

GEI Consultants

Scarborough Flood Vulnerability Assessment
Higgins Beach Public Meeting

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September 5th, 2024

Project Overview and Goals



1. **Understand Coastal Flood Risk**
2. **Prioritize Infrastructure for Adaptation**
3. **Provide Adaptation Options**
4. **Introduce Pilot Projects**
5. **Community Engagement**

Recent Flooding

January 13, 2024: Higgins Beach





Photos from Google Earth and The Maine Monitor

Recent Flooding

Bayview Avenue Aftermath



Photos from WGME and Downeast.com

Higgins Beach



Sand Dunes


Ocean
Pearl
Ashton
Bayview
Sand dunes
Parking lot
Silver Sands
Hotel

1960s


Ocean
Bayview
Pearl
Ashton
Morning
Silver Sands
Hotel
Parking lot
Seawall, no dunes

2024

Sand Dunes

- If undisturbed, sand dunes migrate back and forth across beaches – moving inland or beachward as prevailing winds move sands around.

- With development near dunes, the area that could supply sands becomes reduced. The system becomes no longer dynamic. The protective ability of the sand dunes is diminished.

Sand Dunes

D1:

Frontal Sand Dune

D2:

Back Sand Dune

Red Hash:

Erosion Hazard Area



Sand Dune Restrictions



Not Allowed:

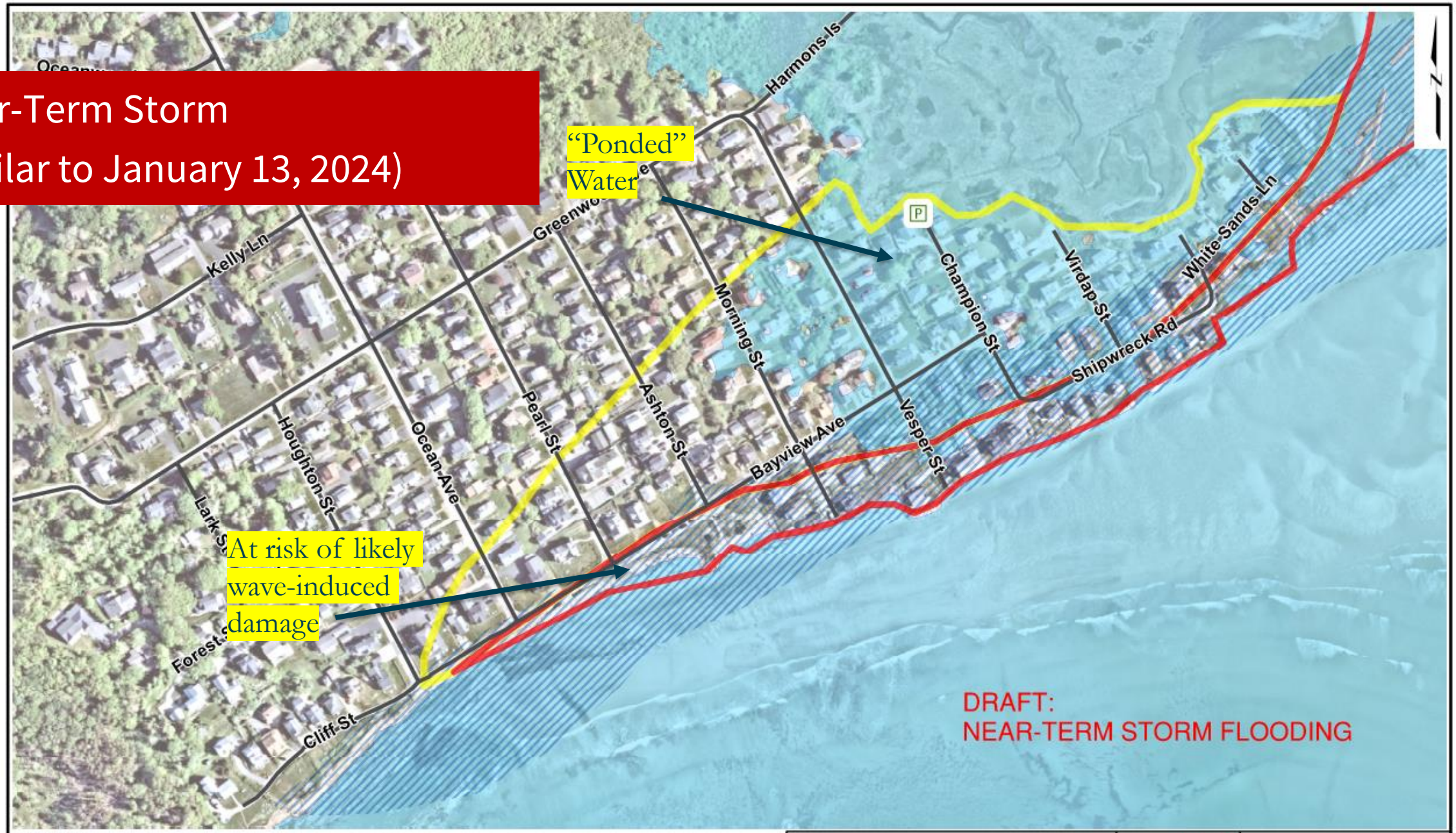
- New seawalls (including sloped barriers constructed out of rocks, wood, concrete or similar materials)
- Expanded road footprints (i.e., elevated roads)
- Closed fences
- In Frontal Dune and Areas Mapped in a V-Zone: New structures or addition to existing structure (some exceptions)

Allowed:

- Pile or post foundations
- Replacement of patio, deck, driveway, walkway, porch, or parking area
- Moving seawall landward or seawall replacement (same location and dimensions, including height)
- Temporary structures (less than 7 months)
- Repair of up to 50% of existing structure
- Elevated boardwalks, open fences, walkways, and driveways
- Beach nourishment / sand dune restoration
- Re-routing of road from frontal dune to back dune

Near-Term Flooding

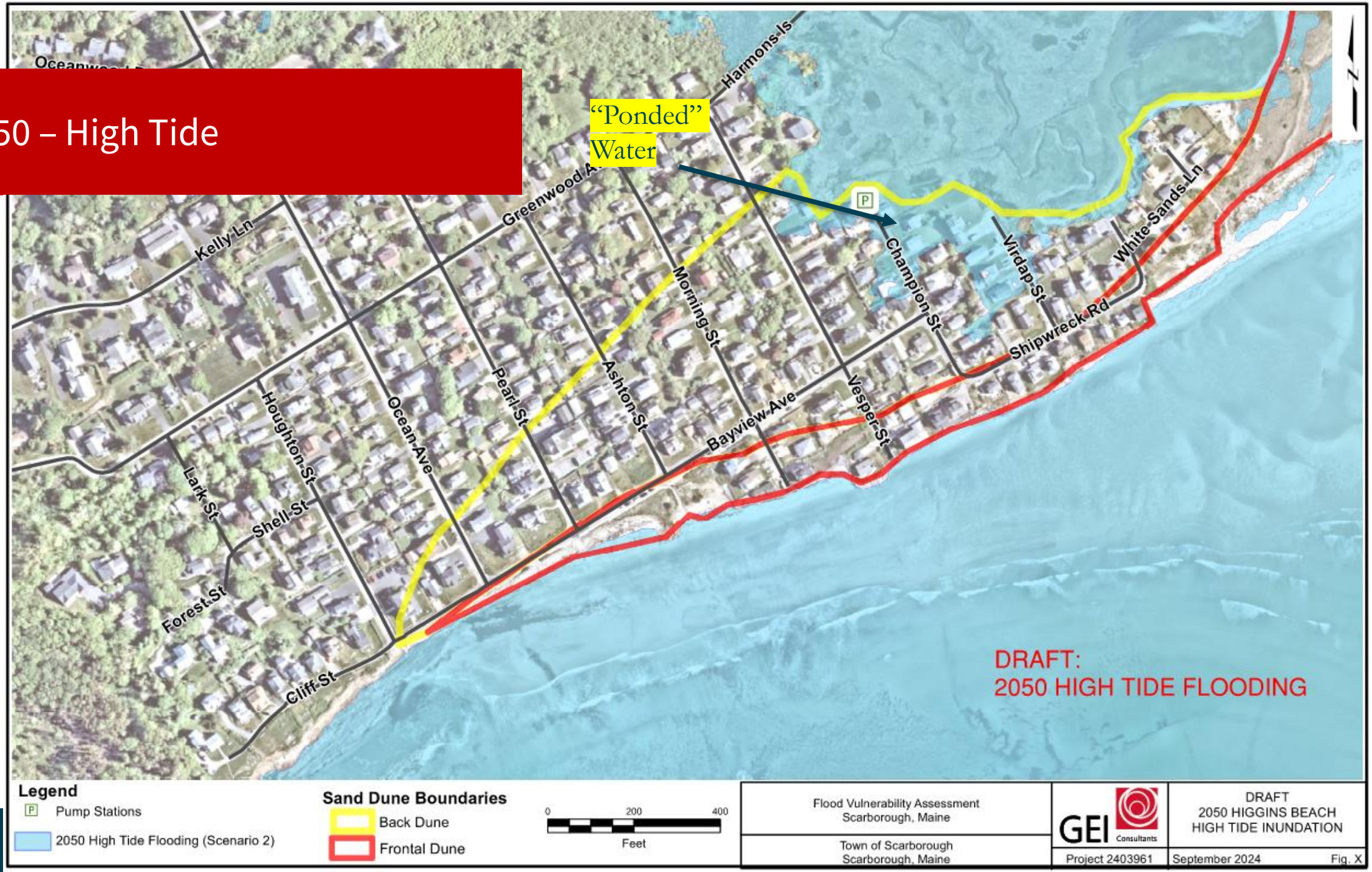
Near-Term Storm
(similar to January 13, 2024)



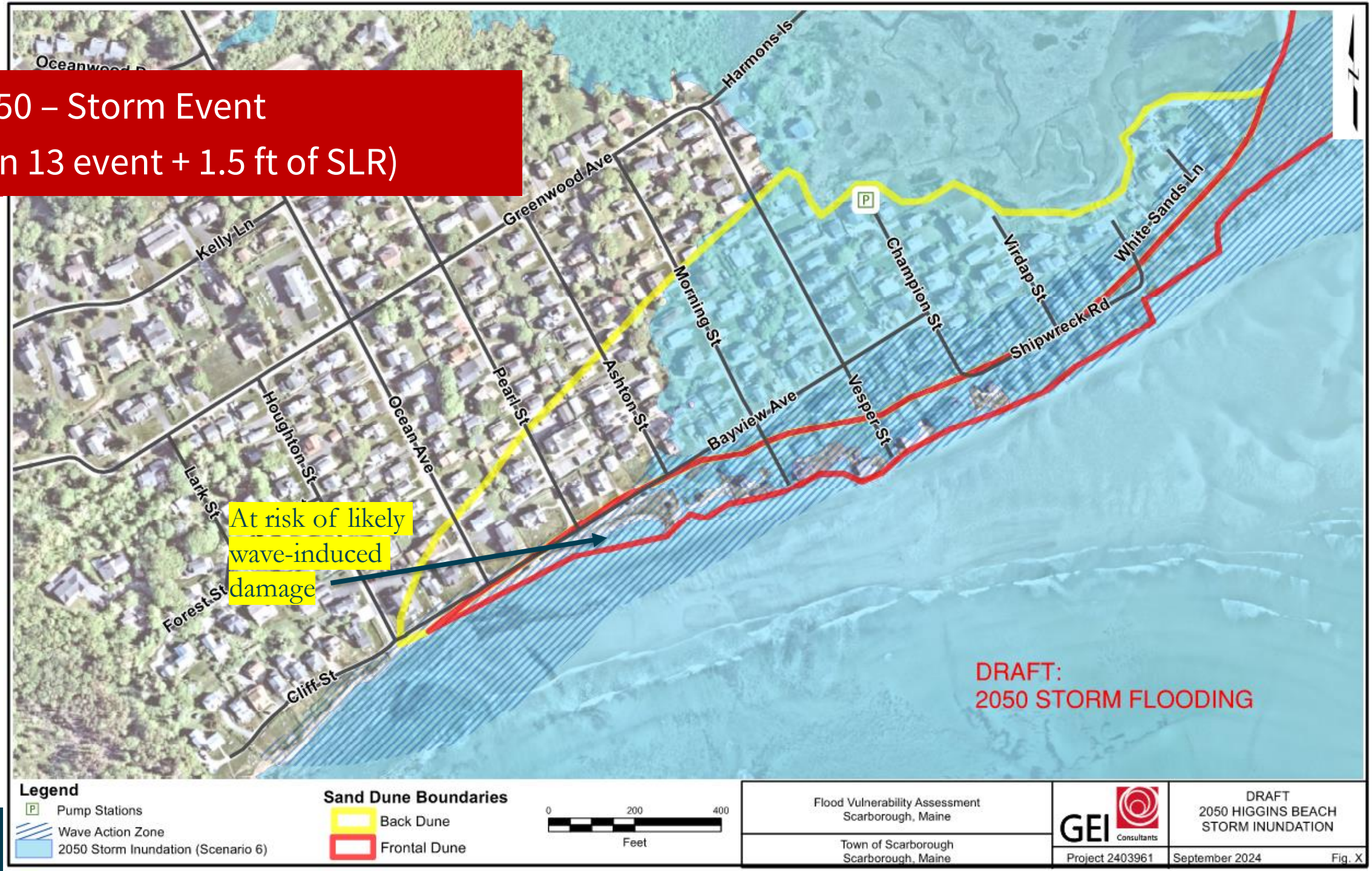
Flood Inundation Maps

2050 Flooding

2050 – High Tide



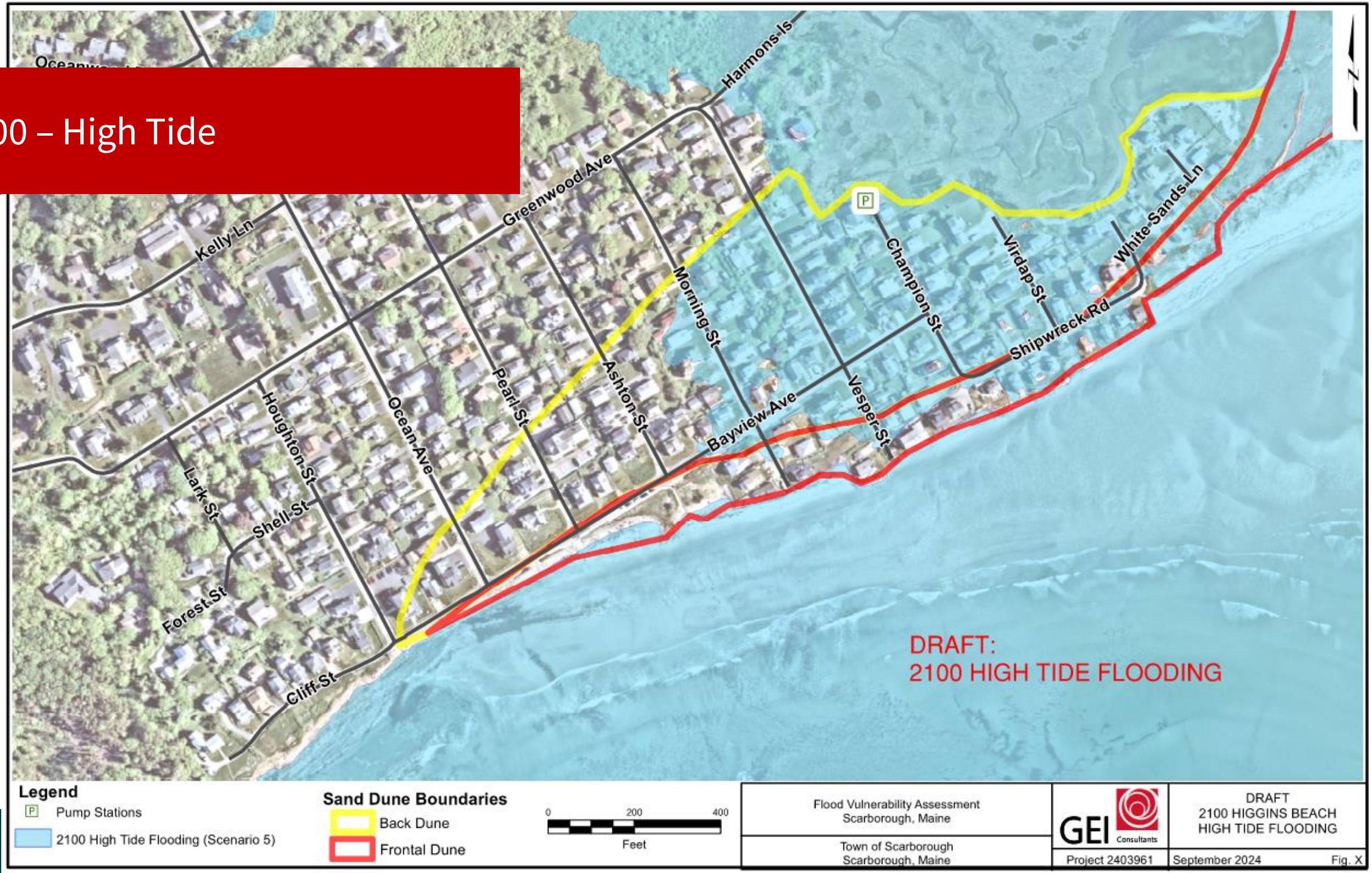
2050 – Storm Event
(Jan 13 event + 1.5 ft of SLR)



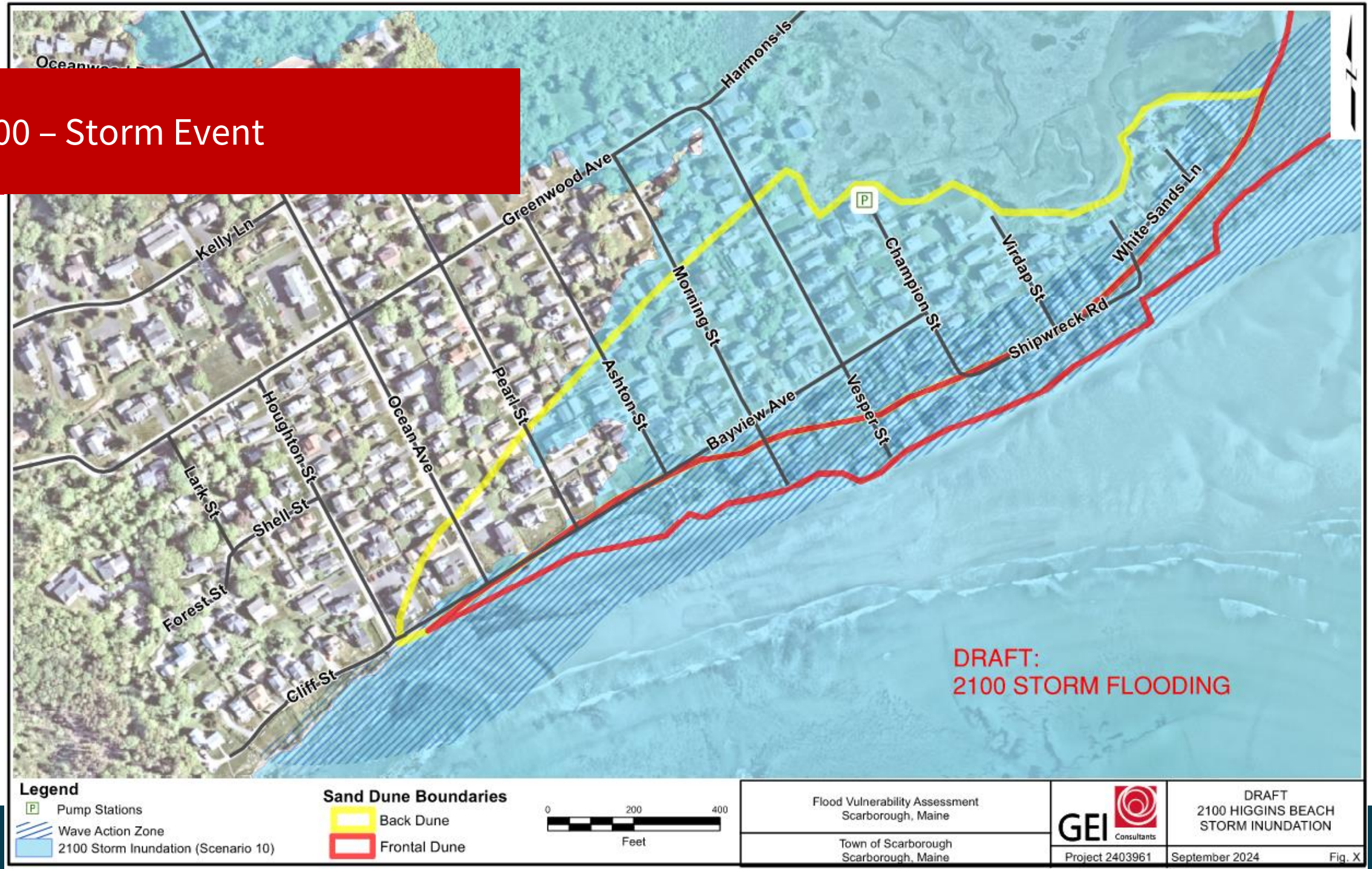
Flood Inundation Maps

2100 Flooding

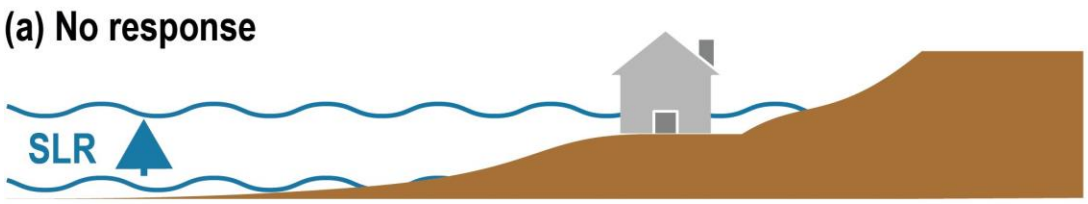
2100 – High Tide



2100 – Storm Event



Adaptation Overview

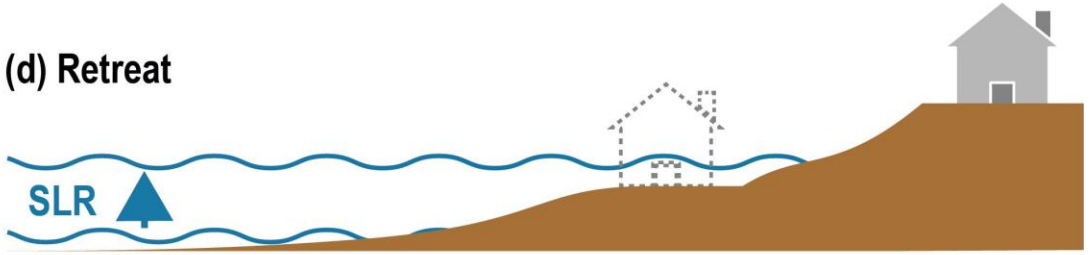


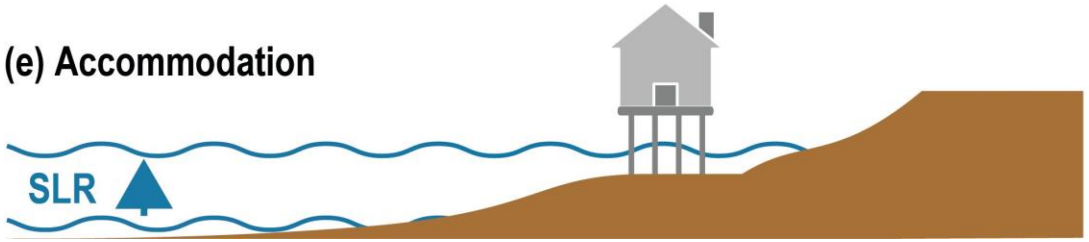


*Not a viable option in 2024 and beyond



*New sea walls not allowed in most of Higgins







From IPCC (2019) Chapter 4, Box 4.3, Fig. 1

Flood Adaptation

Structural Measures

- Elevation (i.e., house on stilts, raised roads *where allowed*)
- ~~Permanent Flood Barrier (i.e., seawall)~~
- "Wet" and "Dry" Floodproofing (structure by structure basis)
- Wave Attenuation Device (WADs)
- Retreat

Flood Adaptation

Non-Structural Measures / “Green” Infrastructure

- Flood Warning System
- Flood Emergency Preparedness Plans
- High Water Rescue Vehicle
- Temporary Barriers / Temporary Floodwalls
- Municipal buy-out, rent-back program (retreat)
- Dune restoration
- Artificial reef system

Wave Action



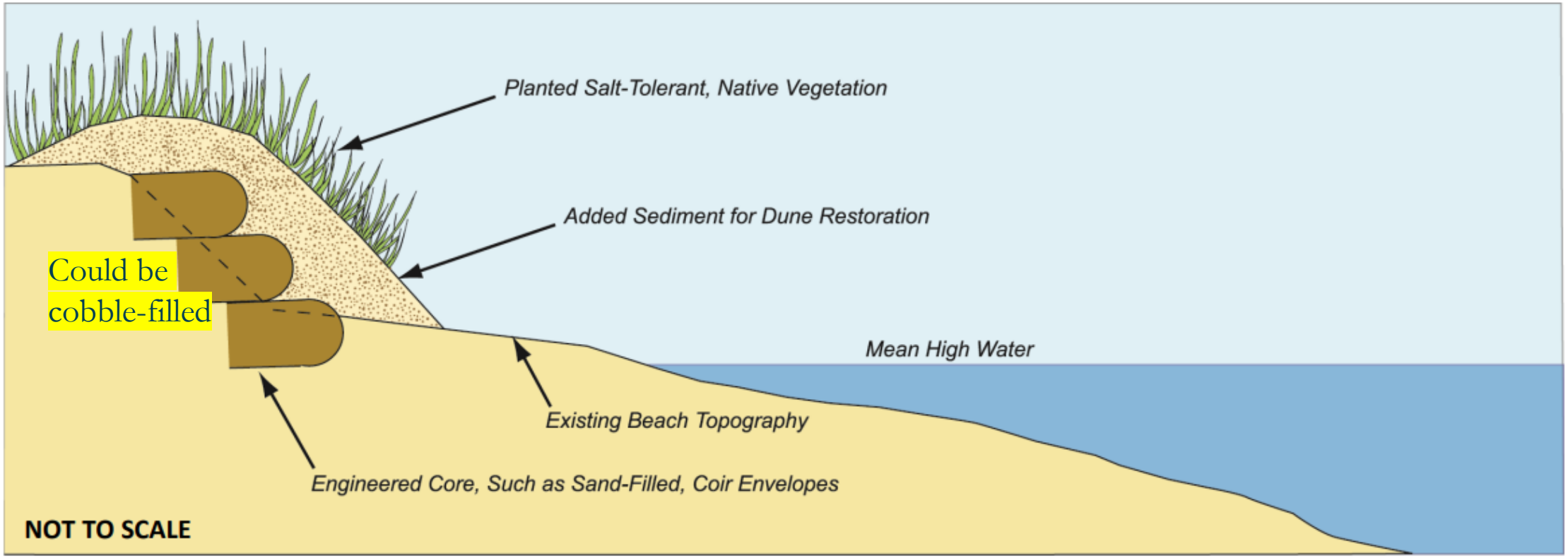
Wave Action



Dune Restoration

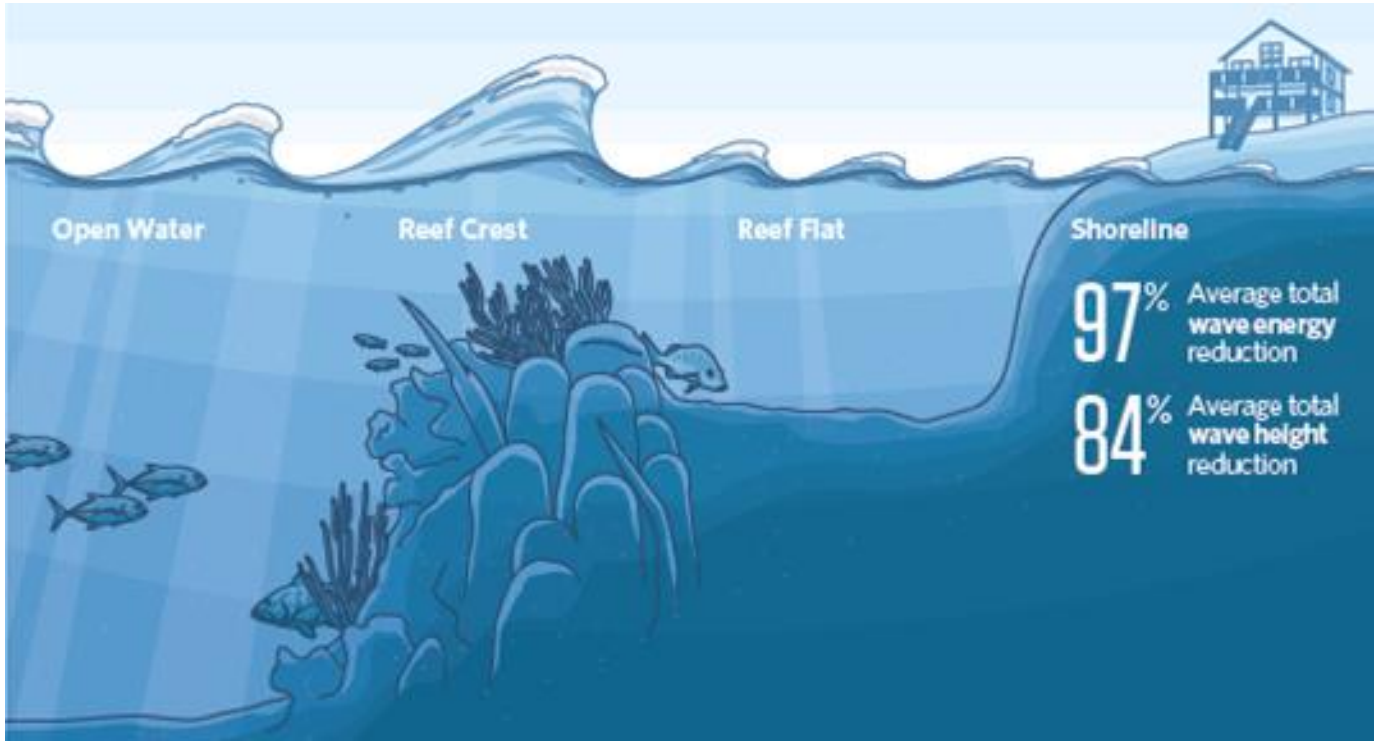
Dunes will reduce damaging effects of wave action. Purposefully dynamic.

Design Schematics



Reef Attenuation System

- Reduces wave energy
- Reduce flooding due to wave action
- Reduce flood damage
- Would not prevent “ponding”
- Can be designed to optimize surfing conditions or create planned surf “breaks”





Temporary Flood Protection



Flood Logs


Deployable Flood Barriers


Tiger Dams


HESCO Baskets

Municipal “buy-out, rent-back”

For example:

- Municipality buys out at-risk properties with a loan
- Municipality rents property to original owner (or anyone)
- Municipality pays off the loan w/rental income
- Property remains occupied until damaged or no longer safe to live in

This is one way to approach retreat.

Break Out Tables Activity

Discuss adaptation ideas for each time horizon:

- High-level thoughts (i.e., elevate, retreat, temporary barrier, etc.)
- Adjust adaptation ideas based on timeline and flood risk
- What do you all value in your neighborhood?
- What are your main concerns with flooding?

Next Steps

- Interactive online StoryMap available in early 2025
- Pilot Project selection and design October 2024 through April 2025
- Project finished July 2025



Thank you!
Questions?

GEI Consultants

Consulting Engineers and Scientists

Flood Scenarios

		Flood Risk Time Horizon	
Mapping Scenario	Water Level (ft, NAVD88)	Coastal Storm Event	"High Tide"
1	7.3	Now	2030
2	8.0	Now	2050
3	8.8	Now	2050
4	9.6	Now	2100
5	10.3	2030	2100
6	10.8	2050	2100
7	11.4	2050	2100
8	12.8	2100	2100
9	13.9	2100	2100
10	16.9	2100	2100

Flood Adaptation

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Non-Structural Measures / "Green" Infrastructure

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Flood Scenarios

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7	11.4
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9	13.9
10	16.9

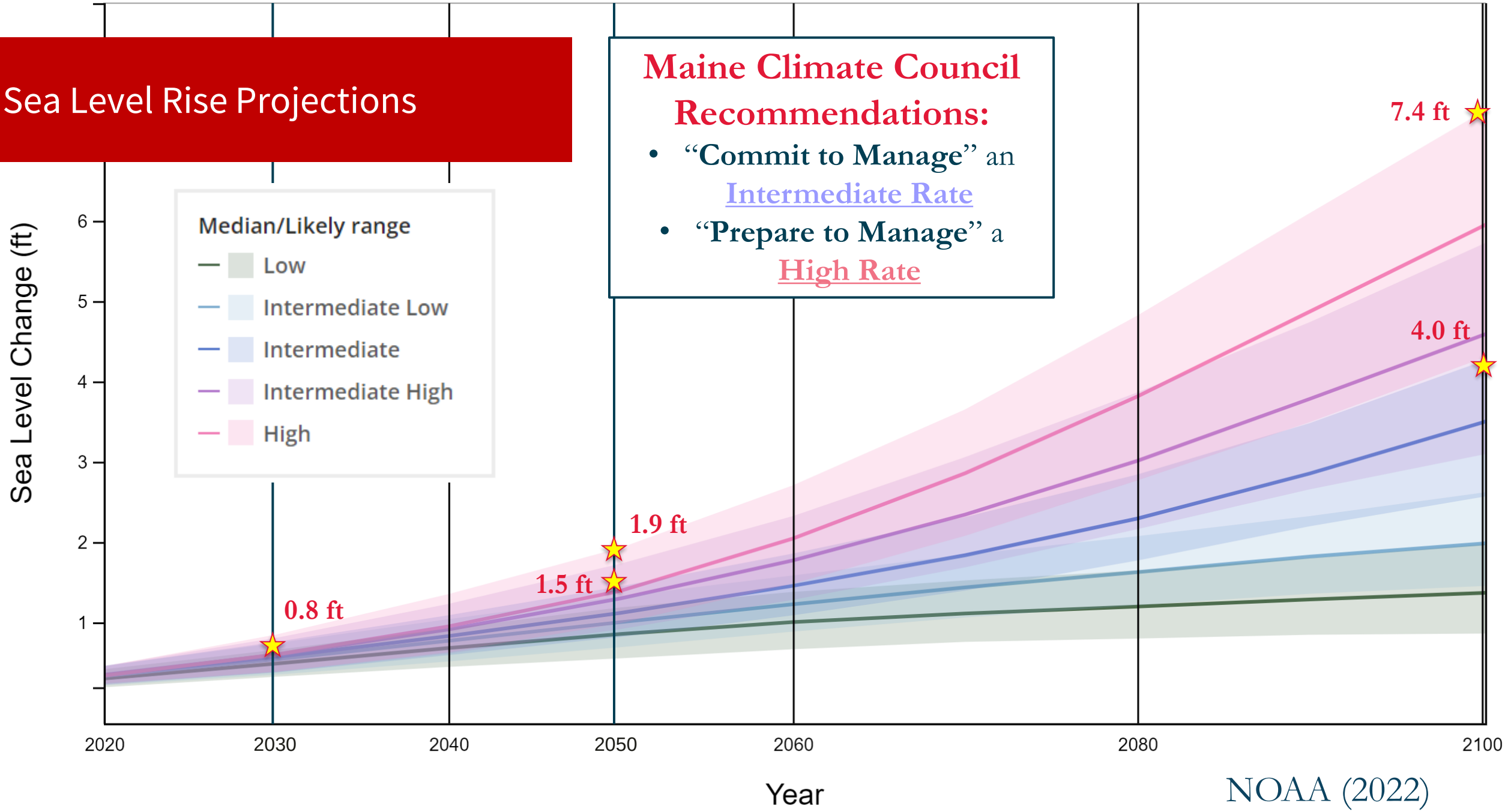
Preliminary (Public) Roads Results: Higgins

Road (Public) Flood Exposure Summary (Length Inundated, ft)											
ROAD NAME	1	2	3	4	5	6	7	8	9	10	Dry Length
Champion St	160	246	402	468	468	468	468	468	468	468	*468*
Vesper St	-	-	411	616	660	691	705	737	756	930	*930*
Bayview Ave	-	-	285	360	603	692	783	884	934	1,373	*1,451*
Shipwreck Rd	-	-	73	363	496	547	547	547	547	547	*547*
Kent St	-	-	19	76	76	76	76	76	76	76	*76*
Morning St	-	-	-	147	461	510	556	585	603	770	*868*
Ocean Ave	-	-	-	-	130	201	263	364	430	1,346	*2,703*
Spurwink Rd	-	-	-	-	93	158	220	332	595	2,100	*15,977*
Ashton St	-	-	-	-	-	-	59	94	146	364	*694*
Greenwood Ave	-	-	-	-	-	-	-	-	190	356	*1,973*
Pearl St	-	-	-	-	-	-	-	-	-	161	*1,107*

Sea Level Rise Projections

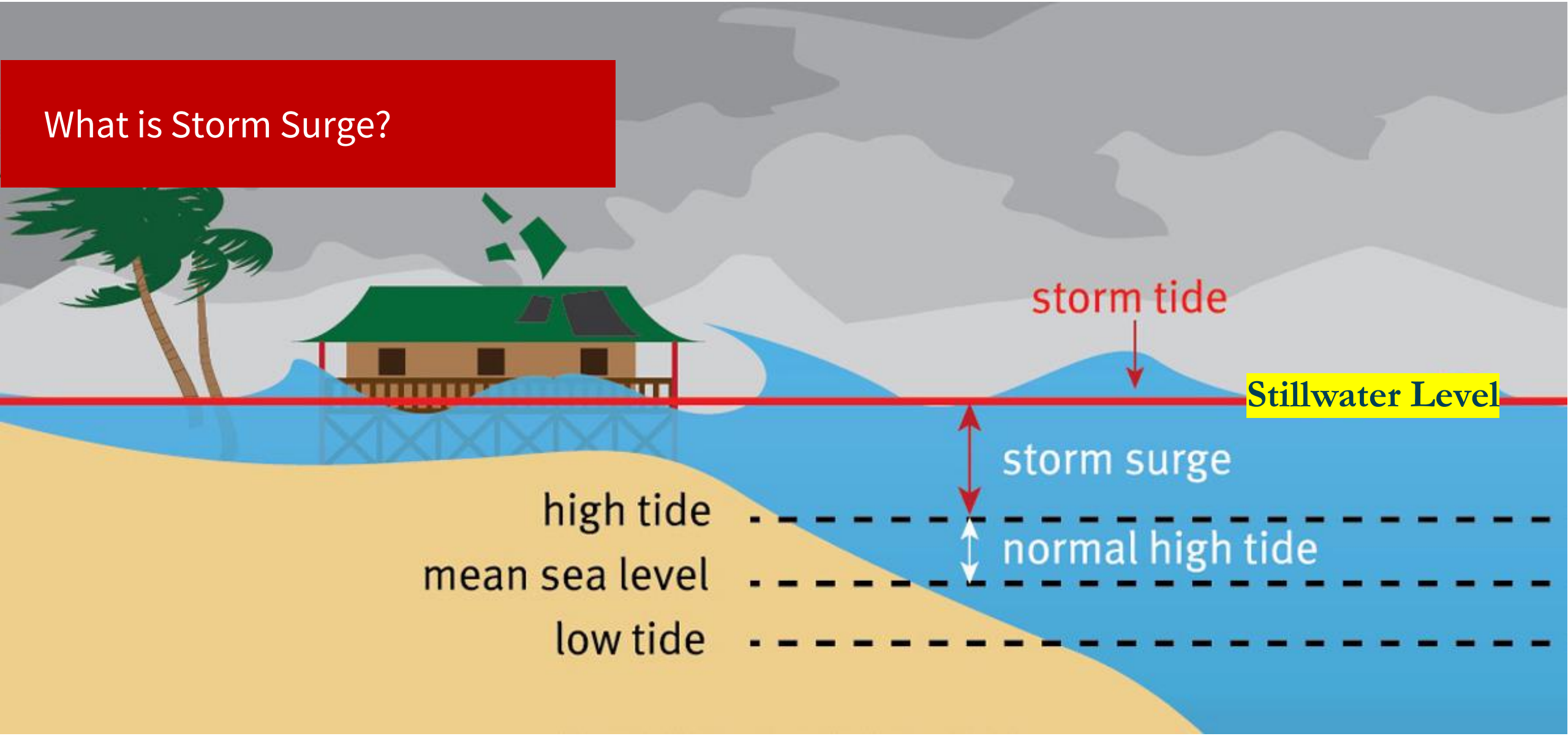
Maine Climate Council Recommendations:

- "**Commit to Manage**" an Intermediate Rate
- "**Prepare to Manage**" a High Rate



NOAA (2022)

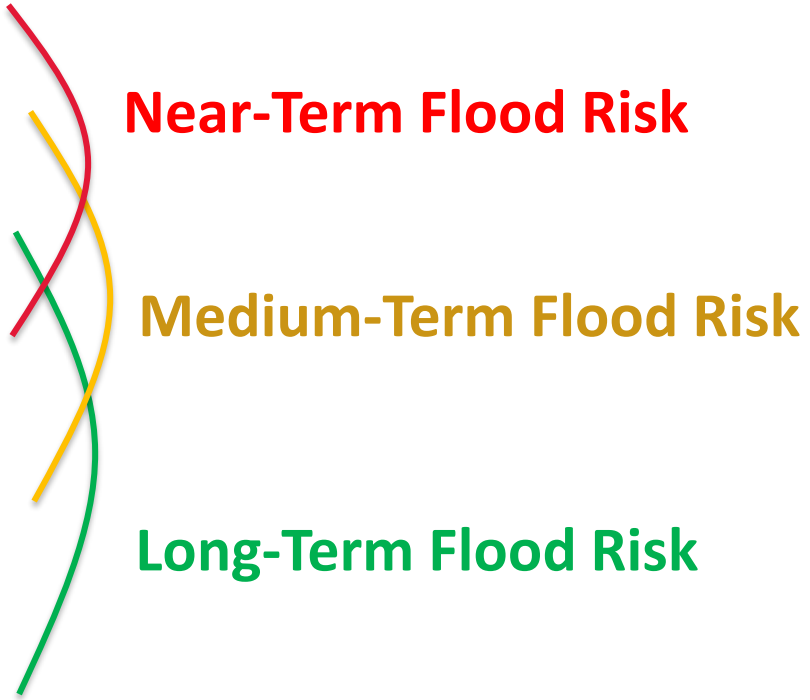
What is Storm Surge?



Source: Rosenstiel Hurricane Hub

Flood Scenarios

Mapping Scenario	Water Level (ft, NAVD88)
1	7.3
2	8.0
3	8.8
4	9.6
5	10.3
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7	11.4
8	12.8
9	13.9
10	16.9



Near-Term Flood Risk

Medium-Term Flood Risk

Long-Term Flood Risk

Assets in Study

Transportation Infrastructure

- Roads
- Rail Lines
- Sidewalks
- Bridges

Sewer Utilities

- Manholes
- Sewer Pump Stations
- Treatment Plant
- Septic Tanks

Buildings/Structures

- Structures (buildings, etc.)
- Municipal Property

Public Health & Safety

- DEP Remediation Sites
- Fire Hydrants
- Fire Stations
- Hospitals
- DEP Registered Tanks
- Police Stations
- Wells
- Evacuation Routes
- Streetlights

Coastal Structures

- Boat Ramps
- Coastal Structures

Drainage Utilities

- Dams
- Catch Basins
- Culverts
- Outfalls
- Outlet Control Structures

Conservation and Recreation

- Beaches
- Parks and Open Spaces
- Sand Dunes
- Walking Trails
- Wetlands

Flood Scenarios

Sea Level Rise		Water Surface Elevations (NAVD88, ft)						
		"High Tides"		Coastal Storm Events				
Planning Scenario	SLR (ft)	MHHW	HAT	10 yr	50 yr	100 yr	Max Tide January 13, 2024	500 yr
Existing Sea Levels	0.0	4.6	6.5	7.9	8.5	8.8	9.3	9.5
2030	0.8	5.4	7.3	8.7	9.3	9.6	10.1	10.3
2050: Commit	1.5	6.1	8.0	9.4	10.0	10.3	10.8	11.0
2050: Prepare	1.9	6.5	8.4	9.8	10.4	10.7	11.2	11.4
2100: Commit	4.0	8.6	10.5	11.9	12.5	12.8	13.3	13.5
2100: Prepare	7.4	12.0	13.9	15.3	15.9	16.2	16.7	16.9

Mapping Scenario	Water Level (ft, NAVD88)	
1	7.3	
★ 2	8.0	2050 "High Tide"
3	8.8	
★ 4	9.6	Present-Day Storm
★ 5	10.3	2100 "High Tide"
★ 6	10.8	2050 Storm
7	11.4	
8	12.8	
9	13.9	
★ 10	16.9	2100 Storm