



# Inner Harbor Coastal Resiliency Improvement Project Harbor Development Committee

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# Inner Harbor Coastal Resiliency Improvement Project

## *Scope of Work*

- Task 1. Updated Coastal Flood Risk Maps - *Complete*
- Task 2. Existing Conditions Model - *Complete*
- Task 3. Proposed Conditions Model - *Complete*
- Task 4. Specific Flooding Processes and Other Coastal Hazards – *Complete*
- Task 5. Engineering Parameters – – *Complete*
- Task 6. Design Review and Final Design Model –*Complete*
- Task 7. Planning for Future Phases – *Complete (focus for today)*
- Task 8. Meetings and Presentations – *last one!*



# Inner Harbor Coastal Resiliency Improvement Project

## *Task 7 Objective*

- Provide conceptual alternatives for long-term coastal flood mitigation improvements
- Can be implemented incrementally
- Achieve a continuous and high level of protection for:
  - Downtown area
  - Evacuation/emergency routes

\*does not include Route 3A from Ship Street through Broad Cove Road

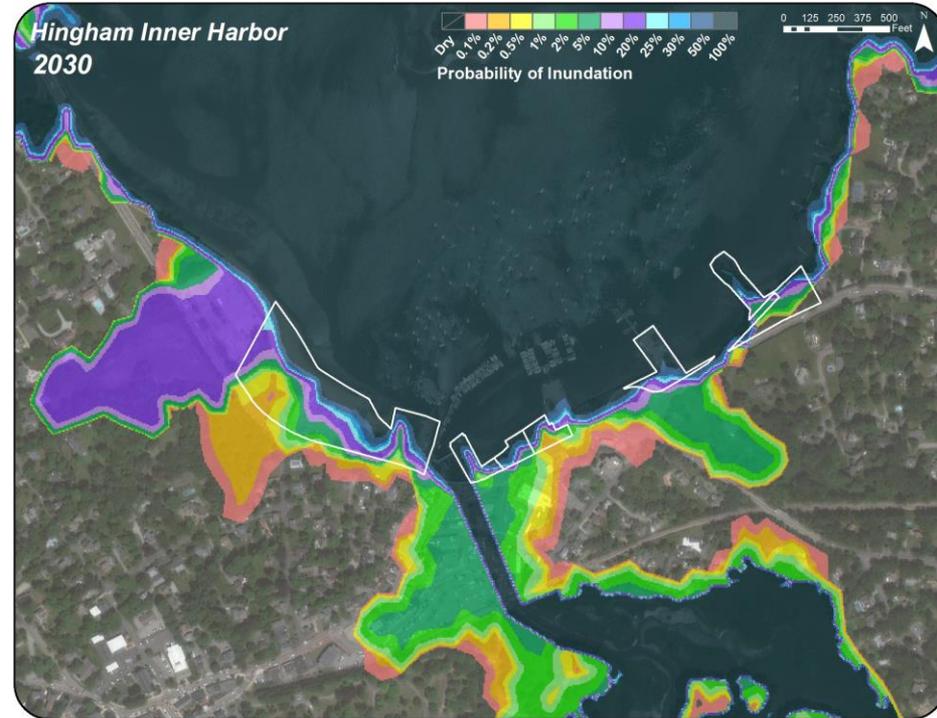
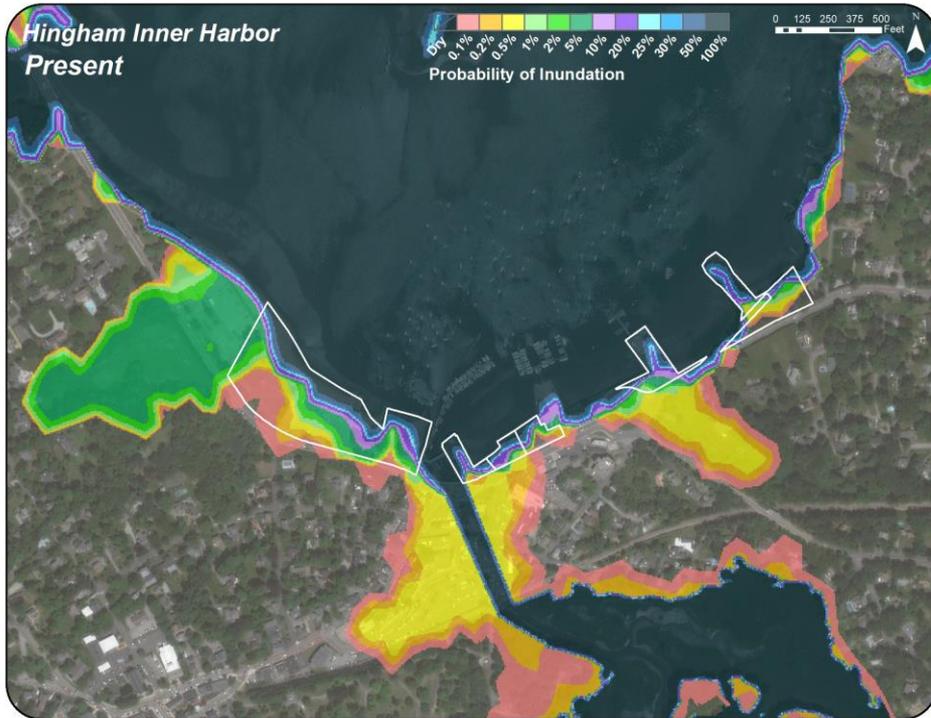


# Hingham Inner Harbor

## Annual Probability of Inundation

Present

2030 (+1.3' RSLR)

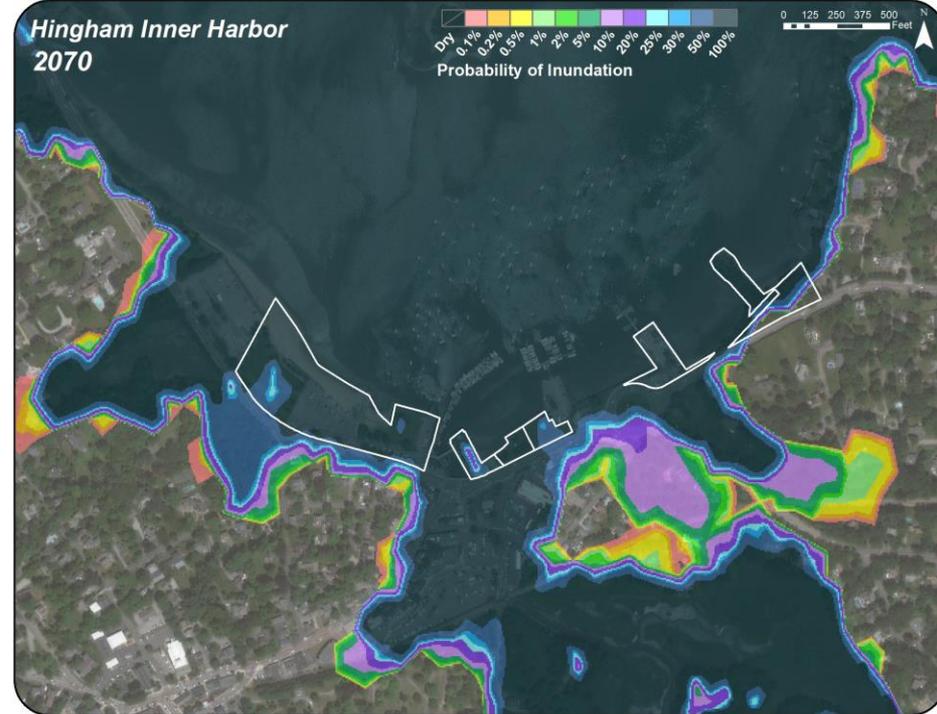
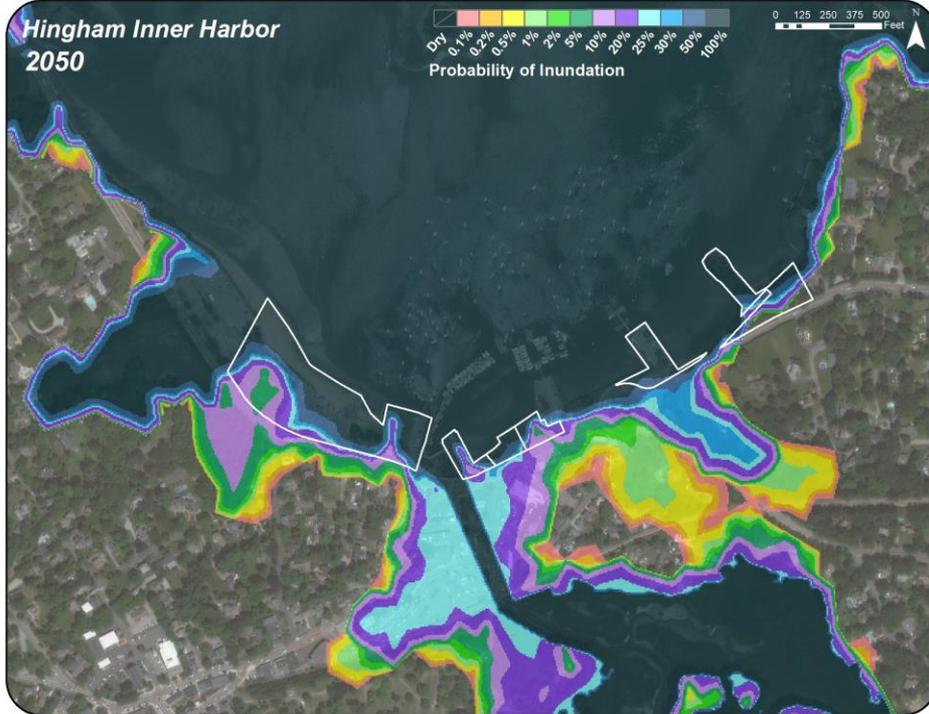


# Hingham Inner Harbor

## *Annual Probability of Inundation*

2050 (+2.5' RSLR, Future Storm Climate)

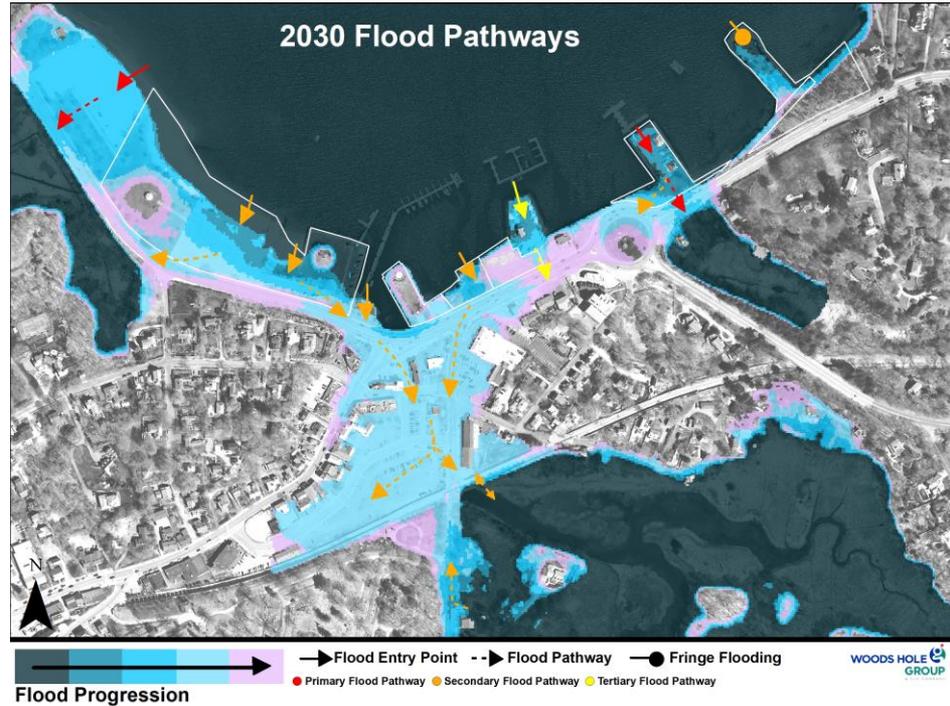
2070 (+4.3' RSLR, Future Storm Climate)



# Hingham Inner Harbor

## Flood Pathways

2030 Flood Pathways



2070 Flood Pathways



# Flood Risk – Existing Conditions

*March 2018*

## Town Pier



## Barnes Wharf



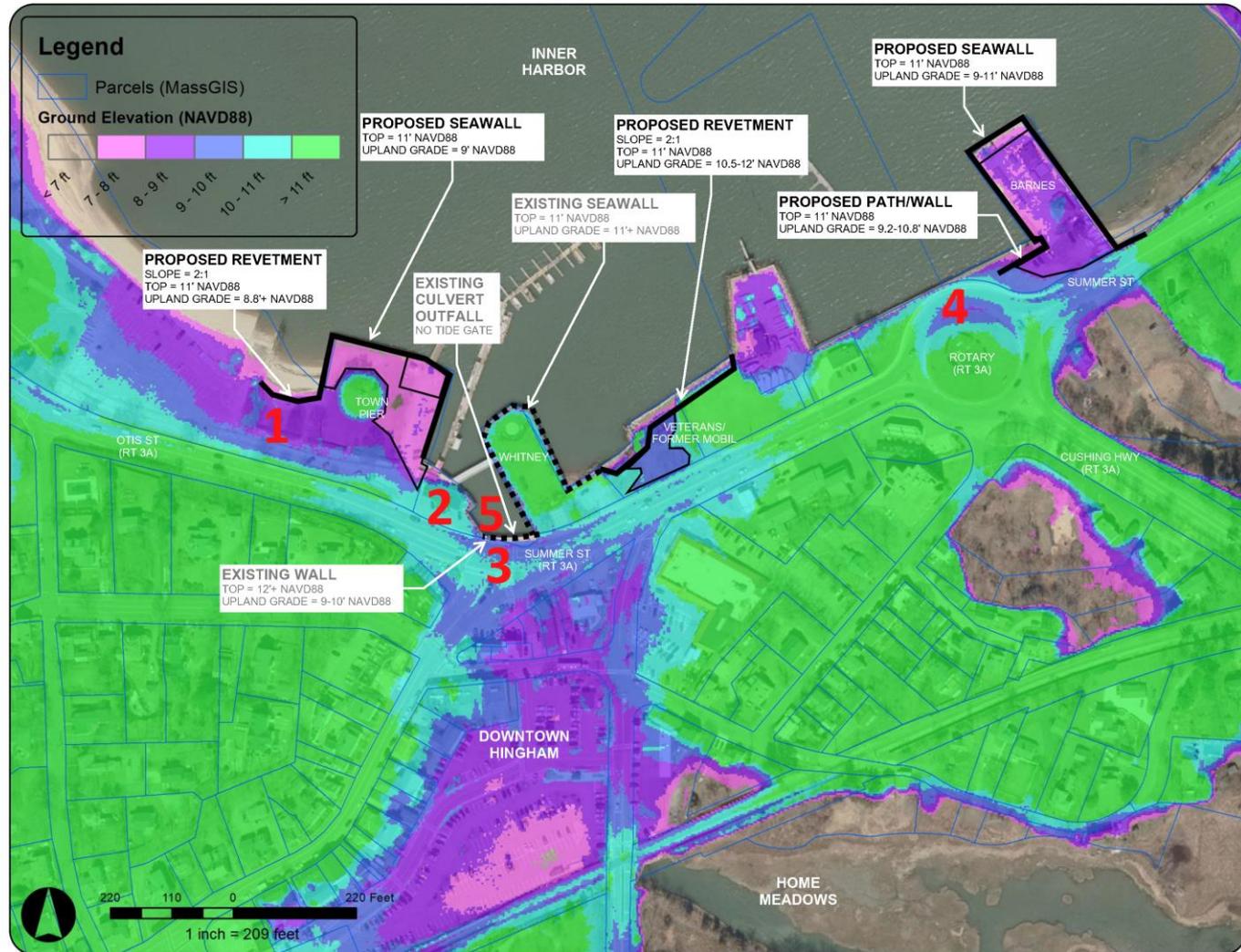
# Existing Proposed Plan

## 11 ft-NAVD88

- Town Pier
- Veterans Park/  
Former Mobil Station
- Barnes Wharf

### GAPS REMAIN

1. Town Pier boat ramp/parking lot
2. 3 Otis St
3. Concrete wall at 3A
4. Rt 3A rotary
5. Outfall

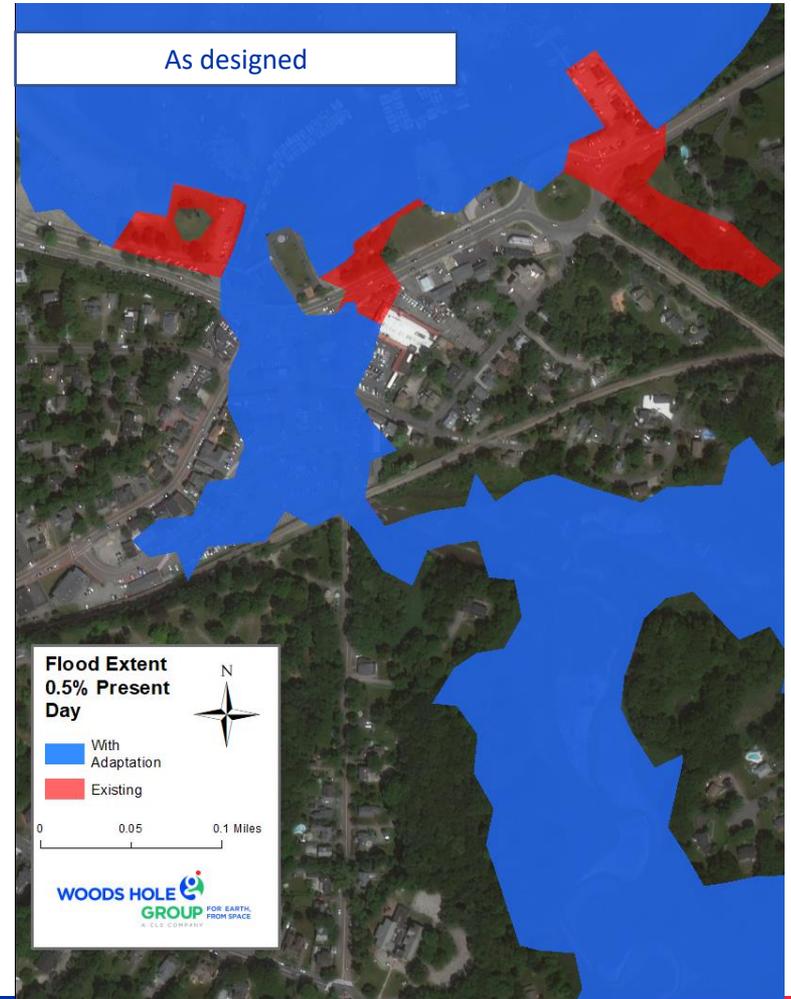


# Existing Proposed Plan

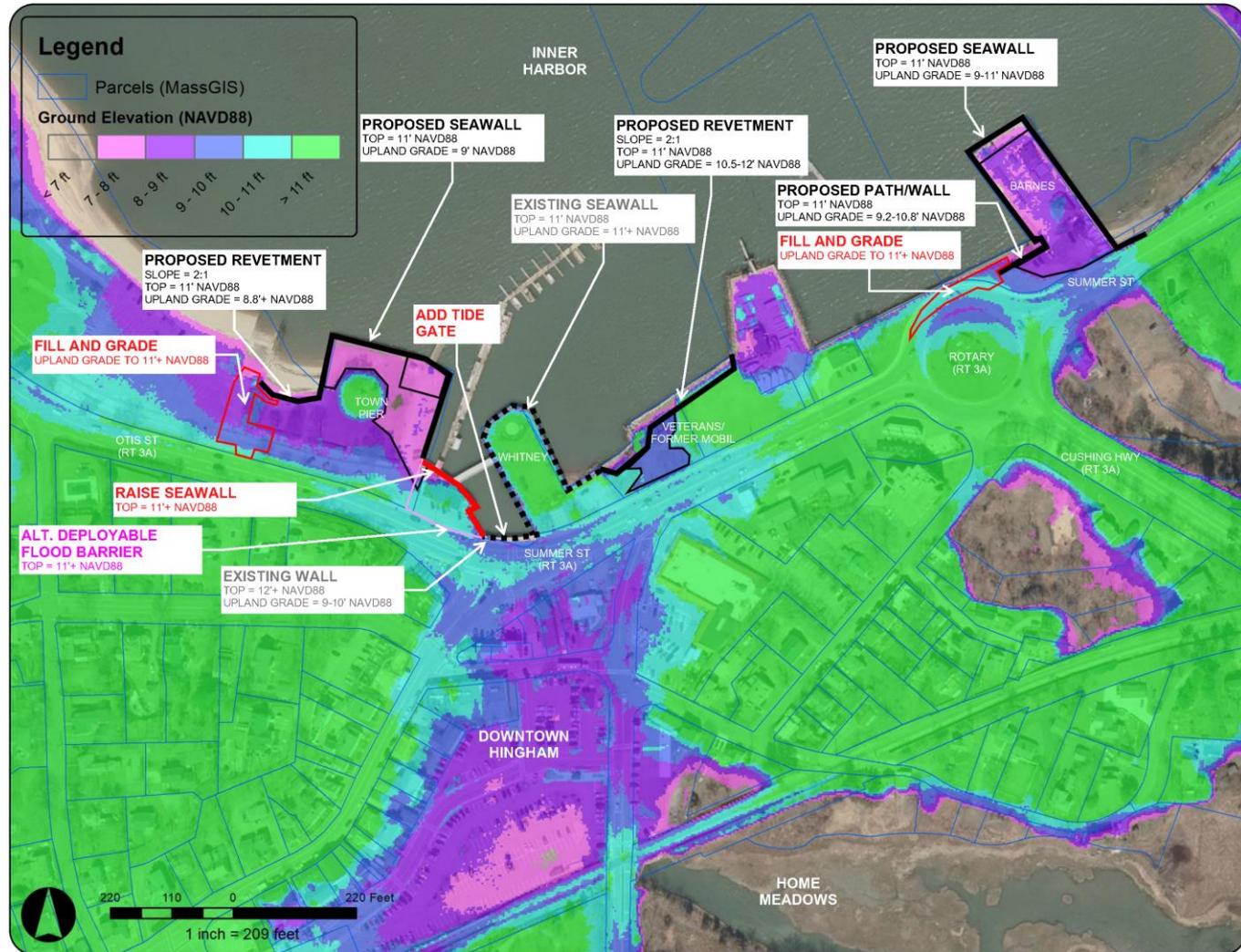
## Flood Modeling Results – Single 200-yr Storm

### Stillwater Flood Elevations (MC-FRM)

Exceedance Probability (%)	Recurrence Interval (years)	Water Surface Elevation (feet, NAVD88)			
		Present	2030	2050	2070
0.1	1,000	11.1	12.1	14.4	16.0
0.2	500	10.6	11.7	13.9	15.6
0.5	200	10.1	11.2	13.2	14.9
1	100	9.7	10.8	12.7	14.4
2	50	9.3	10.4	12.2	13.9
5	20	8.7	9.8	11.5	13.3
10	10	8.3	9.4	11.0	12.8
RSLR vs 2008			+1.3'	+2.5'	+4.3'



# Modified Plan (Near-Term) 11 ft-NAVD88



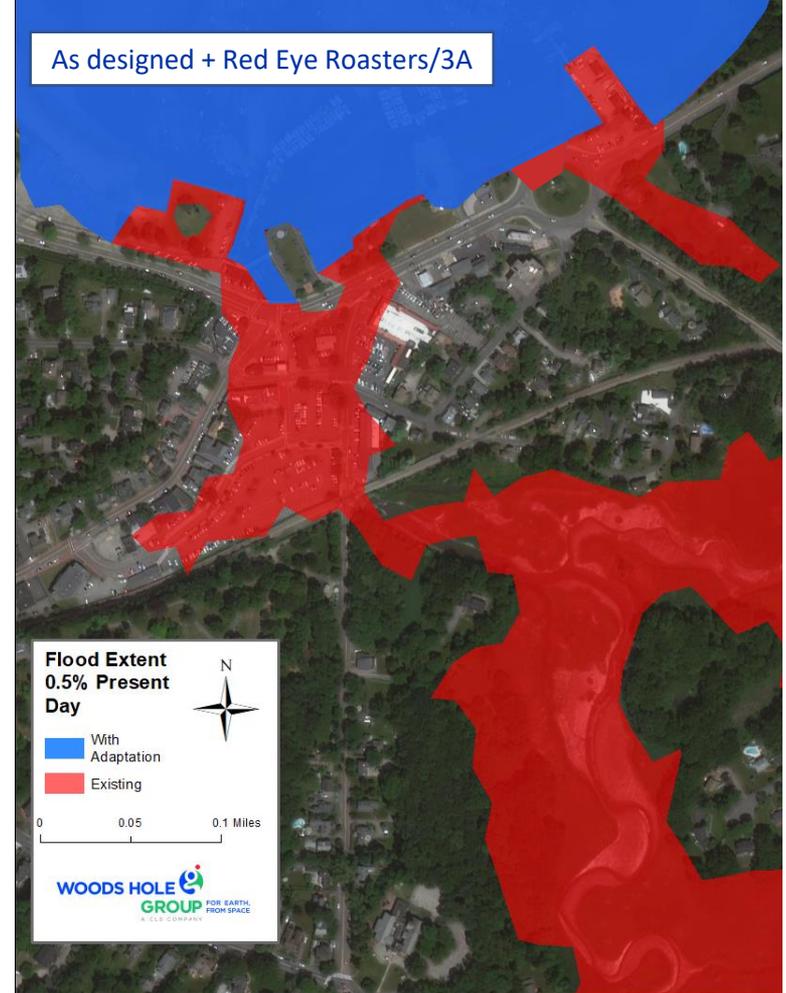
# Modified Proposed Plan

## Flood Modeling Results – Single 0.5% Storm

### Stillwater Flood Elevations (MC-FRM)

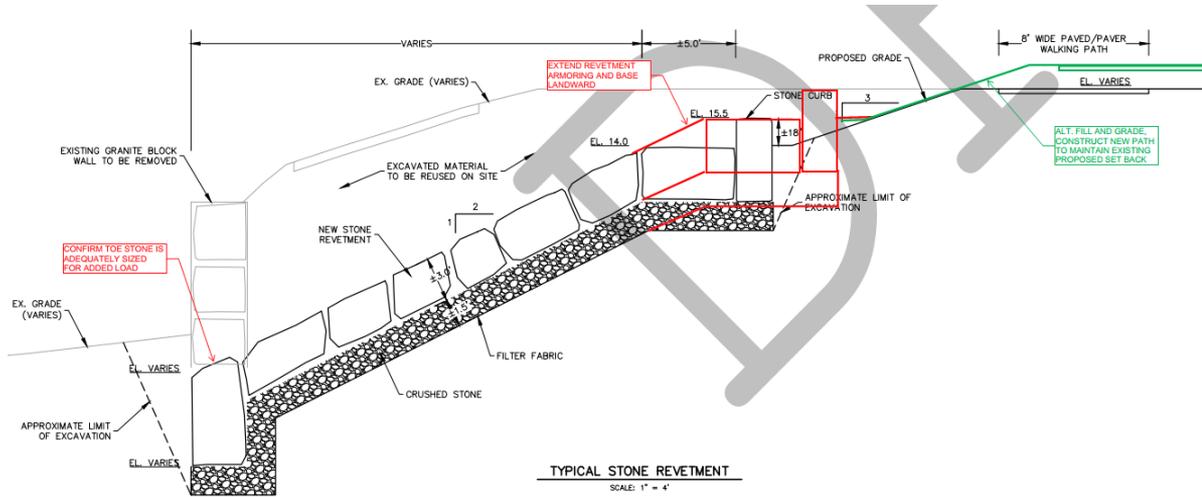
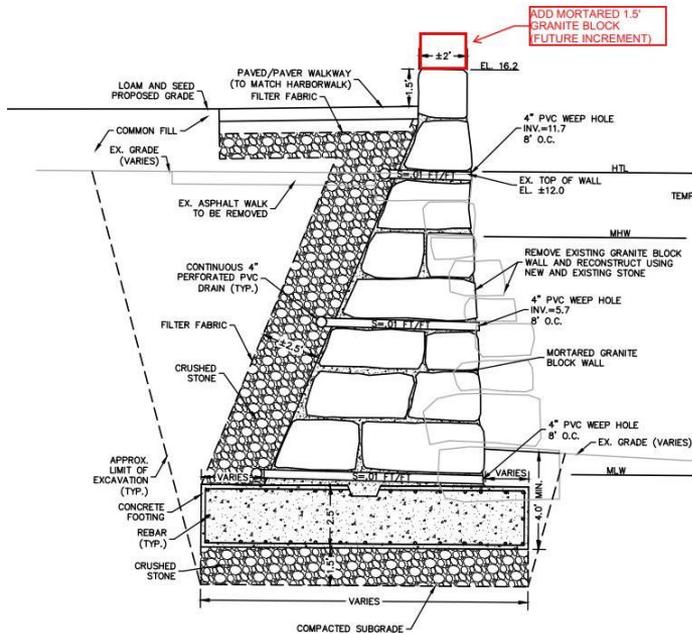
Exceedance Probability (%)	Recurrence Interval (years)	Water Surface Elevation (feet, NAVD88)			
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0.2	500	10.6	11.7	13.9	15.6
<b>0.5</b>	<b>200</b>	<b>10.1</b>	11.2	13.2	14.9
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2	50	9.3	10.4	12.2	13.9
5	20	8.7	9.8	11.5	13.3
10	10	8.3	9.4	11.0	12.8
RSLR vs 2008			+1.3'	+2.5'	+4.3'

As designed + Red Eye Roasters/3A



# Adapted Plan (Medium-Term)

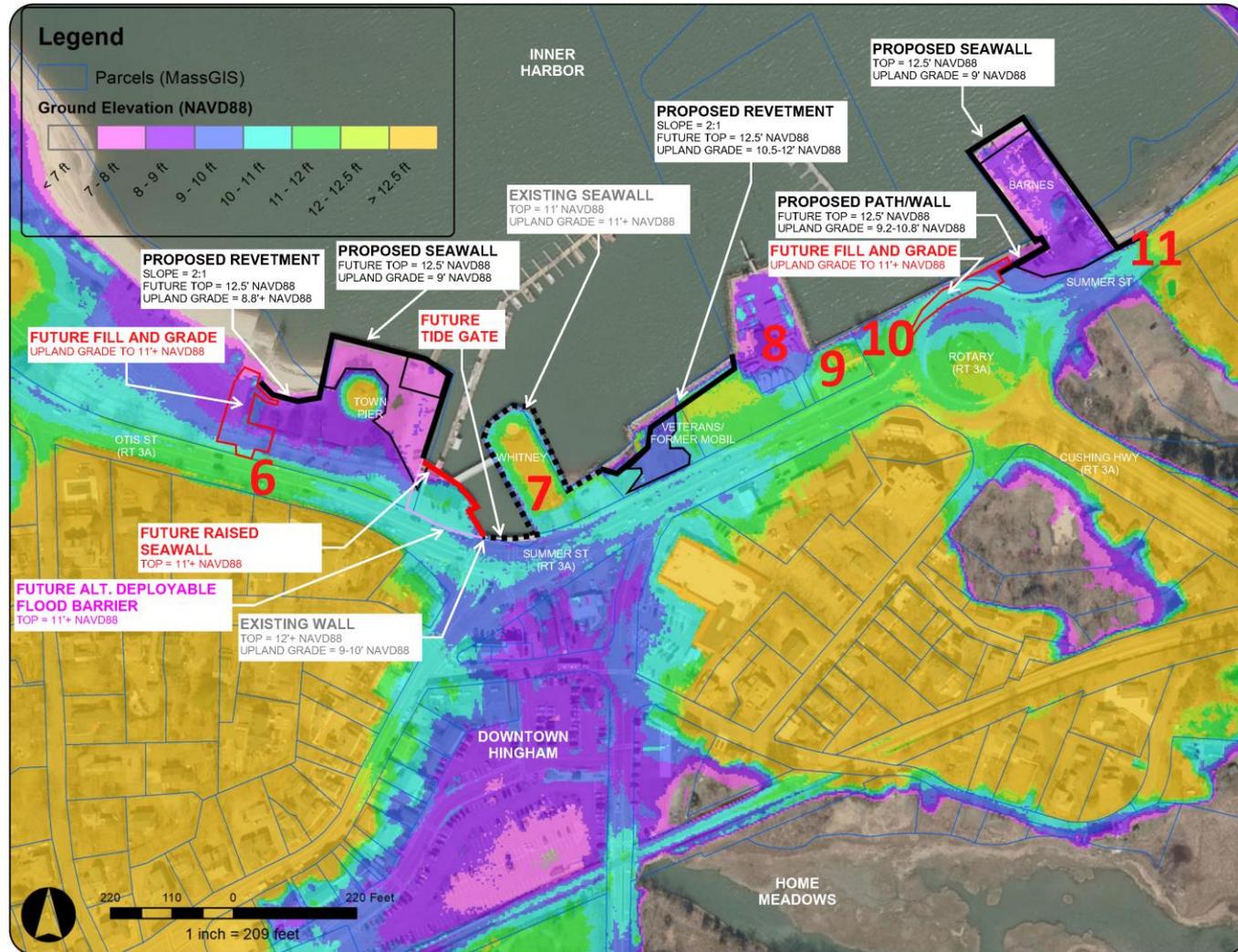
## Raise improved structures by 1.5 ft (12.5 ft-NAVD88)



# Adapted Plan (Medium-Term) 12.5 ft-NAVD88

## GAPS REMAIN

6. Otis St/Rt 3A
7. Whitney Wharf
8. 26 Summer St
9. 30 Summer St
10. Rt 3A rotary
11. Summer St east of Barnes Wharf



# Design Flood Elevations

*Proposed, from MC-FRM*

Long-term  
concepts based on  
15.0 ft-NAVD88

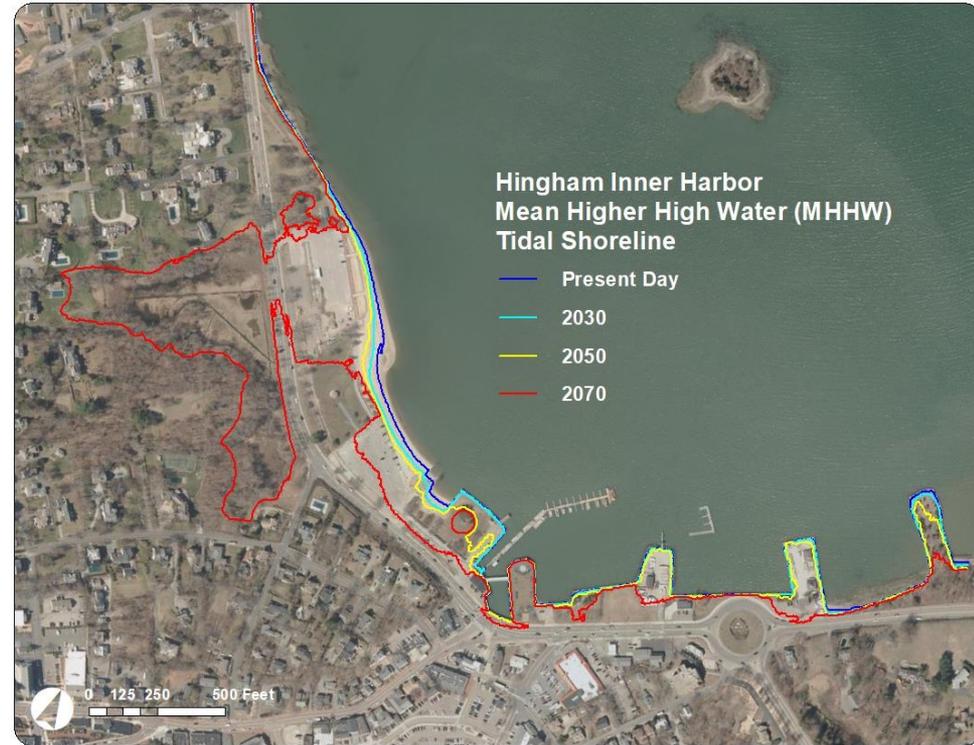
Time Horizon/Return Period	Flood Elevation (ft-NAVD88)	
	Stillwater	DFE (Stillwater + Waves)*
2030 100-year (1% annual chance)	10.8	12.8-13.5
2050 10-year (10% annual chance)	11.0	13.0-14.8
2050 100-year (1% annual chance)	12.7	15.0- 16.6
2070 10-year (10% annual chance)	12.8	14.8-16.6
2070 100-year (1% annual chance)	14.4	16.7-18.3



# Design Flood Elevations

## *Tide Only*

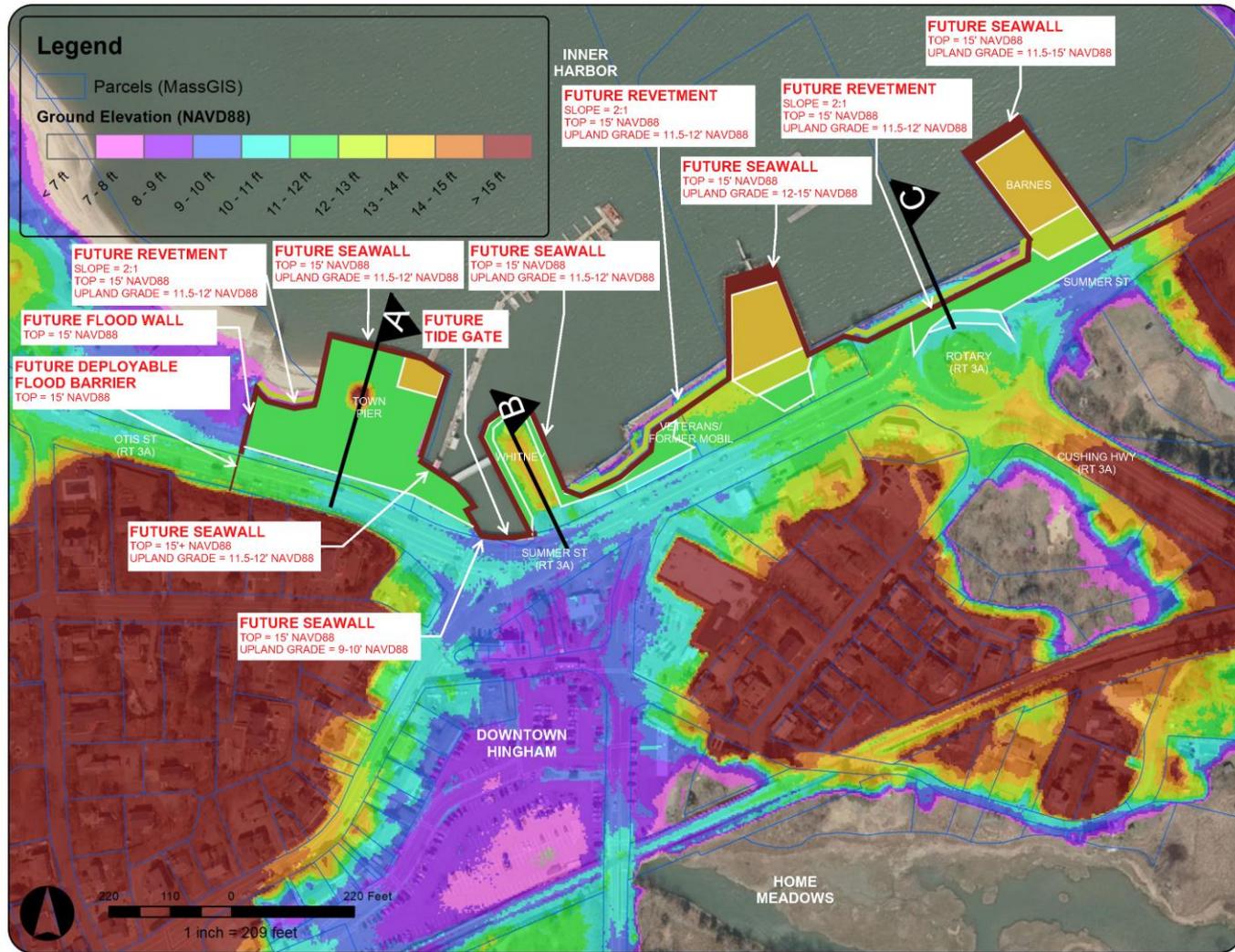
Tidal Datum	Water Surface Elevation (ft-NAVD88)		
	2030	2050	2070
MHHW	6.5	7.8	9.6
MHW	6.1	7.4	9.2



# Raised Shoreline

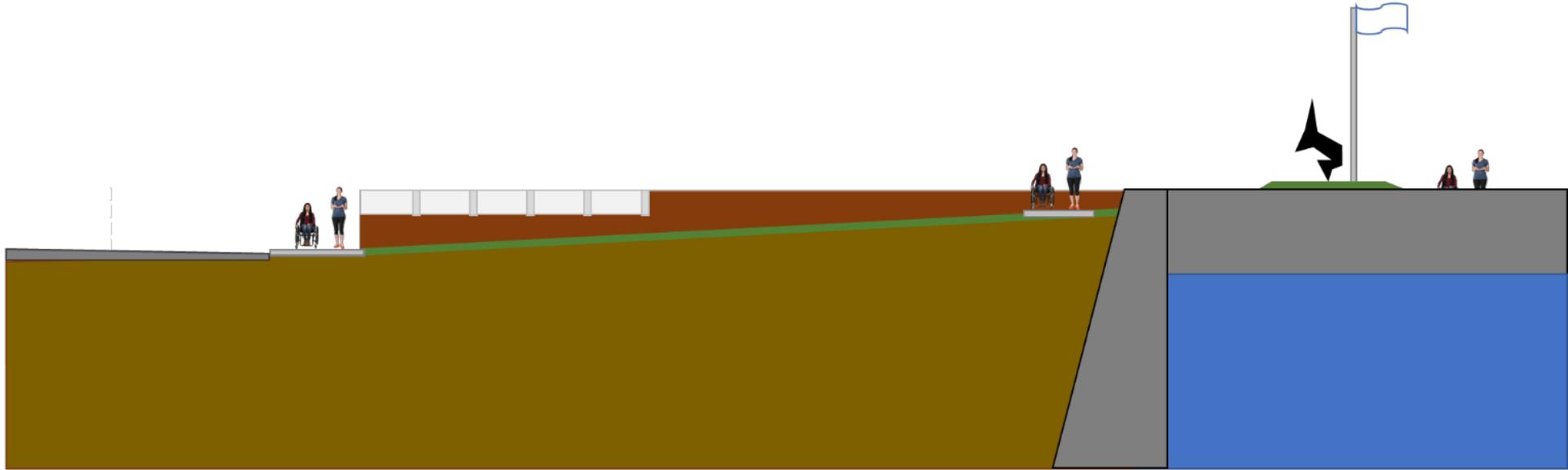
## 15 ft-NAVD88

Order of Magnitude Cost  
\$36M



# Raised Shoreline

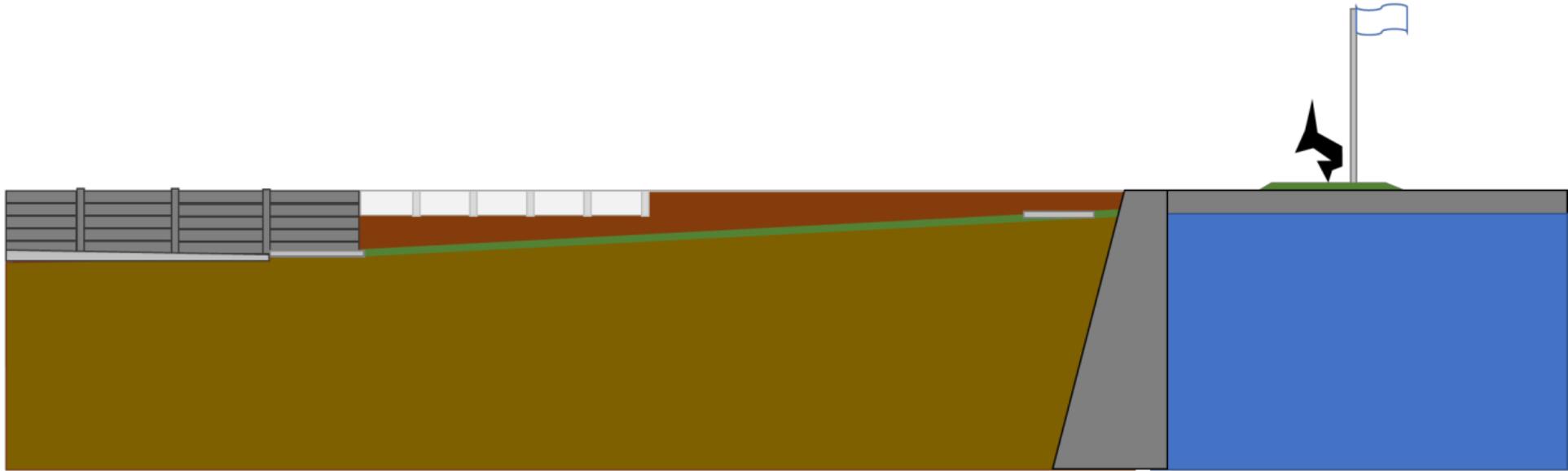
## *Town Pier*



**SECTION A – TOWN PIER**

# Raised Shoreline

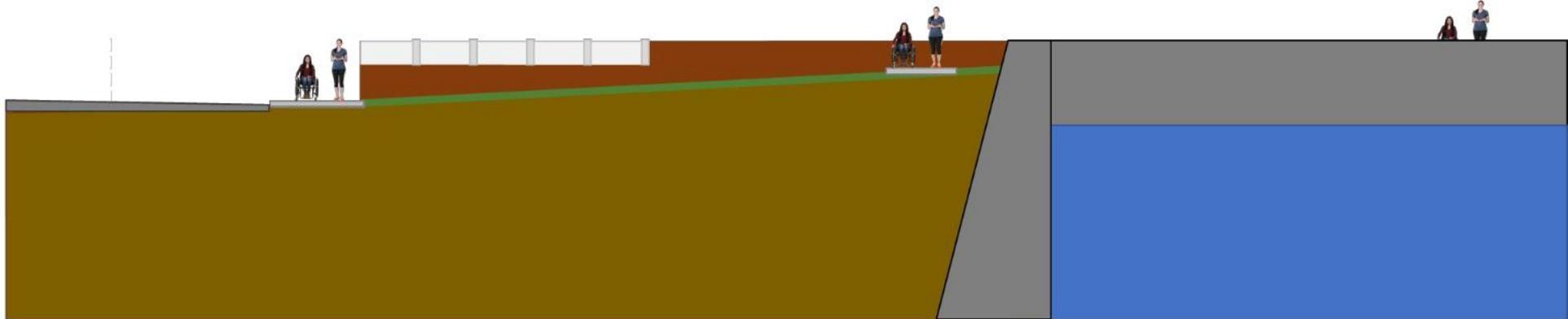
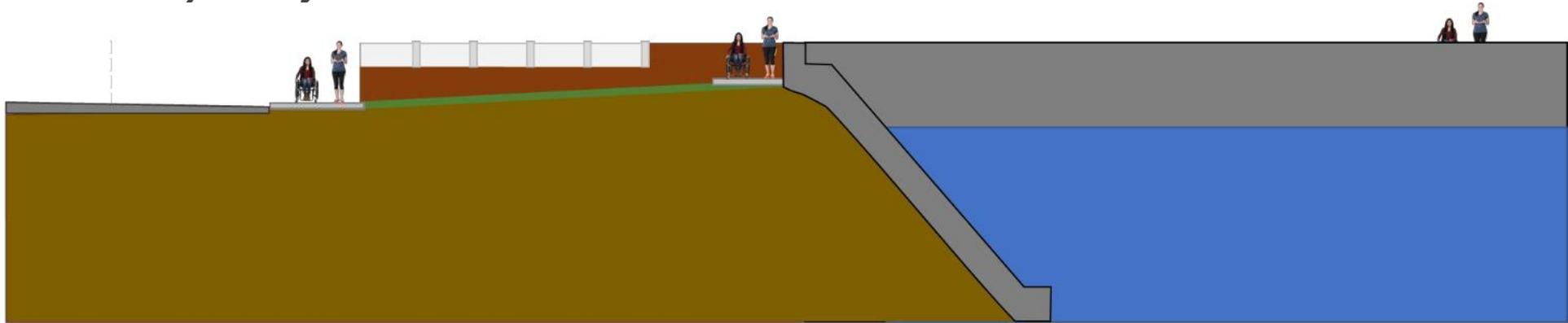
## *Town Pier*



**SECTION A – STORM CONDITION**

# Raised Shoreline

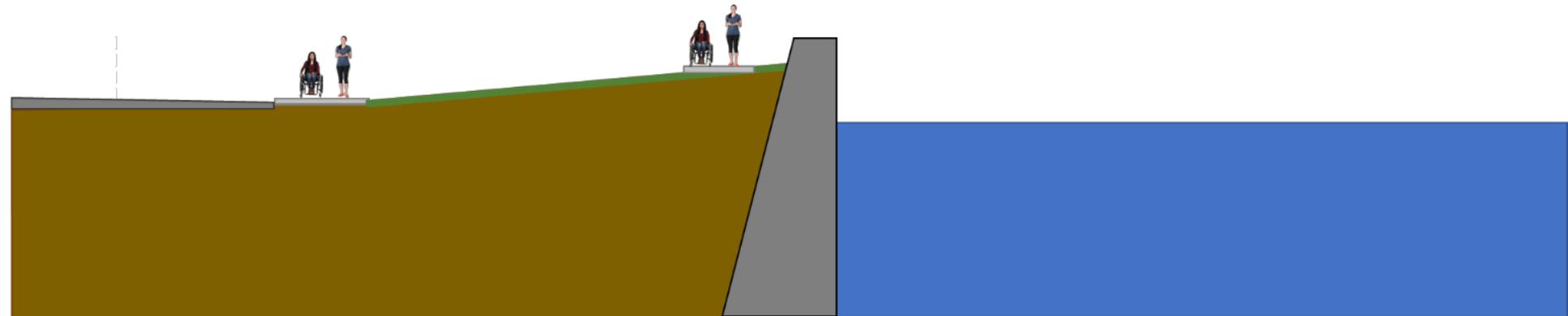
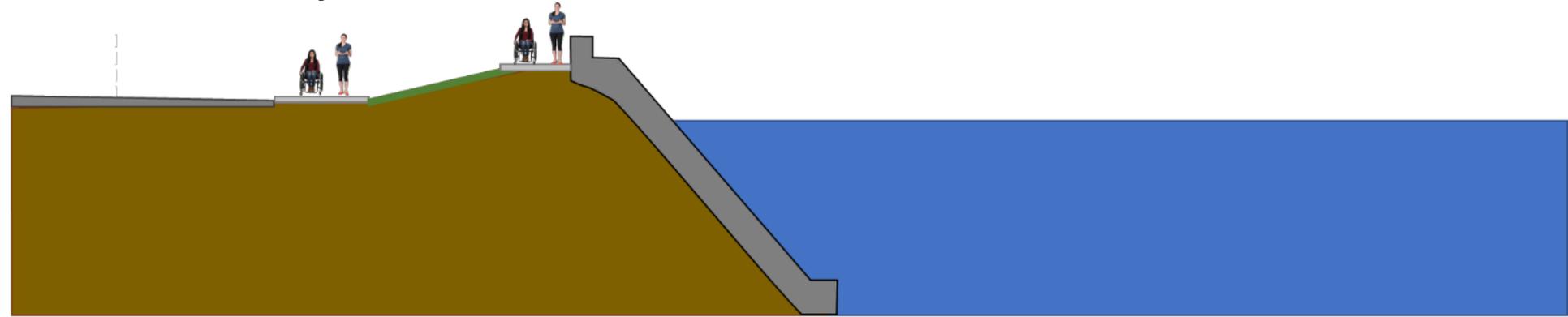
## *Whitney Wharf*



**SECTION B – ALTERNATIVE**

# Raised Shoreline

## *Route 3A Rotary*

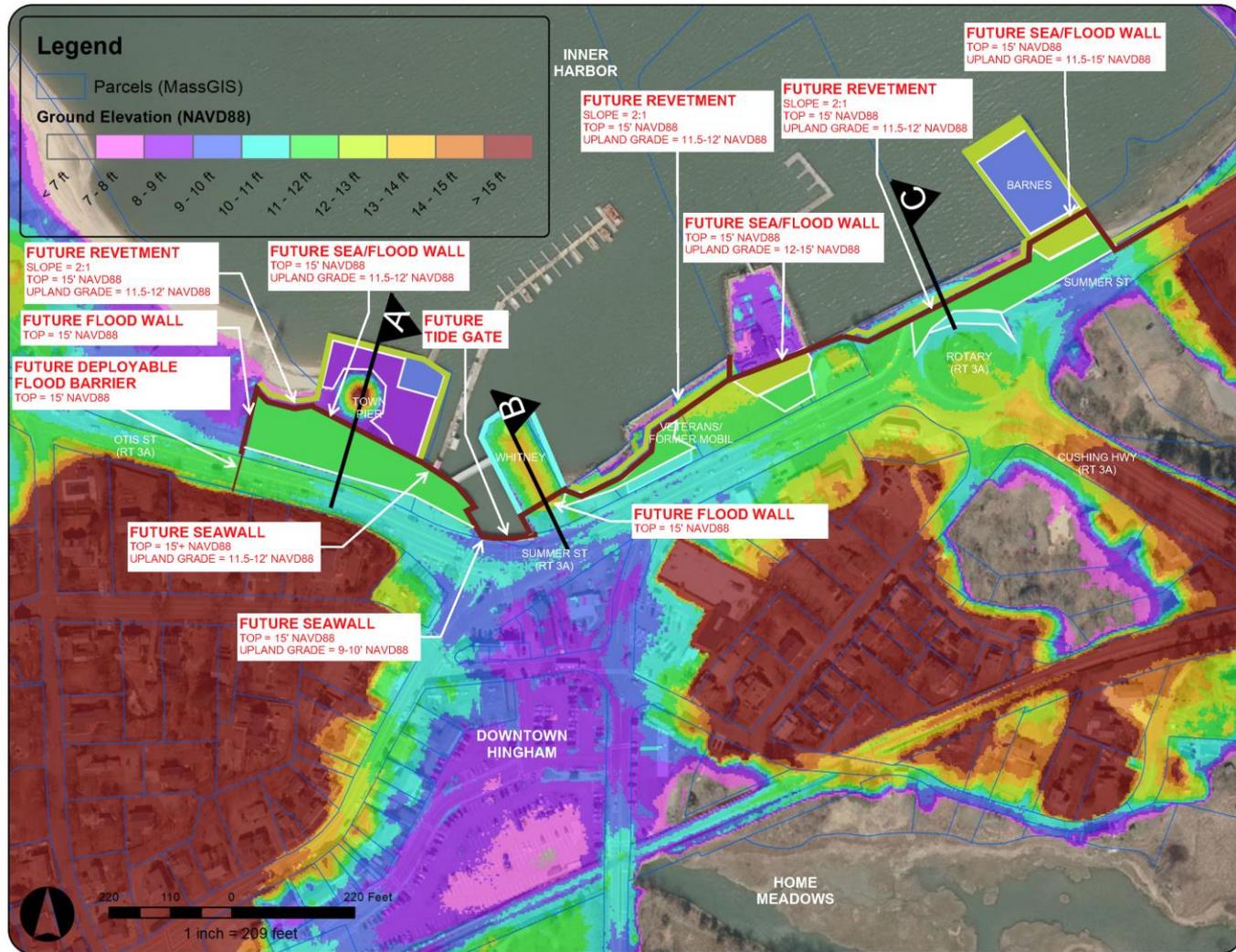


**SECTION C - ALTERNATIVE**

# Tiered Waterfront

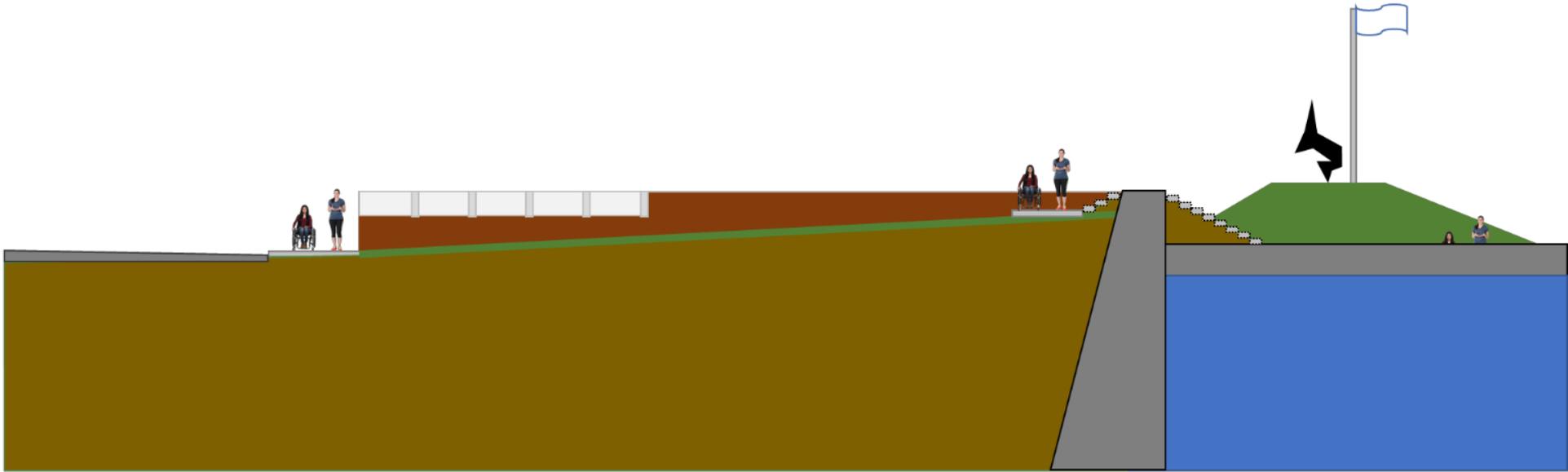
## 15 ft-NAVD88

Order of Magnitude Cost  
\$15M



# Tiered Waterfront

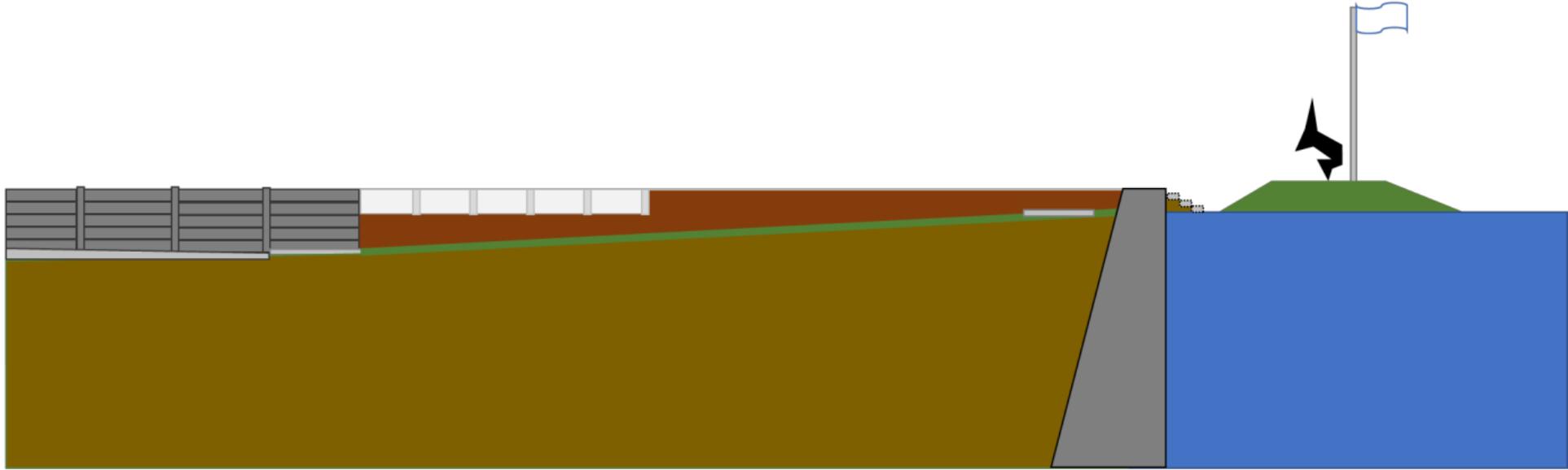
## *Town Pier*



**SECTION A – TOWN PIER**

# Tiered Waterfront

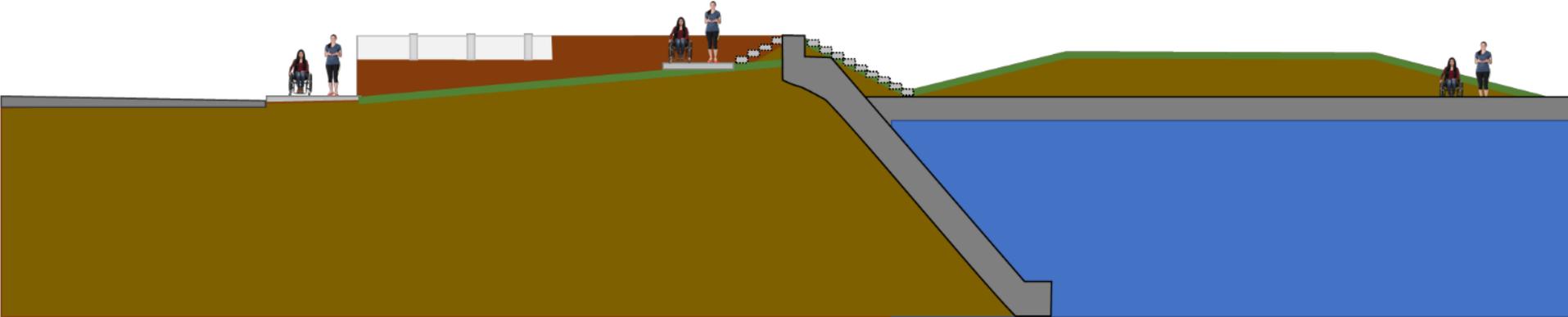
## *Town Pier*



**SECTION A – STORM CONDITION**

# Tiered Waterfront

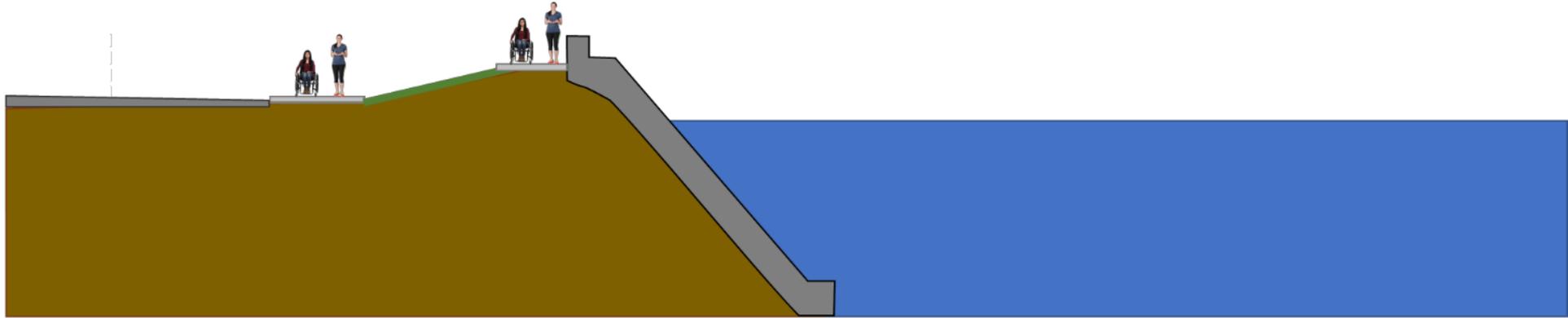
## *Whitney Wharf*



**SECTION B – WHITNEY WHARF**

# Tiered Waterfront

## *Route 3A Rotary*

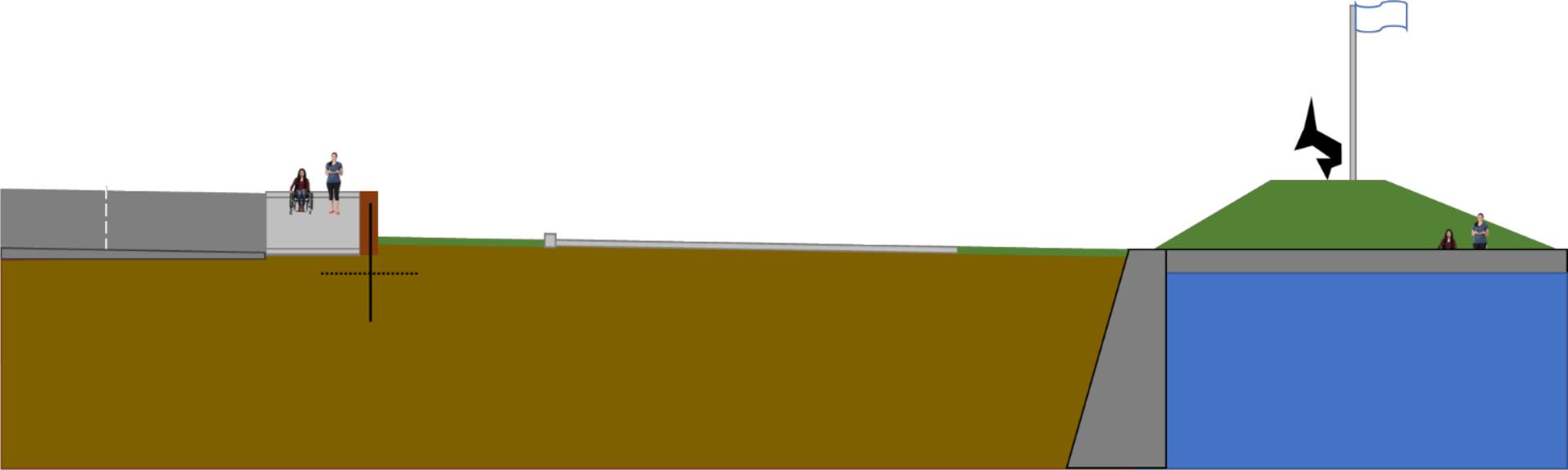


**SECTION C – ROUTE 3A ROTARY**



# Setback System

## Town Pier

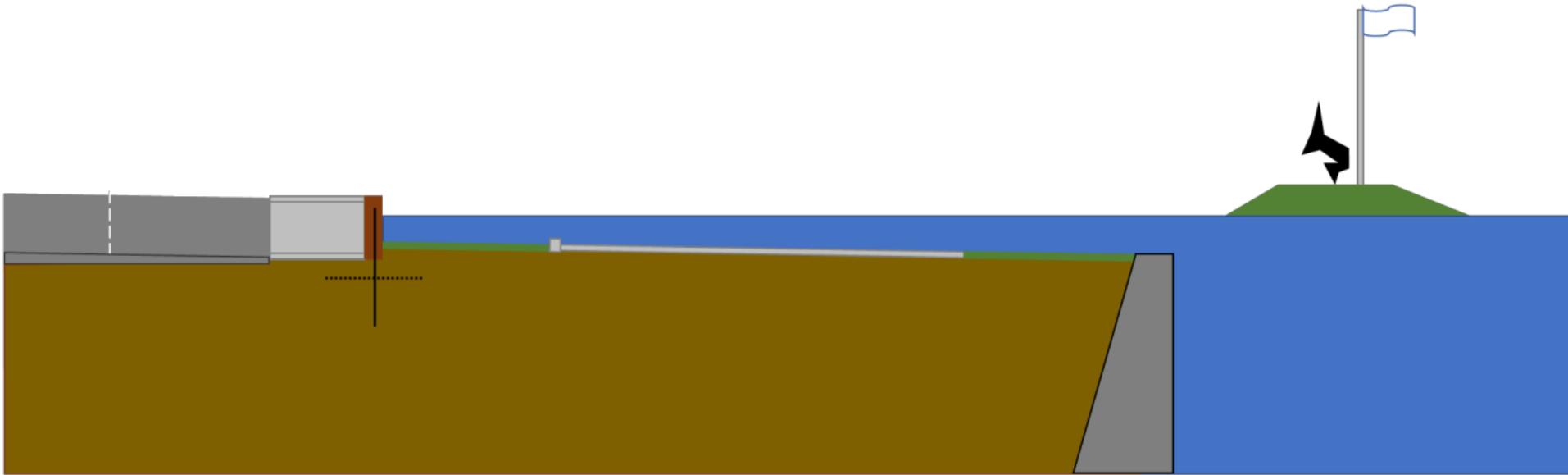


SECTION A – TOWN PIER



# Setback System

## *Town Pier*

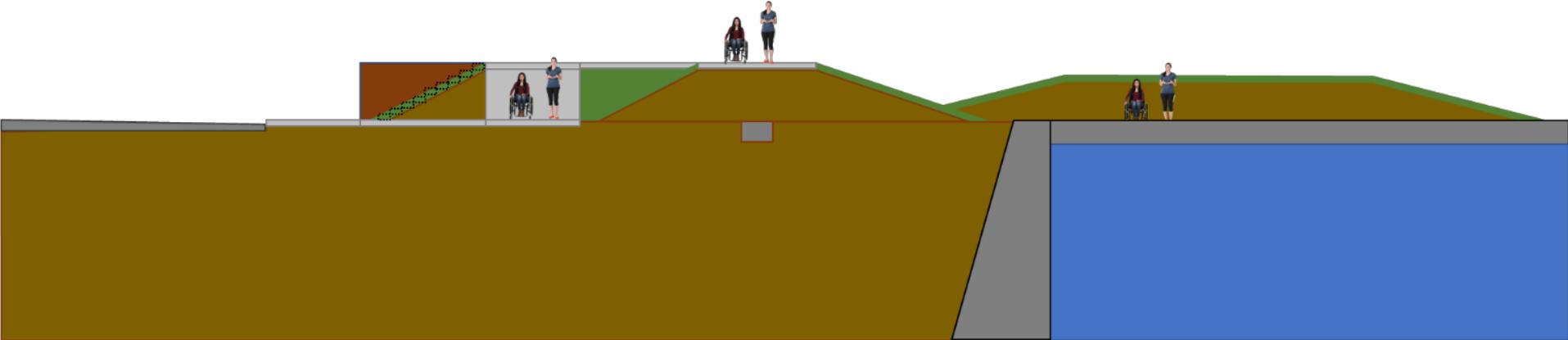


**SECTION A – STORM CONDITION**



# Setback System

## *Whitney Wharf*

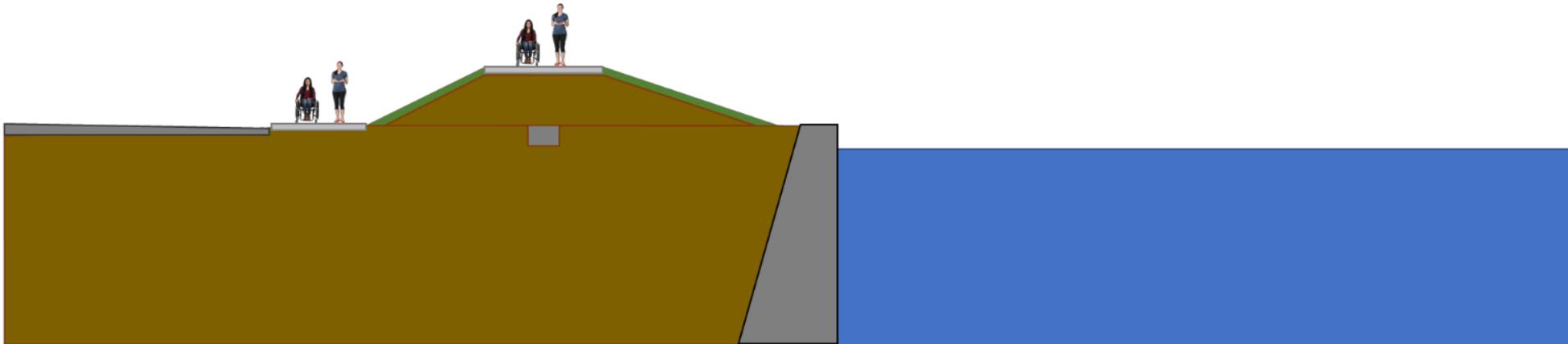


**SECTION B – WHITNEY WHARF**



# Setback System

## *Route 3A Rotary*

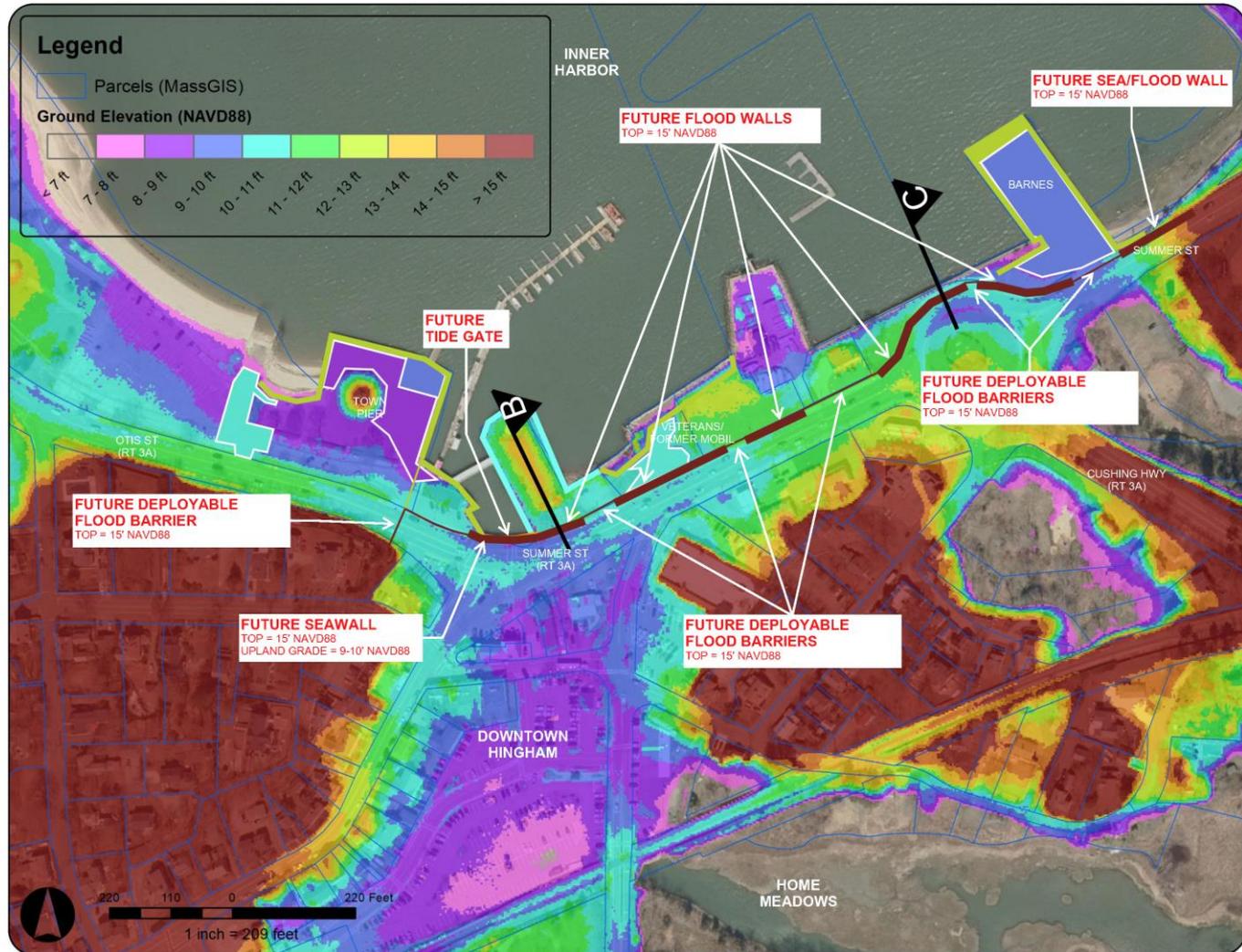


**SECTION C – ROUTE 3A ROTARY**

# Roadside Barrier

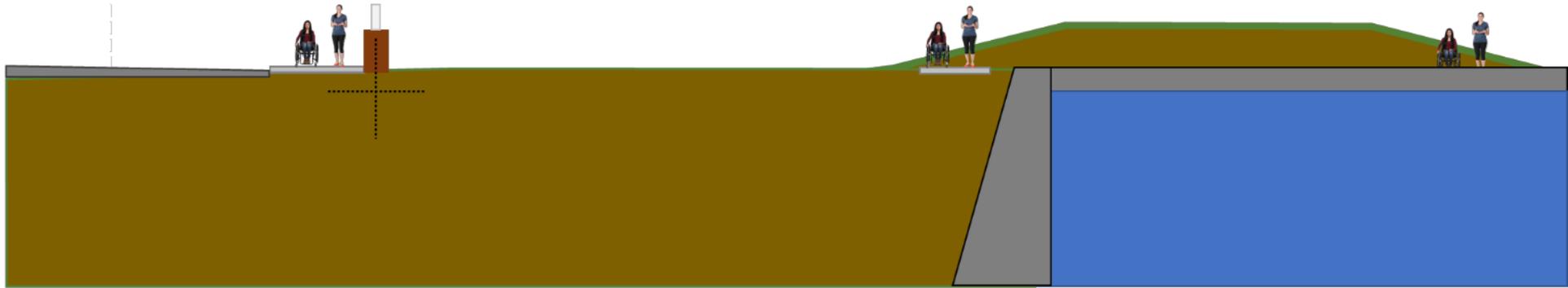
## 15 ft-NAVD88

Order of Magnitude Cost  
\$6M



# Roadside Barrier

## *Whitney Wharf*



**SECTION B – WHITNEY WHARF**

# Roadside Barrier

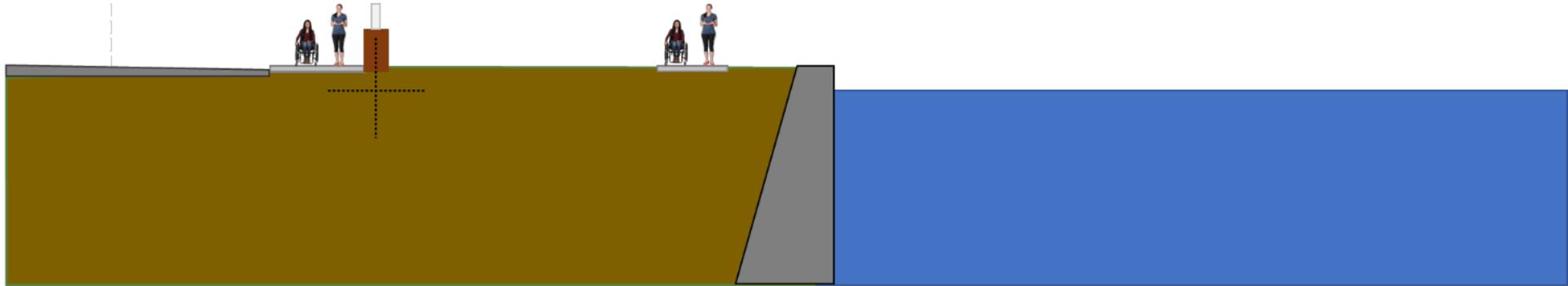
## *Whitney Wharf*



**SECTION B – STORM CONDITION**

# Roadside Barrier

## *Route 3A Rotary*



**SECTION C – ROUTE 3A ROTARY**

# Roadside Barrier

DRIVEWAY

PATHWAY

3.5' FLOOD WALL



BARRIERS  
DEPLOYED



3.5' FLOOD WALL  
+1.5' GLASS EXT



BARRIERS  
DEPLOYED



**TYPICAL FLOOD WALL ELEVATION**

# Roadside Barrier



# Summary Comparison of Long-Term Alternatives

*Green = most advantageous / Red = least advantageous*

Alternative	Downtown Flood Exposure	Emergency Route Flood Exposure (Overtopping)	Waterfront Flood Exposure	Operational Requirements (Barrier Deployment)	Suitability for Continued Maritime Buildings/ Operations/ Access	Environmental Permitting Requirements	Land Ownership	Order-of-Magnitude Construction Costs
<b>Raised Shoreline</b>	1	1	1	1	1	4	4	4
<b>Tiered Waterfront</b>	1	2	2	1	2	3	4	3
<b>Setback System</b>	1	3	3	3	3	2	1	2
<b>Roadside Barrier</b>	1	4	4	4	4	1	1	1





# Discussion