



DORCHESTER

SOUTH BOSTON

DOWNTOWN

EAST BOSTON

Resilient Design and Regulating for Climate Change

Presented by
Mark Costa & Annique Fleurat
June 5, 2019



Agenda

1. What is Resilient Design
2. What is being required / requested?
3. Regulation for Resiliency
4. Approaches/Methodology to requests
5. Case Studies
6. Lessons Learned
 - What's reasonable for developers/municipalities/ agencies



What is Resilient Design?

Regulatory Resilient Design Requirement # 1

Living with water



1. Adaptability

Regulatory Resilient Design Requirement #2



Providing Fill On-site

2. Raise/Elevate Project



3. Compensatory Storage / Conveyance



Regulatory Resilient Design Requirements #4

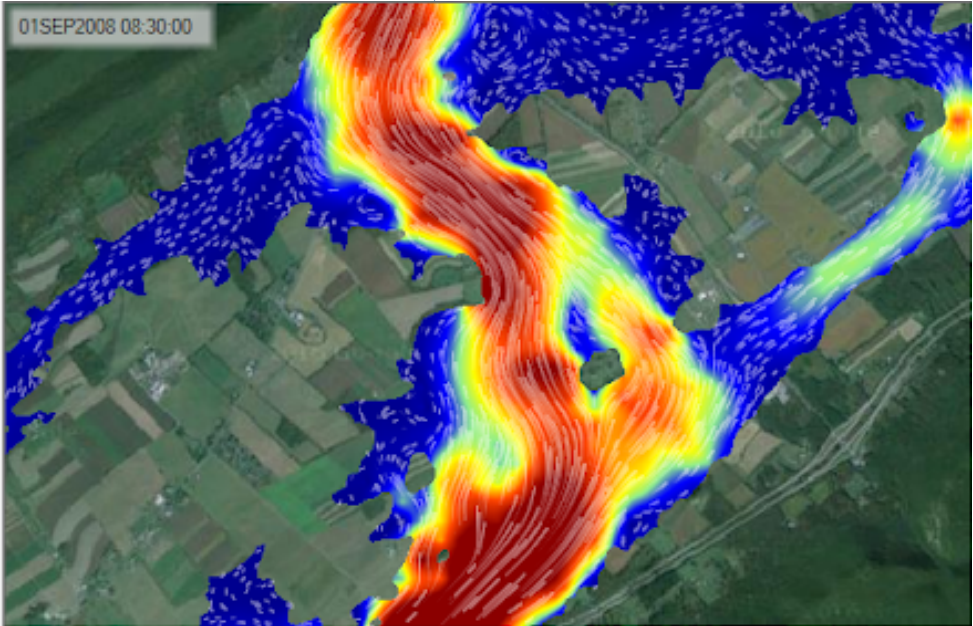
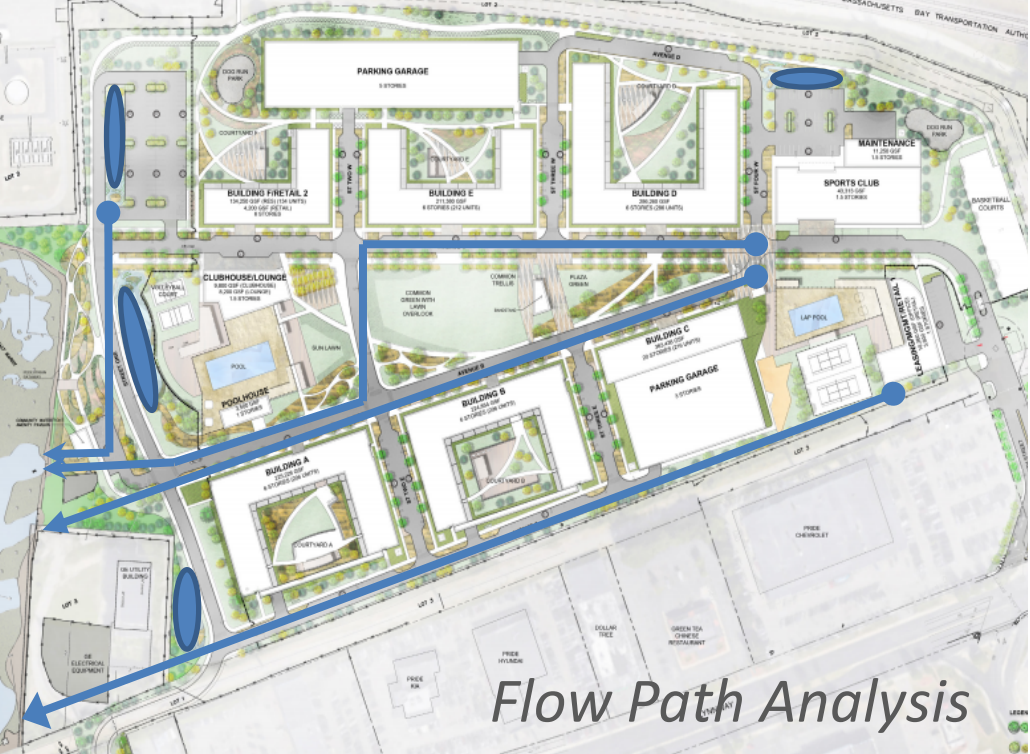
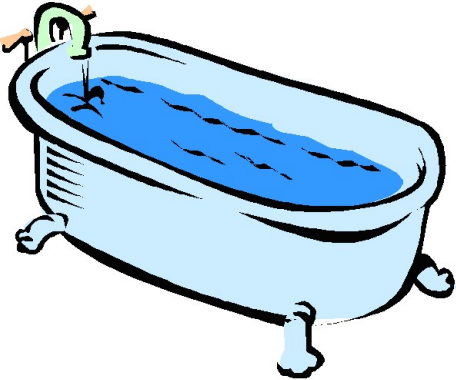
4. What are the Impacts to Abutters?

Qualitatively

vs

Quantitatively

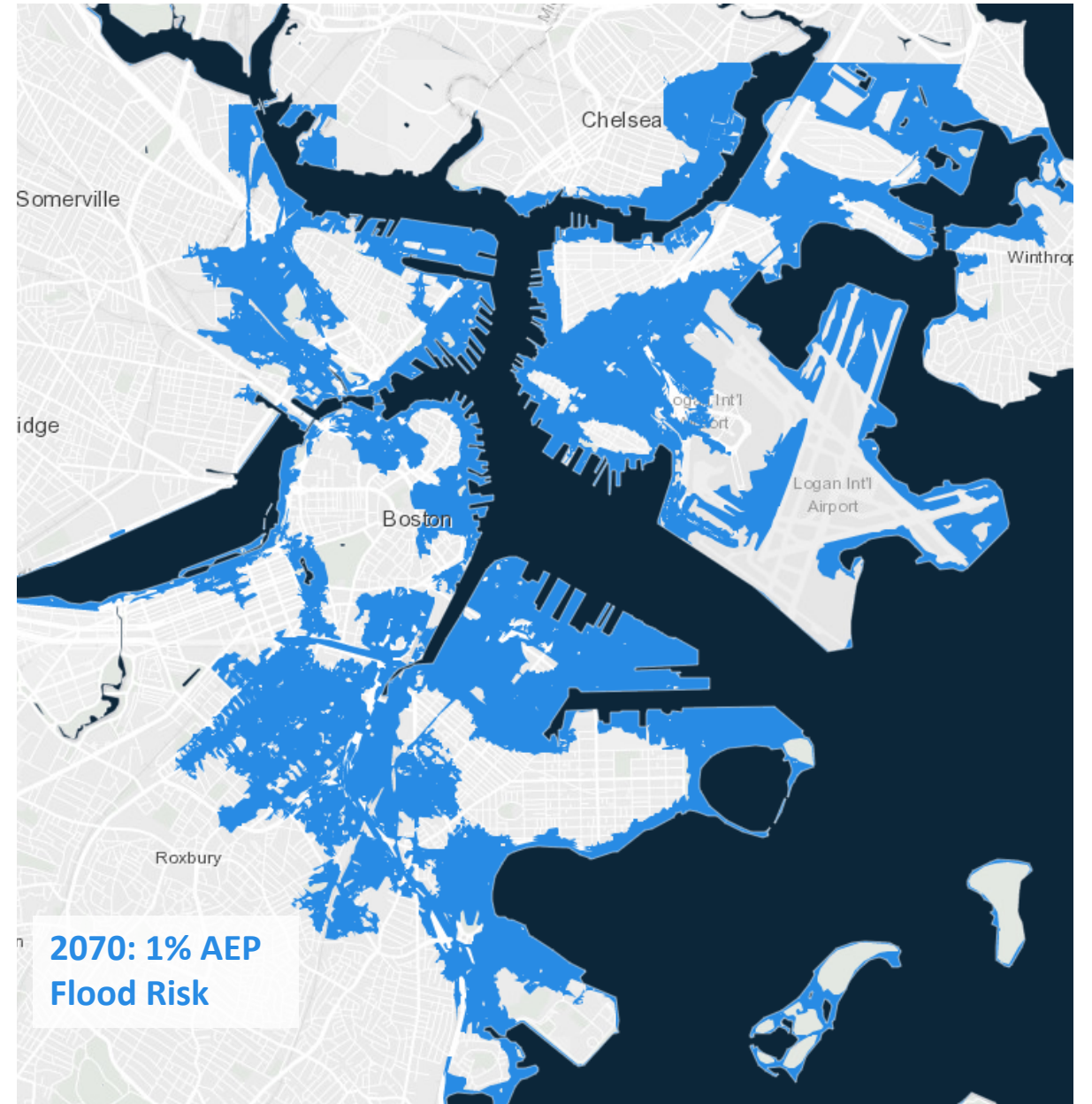
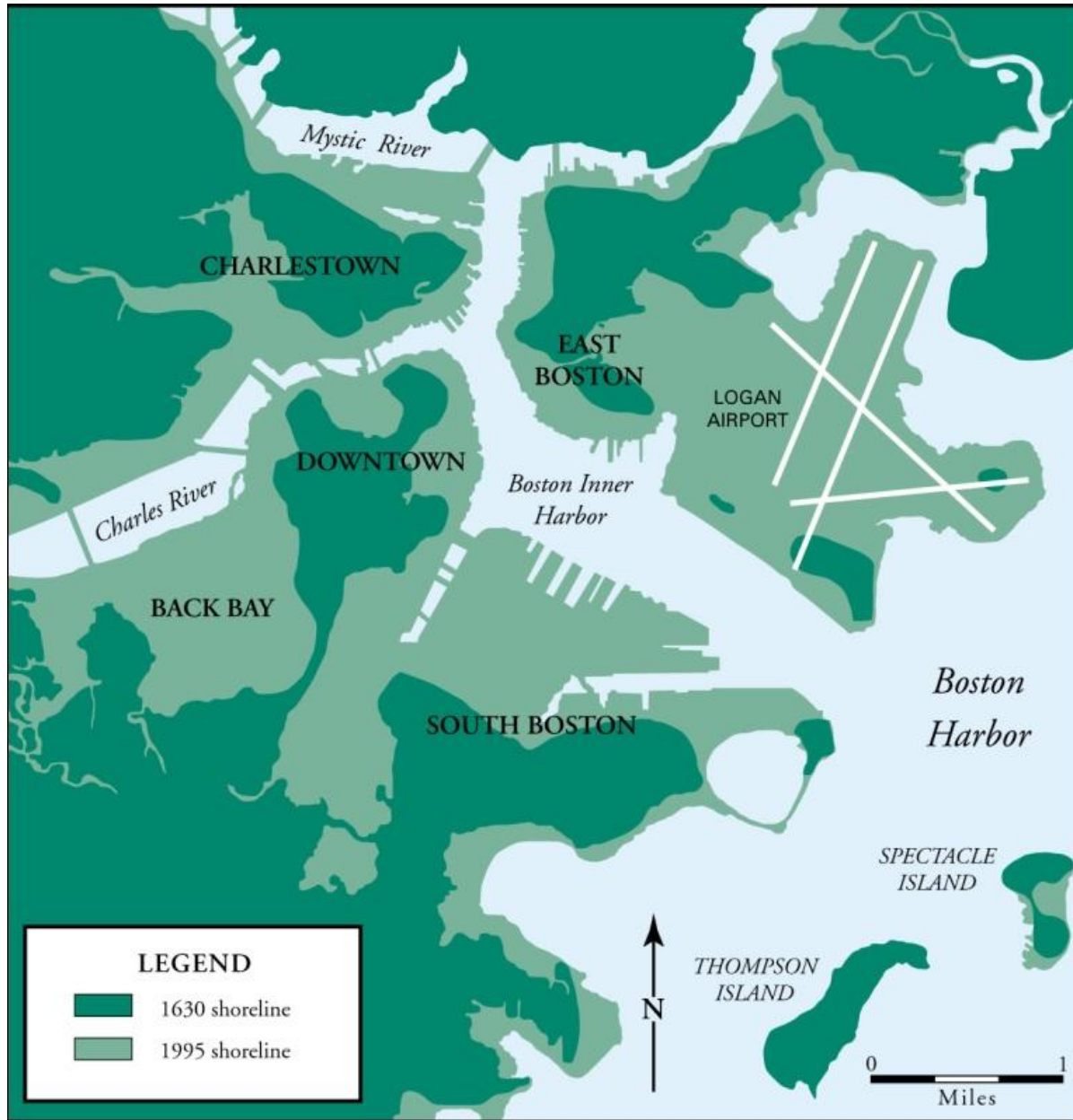
"Bath Tub Model"



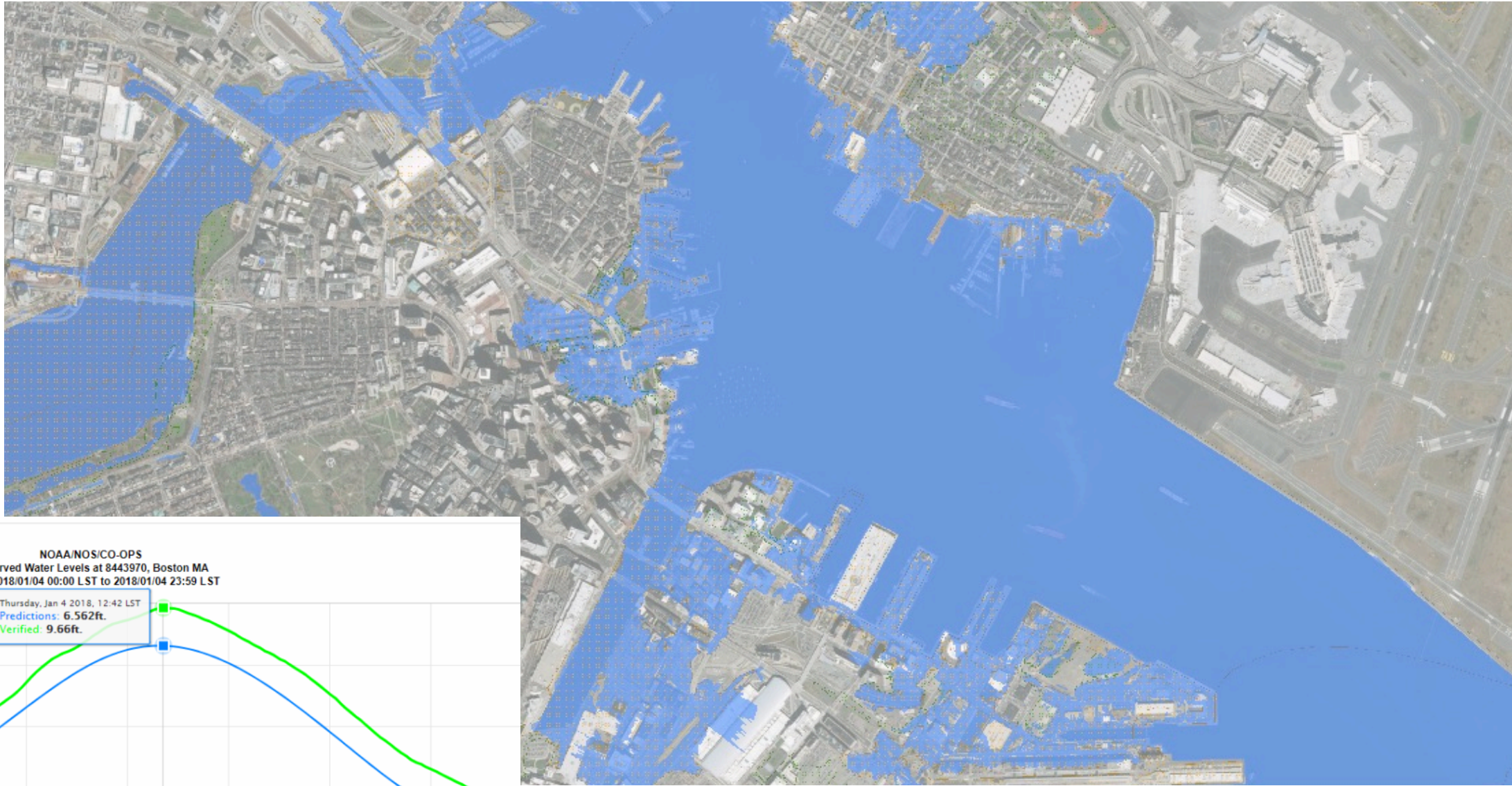
*Hydrologic
and
Hydraulic
Modeling*

Regulation of Resilient Design (Massachusetts)

- Boston Planning and Development Authority (BPDA)
- Massachusetts Environmental Policy Act Office (MEPA)
 - Office of Coastal Zone Management (CZM)
- Chapter 91, The Massachusetts Public Waterfront Act
- Municipalities
- Insurers
- Owners

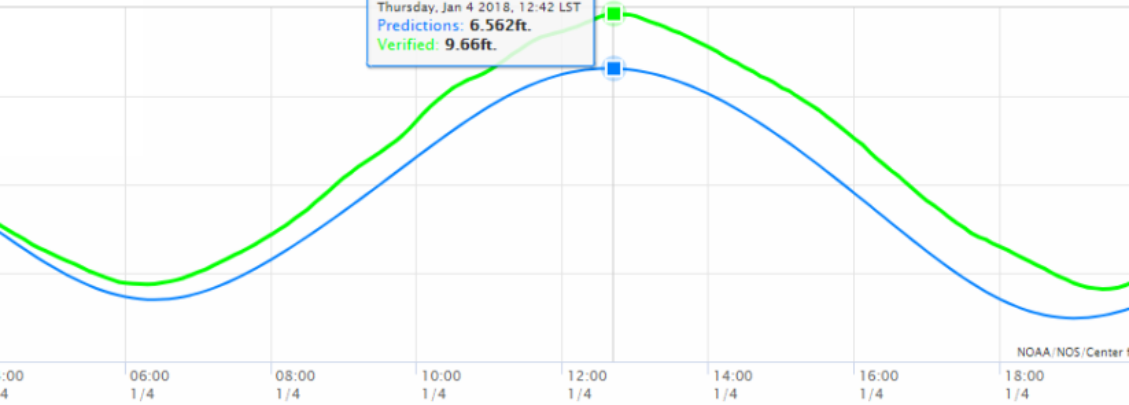


Winter Storm Grayson



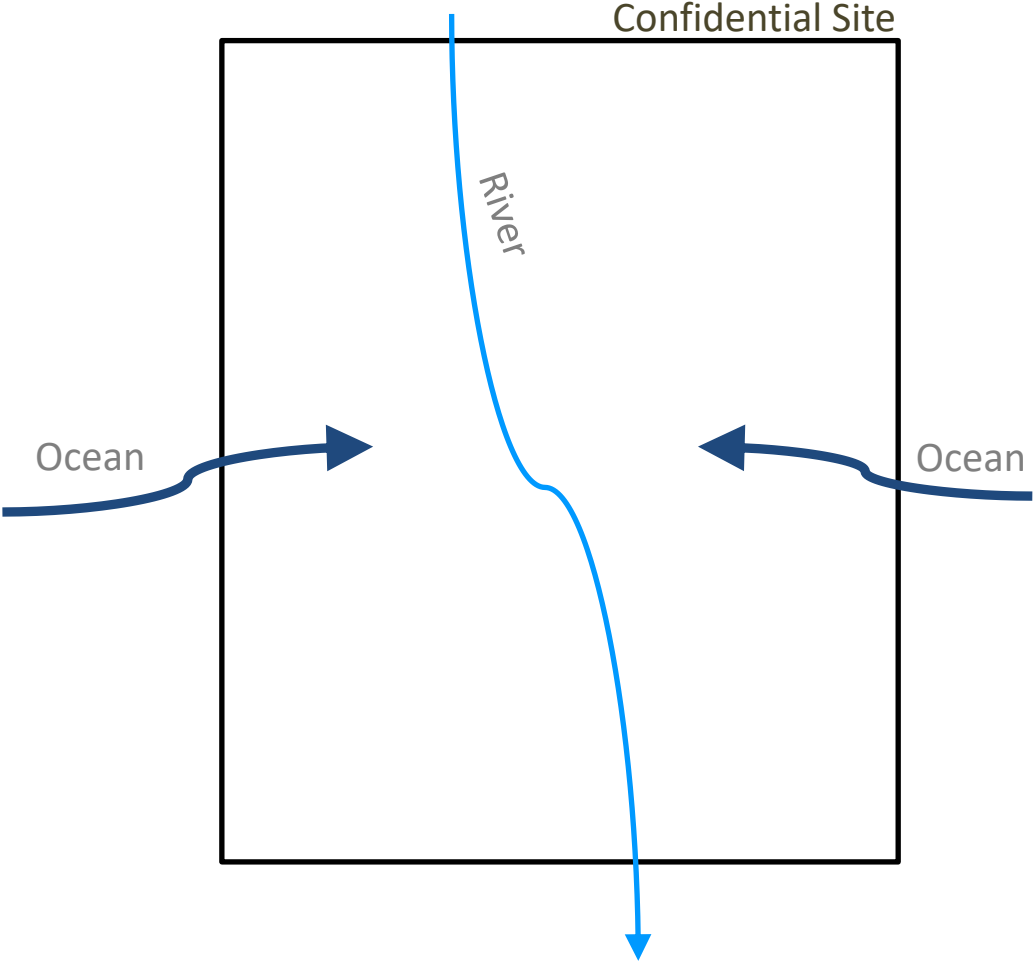
NOAA/NOS/CO-OPS
Observed Water Levels at 8443970, Boston MA
From 2018/01/04 00:00 LST to 2018/01/04 23:59 LST

Thursday, Jan 4 2018, 12:42 LST
Predictions: 6.562ft.
Verified: 9.66ft.



— Predictions — Verified — Preliminary — (Observed - Predicted)

Case Study – Boston, MA



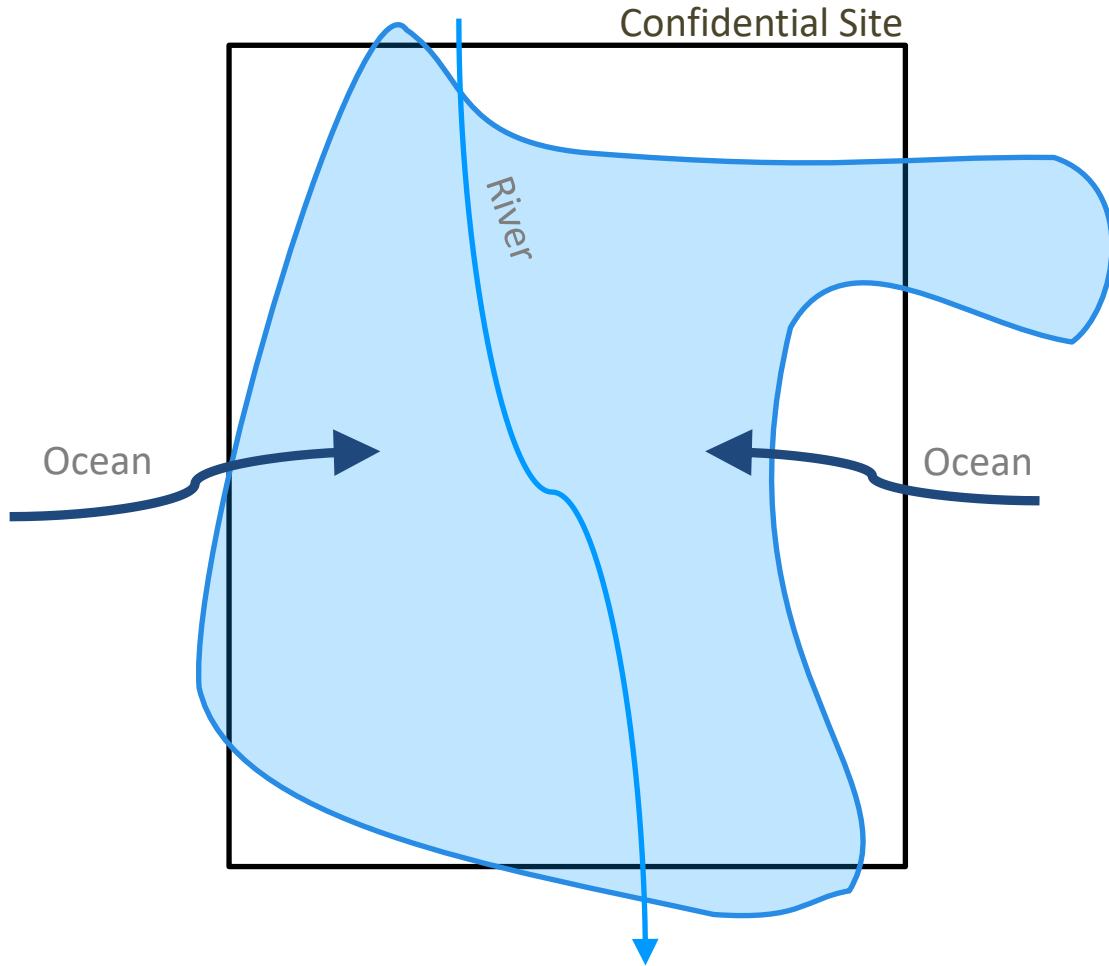
Case Study – Boston, MA

Comment Summarized:

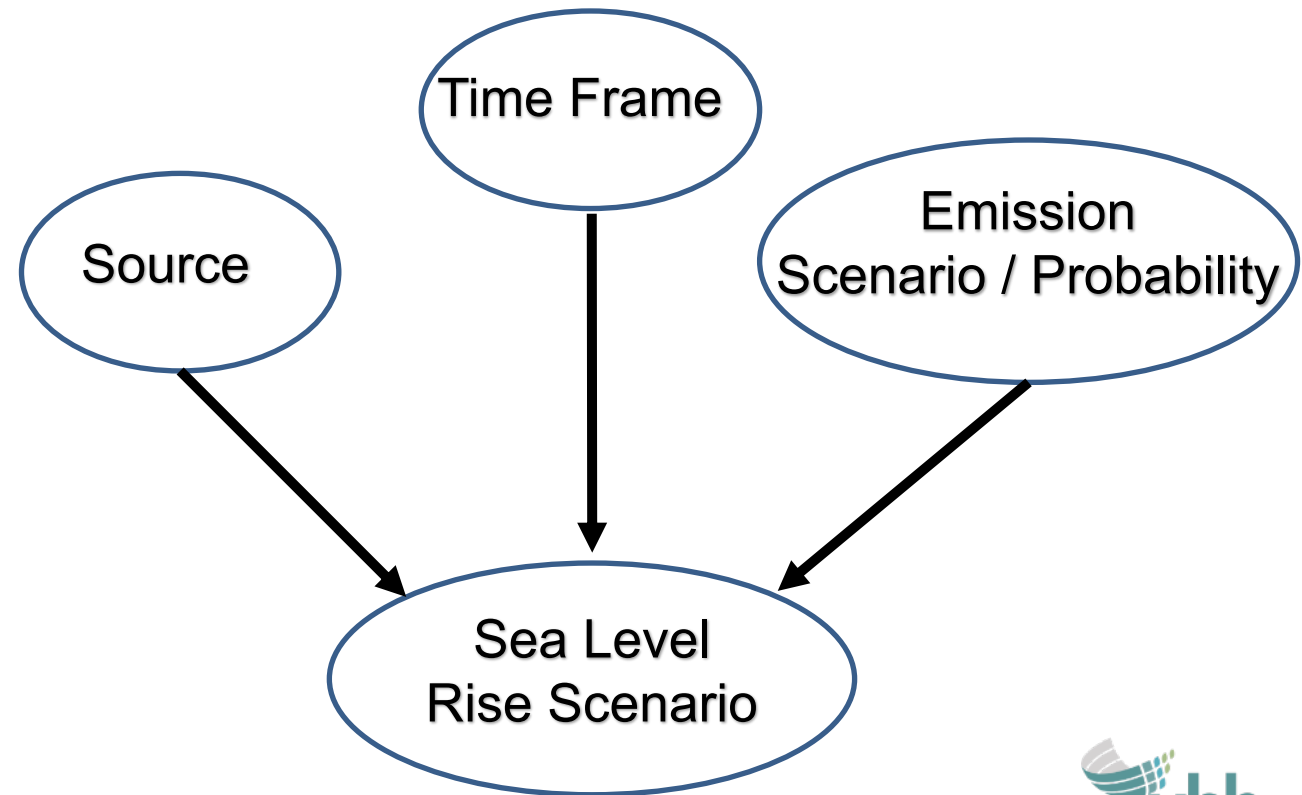
- ***Discuss why a specific scenario (or scenarios) was selected***
 - *identify the extent of inundation areas on-site,*
 - *and indicate how the project will be designed to mitigate this impact or to facilitate adaptation responses*
- ***Demonstrate that the project will not exacerbate flooding conditions of adjacent uses and properties.***

1. Adaptability
2. Rise in First Floor Elevation
3. Compensatory Storage / Conveyance
4. What are the Impacts to Abutters?

Case Study – Boston, MA



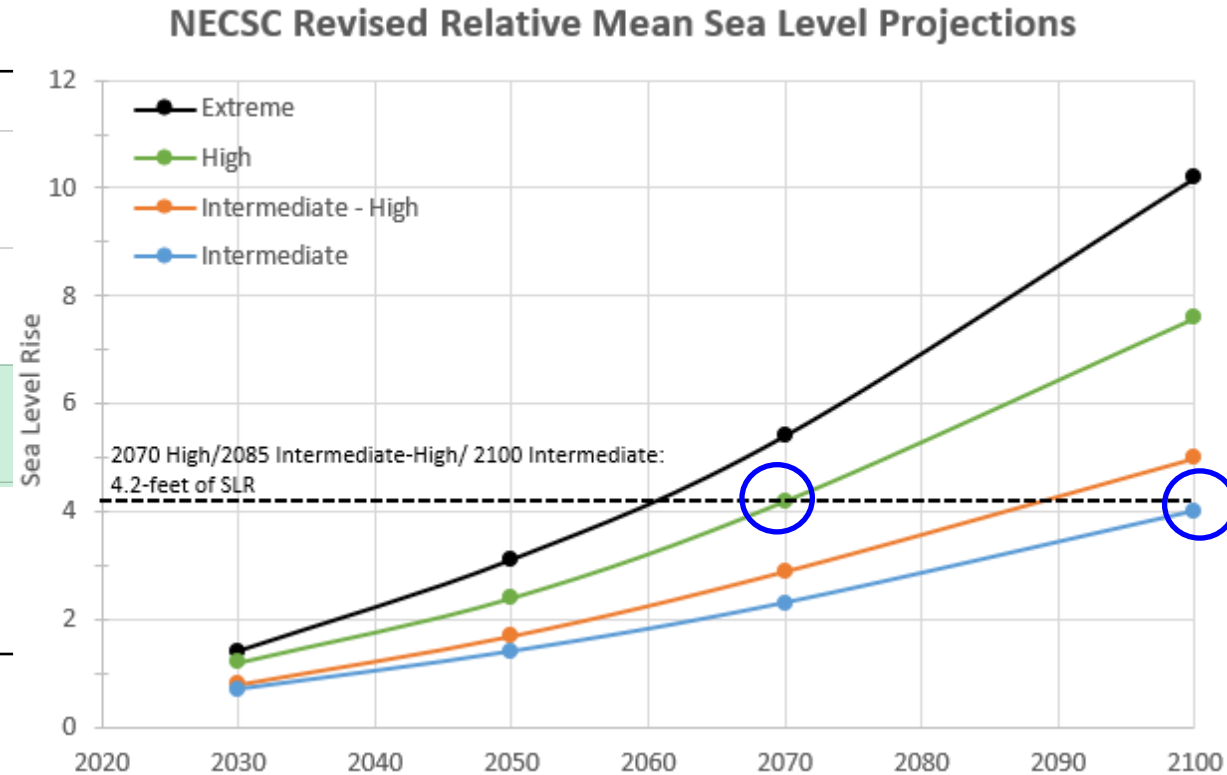
- *Ensure no worsened flooding offsite*
- *For which scenarios?*



Case Study – Boston, MA: Emission Scenario / Probability – Tidal SLR

Sea Level Rise: Northeast Climate Adaptation Science Center (NECASC):
Massachusetts Sea Level Rise Projections

Scenario	2030	2050	2070	2100
Intermediate (17% probability)	0.7	1.4	2.3	4.0
Intermediate - High (5% probability not to exceed)	0.8	1.7	2.9	5.0
High (0.5% probability)	1.2	2.4	4.2	7.6
Extreme (0.1% probability - Maximum physically plausible)	1.4	3.1	5.4	10.2

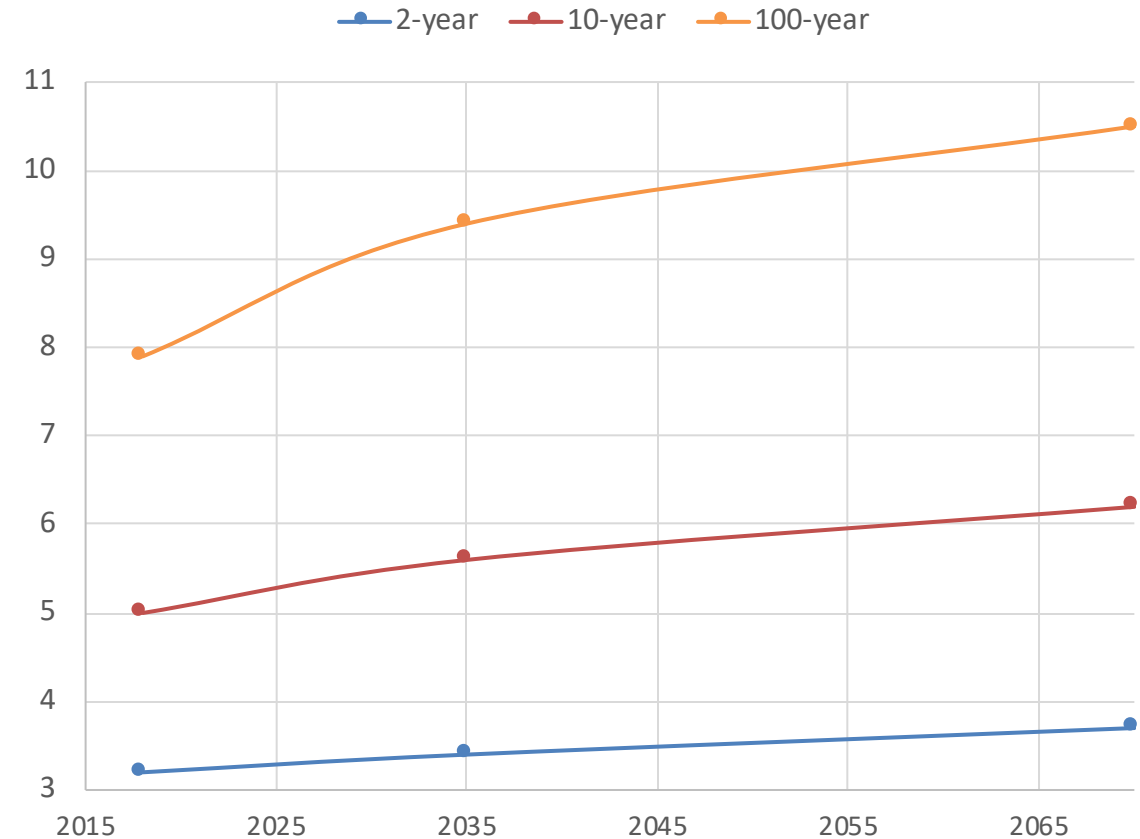


Case Study – Boston, MA: Increased Riverine Flooding

Rain fall events

24-Hour Precipitation Depth (Inches)			
Return Period (Years)	Current (Atlas 14)	2035 (BWSC – A1FI Scenario)	2070 (BWSC - A1FI Scenario)
2	3.2	3.4	3.7
10	5.0	5.6	6.2
100	7.9	9.4	10.5

NOAA Atlas 14 Rainfall Depths
with
BWSC Comprehensive-Integrated
Sustainable Wastewater and Storm
Drainage System Facilities Plan Final Report (June-2015) A1F1
“Precautionary” Scenario



Case Study – Boston, MA

Comment Summarized:

- ***These calculations should be based on the base flood elevation on the effective FIRM plus sea level rise.”***
 1. Adaptability
 2. Rise in First Floor Elevation
 3. Compensatory Storage / Conveyance
 4. What are the Impacts to Abutters?

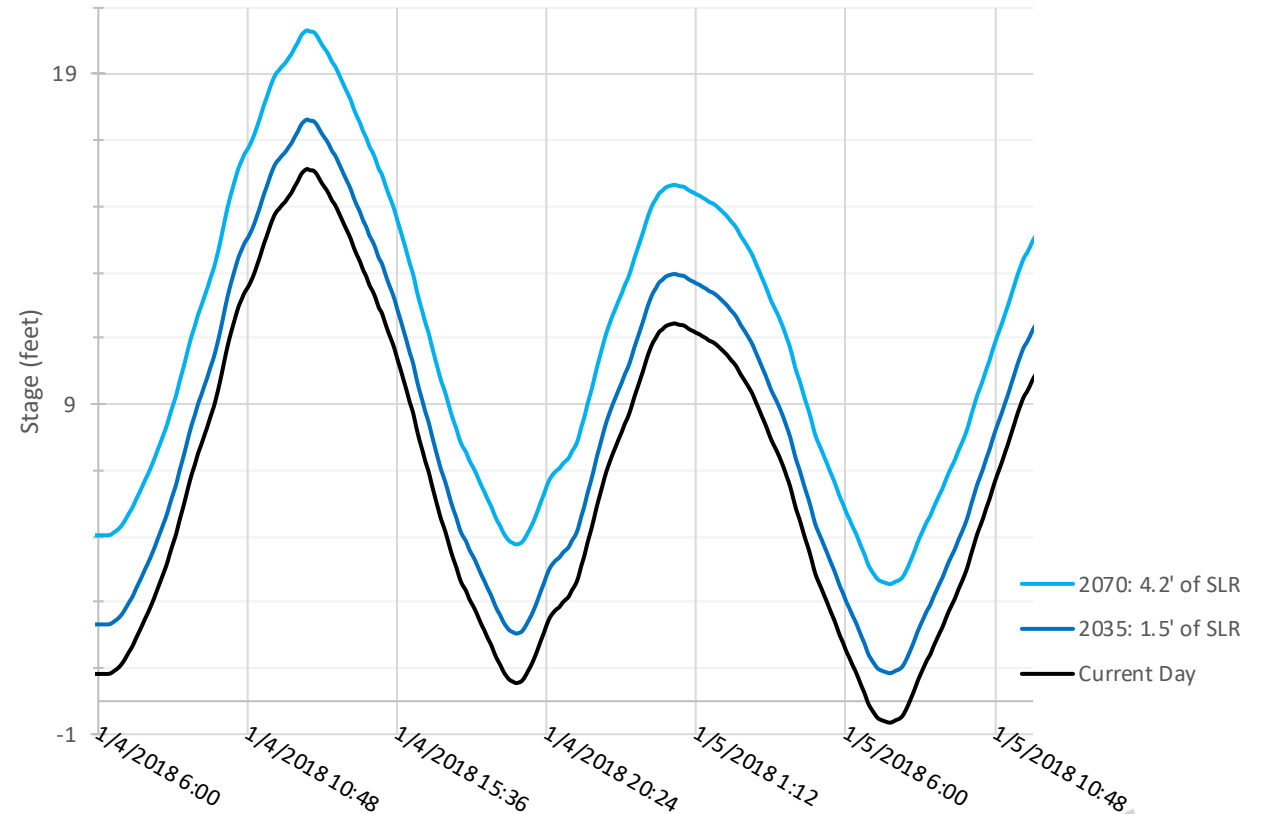
Case Study – Boston, MA

How do we incorporate Sea Level Rise?

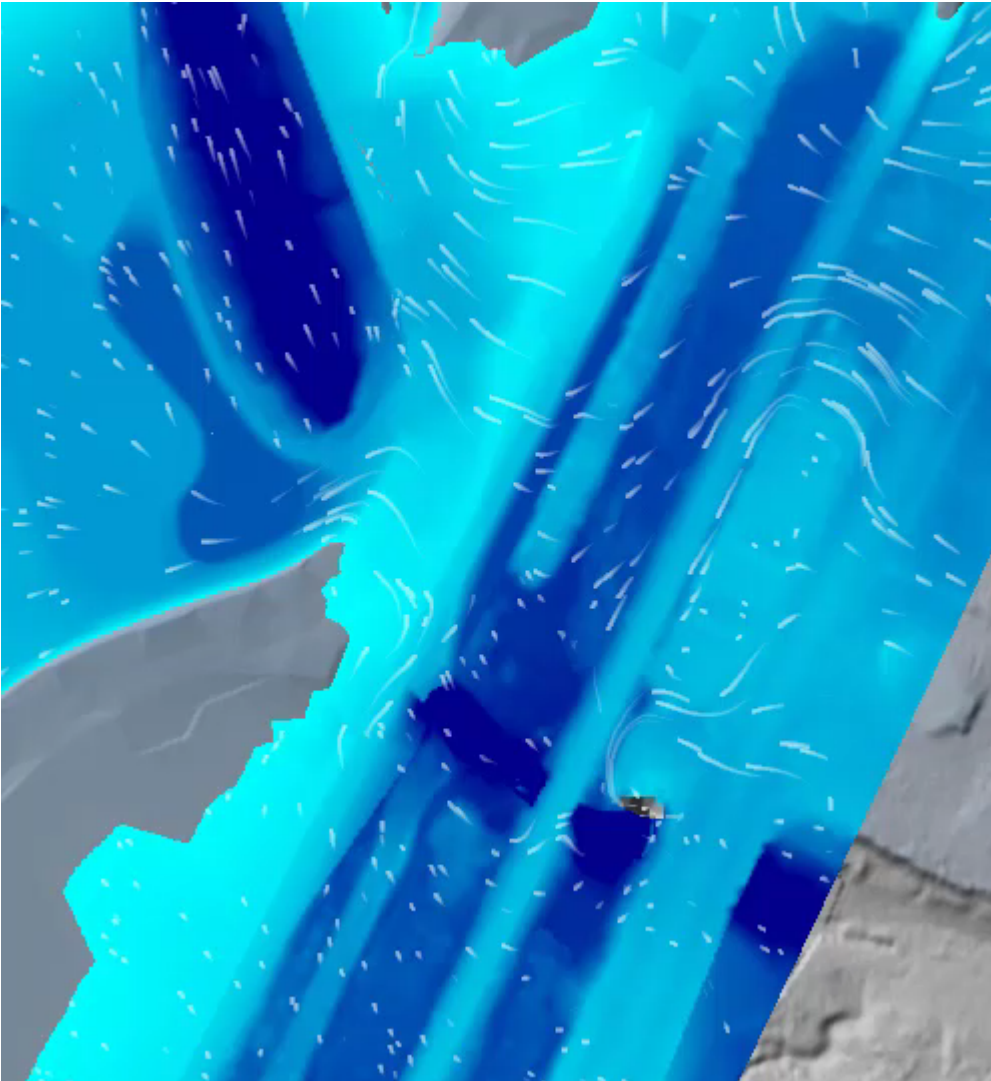
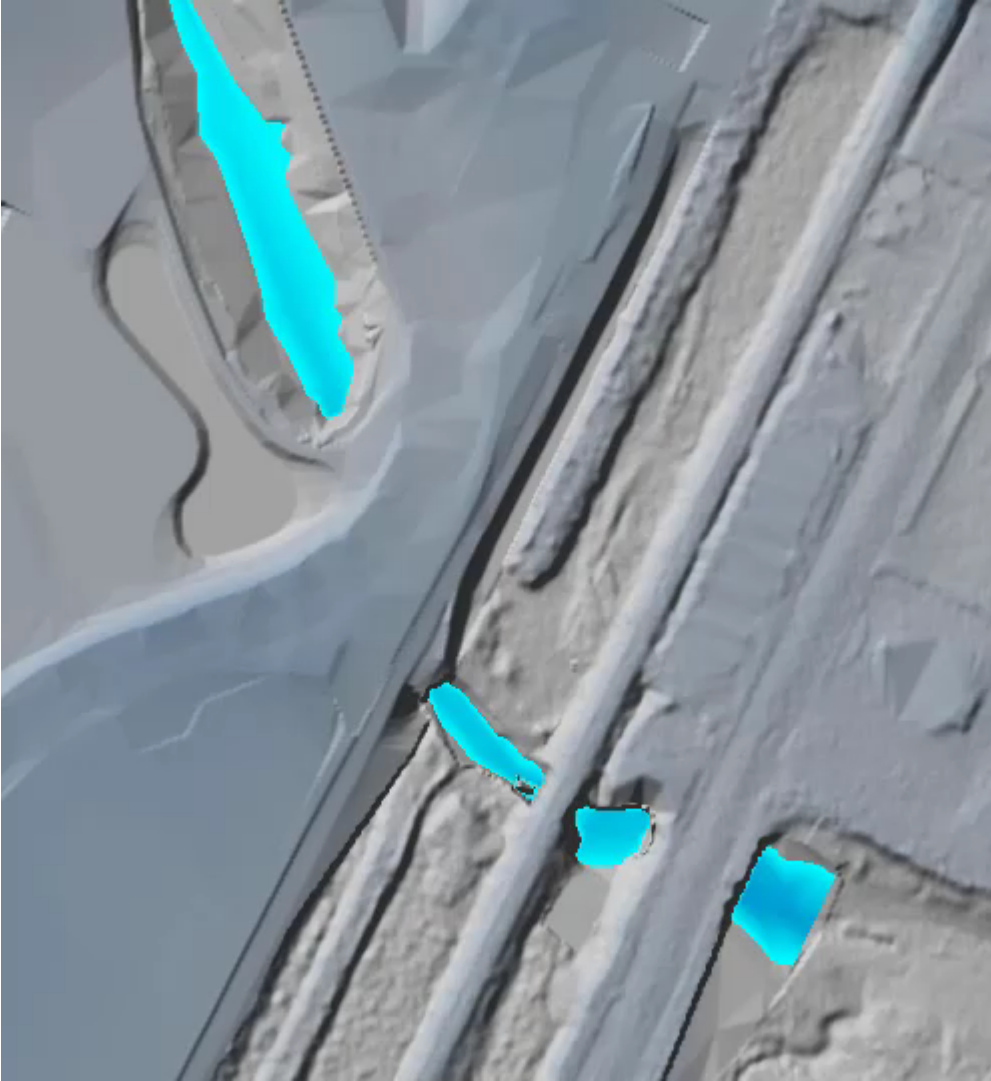
Scenarios for Investigation

Tide Event	Normal	King	100-Yr
Current Sea Level	10.9	13.3	16.1
Forecasted 2035 Sea Level <i>+1.5'</i>	12.4	14.8	17.6
Forecasted 2070 Sea Level <i>+4.2'</i>	15.1	17.5	20.3

Winter Storm Grayson (1/4/2018 - 1/5/2018)
100-Year Tidal Event



Case Study – Boston, MA



Case Study – Lynn Gearworks





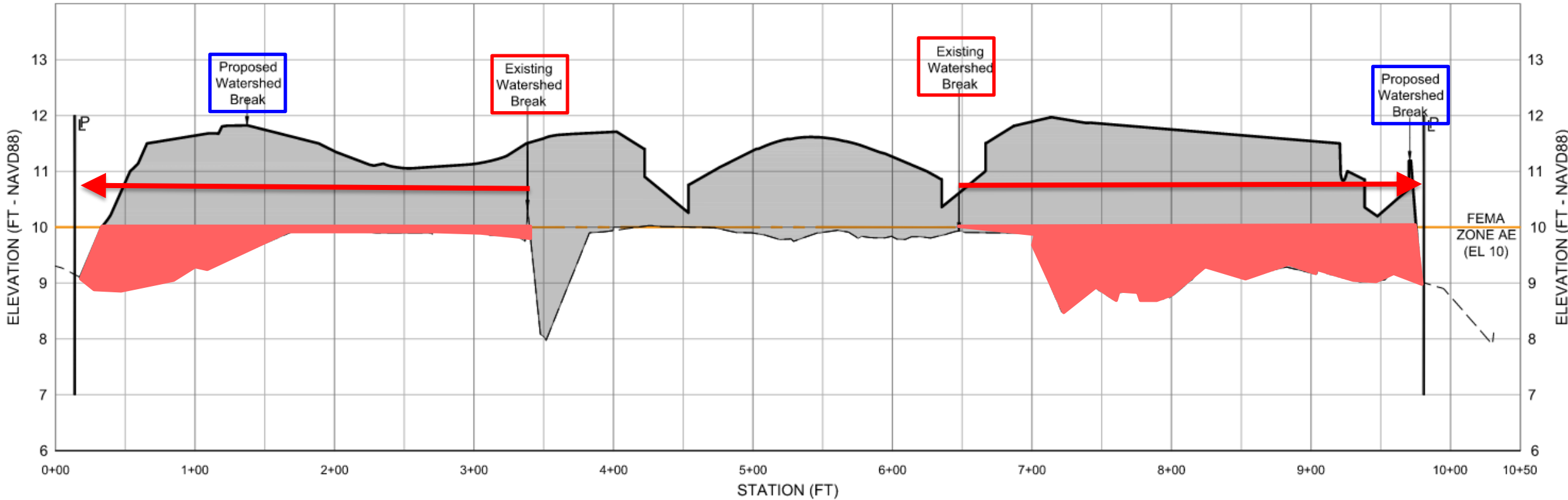
Case Study – Lynn Gearworks

Comment Summarized:

- ***How the proposed fill, grading and structures will affect water flow and drainage patterns within and adjacent to the site***

1. Adaptability
2. Rise in First Floor Elevation
3. Compensatory Storage / Conveyance
4. What are the Impacts to Abutters?

Lynn Gearworks – Qualitative Analysis



Land Subject to Coastal Storm Flowage and Channelization of Flood Waters

- The volume of water represented by the area between the existing watershed break and the proposed watershed break is the flood water that will no longer be channelized off-site. Therefore, channelized flooding to the adjacent properties will decrease under post-development conditions.

LEGEND

- APPROXIMATE AREA THAT WILL NO LONGER PROVIDE FLOOD STORAGE AND WILL NO LONGER BE CHANNELIZED TO ADJACENT PROPERTIES
- PROPOSED GRADE
- EXISTING GRADE
- FEMA ZONE AE (ELE 10)



Lessons Learned: Need for Design Standards

- Source of Data
 - Emission Scenarios
 - Time Frames
 - Precipitation Events
 - Tidal Events
 - No Build vs Build

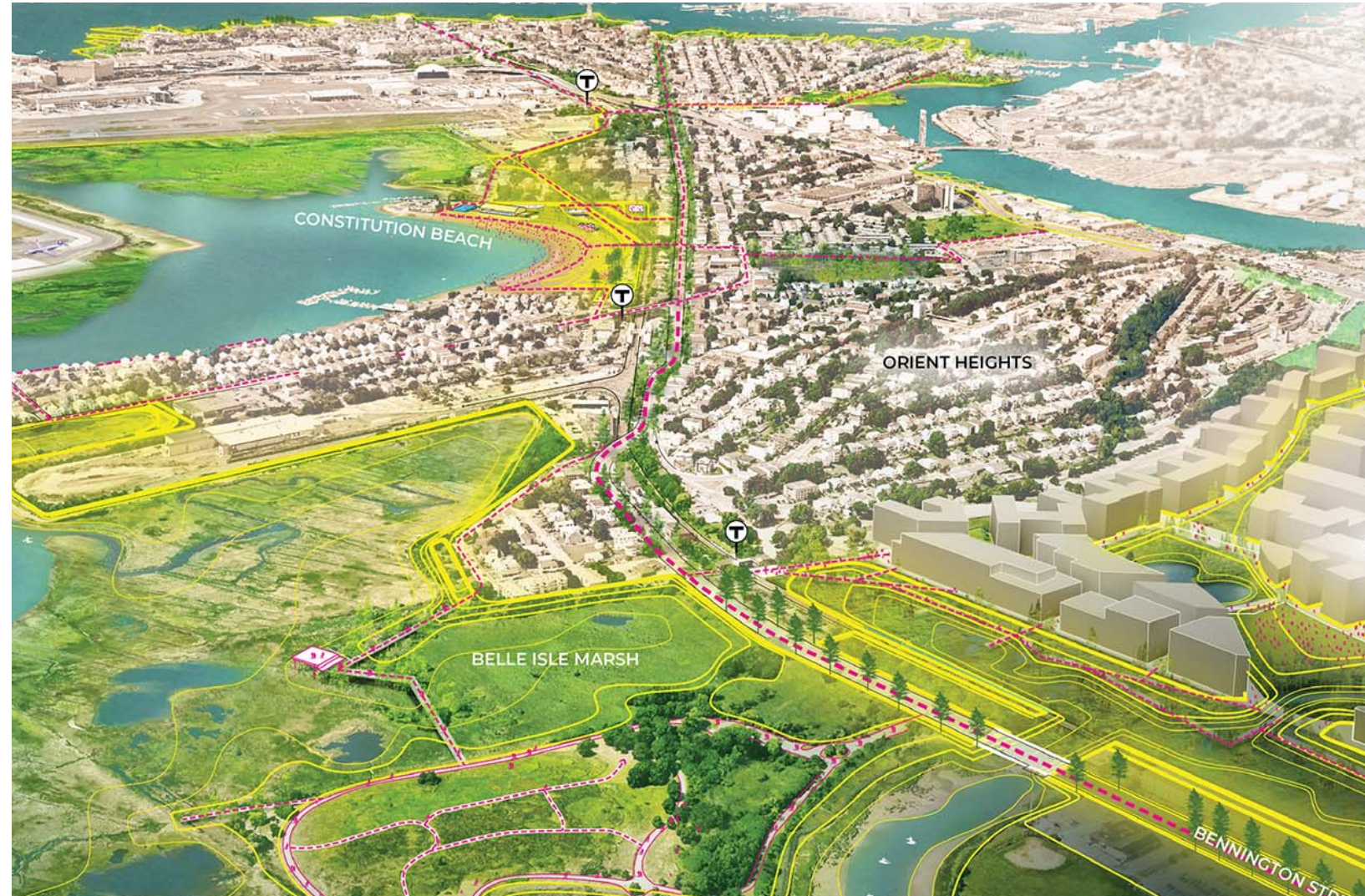
Lessons Learned: Need for Design Standards

Precipitation Event			10-Yr			100-Yr		
Year	Tide Event		Normal	King	100-Yr	Normal	King	100-Yr
			(100%)	(3.3%)	(1%)	(100%)	(3.3%)	(1%)
2018	Current Sea Level	(100%)	10-YR	304-YR	1,000-YR	100-YR	3,042-YR	10,000-YR
2035	1.5' of Sea Level	(0.5%)	2,000-YR	60,833-YR	200,000-YR	20,000-YR	608,333-YR	2,000,000-YR
2070	4.2' of Sea Level	(0.5%)	2,000-YR	60,833-YR	200,000-YR	20,000-YR	608,333-YR	2,000,000-YR

Currently little/no resilient design standards.

Lessons Learned: Site Protection vs Regional Protection

2. Site Protection vs Regional Protection
3. Private Developers VS Public Projects
4. Who's paying for this this and who's being protected (Social Equity)



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