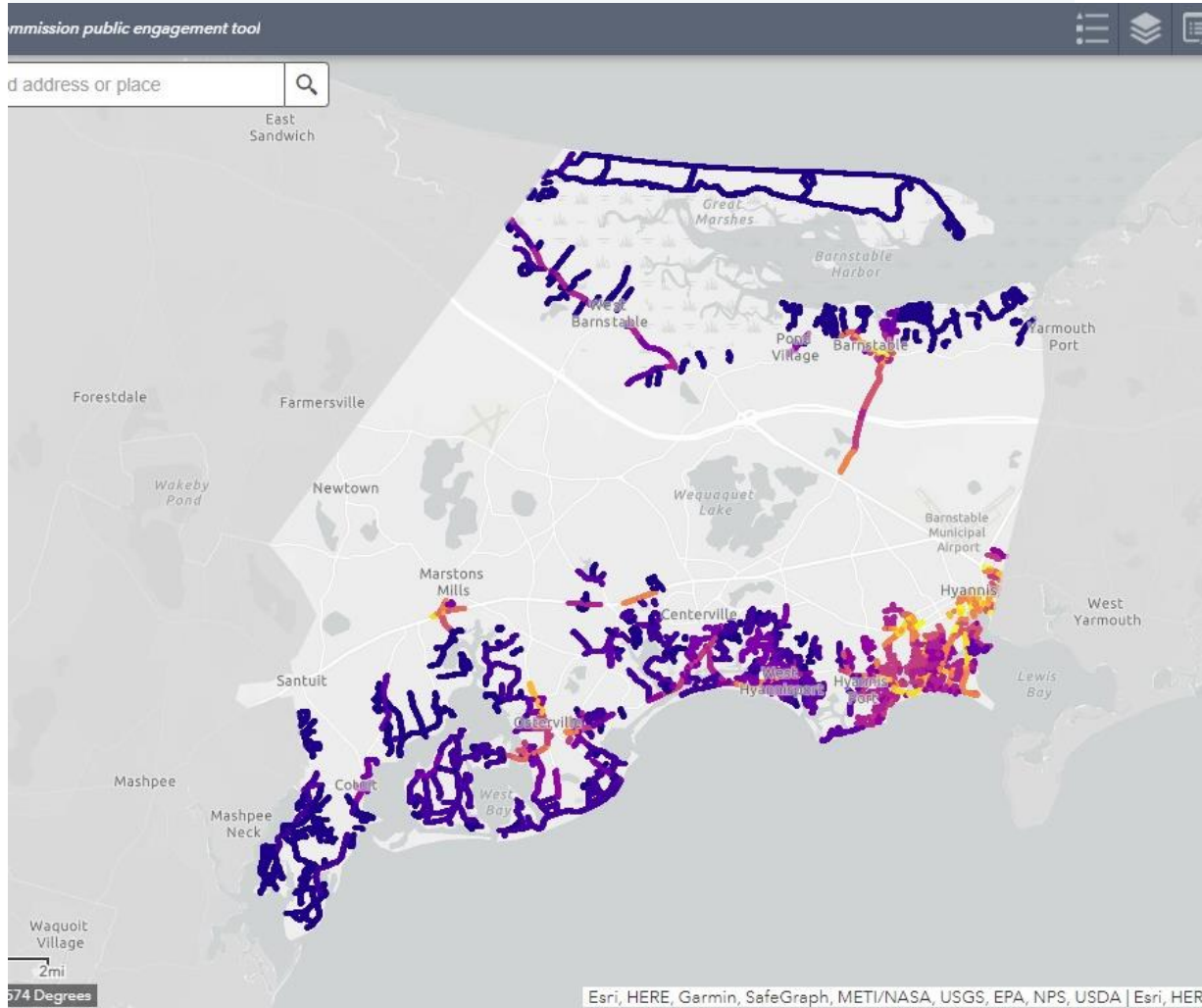
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LOW LYING ROADS

Group Discussion



**REPORT
BACK**

SYNTHESIS



Low Lying Roads: Barnstable

Home > Work > Low Lying Roads: Barnstable

Overview

Materials

Data Viewer

Top Segments

Overview

The Cape Cod Commission is working with 10 Cape towns, including the **Town of Barnstable**, to examine vulnerabilities in the roadway network and identify solutions. With funding support from the U.S. Economic Development Administration (EDA) and the Massachusetts Municipal Vulnerability Preparedness (MVP) program, the

NEXT MEETINGS

MONDAY

MAR 07, 2022

Barnstable Low-lying Roads Public Meeting

START TIME: 9:00 AM

NEXT STEPS

- Town staff to select 2 road segments
- Feasibility analysis
- 3 solutions + costs per segment
- Solutions available to view on Low Lying Road webpage later in 2022: <https://www.capecodcommission.org/our-work/low-lying-roads-project/>
- 2nd Workshop date TBD – winter 2023

THANK YOU!
