

# Regulatory Advisory Committee Meeting: Beach Preservation Act and Dune Health Analysis

October 20, 2026

DNREC

Division of Watershed Stewardship

Shoreline and Waterway Management Section

DNREC DIVISION OF WATERSHED STEWARDSHIP

# Beach Preservation Act of 1972

## Title 7, Chapter 68

- General Assembly recognized that Delaware's beaches were rapidly deteriorating due to a combination of both natural processes and continual development
- Declared the beaches to be "valuable natural features which provide recreational opportunities and storm protection for persons and property"….
- Purpose is to "enhance, preserve and protect the public and private beaches of the state"
- Last bill was in 2008

http://delcode.delaware.gov/title7/c068/index.html

# Definitions

- A “**beach**” is that area from the Delaware/Maryland line at Fenwick Island to the Old Marina Canal immediately north of Pickering Beach, which extends from the mean high water line of the Atlantic Ocean and Delaware Bay landward 1,000 feet and seaward 2,500 feet, respectively.

- *Are these still the right parameters?*

# Definitions

- “Beach erosion” or “erosion” is the wearing away of a beach by water or the elements.

- *Should we add human interaction in addition to elements?*

# Definitions

- “Beach preservation,” “beach erosion control” or “erosion control” is the protection and control of the beach by the conduct and regulation of work and activities likely to affect the physical condition of the beach or shore, and includes, but is not limited to, erosion control, hurricane protection, coastal flood control, shoreline and offshore rehabilitation.

- *Should we revisit these definitions?*
- *Should we add beach nourishment?*
- *Should we separate these out?*

# Definitions

- "Construction" includes any work or activity which is likely to have a material physical effect on existing coastal conditions or natural shore and inlet processes.
- "Material Physical Effect" is defined in regulations as any alteration to the existing characteristics of the beach or dune that could significantly, increase the danger of erosion, storm damage or flooding and includes the moving, digging, or removal of beach or the erection of any temporary or permanent structure.

- *Should construction be redefined?*
- *Should Material Physical Effect be defined in Act? And should it be the same as current regulations?*

# Definitions

- “Regulated area” is the specific area within the defined beach that the Department is directed to regulate construction to preserve dunes and to reduce property damage. The regulated area shall be from the seaward edge of the beach to the landward edge of the third buildable lot in from the mean high water line.

- *Should we redefine this based on a scientific method or natural feature?*
- *Why does this area require regulating?*
- *Should it encompass just the area affected by overwash from coastal storms?*

# Definitions

- “Building line” means a line generally paralleling the coast, seaward of which construction of any kind shall be prohibited without a permit or letter of approval from the Department. The building line shall be set forth on maps prepared by the Department with reference to a vertical datum commonly used by land surveyors, the Delaware State Plane Coordinate System and topographical surveys.

- *What is the building line supposed to represent? The dune?*
- *Does it have to be mapped?*
- *Does it require topographical surveys?*

# Definitions

- “Building line” ……Within the corporate limits of Rehoboth Beach and Bethany Beach, in commercial areas containing boardwalks and where no natural dune exists, the building line shall be along the westerly edge of the boardwalk.

- *Does this afford those structures the same protection?*
- *Is it still relevant?*

# Definitions

- “Building line” ……In those cases where the mapped building line either transects or is landward of lots that, in turn, are landward of lots with existing habitable structures, the building line will not be used to modify either location or dimension of buildings on the more landward lot.

- *Does this still make sense?*
- *Does it need to be in the definition, or can it be in other parts of the Act?*

# Definitions

- “Building line” ……On those ocean and Delaware Bay front lots, where existing buildings are either partially or completely seaward of the building line, the Department is directed to consider beach nourishment work that has enhanced the beach and dune when determining the location and size of reconstruction of those existing buildings if they are destroyed by acts of God or other accidental events. Furthermore, in any such case, property owners shall be permitted to rebuild in the same footprint where federal or state agencies have constructed and continue to maintain a beach and dune that conforms to coastal engineering standards of storm protection.

- *Does this still make sense?*
- *Does it need to be in the definition, or can it be in other parts of the Act?*



# How to define the Building Line & Regulated Area?

Background Information

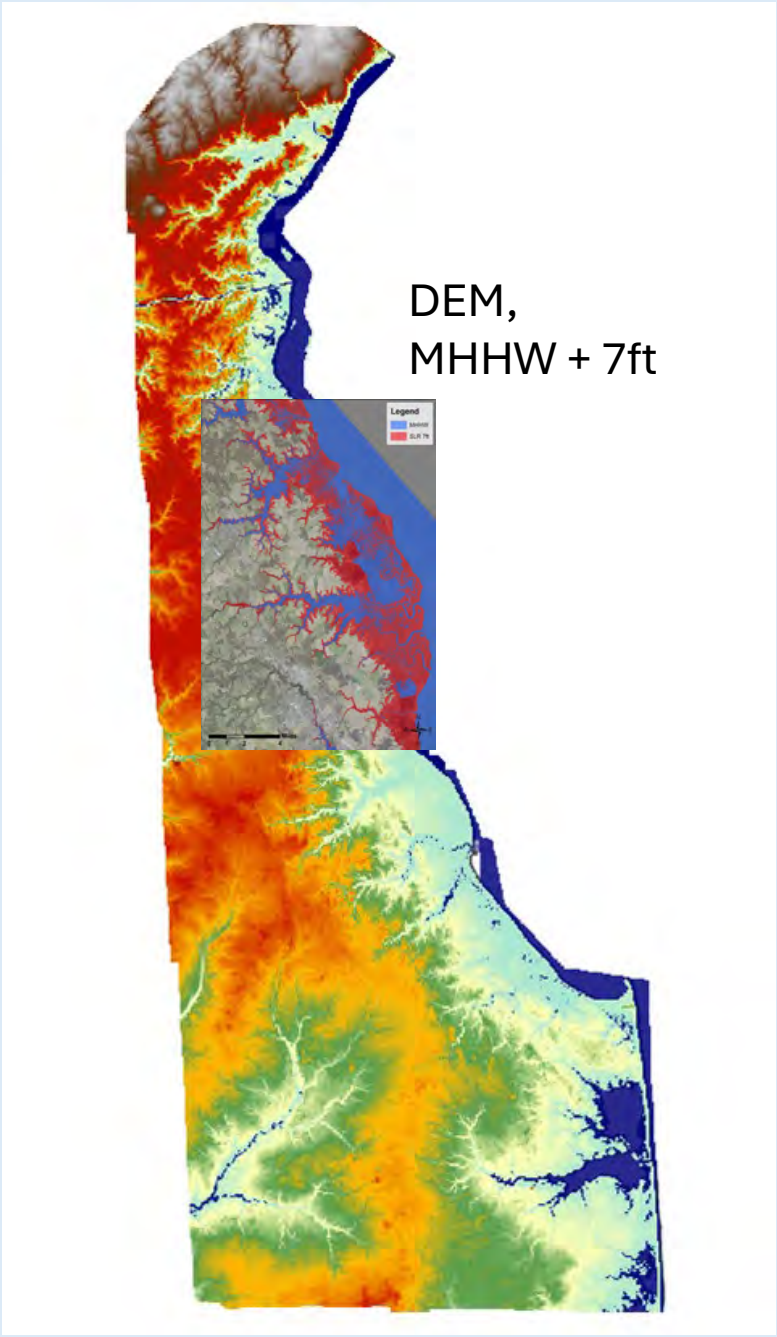
Studies from the Literature, Available Datasets

Initial Ideas & Explorations

# Delaware is a Coastal Plain

- Geologic setting: Atlantic Coastal Plain + tiny Piedmont Region
- Very flat topography along the coast

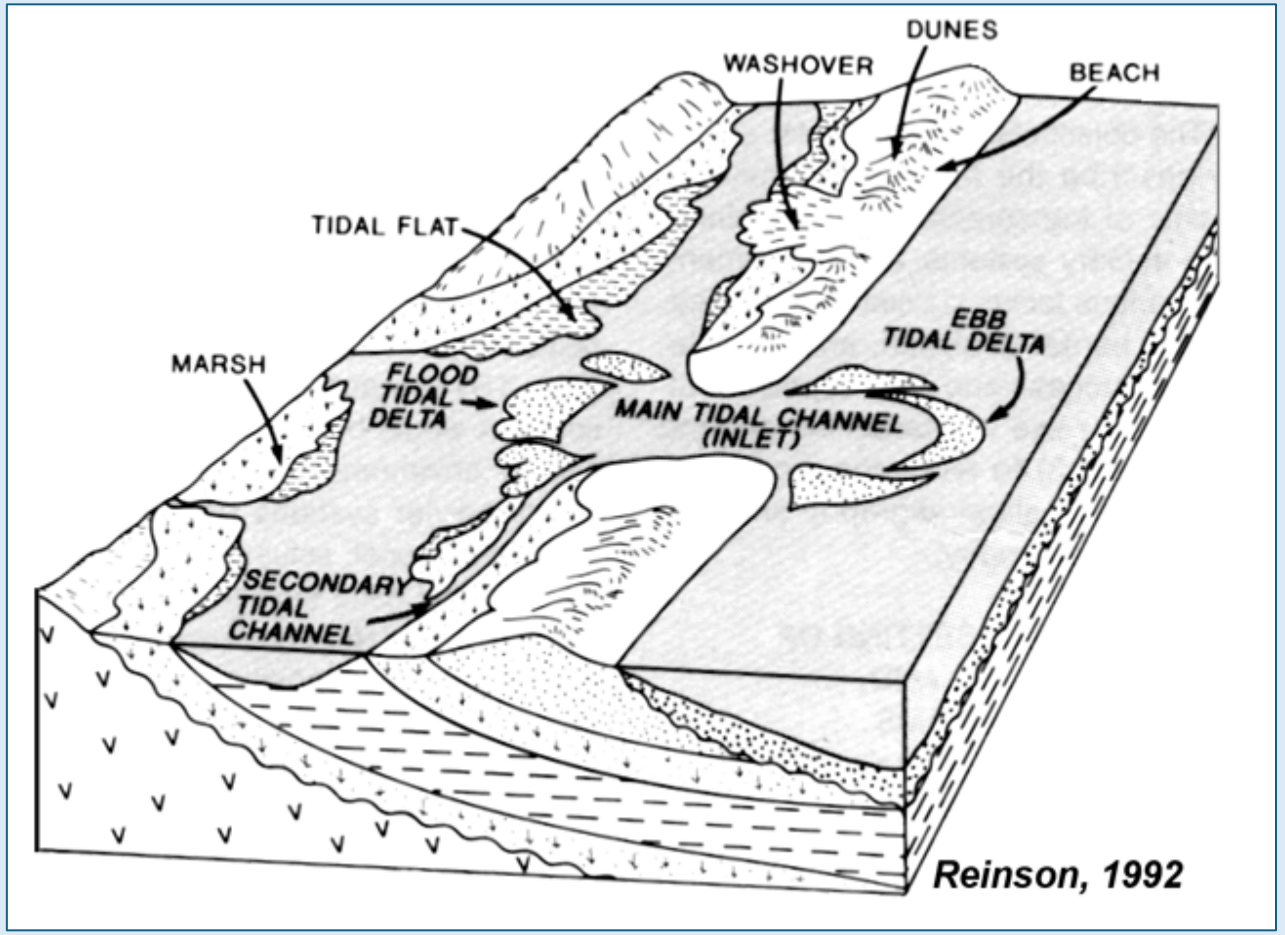




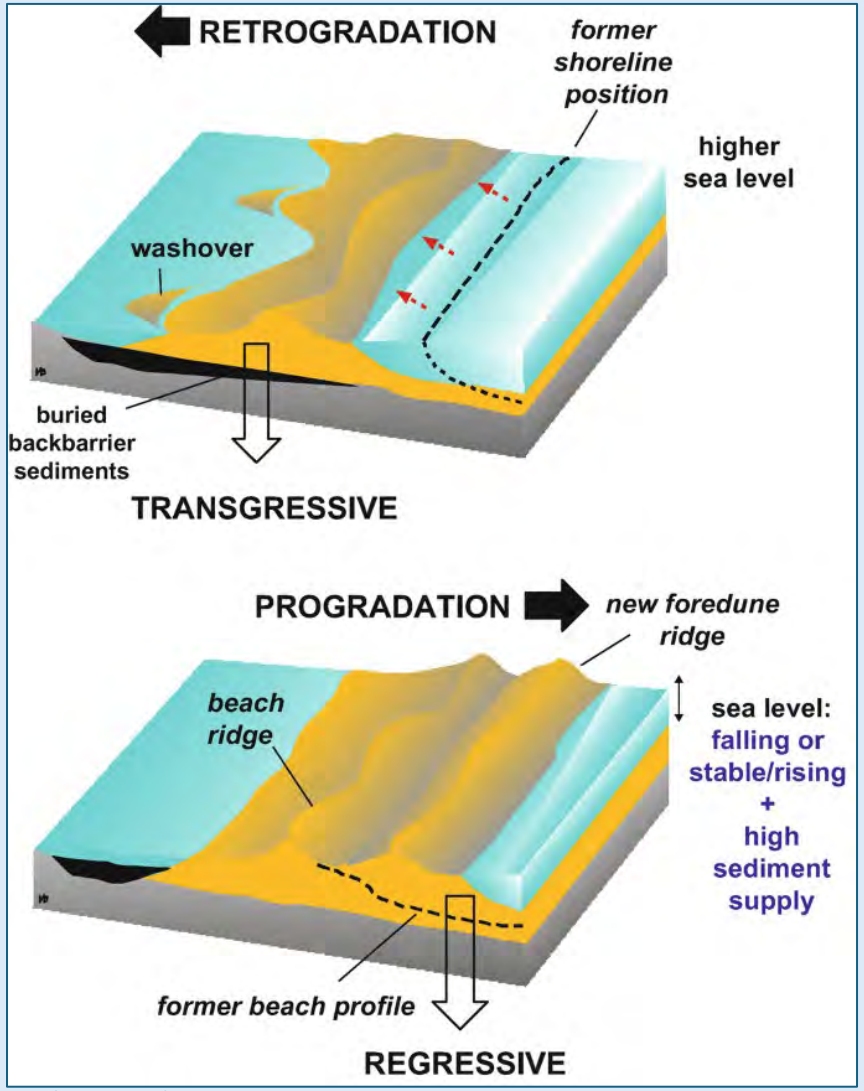

http://coastal-flood.udel.edu/about/

# Barrier Island Systems (like much of the DE Ocean Coast)

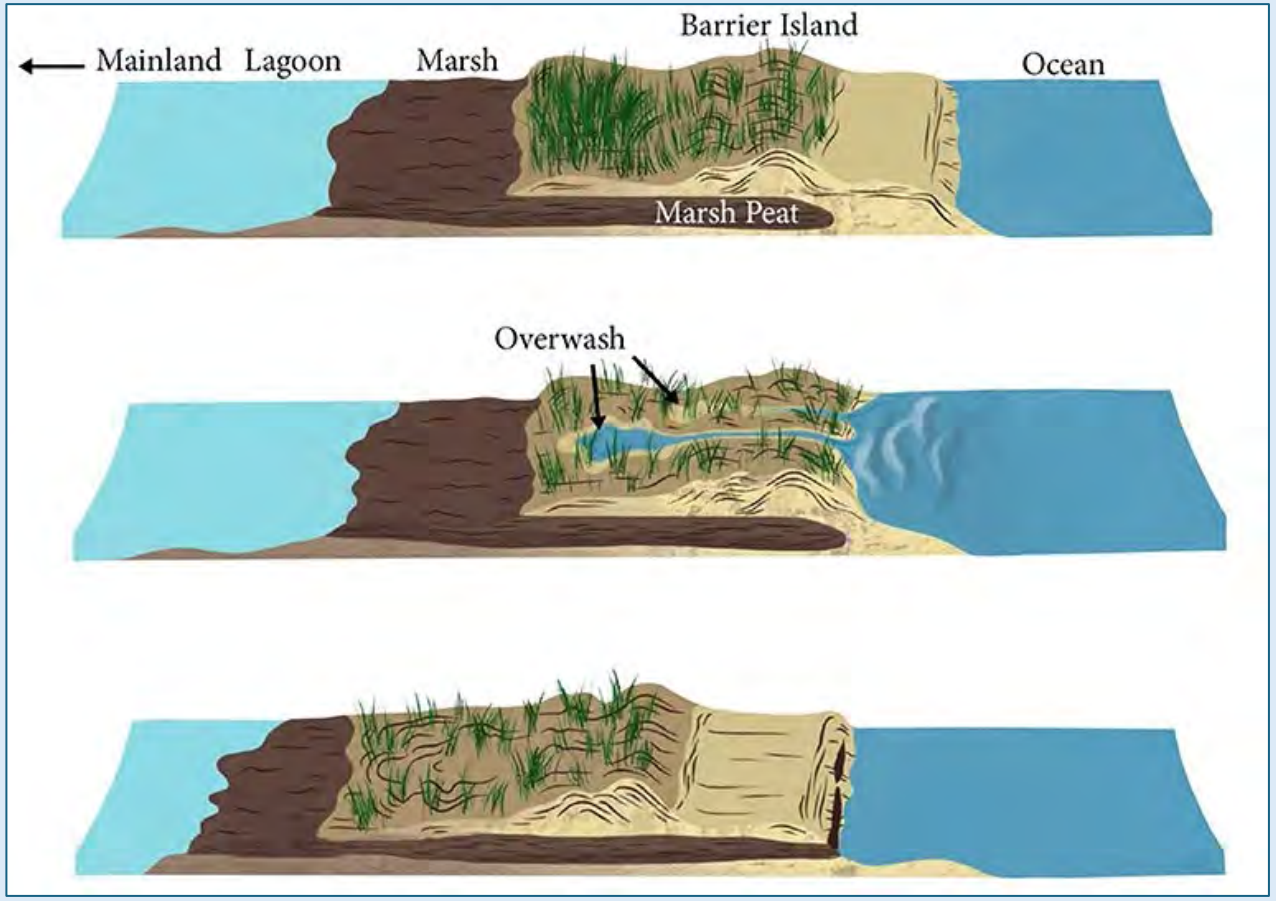
- Ocean and Back Bay flooding hazards
- Ebb and Flood Tidal deltas
- Dune overwash areas
- Tidal inlets & dune inundation areas



# Barrier Island & Beach Natural Evolution




*With the rising Sea Levels in Delaware, the current natural regime is **Retrogradation** or **Transgressive**.*



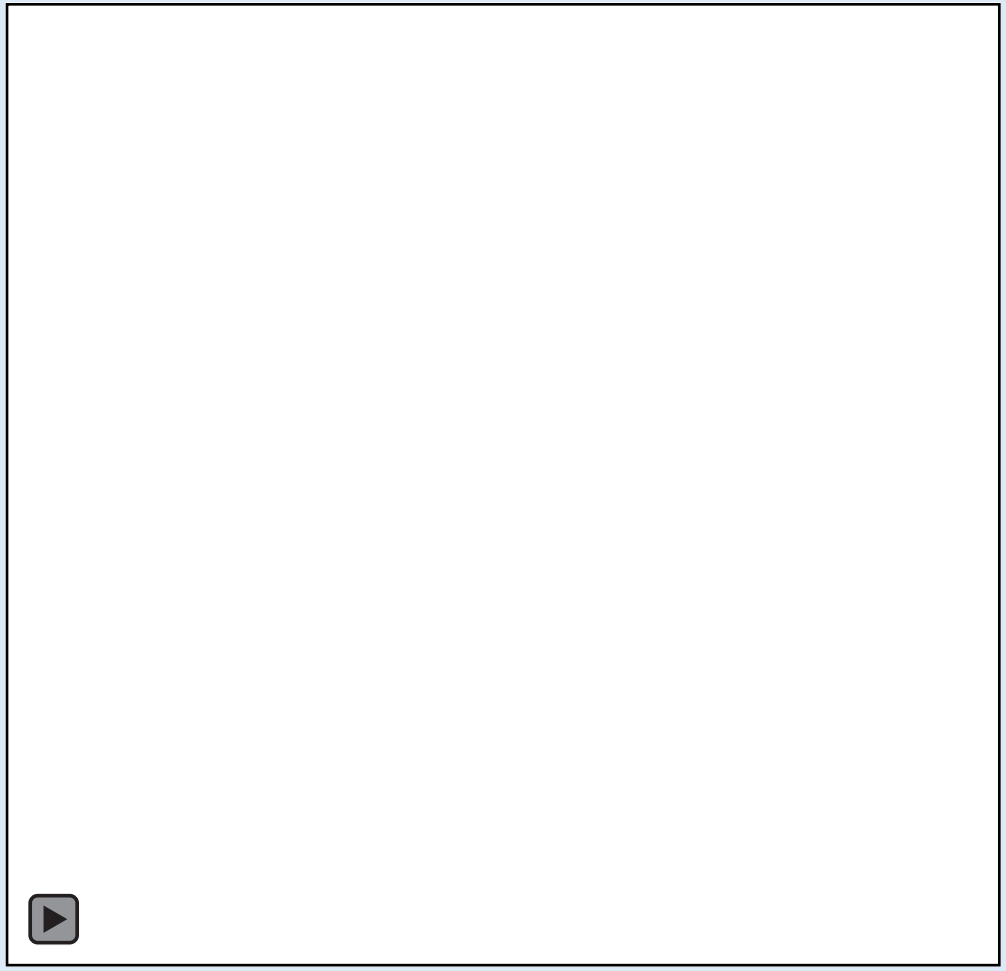

*Beach nourishment can supply sediment to combat rising sea levels to some extent.*

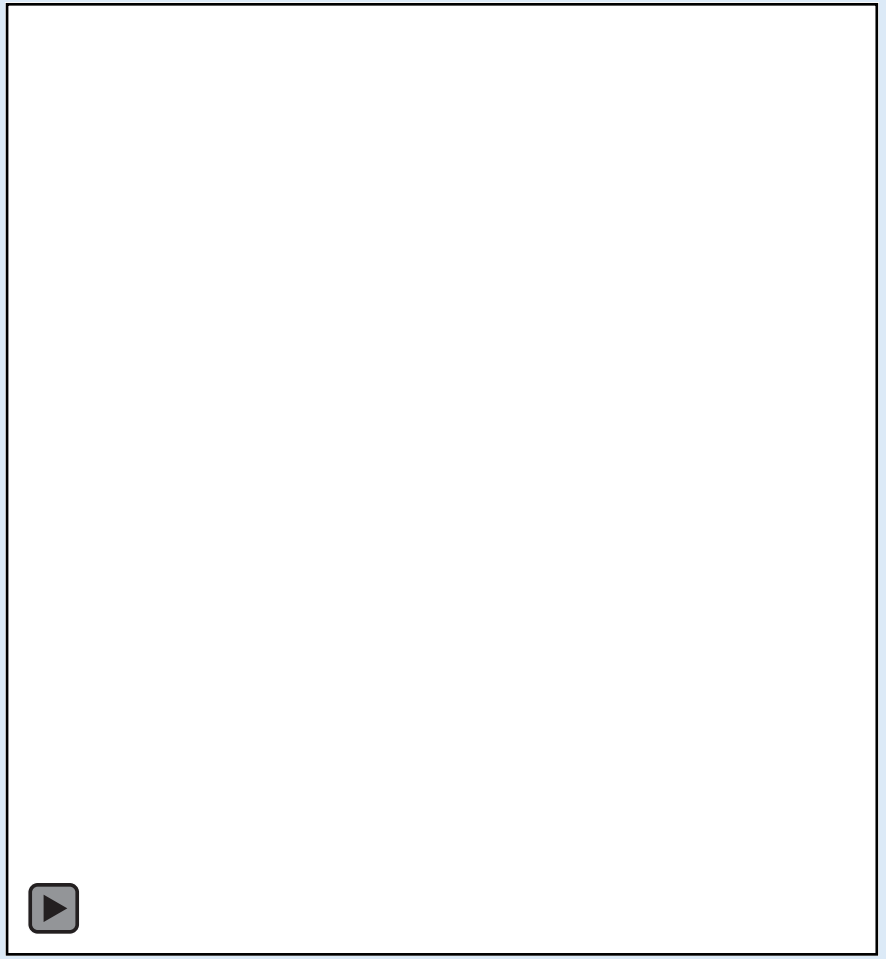
https://link.springer.com/rwe/10.1007/978-3-319-48657-4_367-1

# Sea Level Rise

- The 2017 coastal inundation layers are based on a bathtub model of a 1-m DEM, and are currently being updated (DNREC CCE & DGS)
- FirstMap viewer – also has 3D Scene viewers

- Mean High High-Water (MHHW) line encroaching inland
  - MHHW, MHHW +1 ft, 2 ft, 3 ft, and 4 ft for Slaughter and Dewey Beaches:





# Sea Level Rise – Option to Define the Building Line

- Especially significant in back-bay and marsh areas
  - MHHW + 4 ft Scenario (yellow) is on the low end of the 2100 estimate (4-6 ft)







https://dnrec.delaware.gov/climate-plan/protecting-communities/sea-level-rise/
https://floodplanning.dnrec.delaware.gov/ - *turn on the Sea Level Rise layer and sublayers*

# Sea Level Rise – Option to Define the Building Line

- Incremental yet significant increases on the coast
  - MHHW + 4 ft Scenario (yellow) is on the low end of the 2100 estimate (4-6 ft)







https://dnrec.delaware.gov/climate-plan/protecting-communities/sea-level-rise/
https://floodplanning.dnrec.delaware.gov/ - *turn on the Sea Level Rise layer and sublayers*

# Coastal erosion – Option to define the Building Line

- Enhanced by rising sea levels
- Storms impact the beach and dunes
  - Depends on dune health (height, volume), and
  - Coastal storm characteristics (storm surge, wave heights, etc.)





https://www.delaware-surf-fishing.com/beach-conditions-after-the-storm/

https://www.delawarepublic.org/science-health-tech/2018-07-08/replenishing-delawares-beaches-in-the-face-of-ongoing-erosion-sea-level-rise

# Snapshots from the September Nor'easter

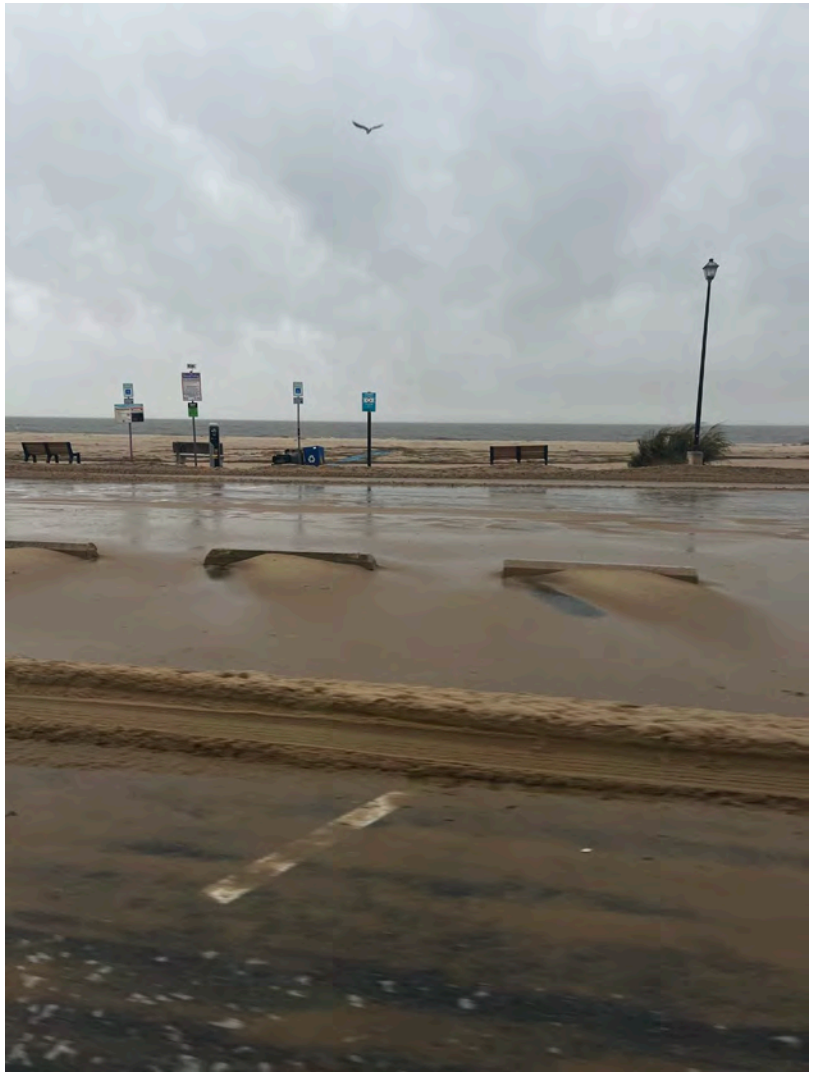


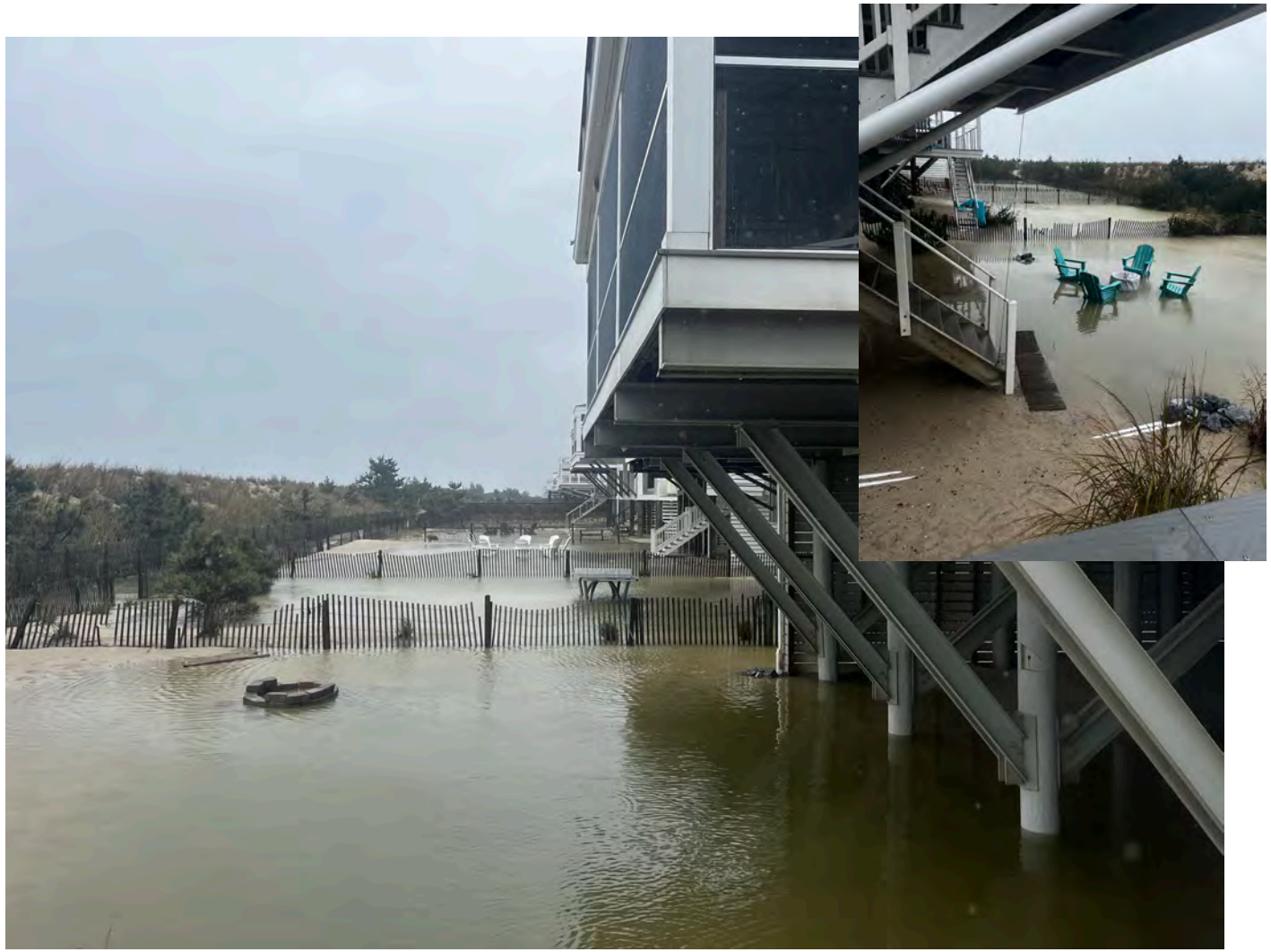

Scour around structures seaward of the dune leading to increased erosion.

Damaged structures become debris.



# Snapshots from the September Nor'easter





Movement of sand due to lack of dune, and floodwater.

# Snapshots from the September Nor'easter









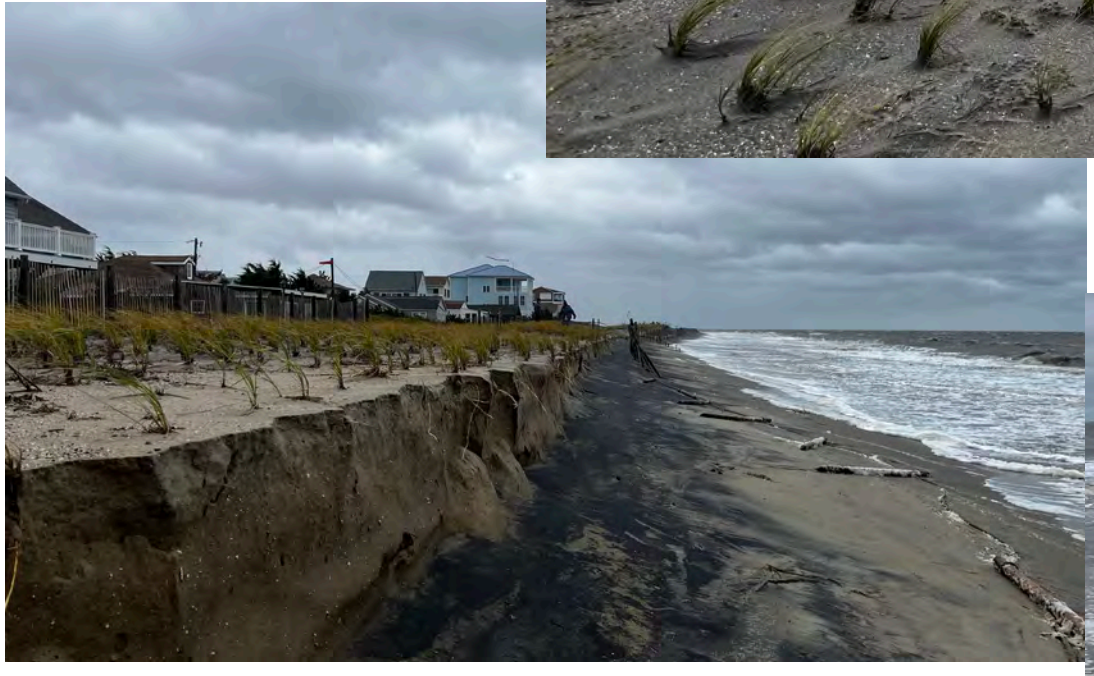


Damage to & scour around coastal structures.

# Snapshots from the September Nor'easter









The realigned dune in Broadkill responded well, especially in the natural low dune forming South.

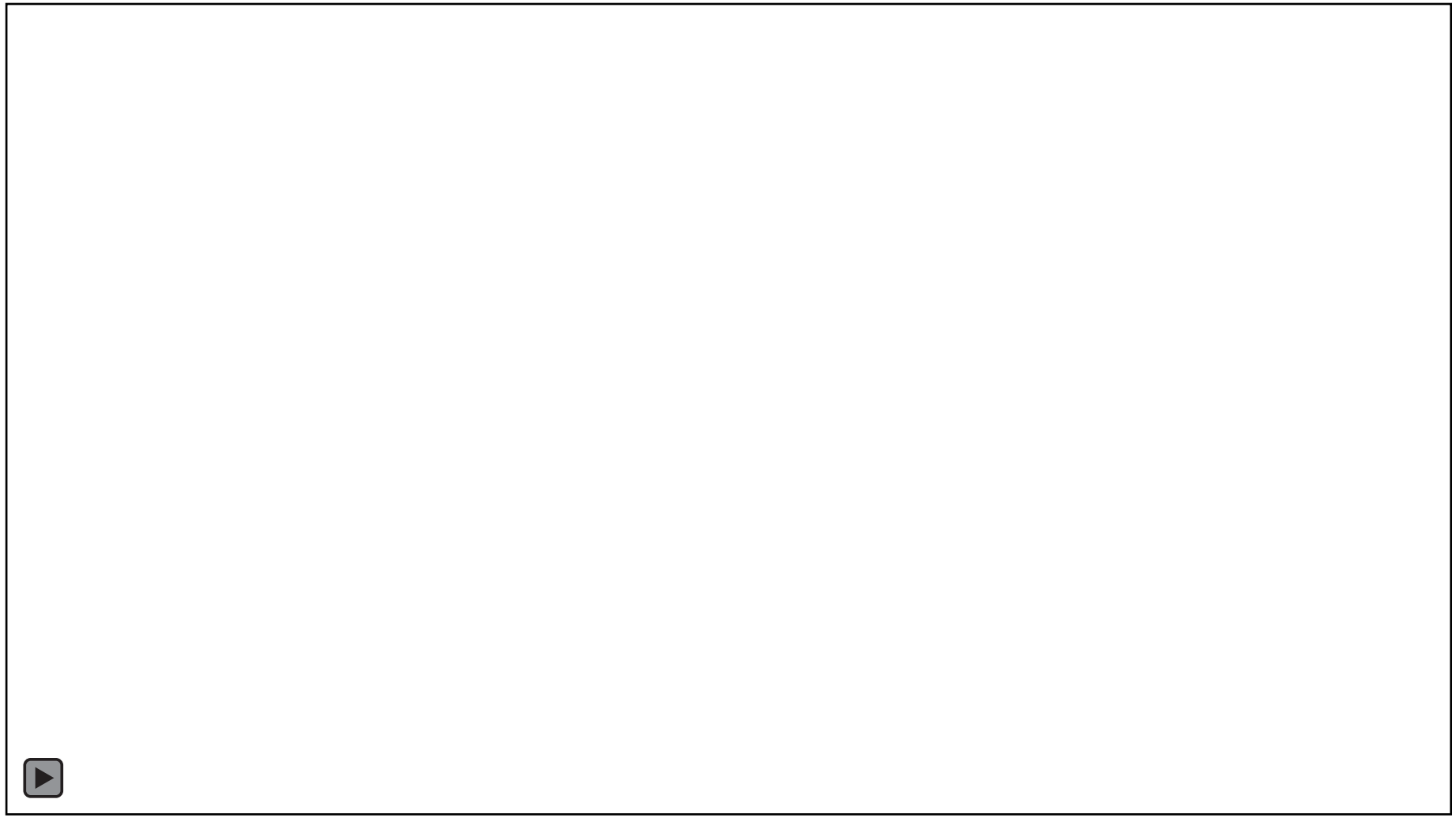
# Snapshots from the September Nor'easter





Impacts Northside and Southside of the Inlet

# Timelapse of erosion in Kitts Hummock Beach



Courtesy of Udel

# Coastal Erosion Rates

## Bay Coast

| Location | Erosion Rate (ft./yr) |
|---|---|
| Lewes Beach | -3 |
| Broadkill Beach | -2 |
| Prime Hook Beach | -0.7 |
| Slaughter Beach | -1.9 |
| Big Stone Beach | -3.6 |
| South Bowers | -3 |
| Bowers Beach | -2.5 |
| Kitts Hummock | -4.3 |
| Pickering Beach | -4.9 |

## Ocean Coast

| Location | Erosion Rate (ft./yr) |
|---|---|
| Fenwick Island | -2.81 |
| South Bethany | -2.92 |
| Middlesex Beach/Sea Colony | -3.16 |
| Bethany/North Bethany | -2.39 |
| Dewey Beach | -3.04 |
| Rehoboth Beach | -2.31 |
| Henlopen Acres/North Shores | -4.19 |

https://dnrec.delaware.gov/watershed-stewardship/beaches/monitoring-shorelines/
Delaware Annual Beach change reports

# Coastal Erosion since the Building Line

Not accounting for beach nourishment

## Bay Coast

| Location | Coast Lost to Erosion (ft) |
|---|---|
| Lewes Beach | 141 |
| Broadkill Beach | 94 |
| Prime Hook Beach | 32.9 |
| Slaughter Beach | 89.3 |
| Big Stone Beach | 169.2 |
| South Bowers | 141 |
| Bowers Beach | 117.5 |
| Kitts Hummock | 202.1 |
| Pickering Beach | 230.3 |

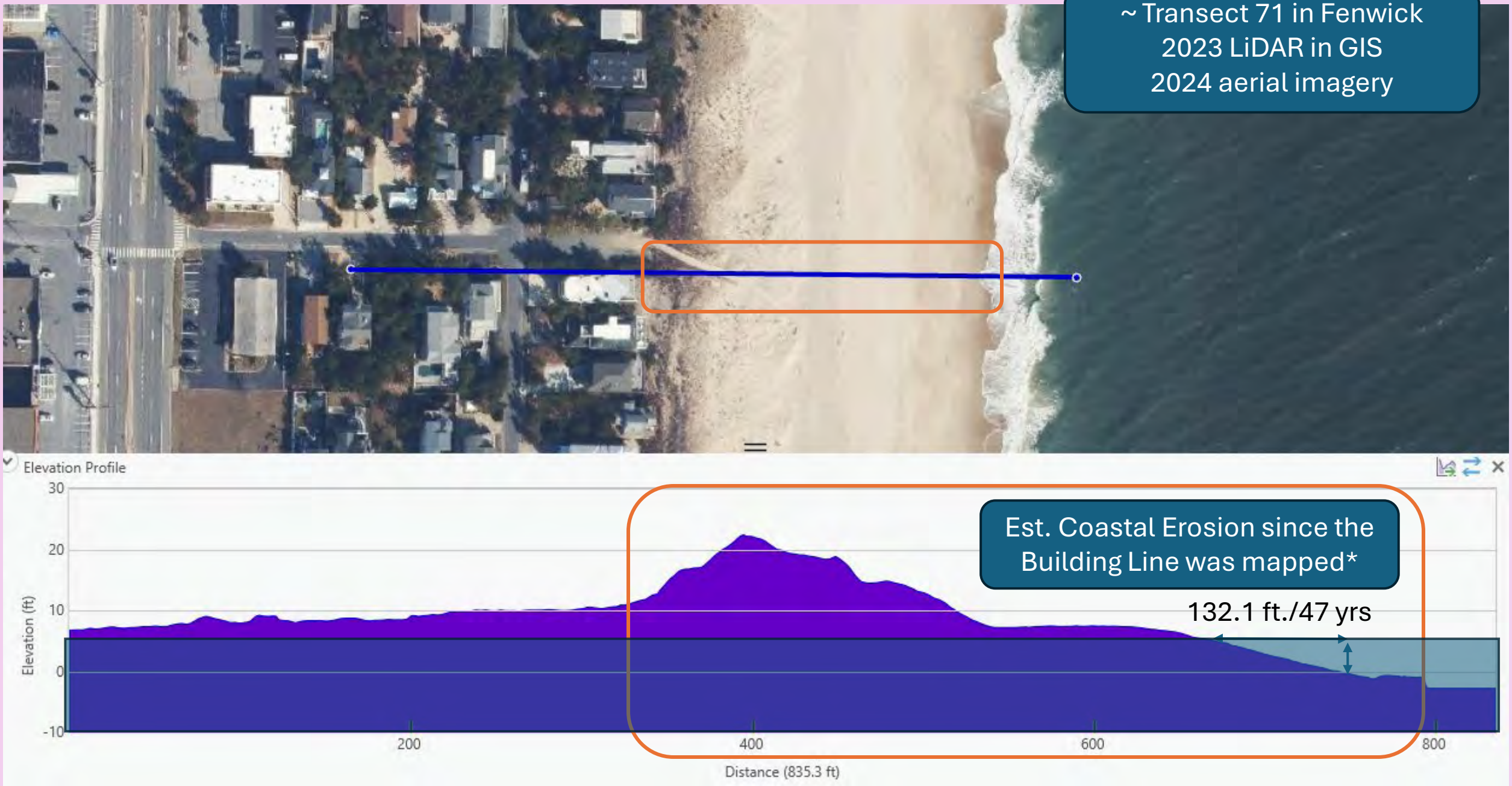
https://dnrec.delaware.gov/watershed-stewardship/beaches/monitoring-shorelines/
Delaware Annual Beach change reports

## Ocean Coast

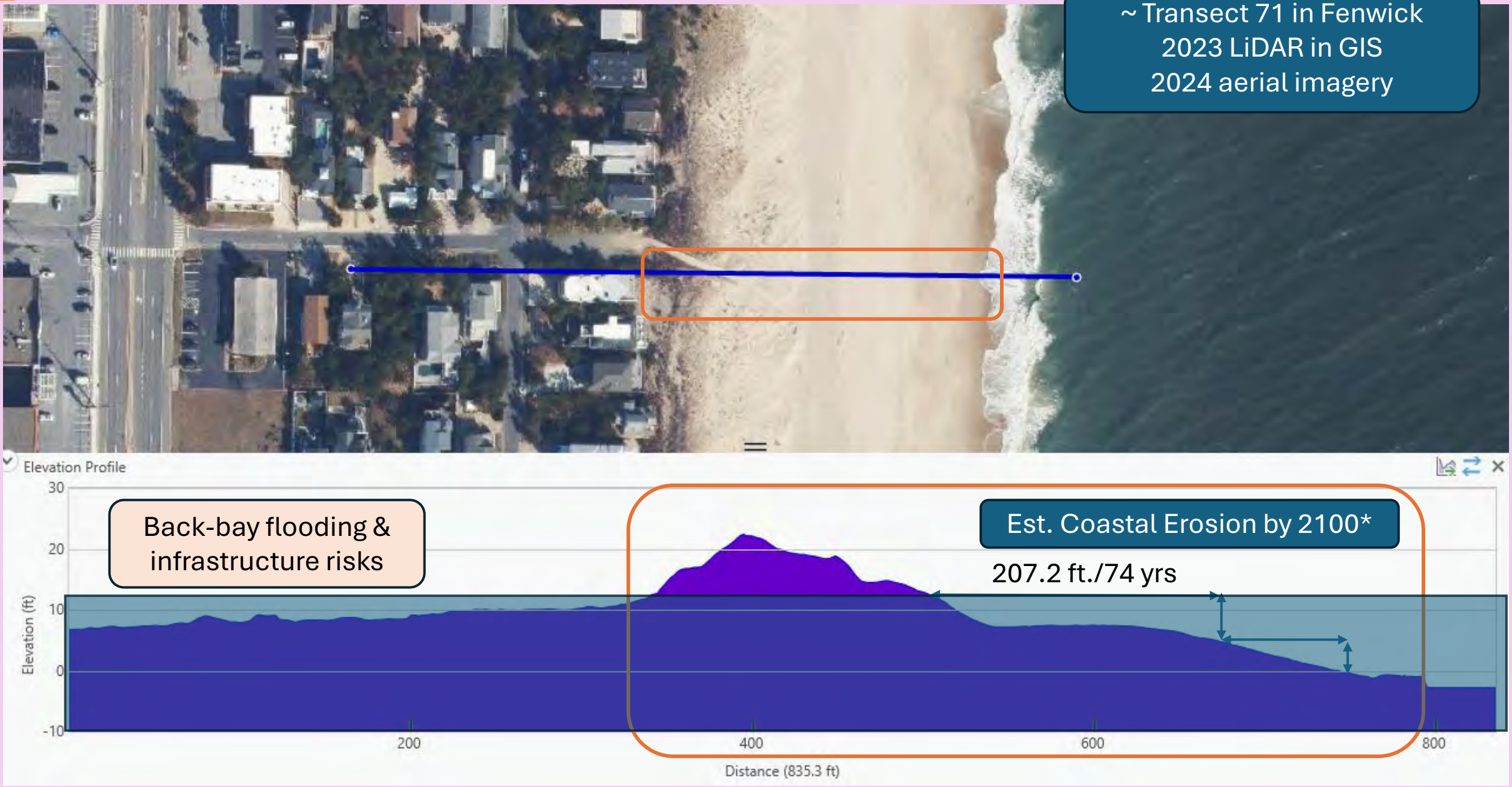
| Location | Coast Lost to Erosion (ft) |
|---|---|
| Fenwick Island | 132.1 |
| South Bethany | 137.2 |
| Middlesex Beach/Sea Colony | 148.5 |
| Bethany/North Bethany | 112.3 |
| Dewey Beach | 142.9 |
| Rehoboth Beach | 108.6 |
| Henlopen Acres/North Shores | 196.9 |

*Multiplied erosion rate (ft./yr) by 47 yrs (2026-1979)*


~ Transect 71 in Fenwick
2023 LiDAR in GIS
2024 aerial imagery
Avg rate of SLR in Delaware
& Avg erosion rate in Fenwick
Elevation Profile
30
20
10
0
-10
Elevation (ft)
200
400
600
800
Distance (835.3 ft)
2.8 ft./yr
3.8 mm./yr



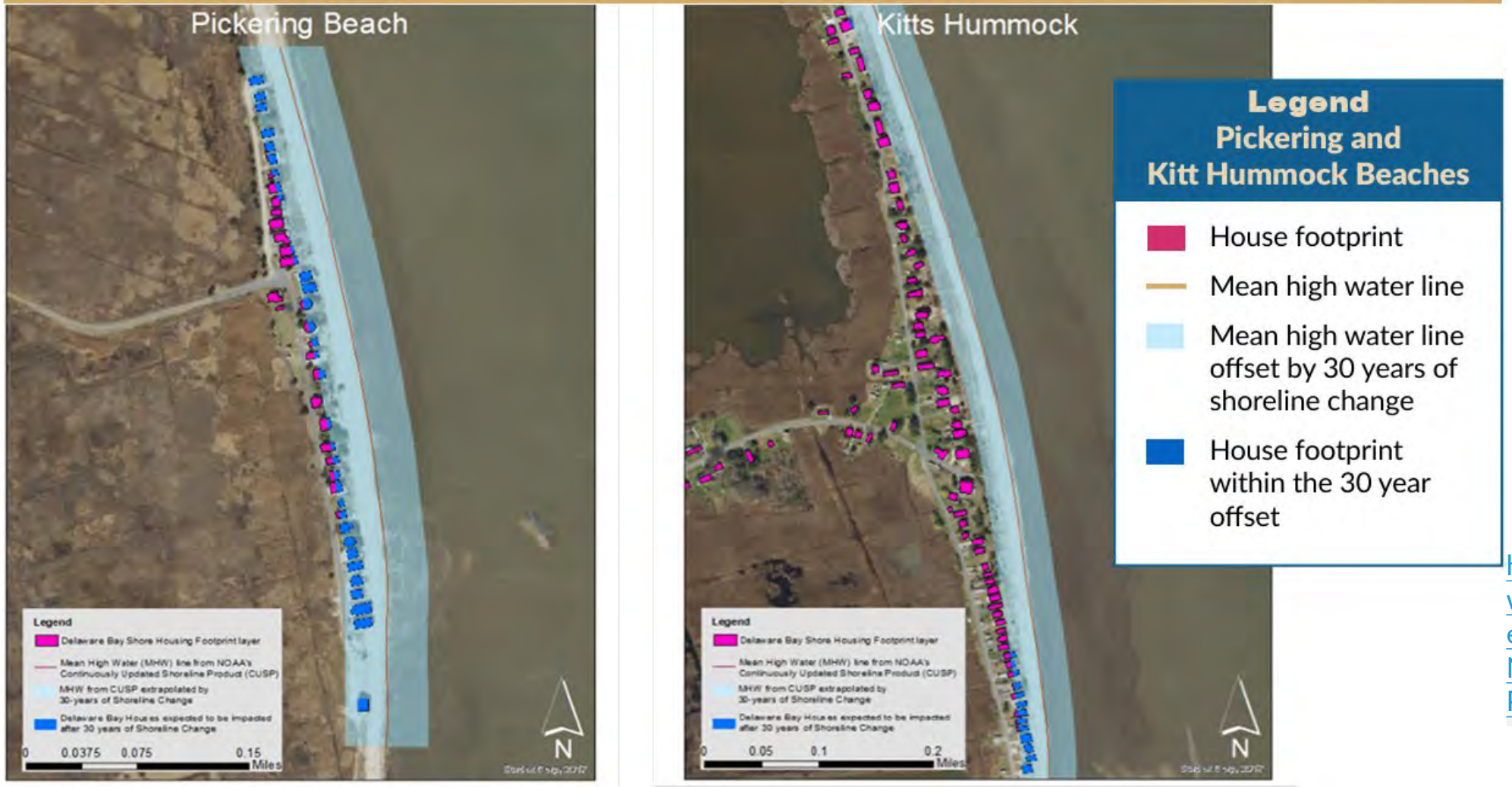

*not accounting for beach nourishment




*not accounting for beach nourishment

# Estimated Bay beach home vulnerability in 30 years

**Figure 3: Houses Seaward of Mean High Water in 30 years for Pickering Beach and Kitts Hummock Beach**




https://documents.dnrec.delaware.gov/Watershed/Shorelines/2023-Bay-Beach-Nourishment-Prioritization-Plan.pdf

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# Building Line based on Erosion Rates & Sea Level Rise (overall, shoreline change)

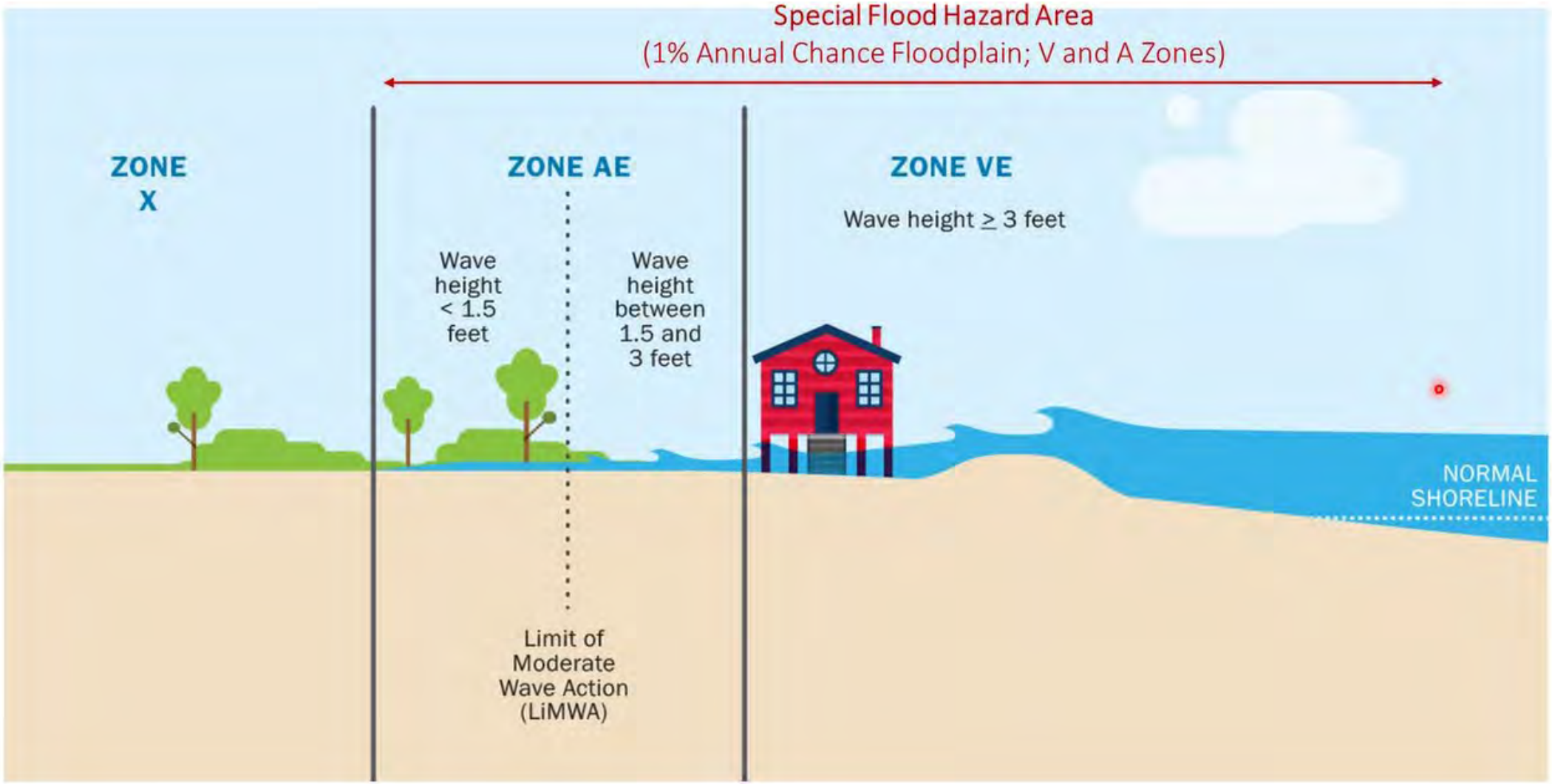
- 2050 or 2100 planning goal based on current/historic erosion rates
  - Multiply erosion rate by # of years between survey and planning goal to determine the setback distance per beach – following other states
  - Map every 250 m based on a current dune contour line or MHHW
- Plus, SLR!
  - 2050 or 2100 estimates!
- Plus, beach nourishment!
  - Or not, since it's not guaranteed?
  - How do we consider beach nourishment in the equation?

# FEMA flood zones

Effective coastal maps & models to define the Building Line / Regulatory Area

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# FEMA Flood Zones

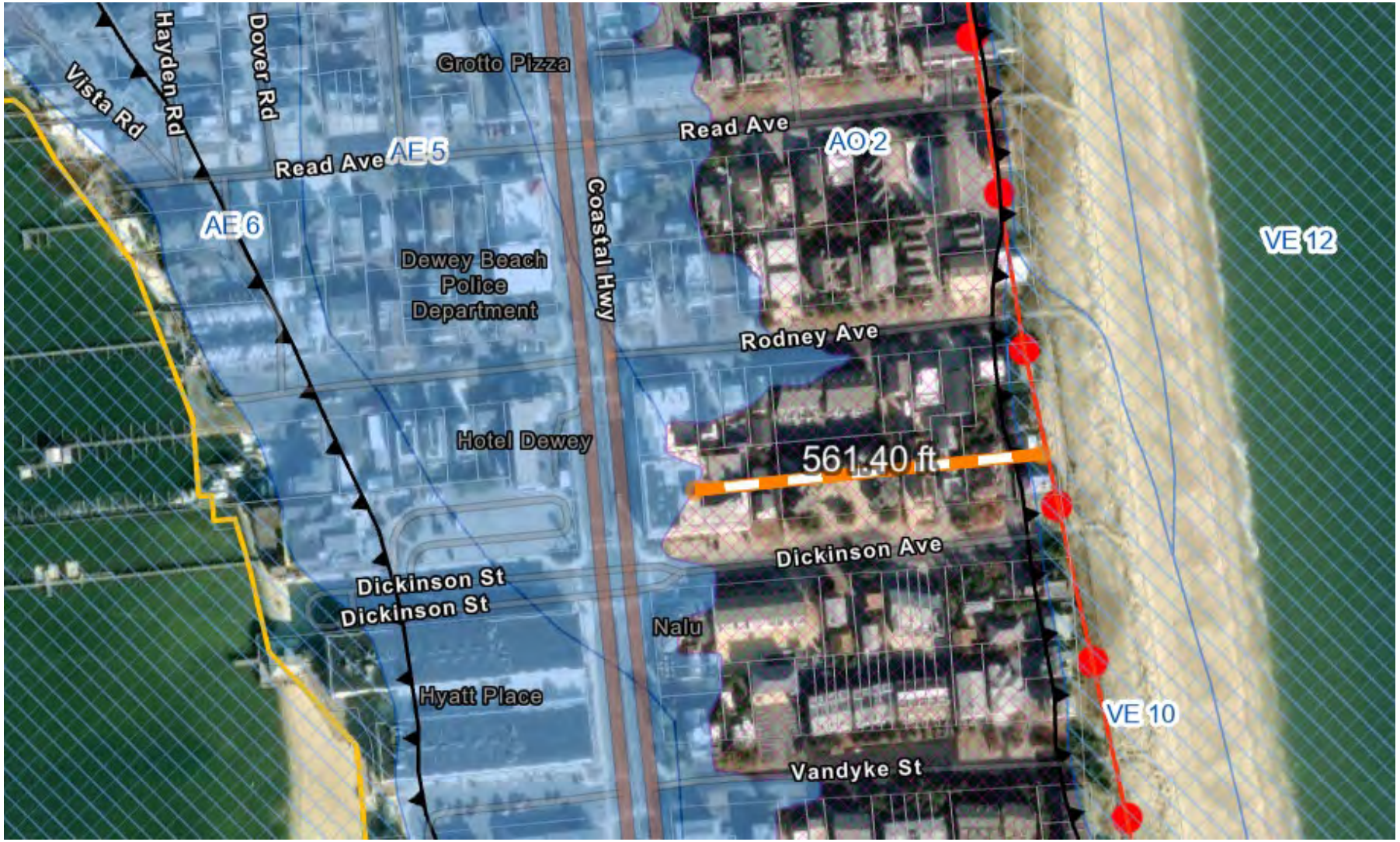



Credit to MA DCR Floodplain Program

# FEMA Flood Zones to guide Regulatory Areas

- **BFEs** for the Base flood scenario (1% chance flood) in coastal areas
  - Add some freeboard for sea level rise, storm surge, tides and runup = DFE
  - Burn the dunes (DEM) into the DFEs to identify which are healthy
- The **LiMWA** defines waves greater than 1.5 ft in the Base flood scenario
  - This was the consultant's recommendation – revisit this option?
- **Zone AO** represents dune overwash in coastal dune environments
  - "**Zone AO** is used to map areas at risk of shallow flooding during a base (1%-annual-chance) flood, where water with average depths of 1 to 3 feet flows over sloping ground. On flood maps in coastal communities, Zone AO usually marks areas at risk of flooding from wave overtopping, where waves are expected to wash over the crest of a dune or bluff and flow down into the area beyond."
  - Let's look back to Dewey Beach

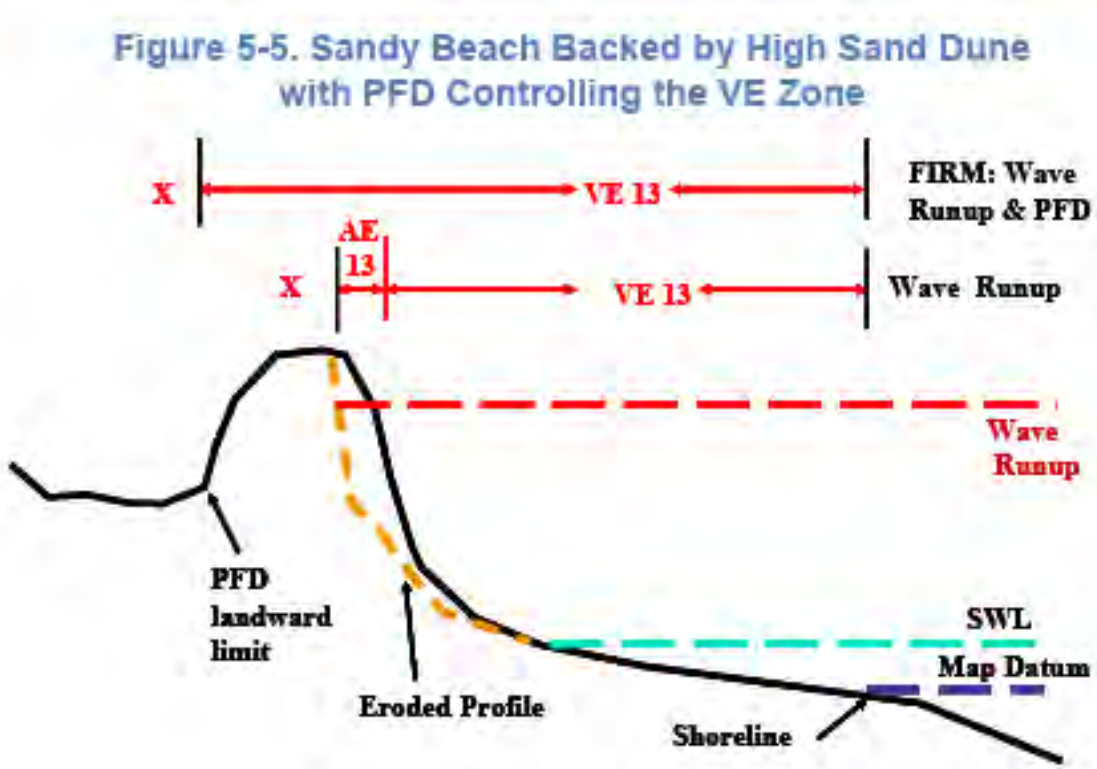
# Coastal AO zone to define dune overwash, and as such the Beach Preservation Zone

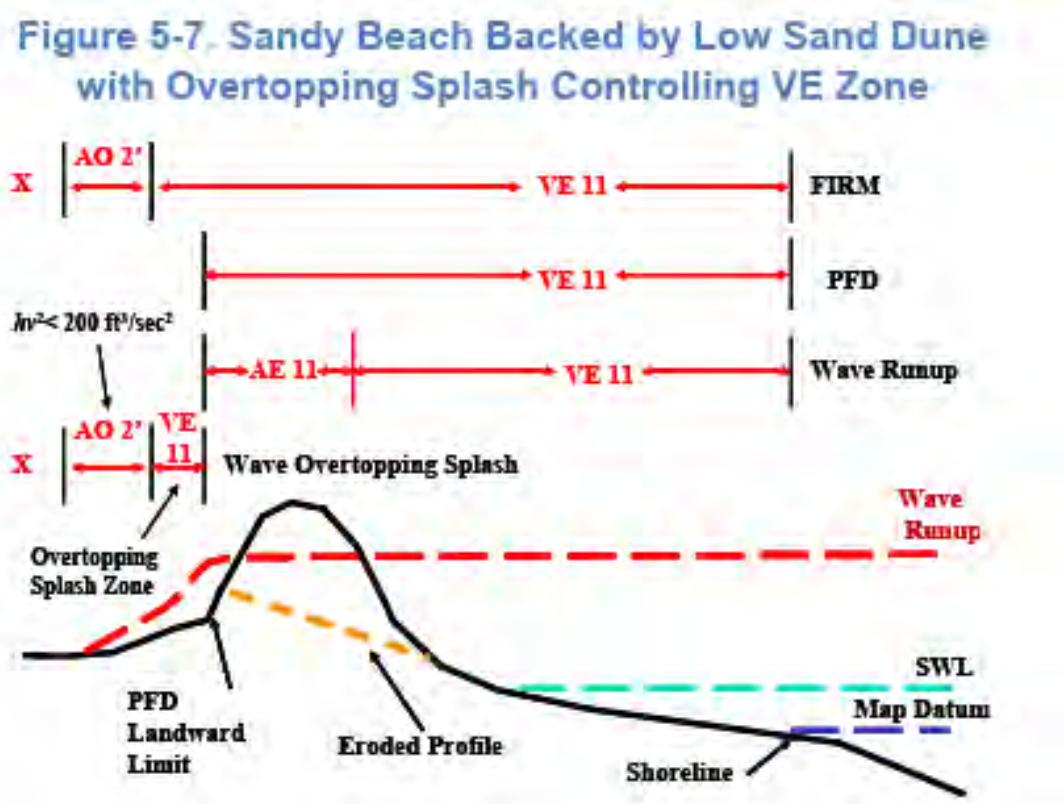



AO zone is mapped in FEMA FIRMs throughout most of the Ocean coast

- We can study the width, take averages
- The Bay coast does not have mapped AO zones, but we could draw a relationship

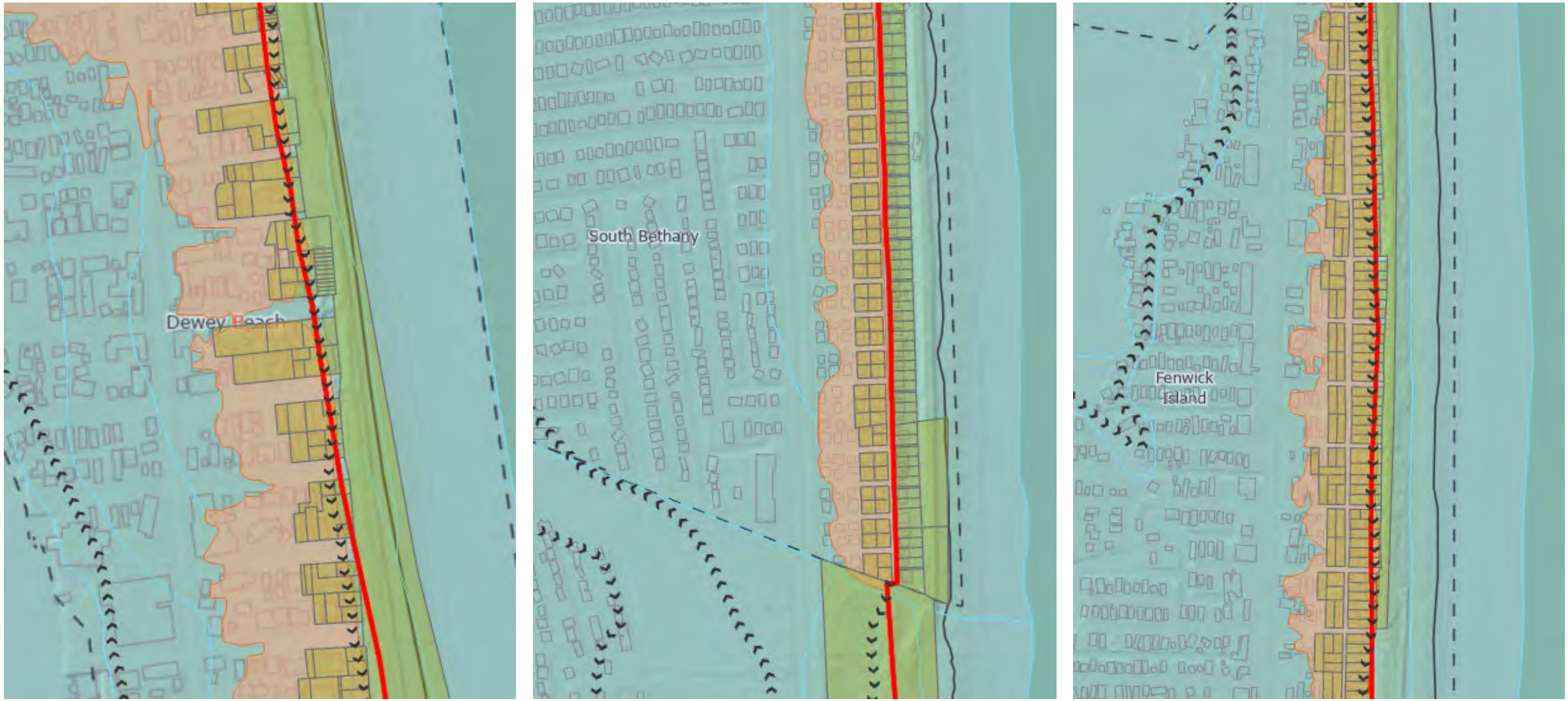
# Coastal AO zone defines dune overwash



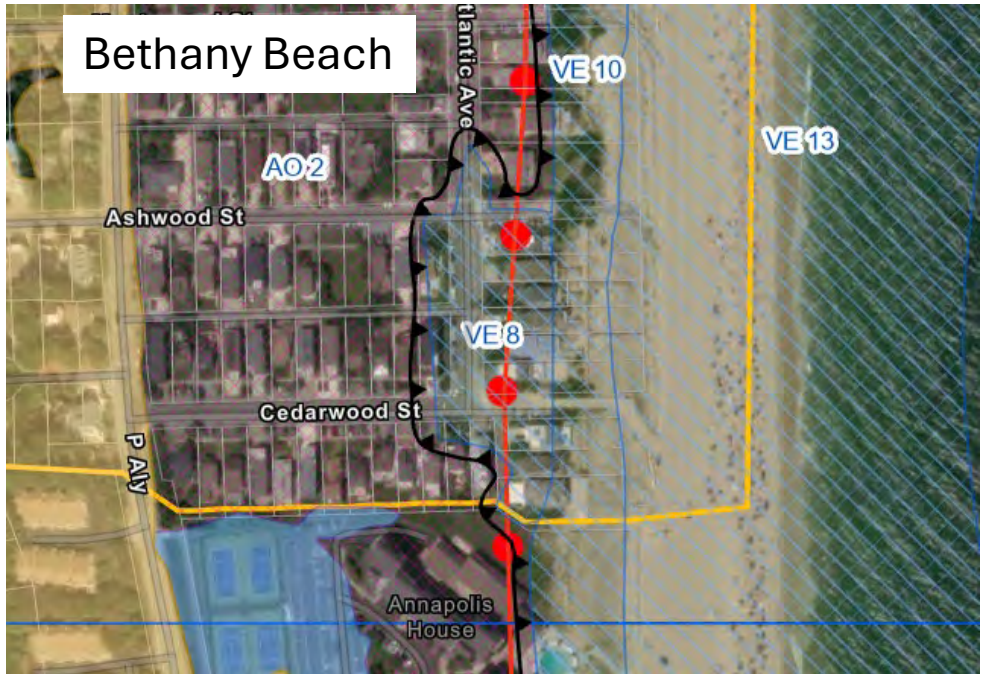




From FEMA Coastal Floodplain Mapping Guidance document
https://www.fema.gov/sites/default/files/documents/Coastal_Floodplain_Mapping_Guidance_Nov_2019.pdf

# Current Beach Regulated Area vs. Zone AO

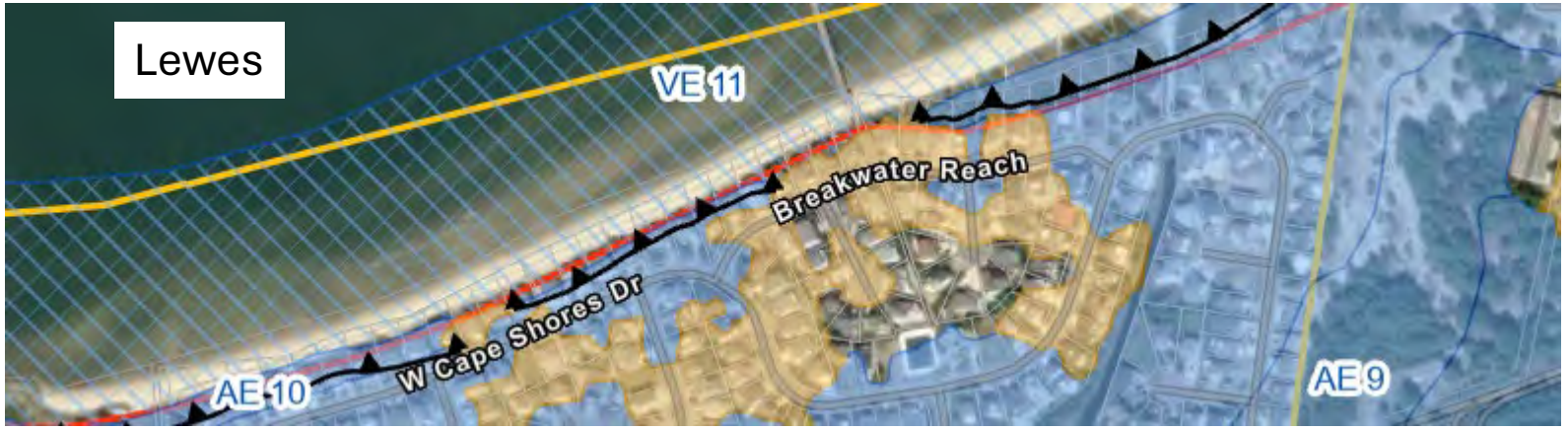


# LiMWA to define high wave hazard, and as such the Building Line









# Remapping the LiMWA

- The effective LiMWA is not mapped throughout the coast
  - May be due to the challenges FEMA faced when mapping it
  - Or communities can choose not to have it shown in the NFHL
- The effective AO Zones are not mapped throughout the coast too
  - Potentially due to the lack of dunes along the Bay coast
- Can we remap the LiMWA line with FEMA practices and use that as the Building Line?
  - Can utilize the Coastal Graduated Future Flood Risk Data *(next slide)*
  - This can be in tandem with our Statewide Floodplain Mapping Initiative
  - Ticks a lot of boxes & improves efficiencies

# Coastal Graduated Future Flood Risk Study

- Statewide coastal raster data for a range of recurrence interval storms and 3 SLR conditions
  - Provides localized SWEL and TWEL estimates
  - **Identifies high wave hazard areas**
- Map Server of select scenarios
- We could highlight the coastal high wave hazard zones, and/or use the data to remap the LiMWA



# Other resources

Potential data sources for Building Line and Regulatory Area mapping

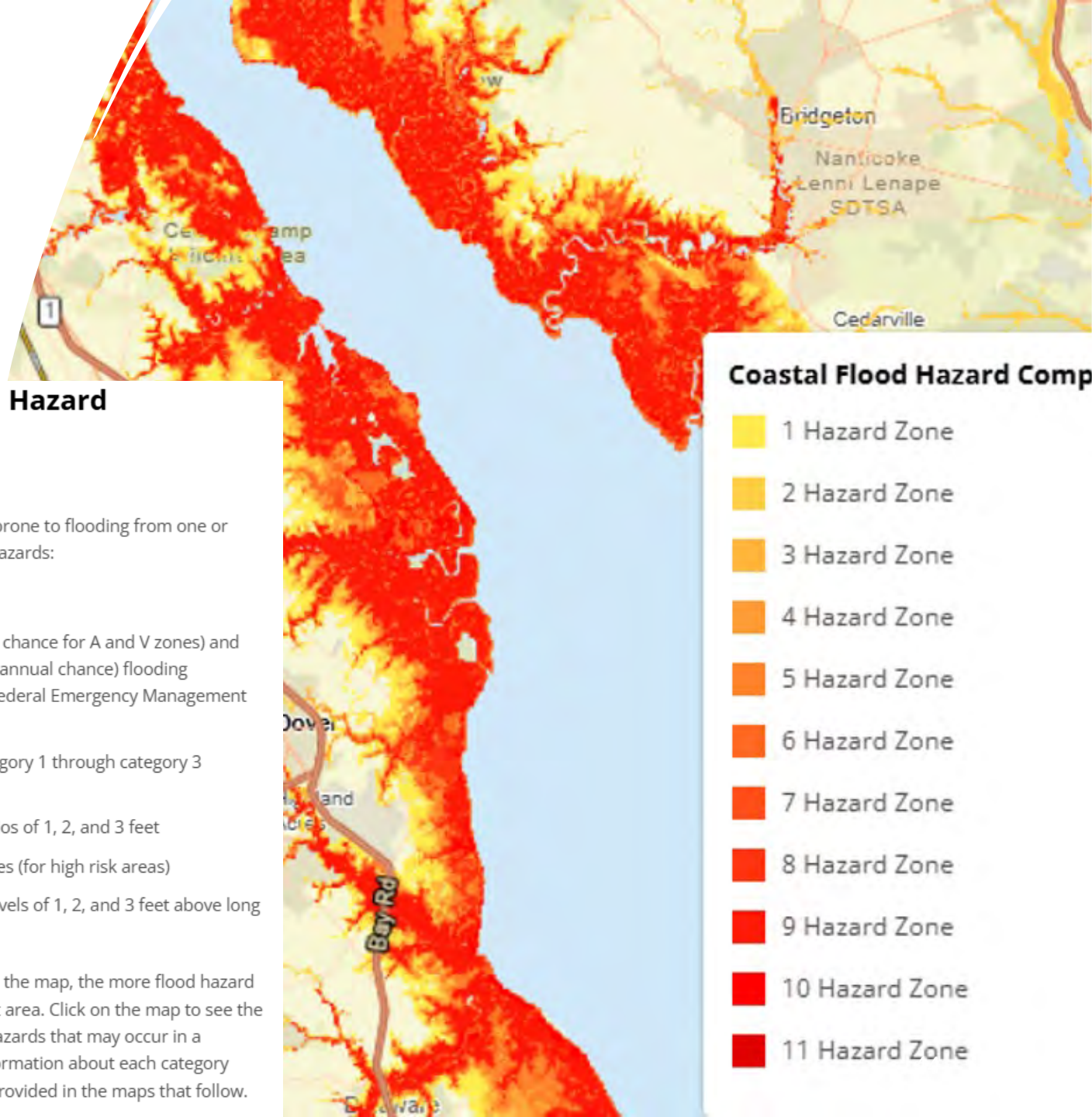
# NOAA Response Imagery

- We could look for historic coastal impacts with imagery
- Hurricane Irene 2011 NOAA Response Imagery
  - https://geodesy.noaa.gov/storm_archive/storms/irene/index.html
- November 2009 Nor'easter NOAA Response Imagery
  - https://geodesy.noaa.gov/storm_archive/storms/nov09_ne/index.html



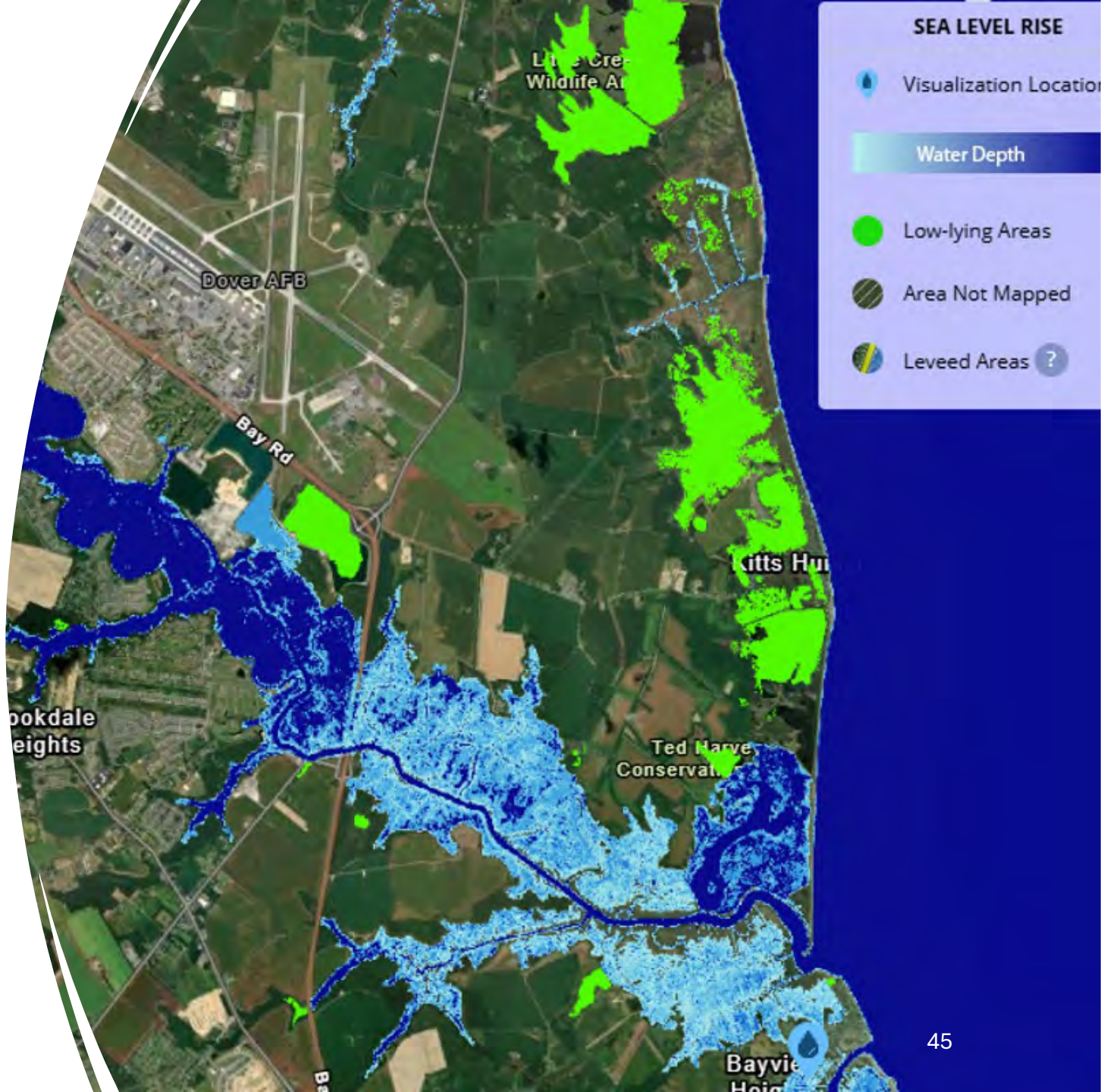
# NOAA Coastal Risk Mapper

- Coastal Flood Hazard Composite layer
  - Combines flood maps, high tide flooding, sea level rise scenarios, and socioeconomic factors
  - Mapper also maps these individually
- Referenced in the DNREC Building Line Alternatives study



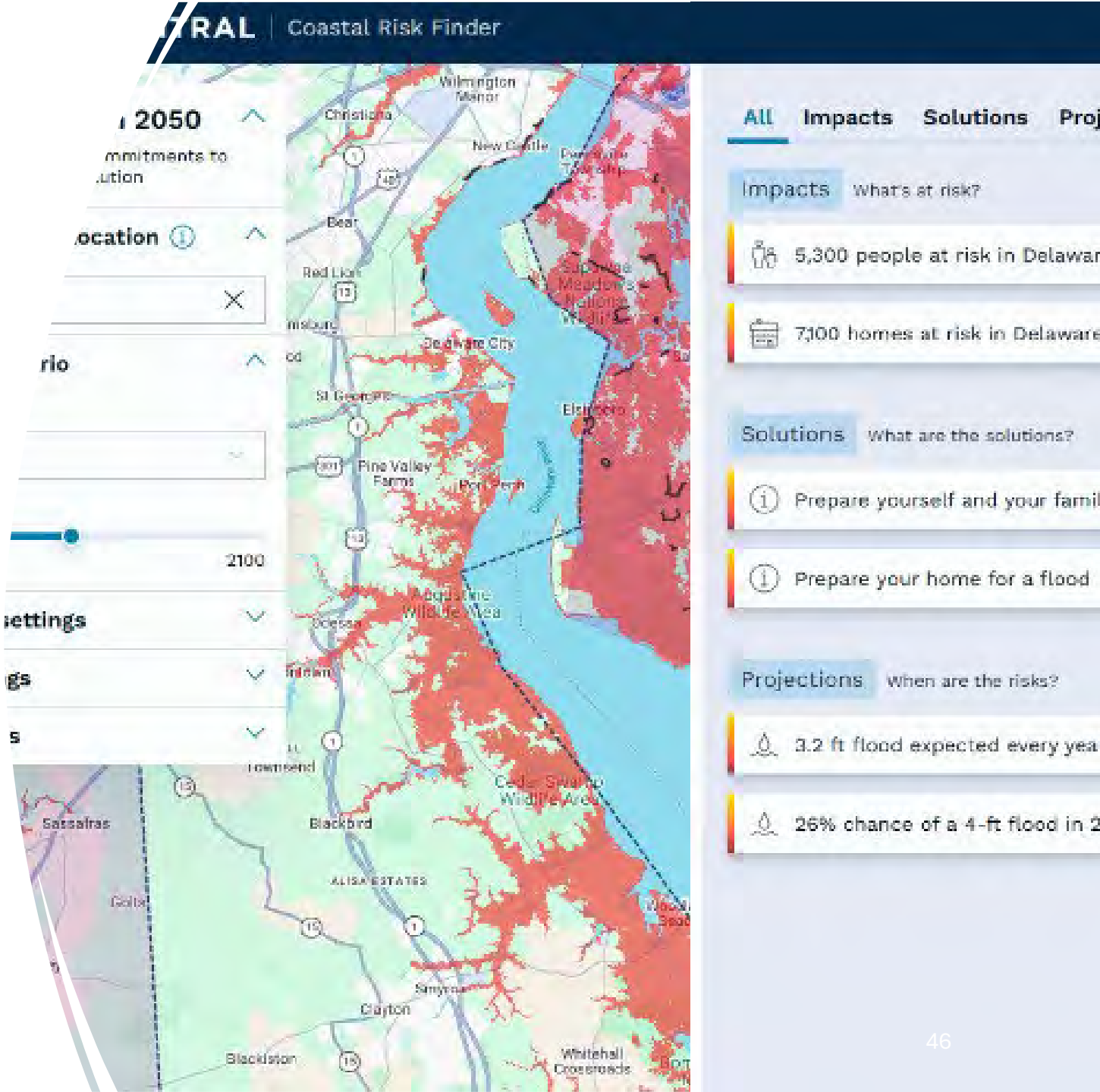
# NOAA Sea Level Rise Viewer

- Sea Level Rise interactive viewer
  - Data is also downloadable
- Slider to control the SLR (pictured is 0.5 ft)
- Mapped separately:
  - High tide flooding
  - Marsh migration
  - Mapping confidence
- Referenced in the DNREC Building Line Alternatives study
- They use bathtub methods from MHHW
  - Same base code as CCE/DGS?



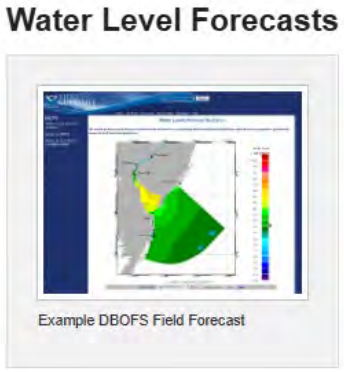
# Climate Central Coastal Risk Finder

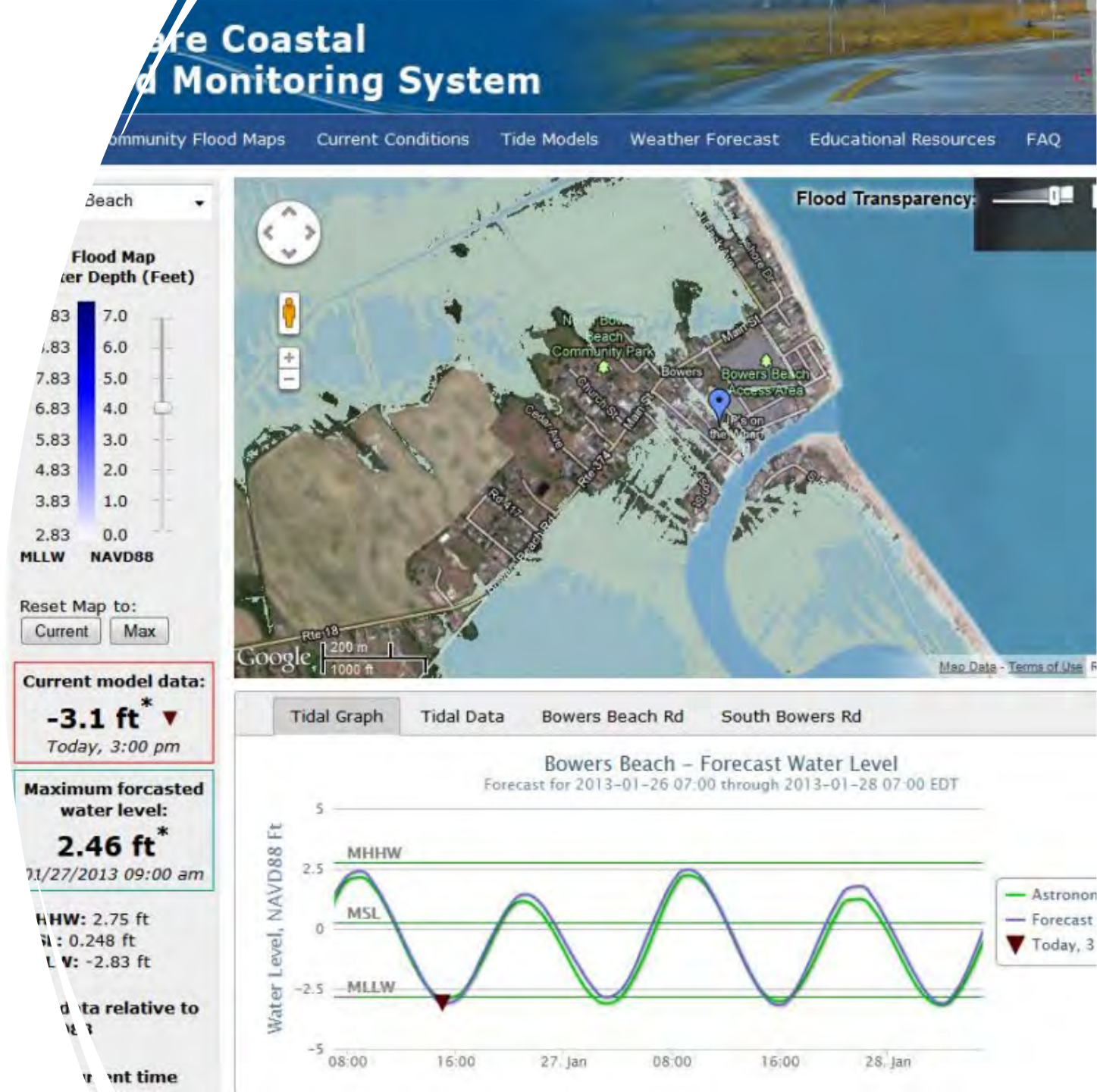
- Coastal Risk Finder
- Sea level rise plus annual, 10-year, or 100-year floods
- Lists impacts, solutions and projections
- National report



# DE Coastal Flood Monitoring System (CFMS)

- Webpage
- Presentation
- Takes in Water Level forecasts from NOAA Delaware Bay Operational Forecast System (DBOFS), DEM data, and tidal parameters






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# Definitions

- Dune - means a mound, hill or ridge of windblown sand, either bare or covered with vegetation, naturally or artificially accumulated
- Primary Dune - means that dune which roughly parallels the shoreline in a more or less continuous fashion and is generally the first and largest dune encountered moving landward from the shoreline.

- *Is the definition of dune too vague for regulatory purposes?*
- *Should the building line be based on the primary dune? As defined?*

# Definitions

- Coastal Engineering Standards of Storm Protection - means level of protection for a location that consists of at least 100 feet of vegetated dune landward of the seawardmost 9-foot elevation contour above NAVD from the Delaware/Maryland line to the tip of Cape Henlopen, 100 feet landward of the seawardmost 6-foot elevation contour above NAVD from the tip of Cape Henlopen to Rosemary Street in Prime Hook Beach, and 75 feet landward of the seawardmost 6-foot elevation contour above NAVD from Rosemary Street in Prime hook Beach to the Old Marina Canal north of Pickering Beach.

- *Should this be used find the building line on a case-by-case basis?*

# Definitions

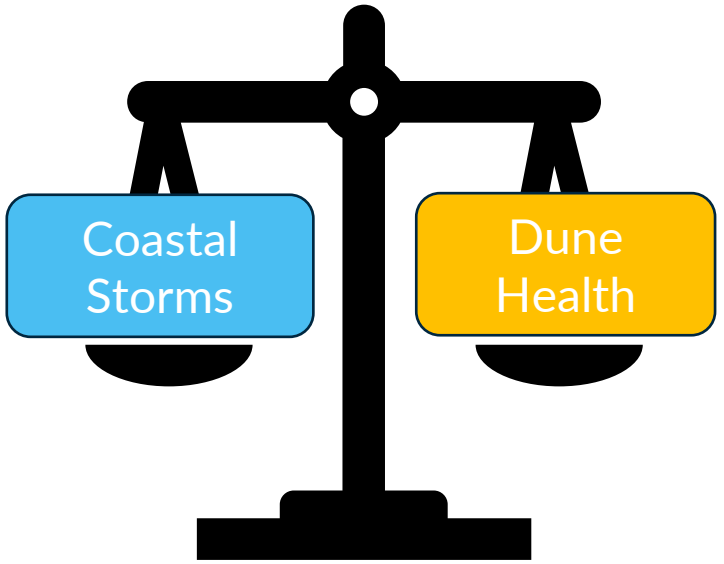
- “Emergency” means any unusual incident resulting from natural or unnatural causes which endangers the health, safety or resources of the general public, including damages or erosion of any shoreline resulting from a hurricane, storm or any such natural disturbance.

- *Does this need to be declared by Governor?*
- *Does this allow us to start over?*

# Emergency/Disaster

- What happens after a catastrophic event?
- What constitutes an emergency situation?
- How do we rebuild? Do we rebuild?



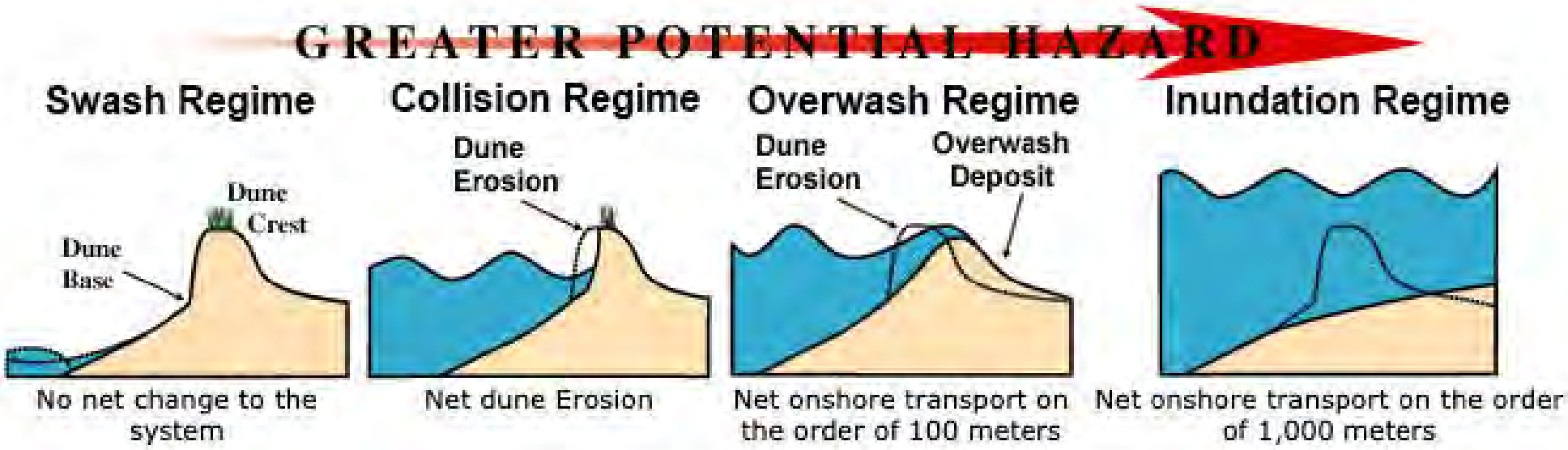



# Sallenger Model

To define the Regulated Area or Catastrophic Risk Scenario

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# The Sallenger Model to Classify Storm Impacts (USGS, 2020)



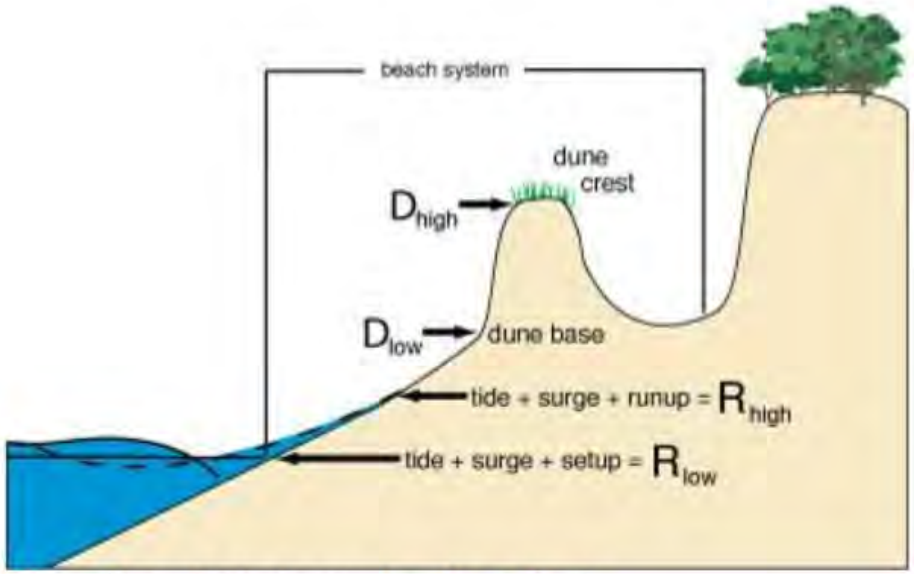

## Storm Regimes on Dune Systems

Dune crest elevation is defined as "the highest-elevation peak landward of the shoreline and within a user-defined beach width,"

- https://www.usgs.gov/centers/spcmsc/science/coastal-hazards-how-storm-impact-regimes-affect-beach-complexes
- https://www.usgs.gov/centers/spcmsc/science/storm-impact-scale

# Using Sallenger Model for our analysis

- Determine analysis design parameters
  - Design storm (1%? 1,000-year storm?)
  - Could use ADCIRC coastal outputs or similar product
  - Analysis resolution (per community, or every 250 ft?)
- Identify the elevations of Dune toe and Crest
  - As they vary along the beaches, measure the smallest part of the dune per analysis section
  - Would require dune surveys or use recent DEM?
    - Low impact activities could instead require a LOA (i.e., moving sand, sand fence)
- Compare Rhigh, Rlow, Dhigh, Dlow to classify Storm Impact
  - This could help determine where to draw the zone
  - If Overwash, zone is similar to what we have today, if Inundated, zone is huge




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Definition sketch showing Rhigh Rlow, Dhigh and Dlow. The dashed lines represent the swash excursion about wave setup (solid line). (Public domain.)

**Swash**: Total water levels are lower than the dune toe ($R_{high} < D_{low}$)
**Collision**: Total water levels exceed the dune toe ($D_{low} < R_{high} < D_{high}$)
**Overwash**: Total water levels exceed the dune crest ($R_{high} > D_{high}$)
**Inundation**: Storm surge and tide exceed the dune crest ($R_{low} > D_{high}$)

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Approx. 3-4 buildable lots

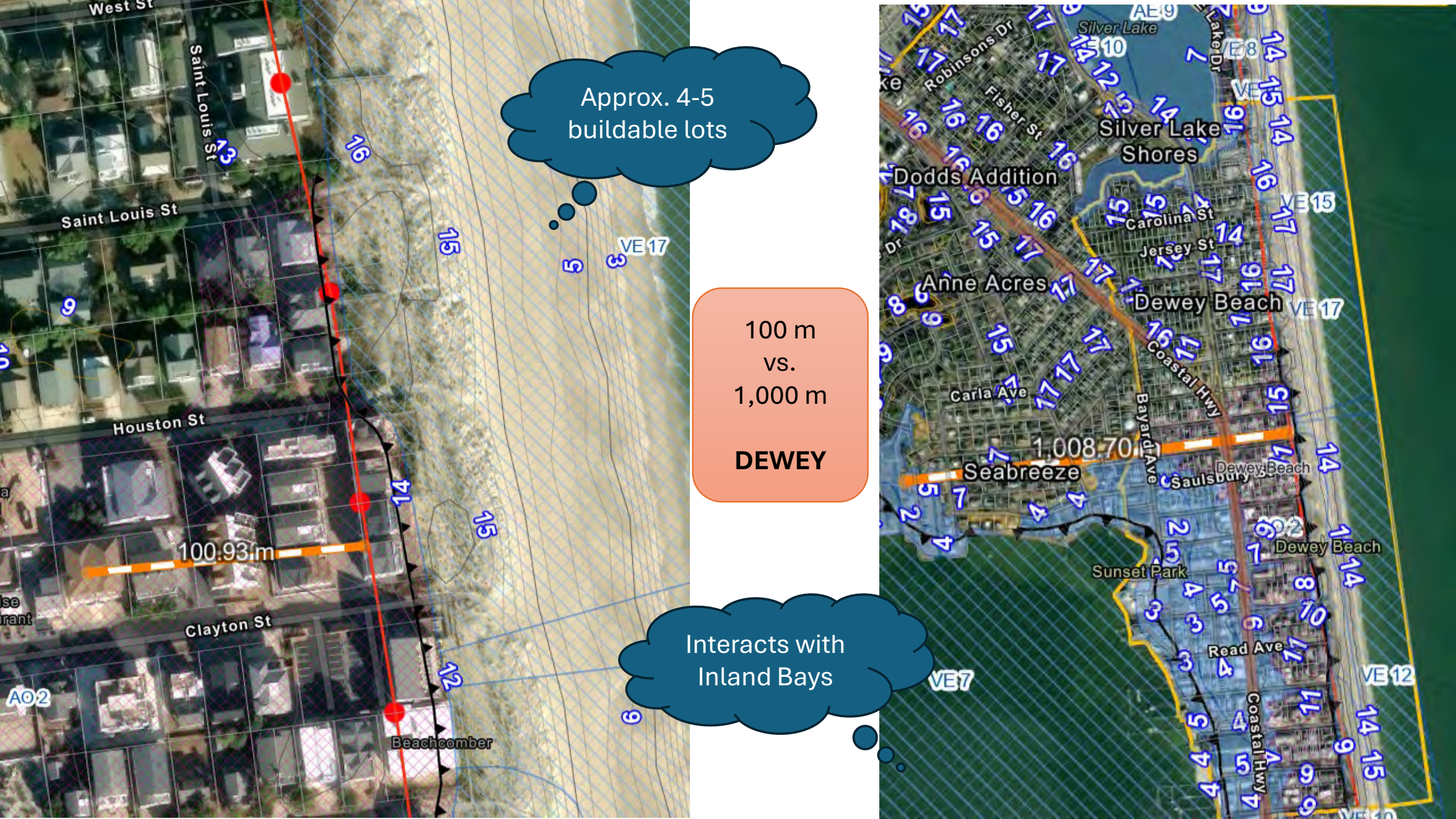
100 m
vs.
1,000 m

**LEWES**




Extends beyond SFHA

Planning for "the big one"


Approx. 4-5
buildable lots
100 m
vs.
1,000 m
DEWEY
Interacts with
Inland Bays
West St
Saint Louis St
Houston St
Clayton St
Beachcomber
100.93 m
Silver Lake
Silver Lake
Shores
Dodds Addition
Anne Acres
Dewey Beach
Carolina St
Jersey St
Coastal Hwy
Carla Ave
Bayard Ave
1,008.70
Seabreeze
Saulsbury
Dewey Beach
Sunset Park
Read Ave
Coastal Hwy
Robinsons Dr
Fisher St
Lake Dr
VE 17
VE 15
VE 12
VE 7
AO 2

# Guiding Questions & General Ideas

- **What design scenario are we planning for?**
  - 1%, 0.2%, “The Big One”? 2050, 2100 SLR projections?
- **What do we do in the case of a catastrophic disaster?**
  - These are the hard, yet important questions
  - Coordinate with State Hazard Mitigation Planning
  - Rebuild within old footprint and wait for more beach nourishment?
  - Managed retreat? While mindful of inland flooding sources that are heavily affected by SLR!

- **DNREC Building Line:**
  - Use erosion rates x 30-70 (in-line with mortgage rates or year 2100)
    - From a setback line i.e., MHHW, dune crest, dune toe
  - Use FEMA's LiMWA (Limit of Moderate Wave Action) or similar
- **Regulatory Area:**
  - Use FEMA's Zone AO (Overwash area)
  - Use Sallenger model to decide on 100 m or 1,000 m zone based on dune health and design scenario



# Any other DNREC Building Line / Regulatory Area ideas from the group?

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# Thank you!

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DNREC

Division of Watershed Stewardship

Shoreline and Waterway Management Section

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