Future-Proofing Current Decisions: Lessons Learned about Incorporating Sea Level Rise into Planning

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CoastSmart
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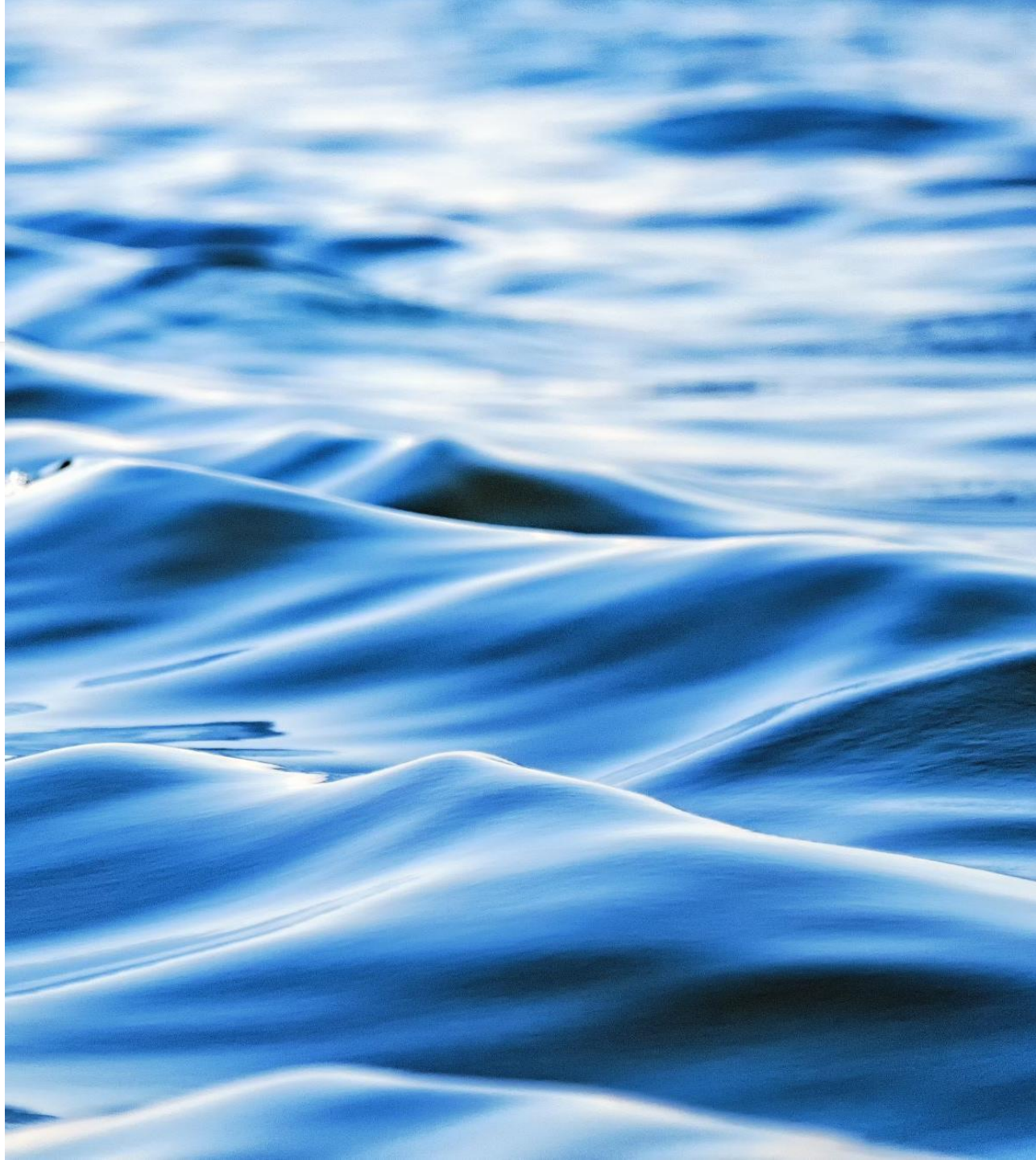
We will talk about

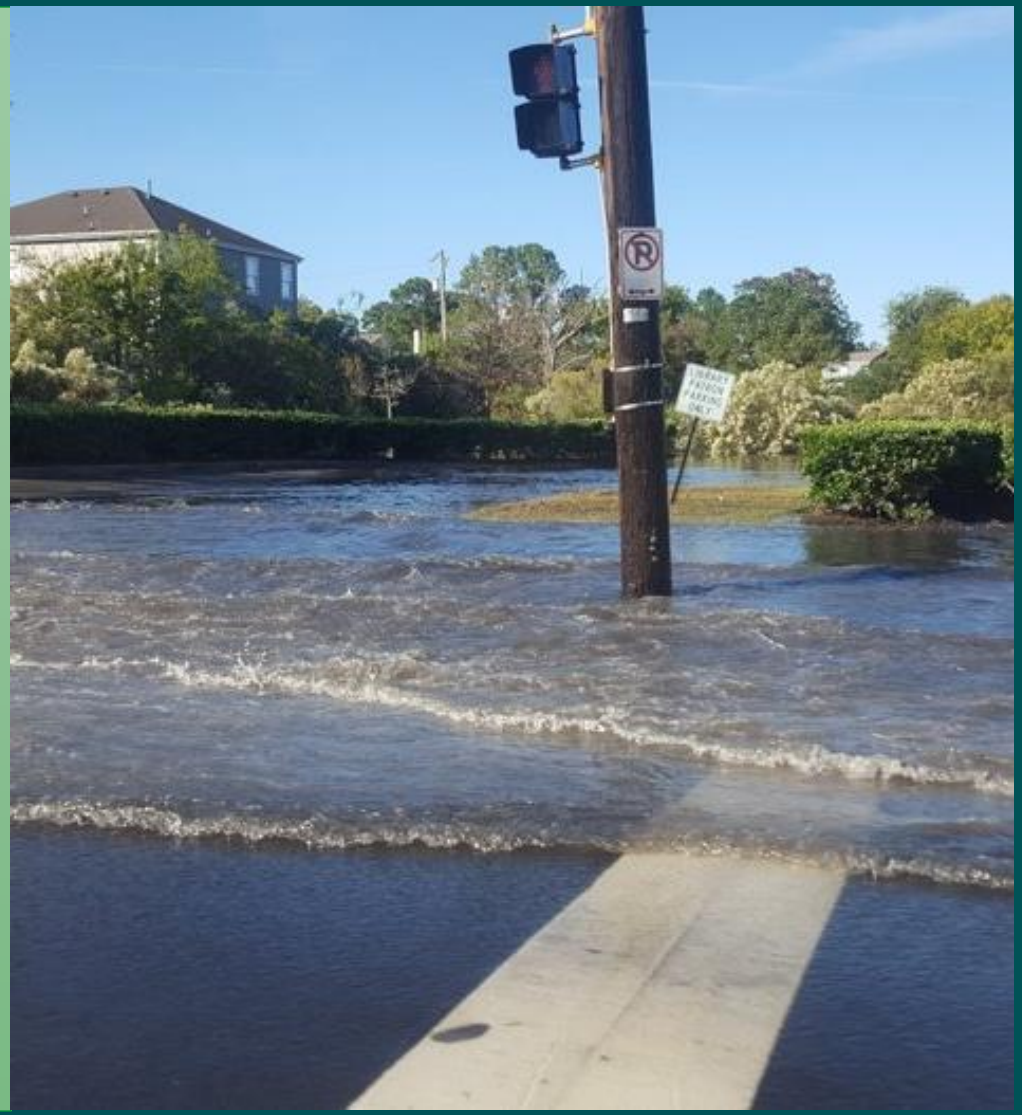
- What forecasts show, what they don’t
  - Variability & Uncertainty
- Challenges of conveying water level forecasts in a comprehensible and actionable manner for coastal planning purposes.
- Compare graphs and maps for conveying information



What do we use water level forecasts for?

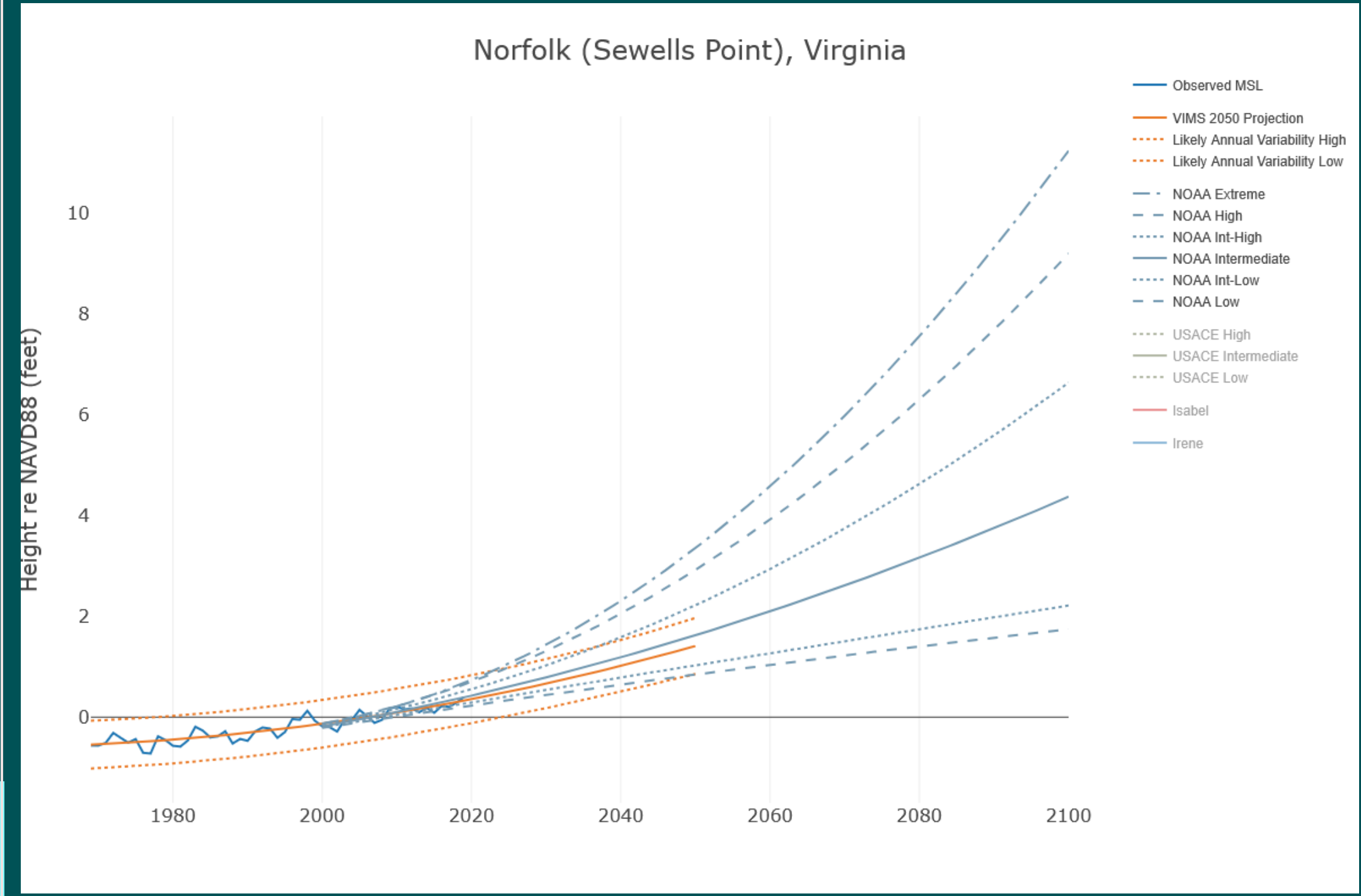
- Planning design standards for buildings & roads
- Comp plan/zoning decisions
- Rolling conservation easement/regulatory overlay
- Time-aware permitting

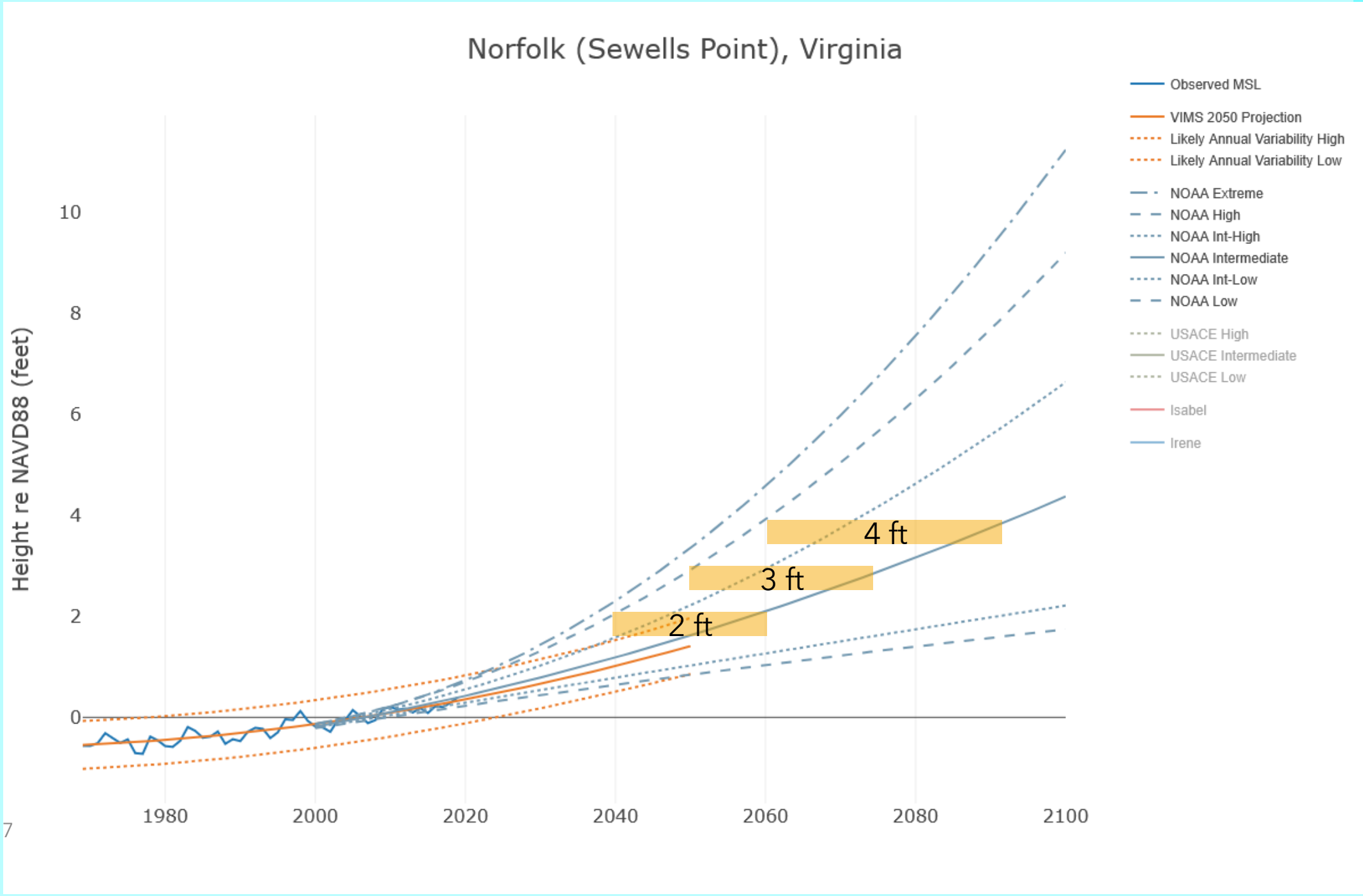
1. Changing baselines
2. Uncertainty in projections
3. Annual variability
4. Flooding proceeds ahead of tides



We can forecast water levels…

- Long term
  - Sea level rise
  - Typically an annual average water level (but surrounding by variability)
  - Uncertainty increases as you move further into the future
- Short term
  - Tide, storm surge & combined flooding
  - Very specific to the storm
  - Less uncertainty and variability to incorporate in visualizations (but scale is important)


Norfolk (Sewells Point), Virginia
Height re NAVD88 (feet)
10
8
6
4
2
0
1980
2000
2020
2040
2060
2080
2100
Observed MSL
VIMS 2050 Projection
Likely Annual Variability High
Likely Annual Variability Low
NOAA Extreme
NOAA High
NOAA Int-High
NOAA Intermediate
NOAA Int-Low
NOAA Low
USACE High
USACE Intermediate
USACE Low
Isabel
Irene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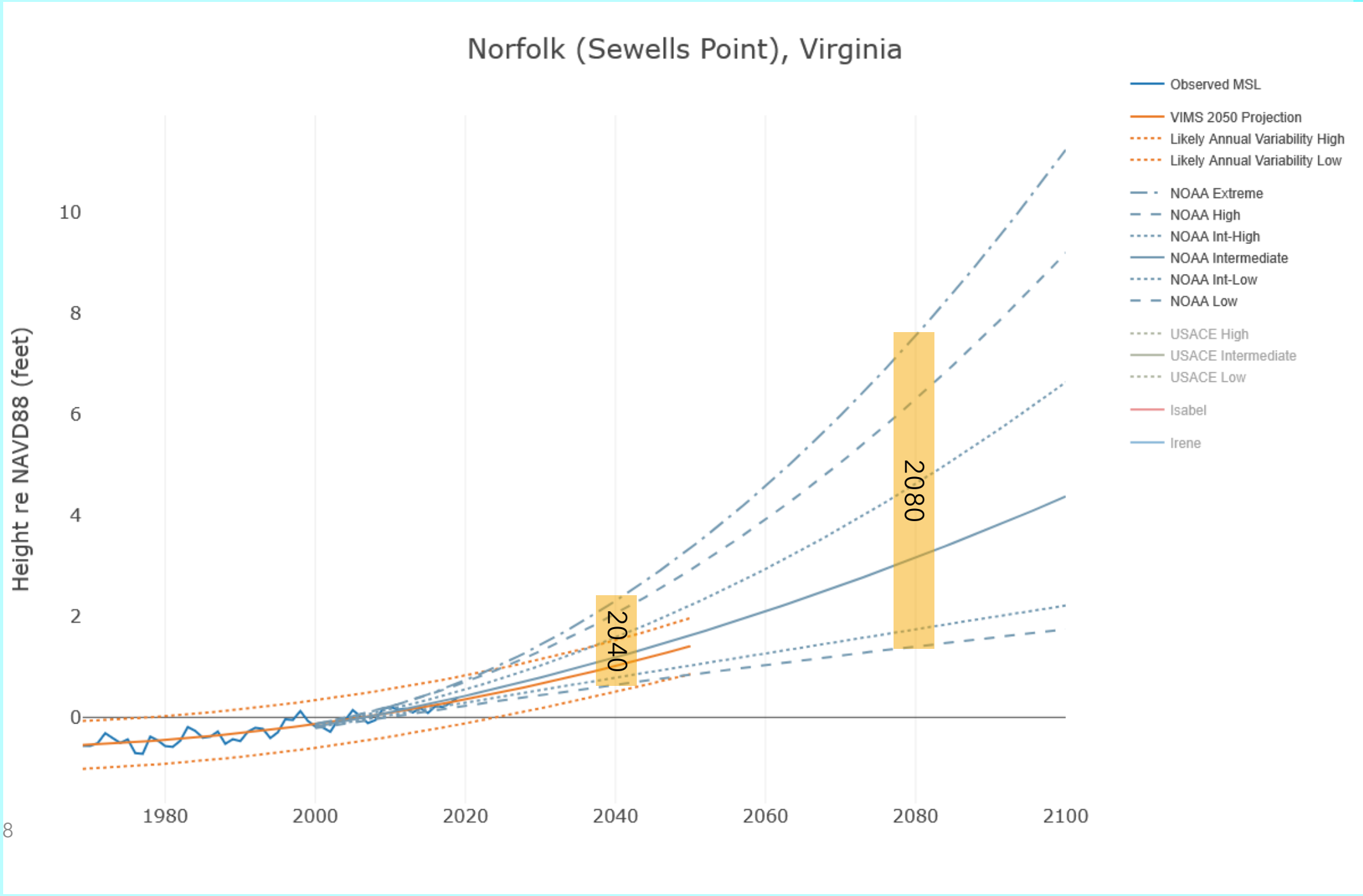
Height re NAVD88 (feet)
10
8
6
4
2
0
1980
2000
2020
2040
2060
2080
2100
4 ft
3 ft
2 ft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Height re NAVD88 (feet)
10
8
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2000
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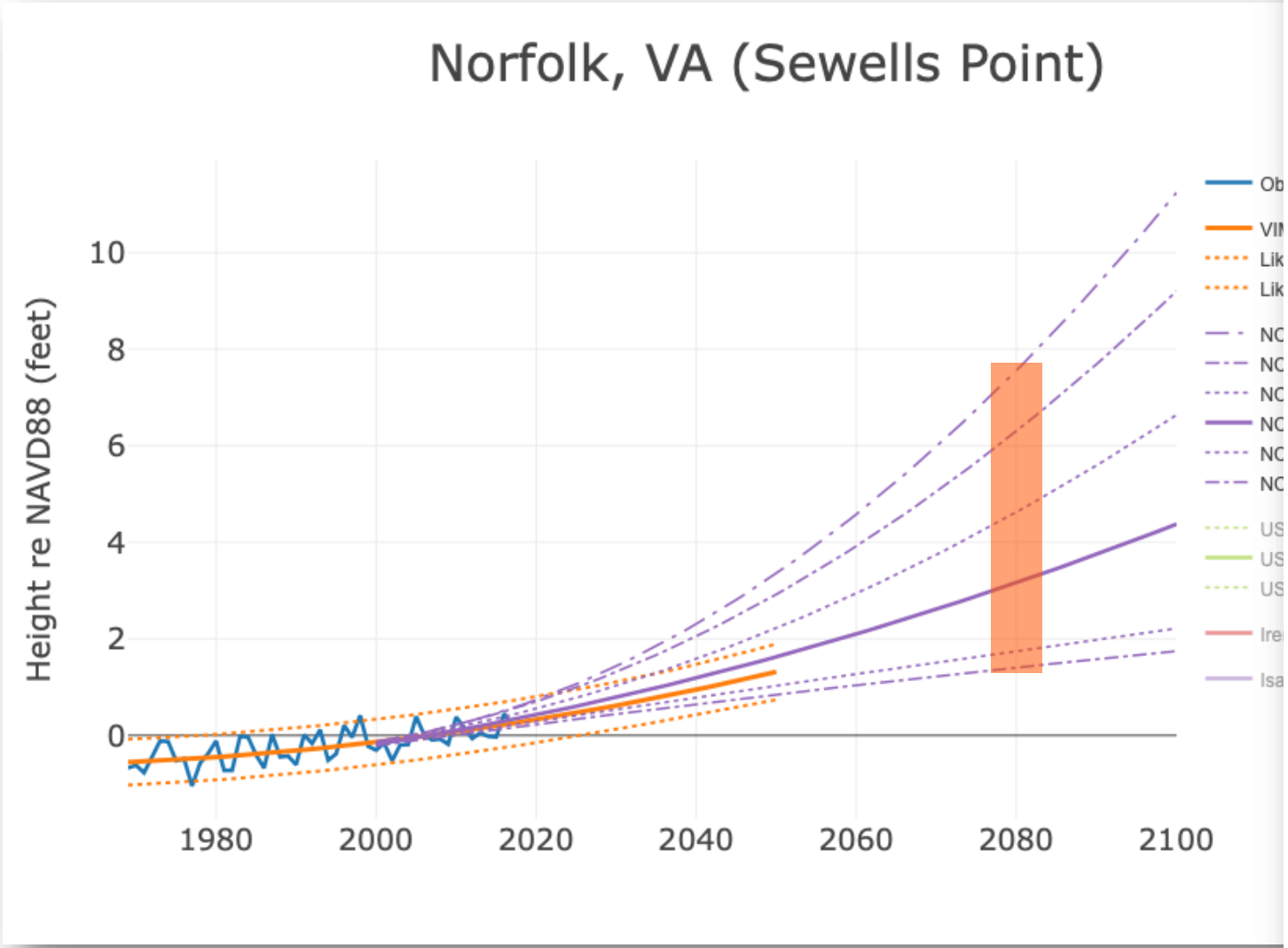
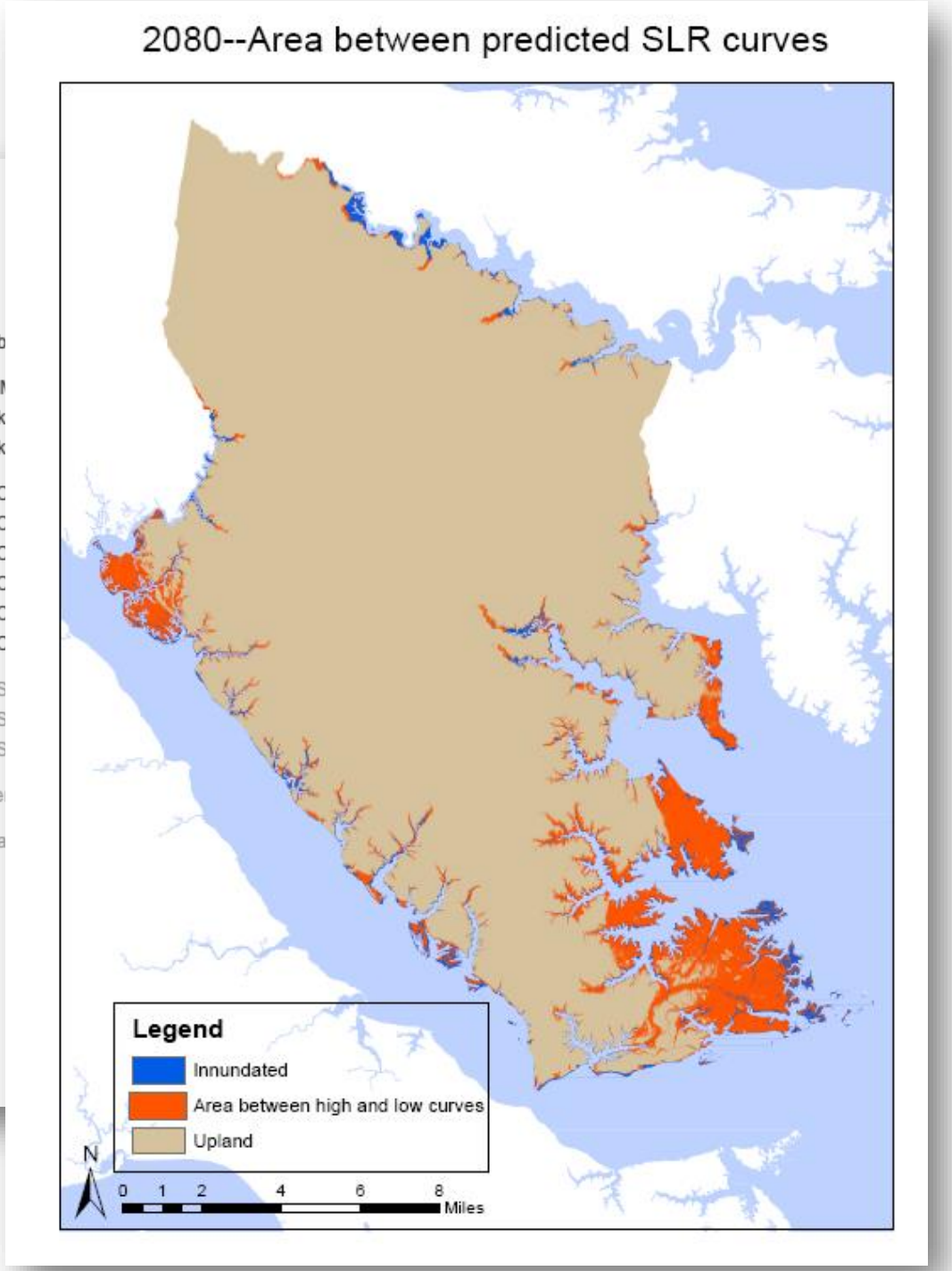
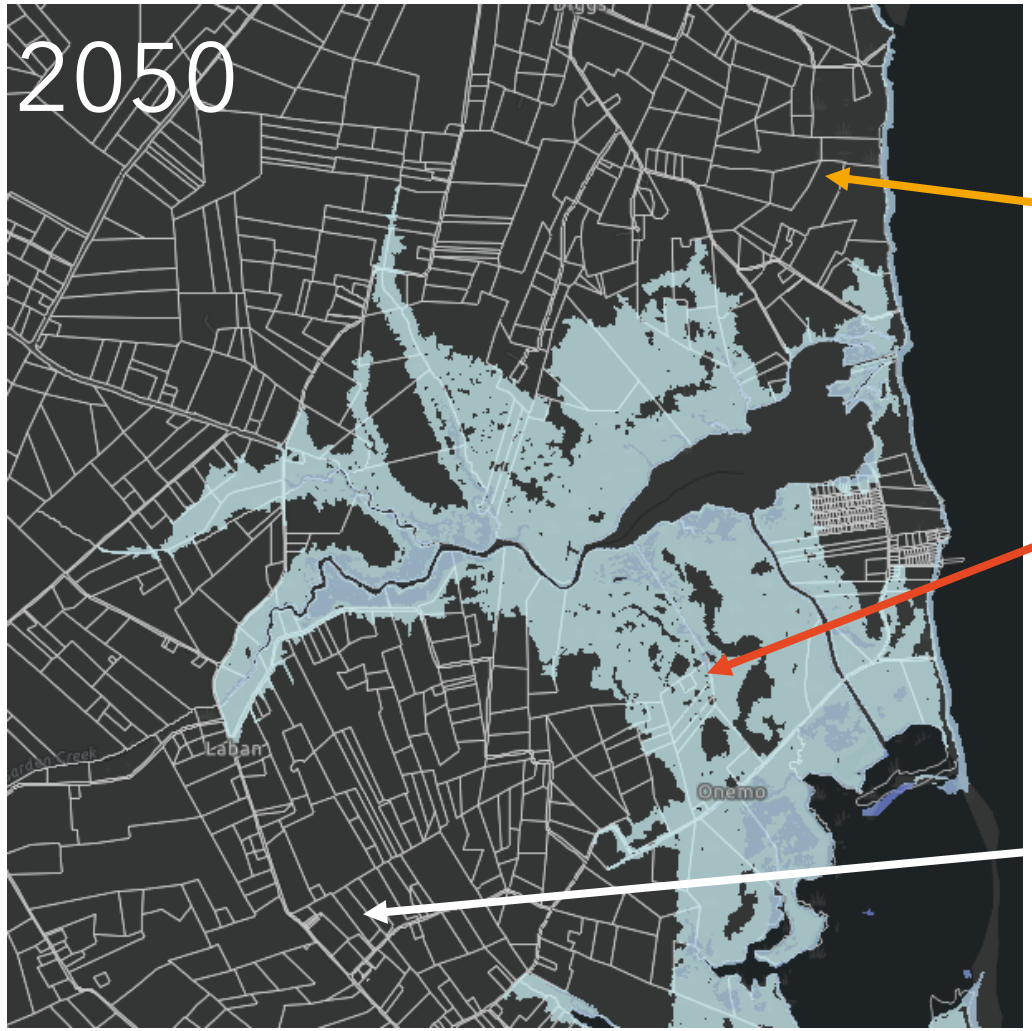

Norfolk, VA (Sewells Point)
Height re NAVD88 (feet)
10
8
6
4
2
0
1980
2000
2020
2040
2060
2080
2100


2080--Area between predicted SLR curves
Legend
Innundated
Area between high and low curves
Upland
N
0 1 2 4 6 8
Miles

Best case

MHW NOAA 2017 Low scenario



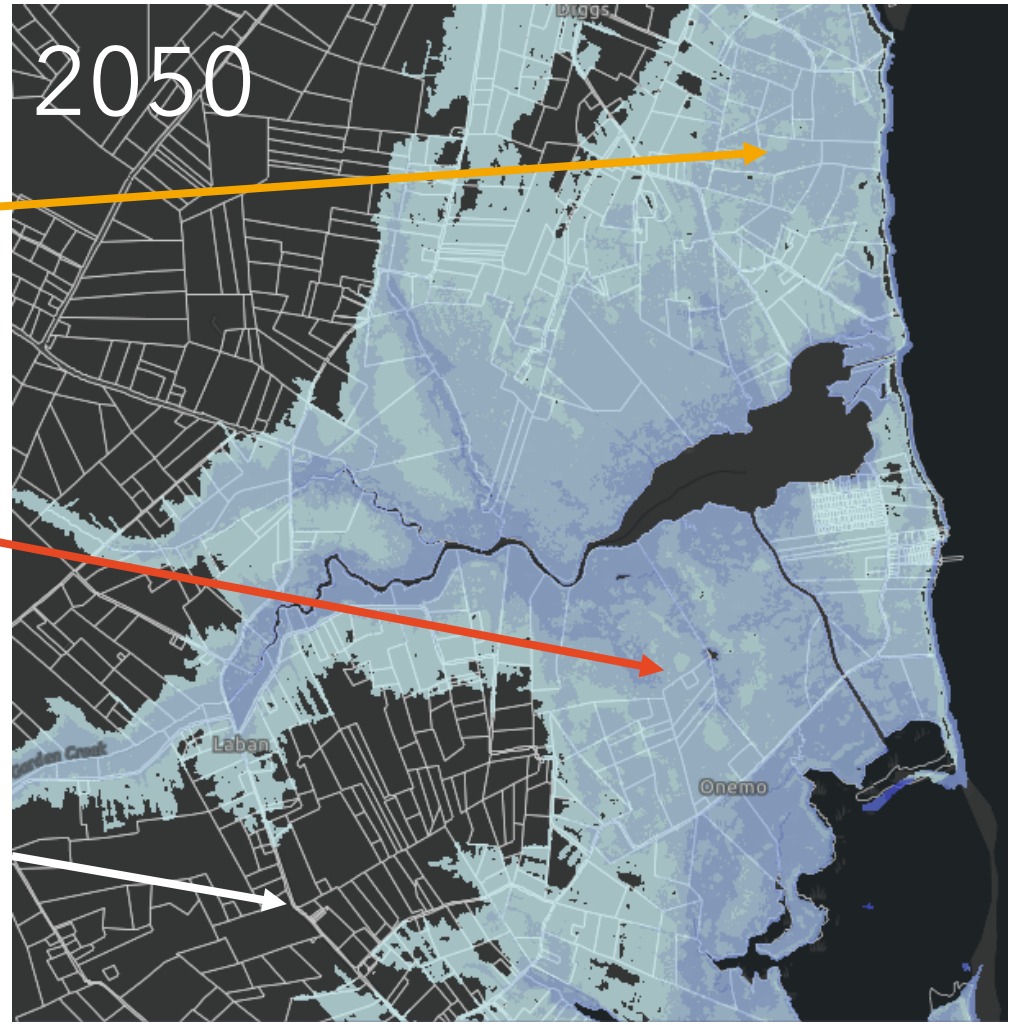
Hard to predict outcome

Likely to be underwater

Unlikely to be underwater

Worst case

MHW NOAA 2017 Extreme scenario



Adapt VA Interactive Map

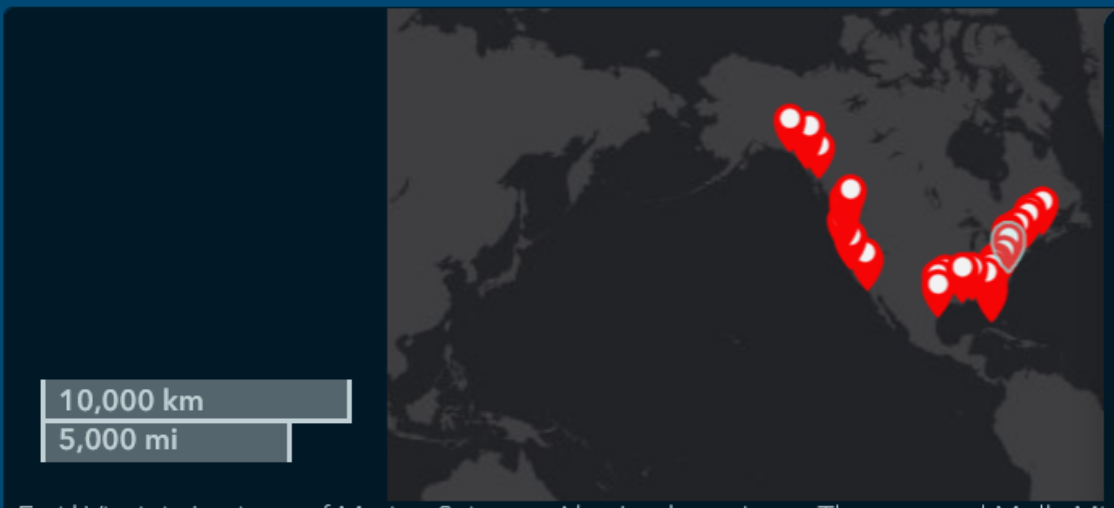
VIMS Sea-Level Report Cards Dashboard

Stations

Search...

- Eastport, ME
- Portland, ME
- Boston, MA
- New York, NY
- Sandy Hook, NJ
- Baltimore, MD
- Annapolis, MD
- Solomons Island, MD
- Yorktown, VA

Select a station from this list for associated map and graph data - Click right arrow below for stations ranked by Rise and Acceleration Rates



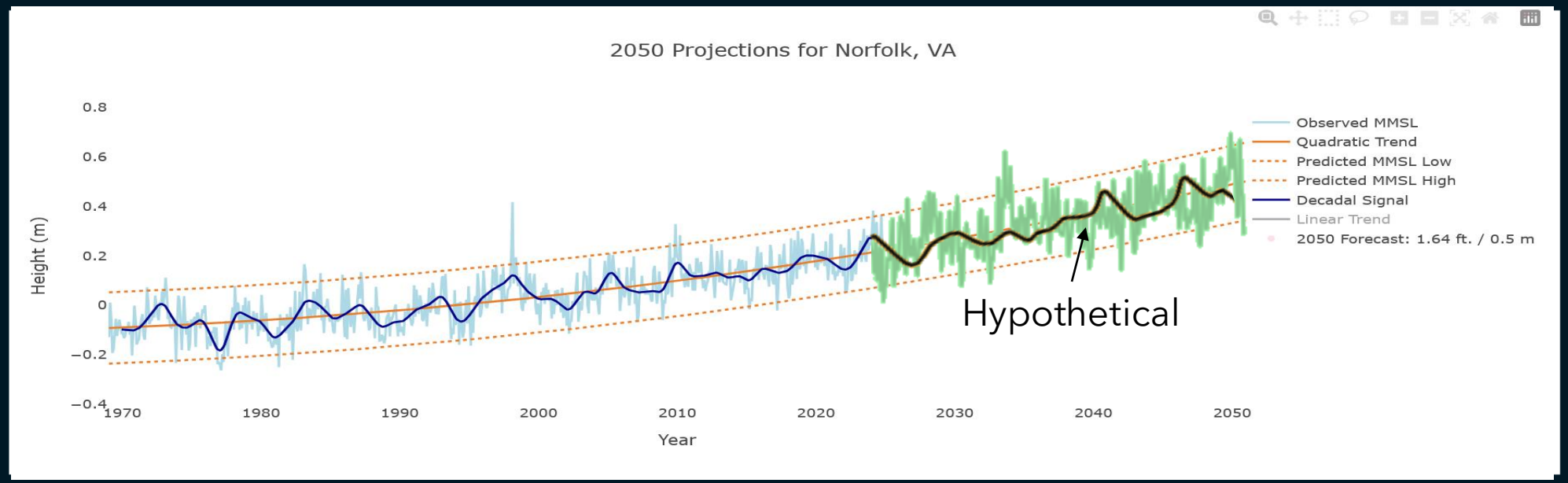
Norfolk, VA

Zoom to Pan

Station ID: 8638610

The 2050 sea level is projected to be **0.47 meters (1.54 feet) above current MSL** (Mean Sea Level).

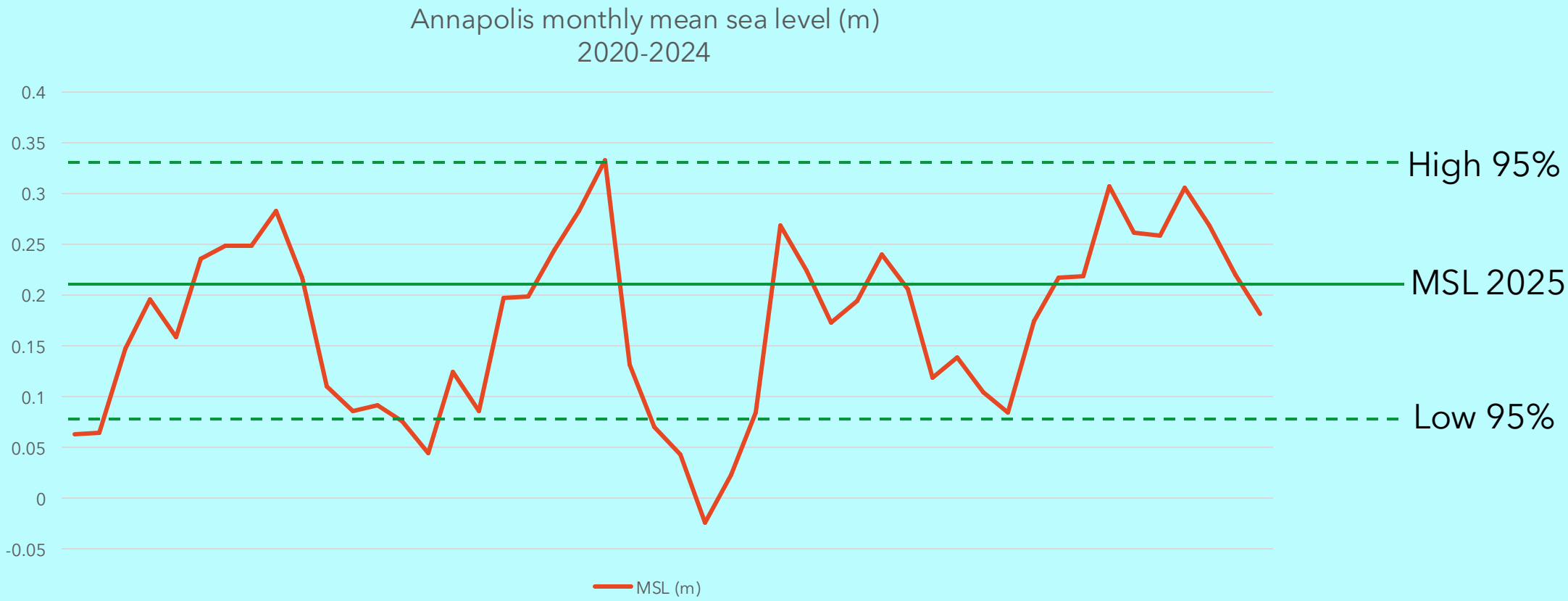
The Rise Rate is **5.60 mm/yr**.



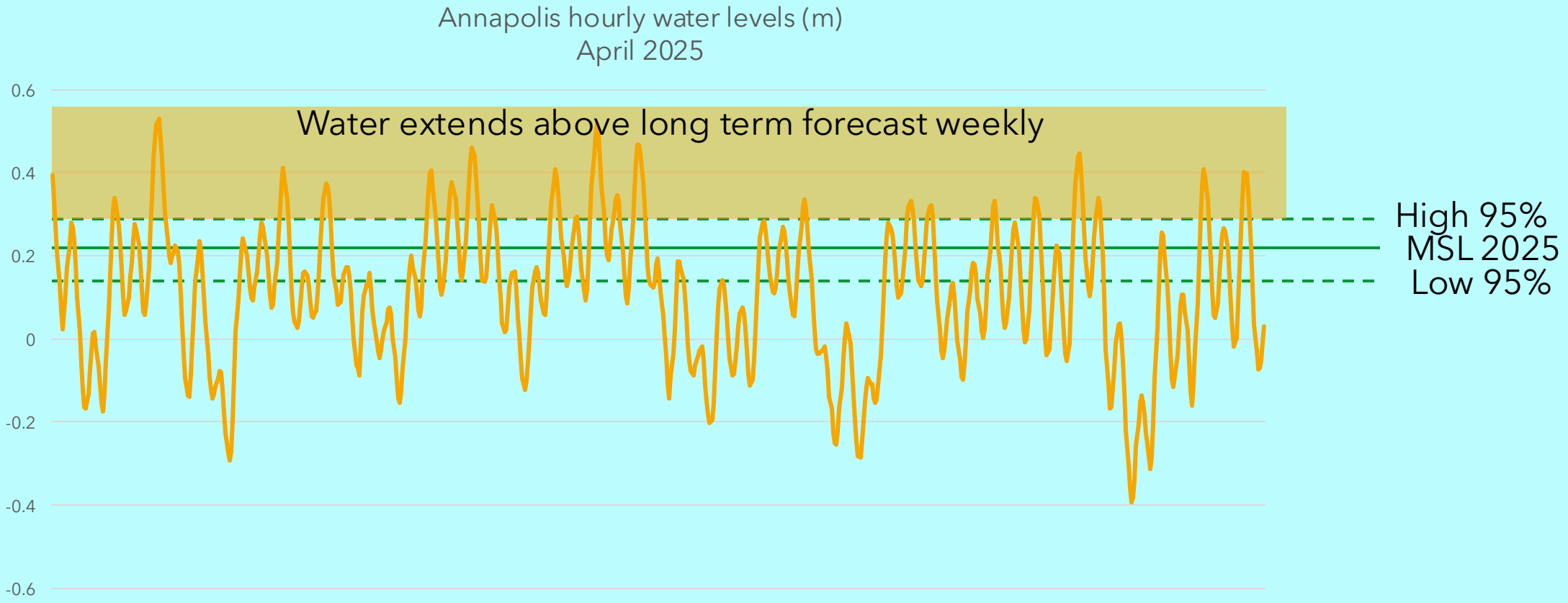
Stations

Projection 2050 Graph | Rise Rate Graph | Acceleration Rate Graph

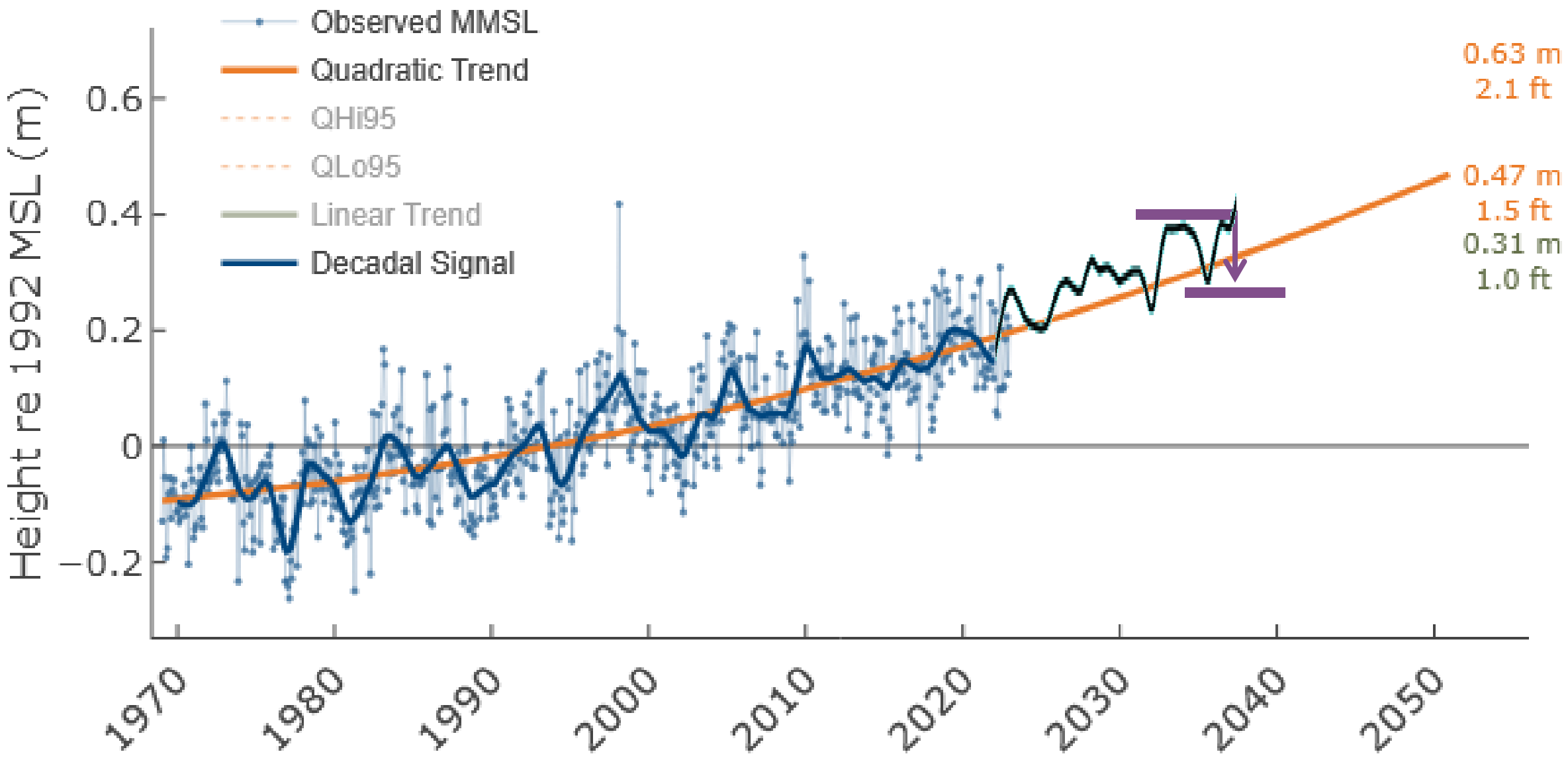
Monthly water level variation



Hourly water level variation



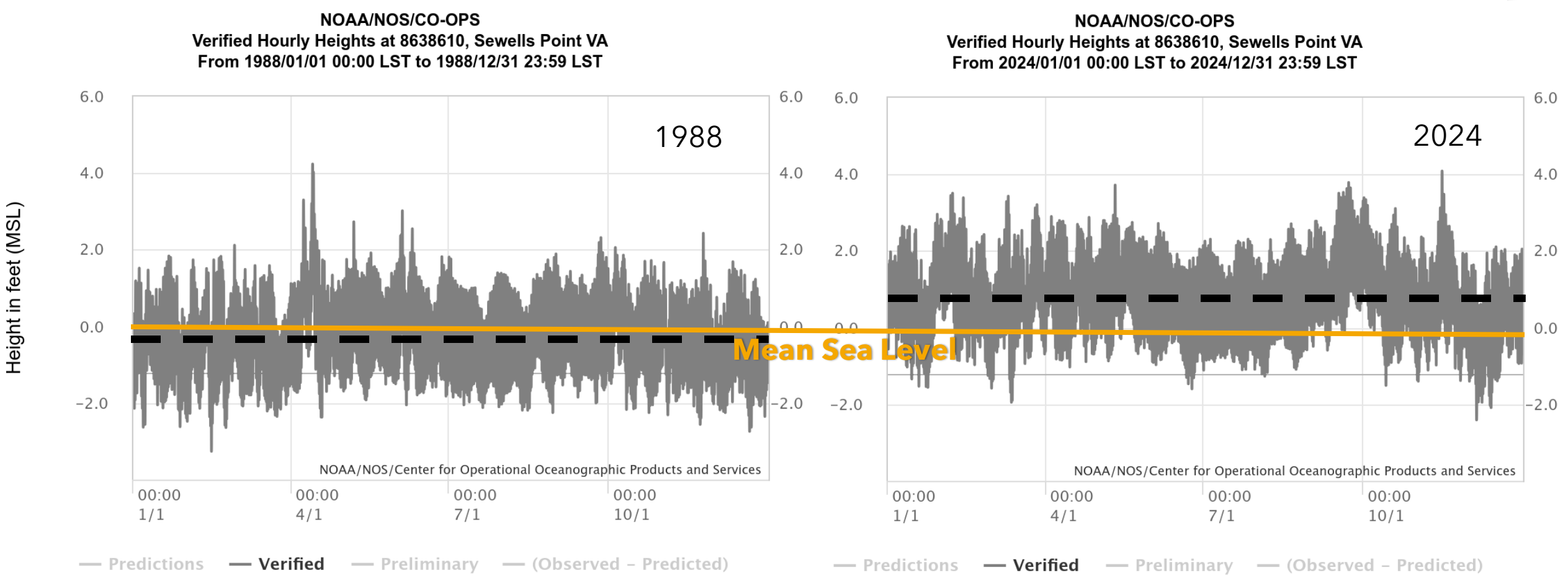
Norfolk (Sewells Point), Virginia

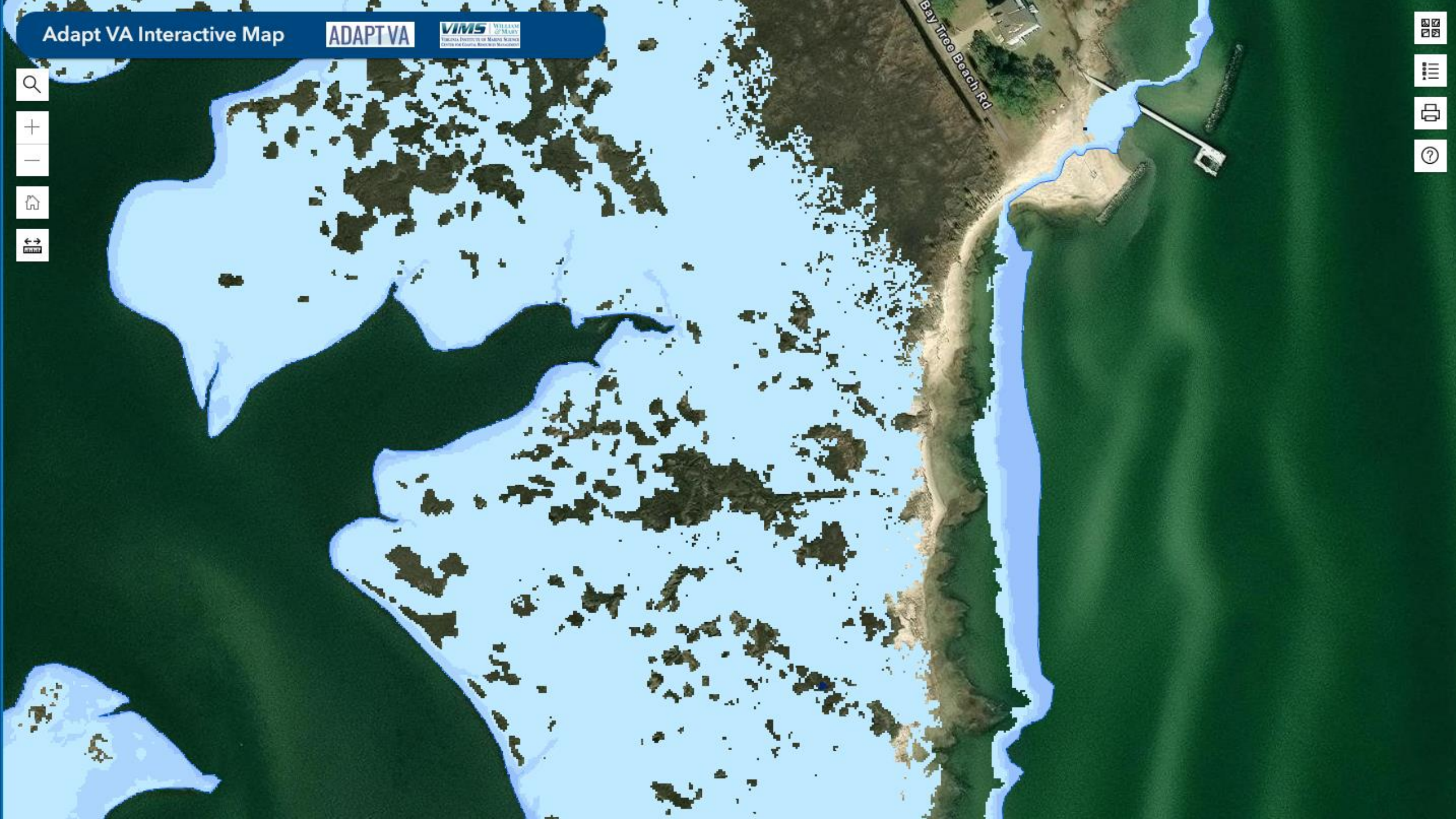


Changing baselines

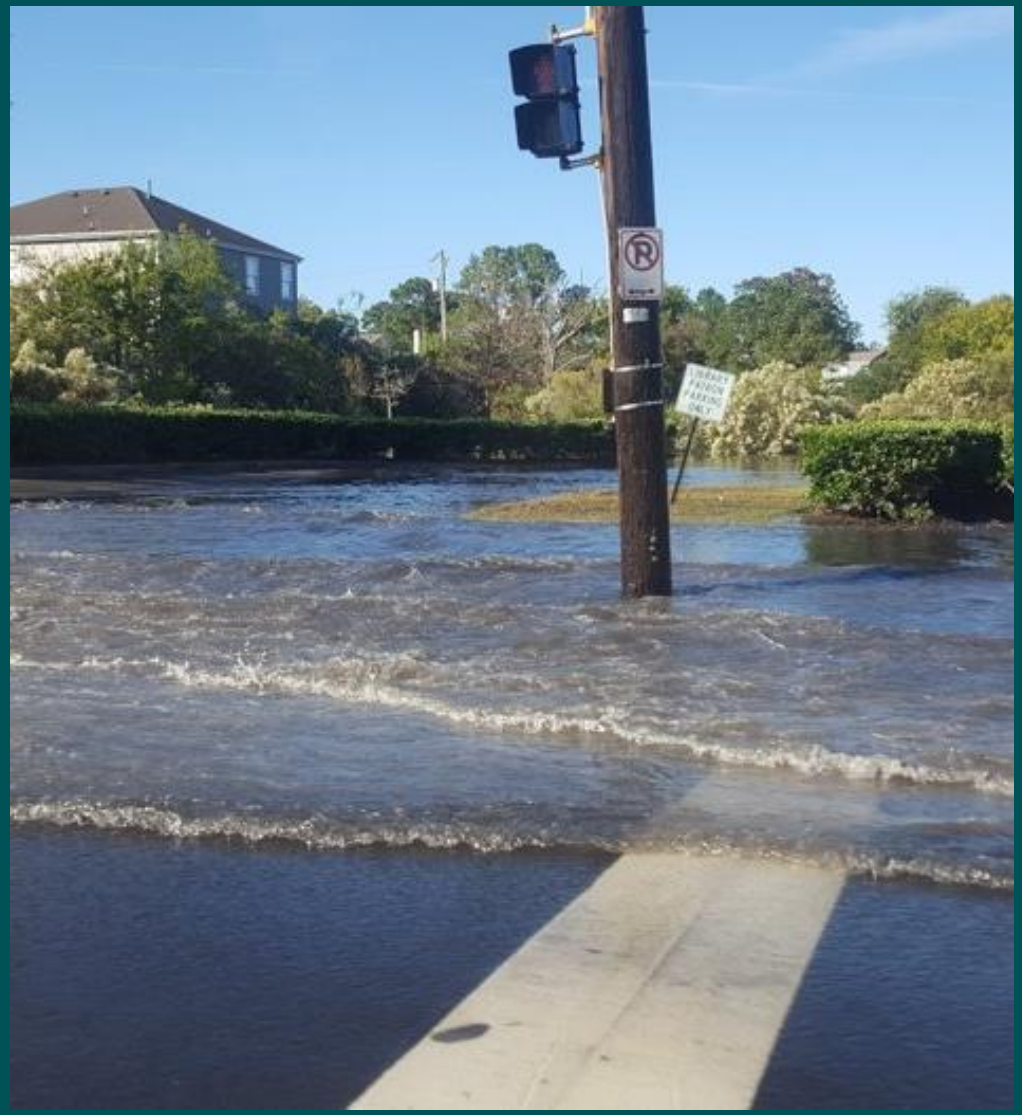
A problem with how we reference things

Mean sea level?

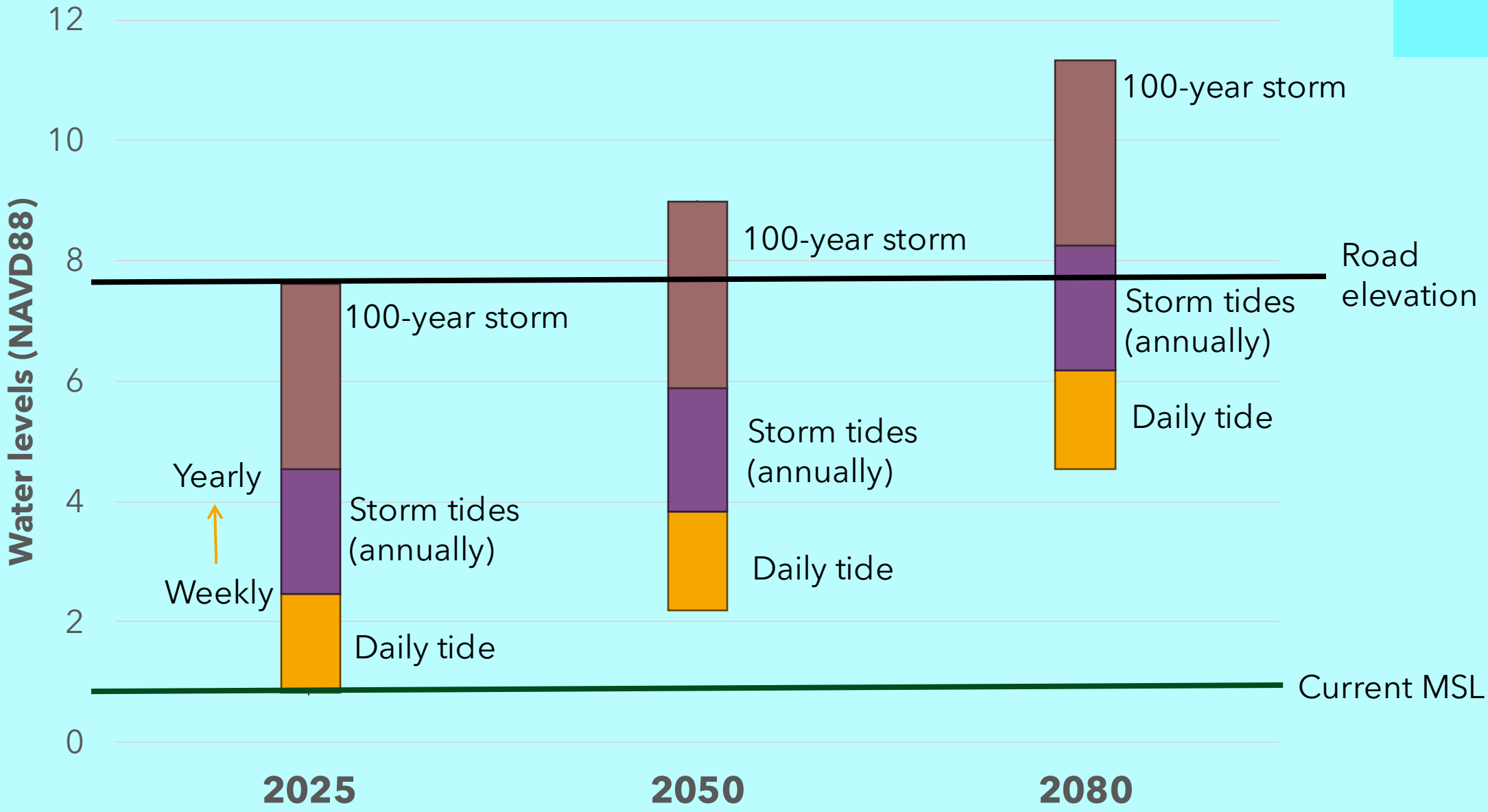



Adapt VA Interactive Map
ADAPT VA
VIMS
Bay Tree Beach Rd

This is what is underwater– but what will flood?



Roads flood ~ monthly long before models show inundation



VIRGINIA COASTAL RESILIENCE WEB EXPLORER Ver 1.0

Sea level rise increases coastal flood hazards in both extent and frequency.

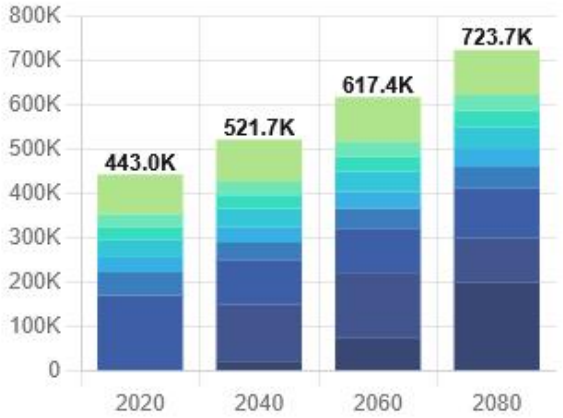
Select Area of Interest:

Commonwealth | Virginia

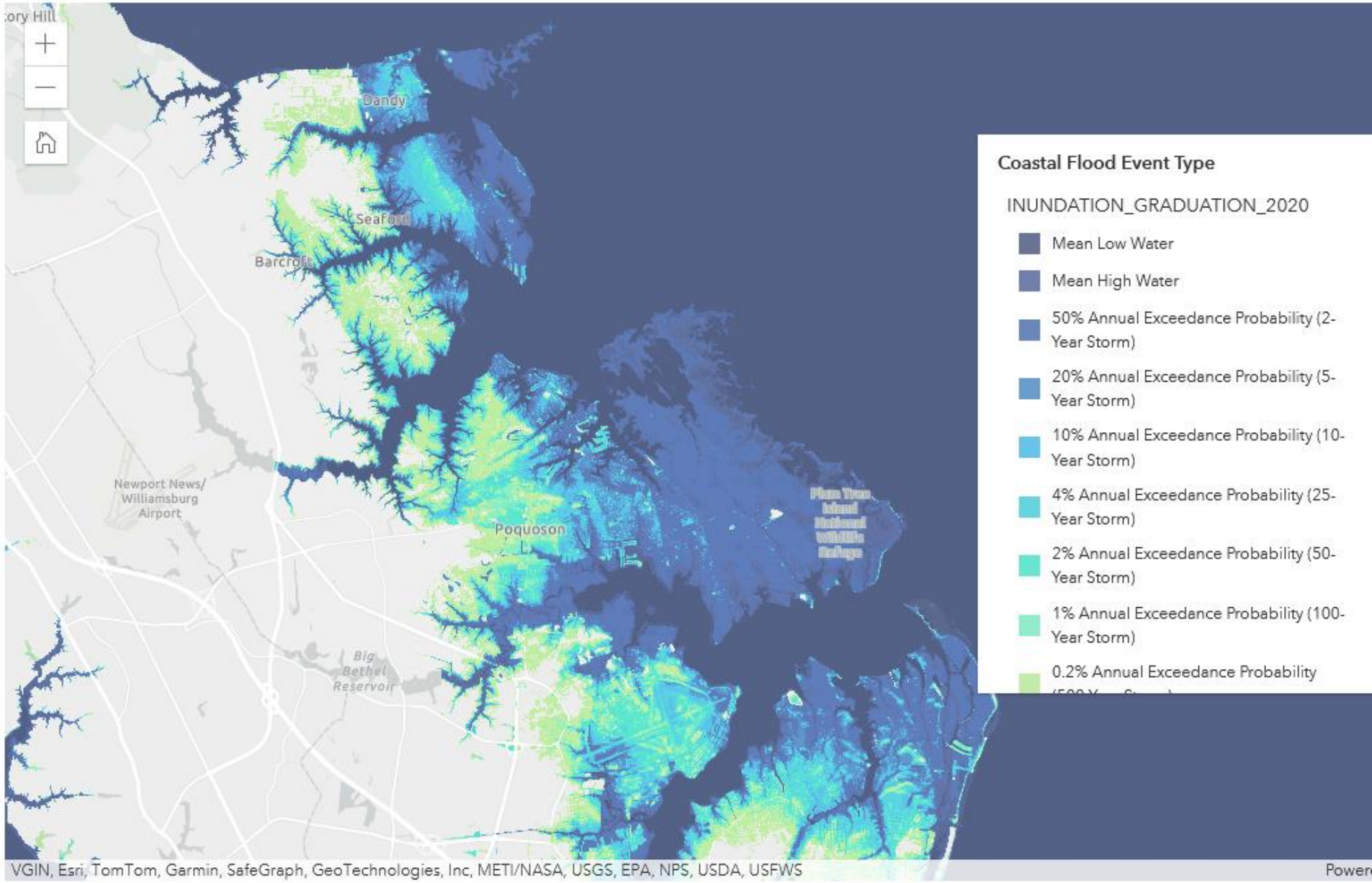
Coastal Flood Time Horizon:

2020 | 2040 | 2060 | 2080

Acres of Land Area Inundated Across Flood Event Type



- Mean Low Water
- Mean High Water
- 50% Annual Exceedance Probability (2-Year Flood)
- 20% Annual Exceedance Probability (5-Year Flood)
- 10% Annual Exceedance Probability (10-Year Flood)
- 4% Annual Exceedance Probability (25-Year Flood)
- 2% Annual Exceedance Probability (50-Year Flood)
- 1% Annual Exceedance Probability (100-Year Flood)
- 0.2% Annual Exceedance Probability (500-Year Flood)



Notes and Limitations

VIRGINIA COASTAL RESILIENCE WEB EXPLORER
Ver 1.0

Introduction | **Hazards** | Impacts | Community Context | Projects and Initiatives | Funding Opportunit

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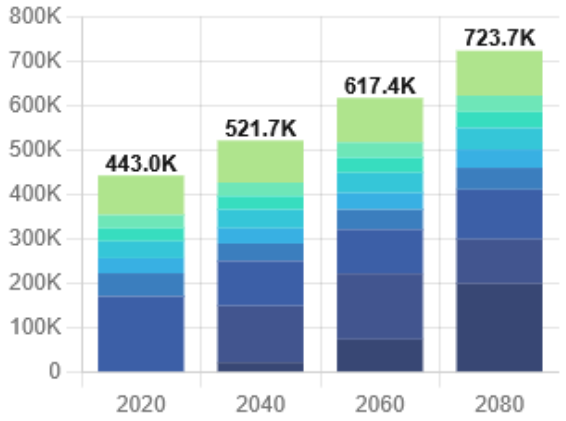

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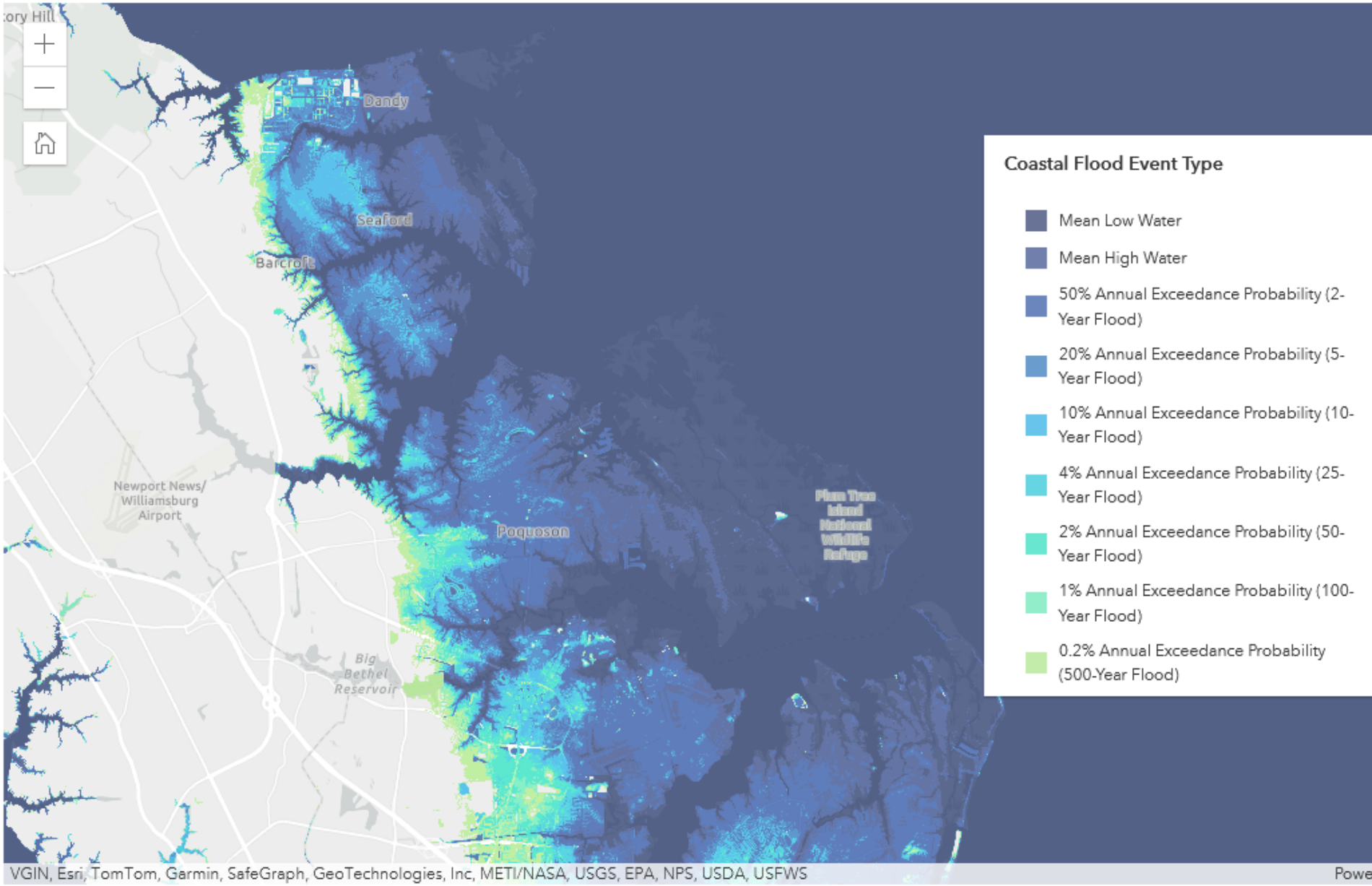

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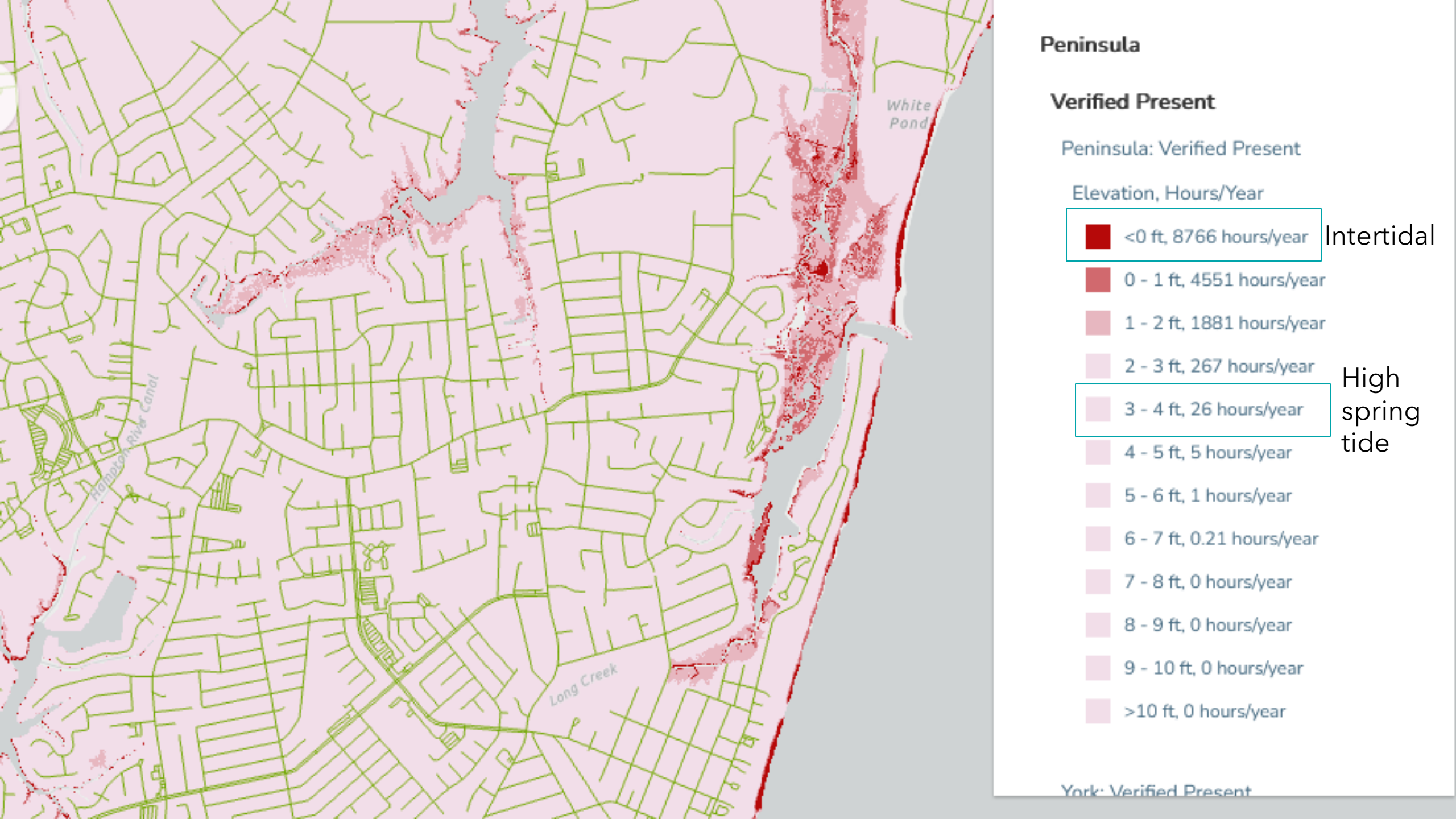
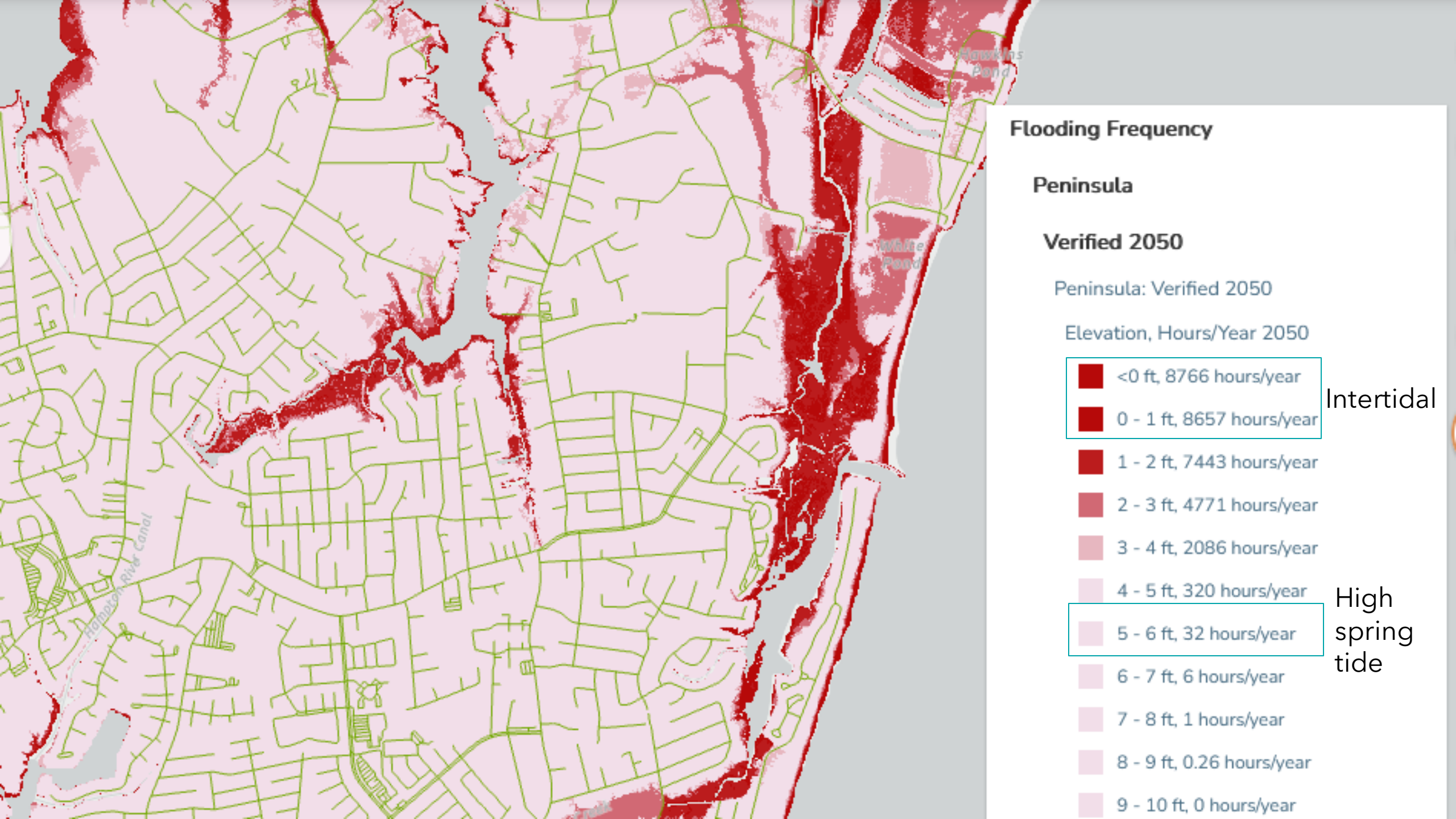
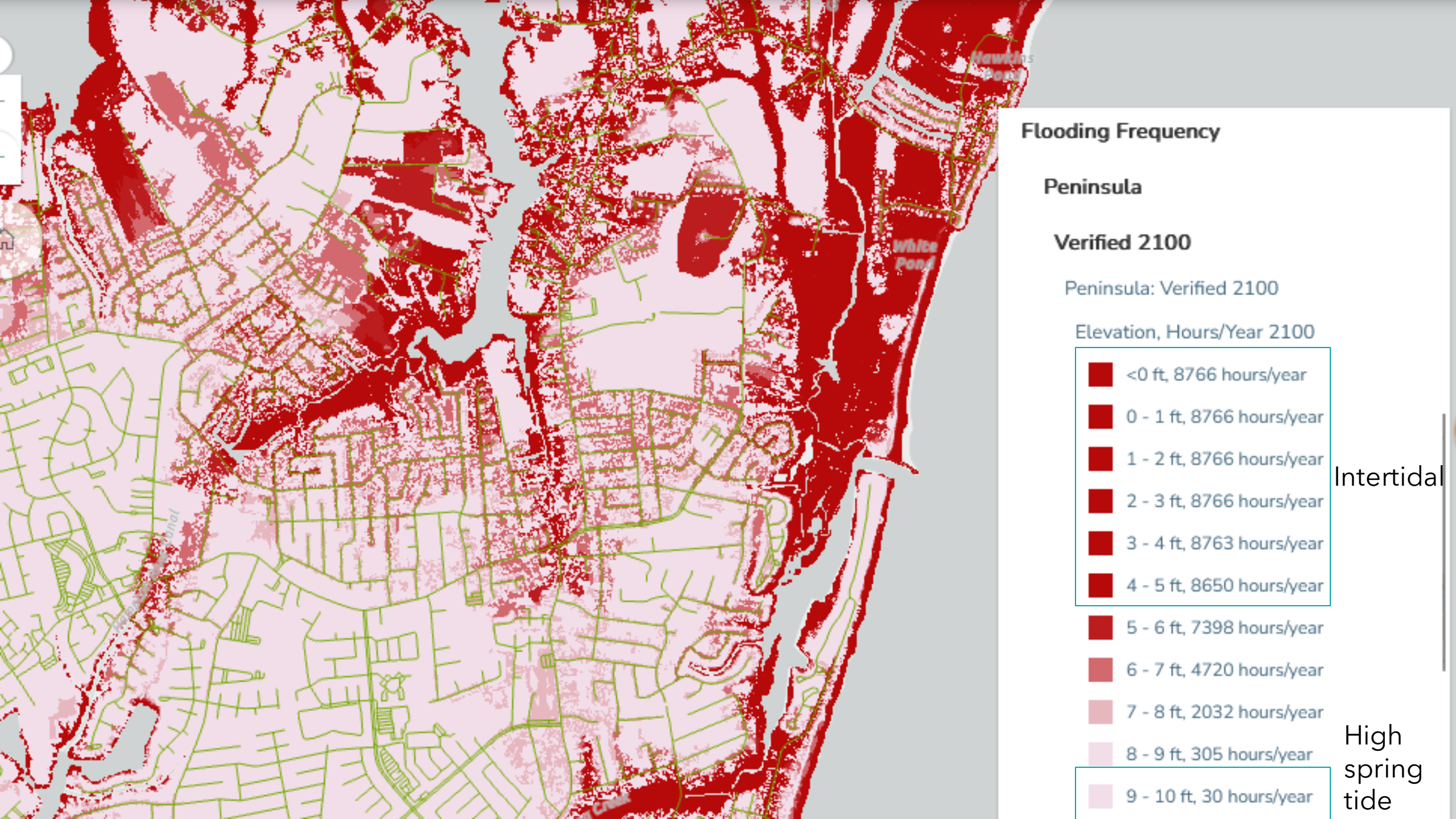

Peninsula
Verified Present
Peninsula: Verified Present
Elevation, Hours/Year
<0 ft, 8766 hours/year
0 - 1 ft, 4551 hours/year
1 - 2 ft, 1881 hours/year
2 - 3 ft, 267 hours/year
3 - 4 ft, 26 hours/year
4 - 5 ft, 5 hours/year
5 - 6 ft, 1 hours/year
6 - 7 ft, 0.21 hours/year
7 - 8 ft, 0 hours/year
8 - 9 ft, 0 hours/year
9 - 10 ft, 0 hours/year
>10 ft, 0 hours/year
York: Verified Present
Intertidal
High spring tide
White Pond
Hampton River Canal
Long Creek


Flooding Frequency
Peninsula
Verified 2050
Peninsula: Verified 2050
Elevation, Hours/Year 2050
<0 ft, 8766 hours/year
0 - 1 ft, 8657 hours/year
1 - 2 ft, 7443 hours/year
2 - 3 ft, 4771 hours/year
3 - 4 ft, 2086 hours/year
4 - 5 ft, 320 hours/year
5 - 6 ft, 32 hours/year
6 - 7 ft, 6 hours/year
7 - 8 ft, 1 hours/year
8 - 9 ft, 0.26 hours/year
9 - 10 ft, 0 hours/year
Intertidal
High spring tide
Hampton River Canal
White Pond
Hawkins Pond


Flooding Frequency
Peninsula
Verified 2100
Peninsula: Verified 2100
Elevation, Hours/Year 2100
<0 ft, 8766 hours/year
0 - 1 ft, 8766 hours/year
1 - 2 ft, 8766 hours/year
2 - 3 ft, 8766 hours/year
3 - 4 ft, 8763 hours/year
4 - 5 ft, 8650 hours/year
5 - 6 ft, 7398 hours/year
6 - 7 ft, 4720 hours/year
7 - 8 ft, 2032 hours/year
8 - 9 ft, 305 hours/year
9 - 10 ft, 30 hours/year
Intertidal
High spring tide
White Pond
Hawkins Pond

Some best practices?

- Uncertainty is easier to constrain in a map, variability is easier to convey in a graph
- Our focus on mean sea level may leave us unprepared for flooding so we need to incorporate other flood levels into our planning
- Good regulatory language is hard to form for an uncertain and variable future so monitoring and flexible policies are better than fixed future policies