Implementing Resilience:
Climate Resilient Zoning for Portland, Maine

NNECAPA 2023

The Challenges

High heat

+

More precipitation

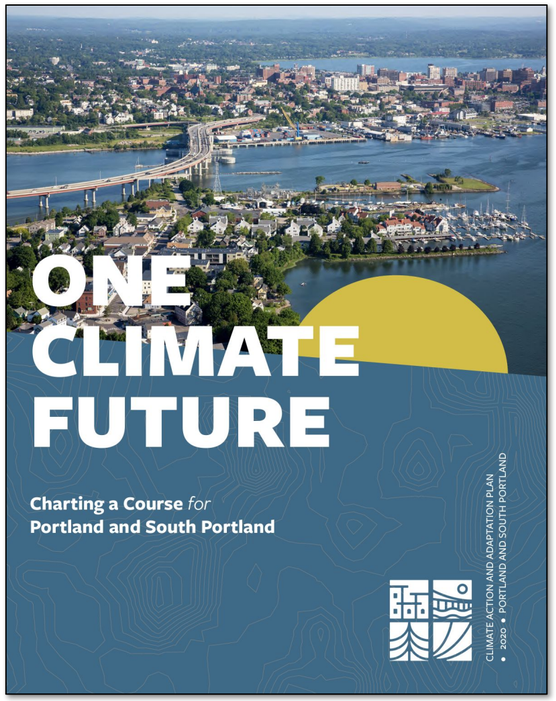
+

Sea level rise

Vulnerable properties and vulnerable people

Photo credits: *PPH, MainePublic, Portland Trails, Roux Institute*

Foundations in Planning & Engagement



Portland's Plan 2030

Identified need for a climate resilience adaptation plan

- 40 events with 400+ people
- 2,105 survey responses

One Climate Future

Validated need for and established a framework for resilience zoning

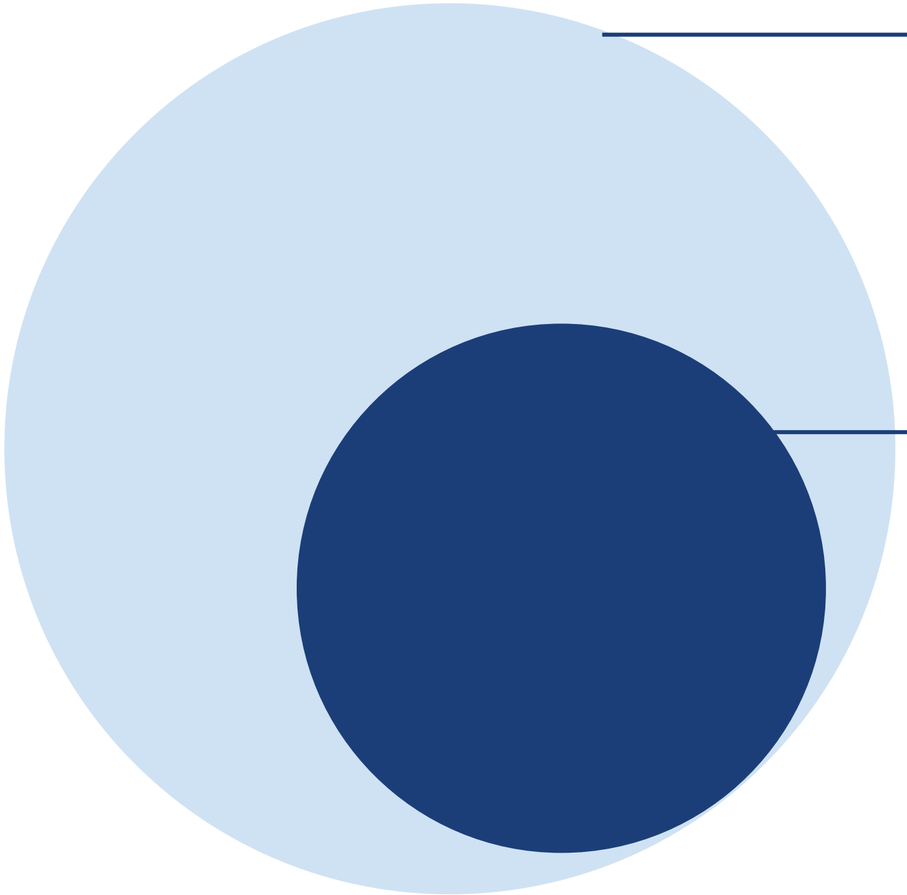
- 91 events
- 1,625 survey responses

ReCode Portland & Climate Resilience Zoning

Balancing Resilience with Other Goals

- Housing creation and affordability
- Investment in Portland's priority growth areas
- Accessibility for individuals living with disabilities
- Social connection and activation of the public realm
- Operational viability of ground floor retail & job-generating commercial/industrial uses
- Viability of the working waterfront and Maine's largest port
- Health and safety of historically disadvantaged neighborhoods

What are the climate risks and where should they be addressed?



Whole City

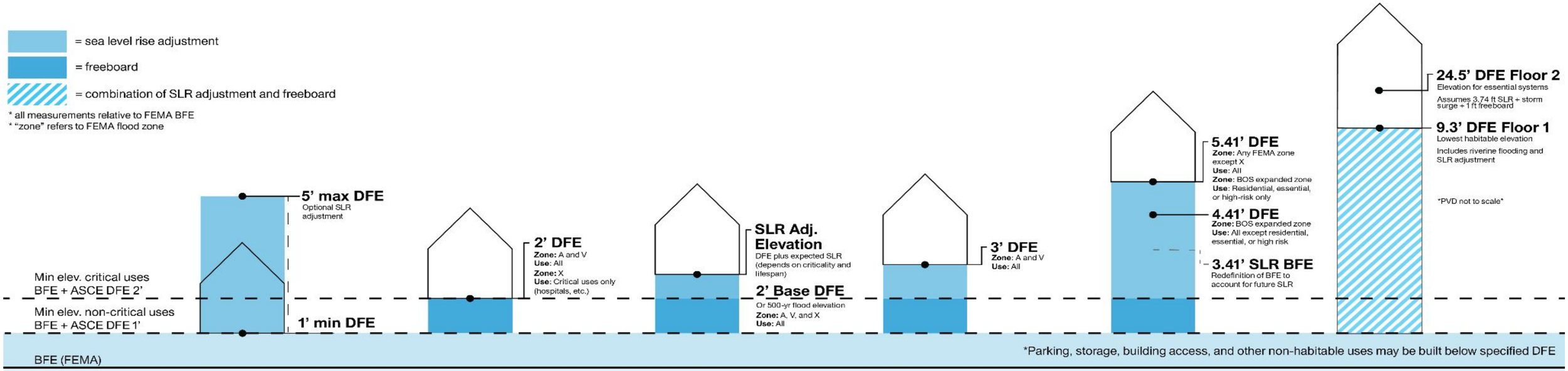
High Heat
More frequent high heat events that last longer. Areas with fewer trees and more pavement are most vulnerable.

Stormwater
Increasingly intense or frequent storms resulting in precipitation that exceeds the capacity of local green and grey infrastructure, contributing to local flooding and combined sewer overflows.

Coastal Areas

Coastal Flooding
Sea level rise combined with increasingly intense or frequent storms will result in coastal flooding at high tides and from storm surges. The Downtown waterfront and Bayside will be most affected.

Flood Resilience Zoning Case Studies



Miami
2019

Summary: The city's approach provides allowances for increased elevation, though does not require it. It sets a minimum DFE at 1' above FEMA BFE. There are optional allowances for development to further elevate the ground floor up to 5' above FEMA BFE.

Source: Miami 21 Zoning Code

New York City
2019

Summary: The city sets the minimum DFE at 2' above FEMA BFE. Builders may continue to elevate up to 10' above grade in 1% floodplain and up to 5' above grade in 0.2% floodplain. This increases the "reference plane" of the building, from which height is measured. New York City is unique because it has its own building code.

Source: NYC Building Code

District of Columbia
2021

Summary: The city requires a 2' DFE above 100-yr FEMA floodplain (or 500 yr floodplain, whichever is higher). The city adds a required adjustment for SLR which varies based on lifespan of the project and criticality of the building.

Source: Climate Ready DC

Norfolk
2018

Summary: The city first requires 1' of freeboard above FEMA BFE. It also has a 2' requirement to account for SLR, bringing the total required DFE to 3' above FEMA BFE. Outside of the FEMA Zones a citywide points system called a "Resilience Quotient" applies.

Source: Norfolk Zoning Ordinance

Boston
2019

Summary: In 2019, the city redefined BFE and expanded its flood district to account for future sea level rise. In addition, buildings must be elevated either 1 or 2', depending on building use and FEMA zone.

Source: Coastal Flood Resilience Design Guidelines

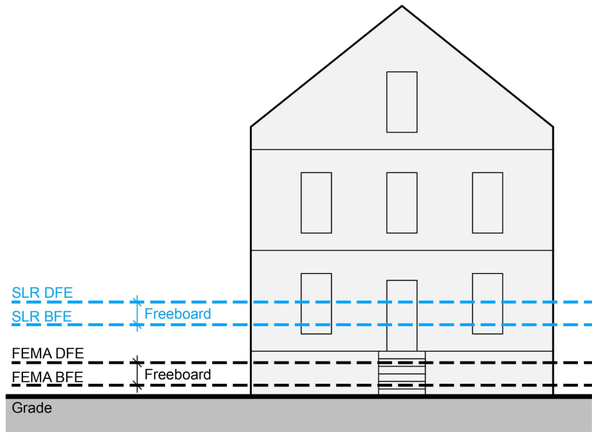
Providence I-195 District
2022

Summary: The district has two separate DFEs. The ground floor DFE addresses riverine flooding, SLR and necessary freeboard. The 2nd story DFE mitigates against flood barrier failure and SLR.

Source: Providence I-195 District Design Guidelines

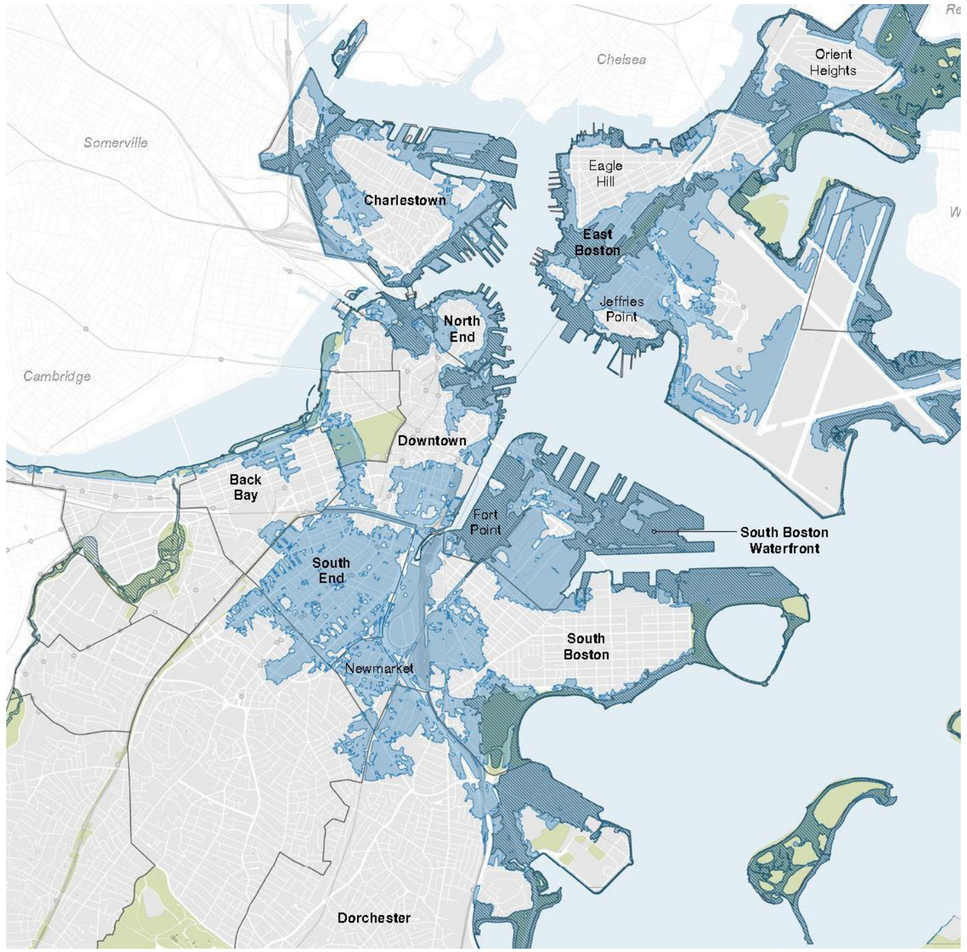
Boston Case Study

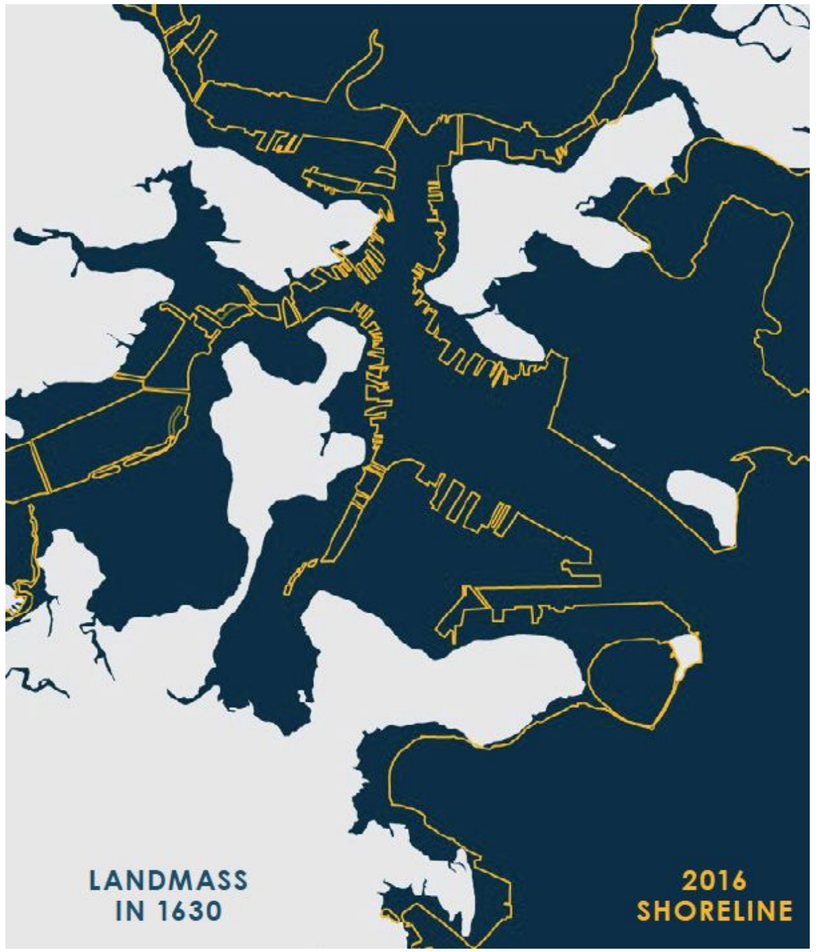
1% Annual Chance Flood - 2070s
Assumes 40” of Sea Level Rise



Current Flood Risks (Zoning Article 25)
Areas with a 1% annual chance of flooding

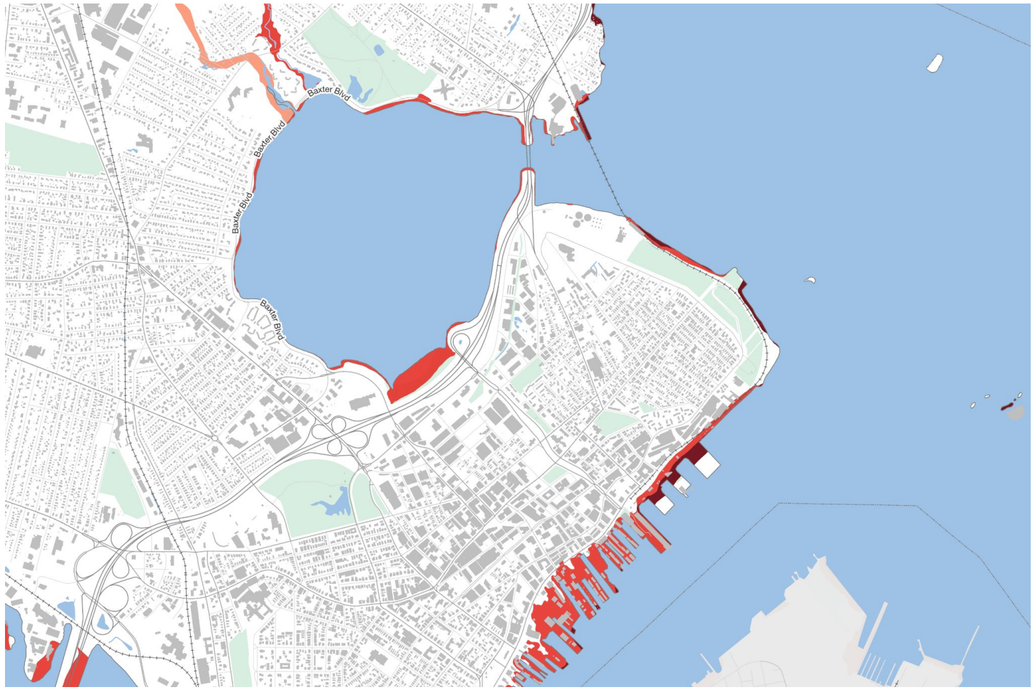
Future Flood Risks (Coastal Flood Resilience Zoning Overlay District)
Areas with a projected 1% annual chance of flooding in the year 2070 with 40 inches of sea level rise





FEMA vs. Model Comparison

Current FEMA Floodplain

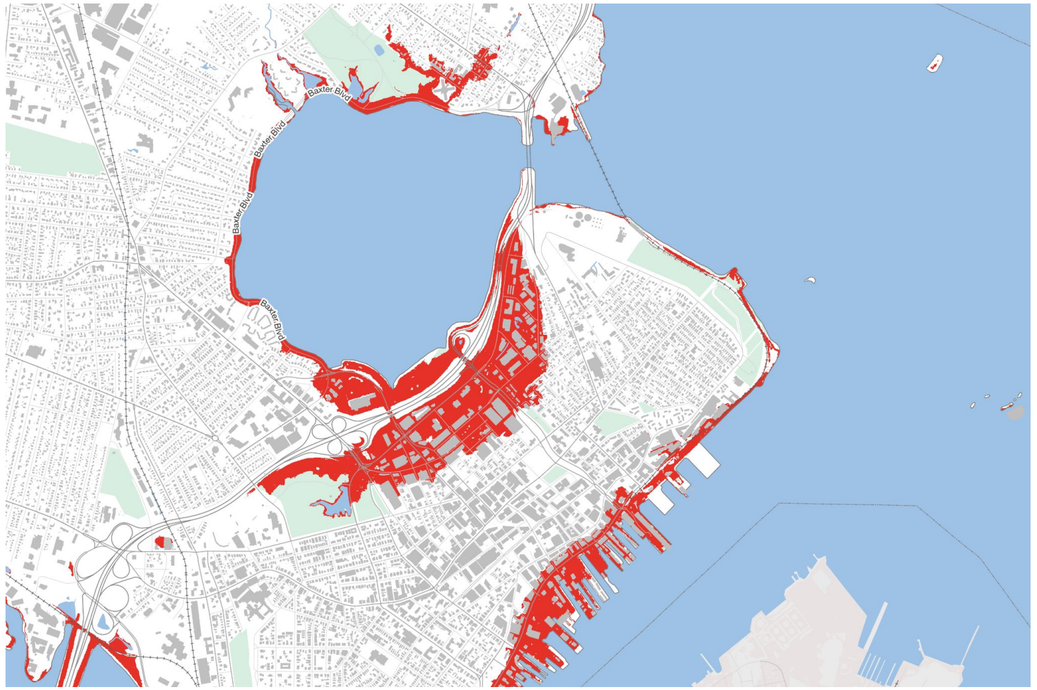


100 year flood zone + wave action

100 year flood zone

500 year flood zone

New Modeled Floodplain



100 year flood zone

Coastal Flood Resilience Overlay Zone (CFROZ) Approach

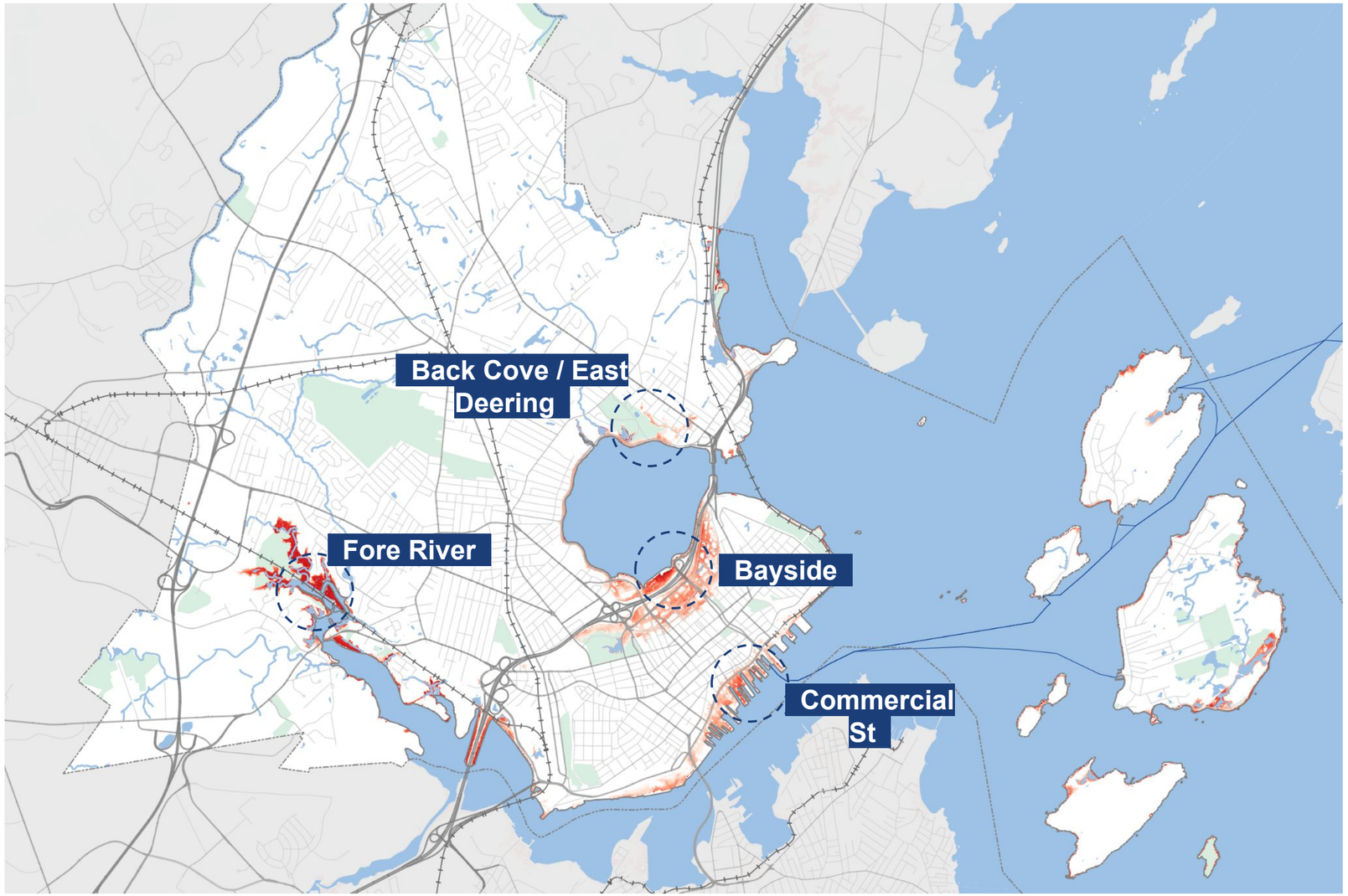
Boundary:
All parcels that intersect with the modeled flood scenario.

Requirements:

- A new higher Design Flood Elevation (DFE)
- Tiered elevation requirements based on the vulnerability of the use
- Increased 2nd floor heights to allow for adaptation
- Some exceptions for renovations and adaptive reuse

Relationship to FEMA floodplain:

- Higher standards for flood protection than FEMA
- Underlying requirements of FEMA floodplain still apply



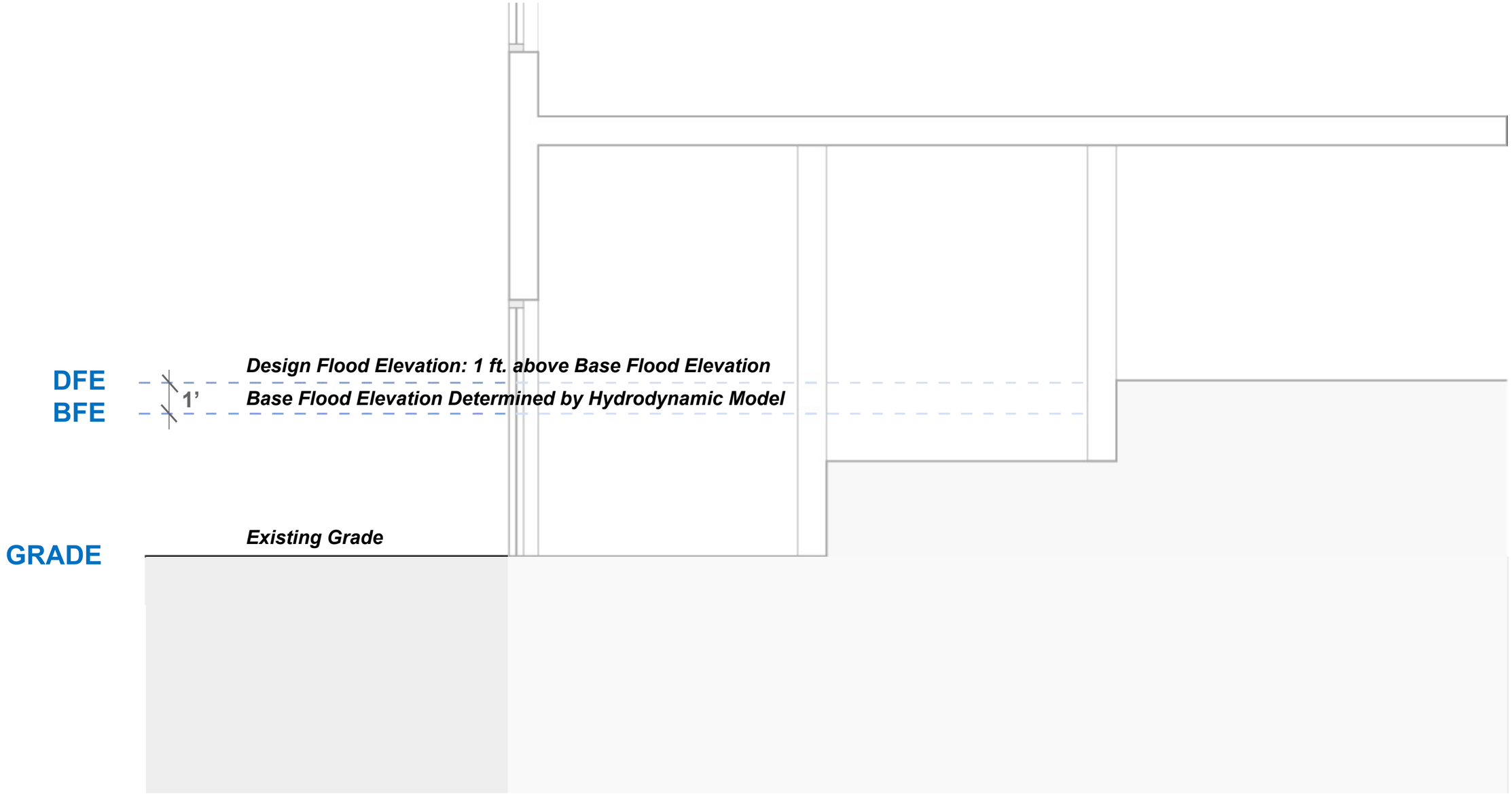
Most Impacted Areas

Downtown Waterfront

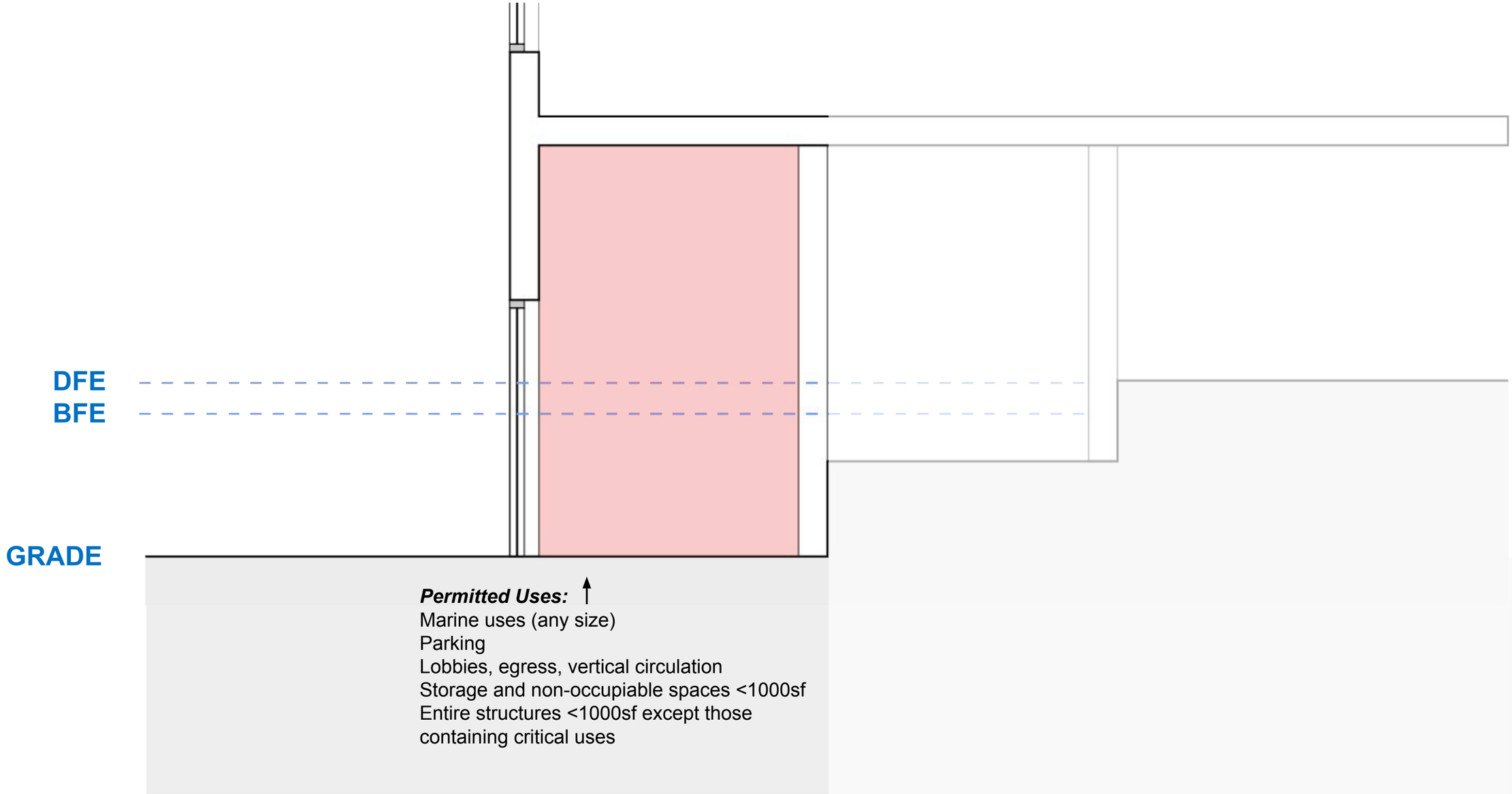
Bayside

Back Cove / East Deering

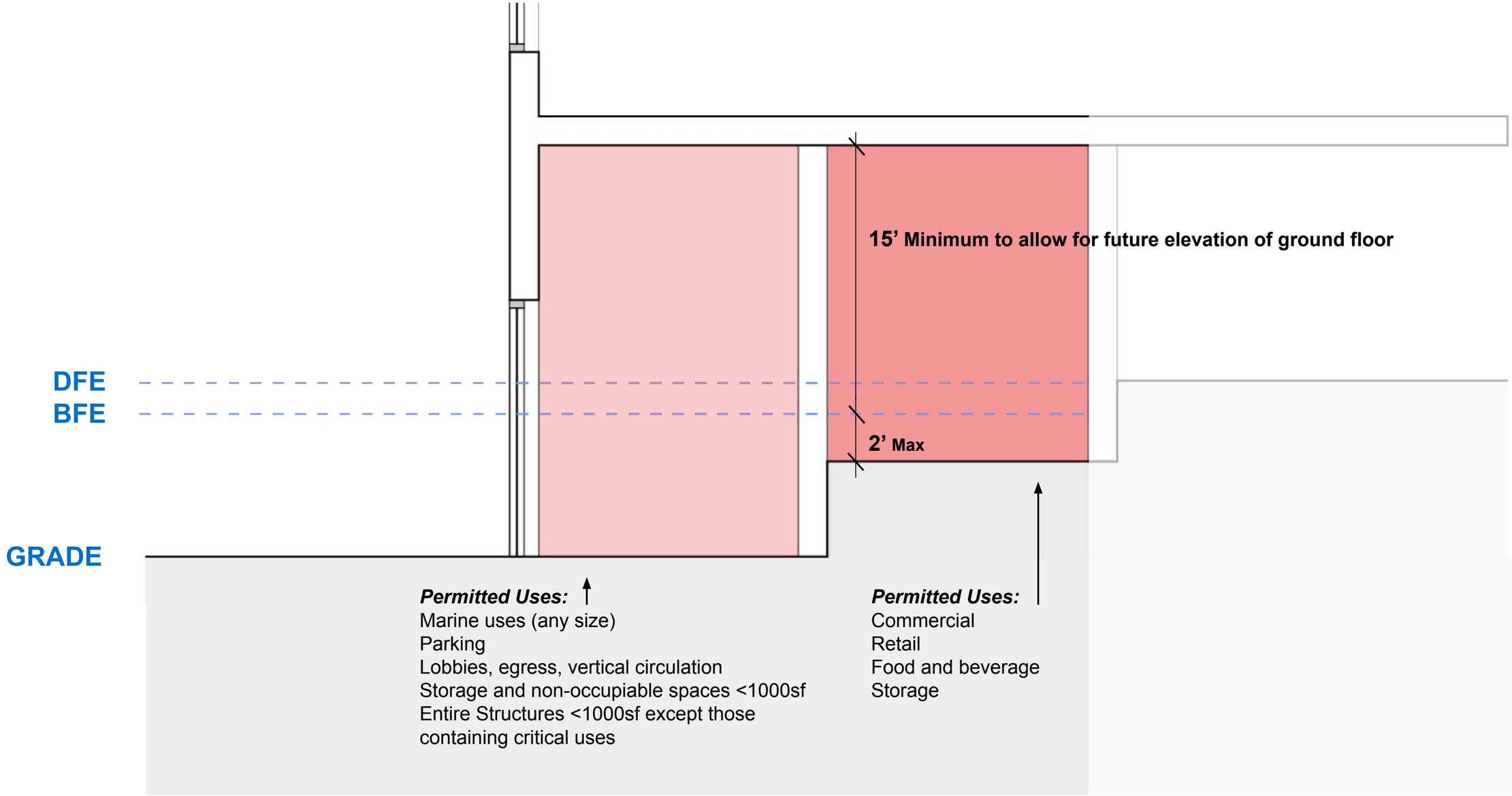
Proposed Approach: Define a New Design Flood Elevation in the CFROZ



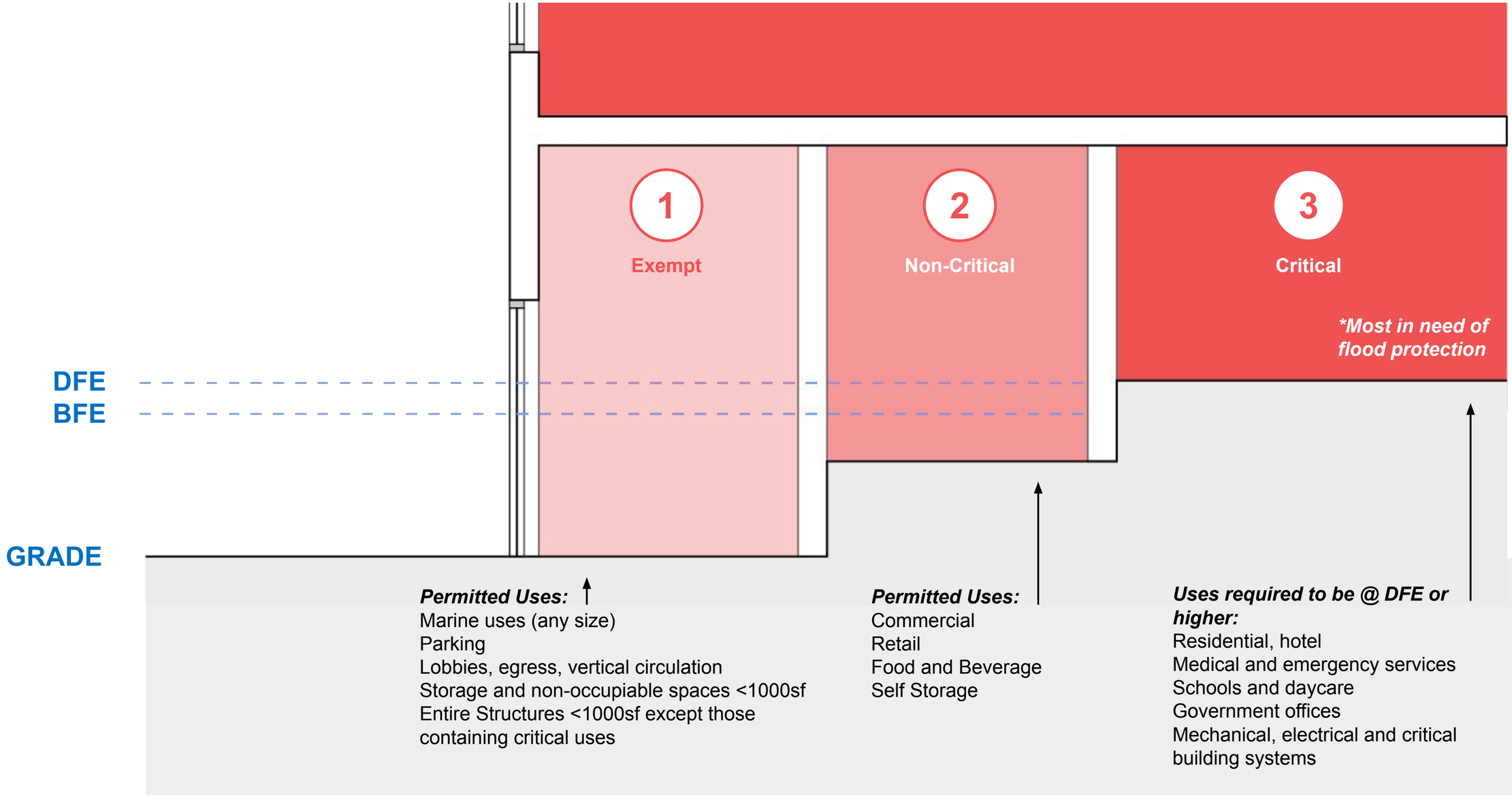
Proposed Approach: Floor Elevation Based on Use - Exempt Uses



Proposed Approach: Floor Elevation Based on Use - Non-Critical Uses



Proposed Approach: Floor Elevation Based on Use - Critical Uses



Bayside Case Study

Design Flood Elevations* for **Critical & Non-Critical Uses**

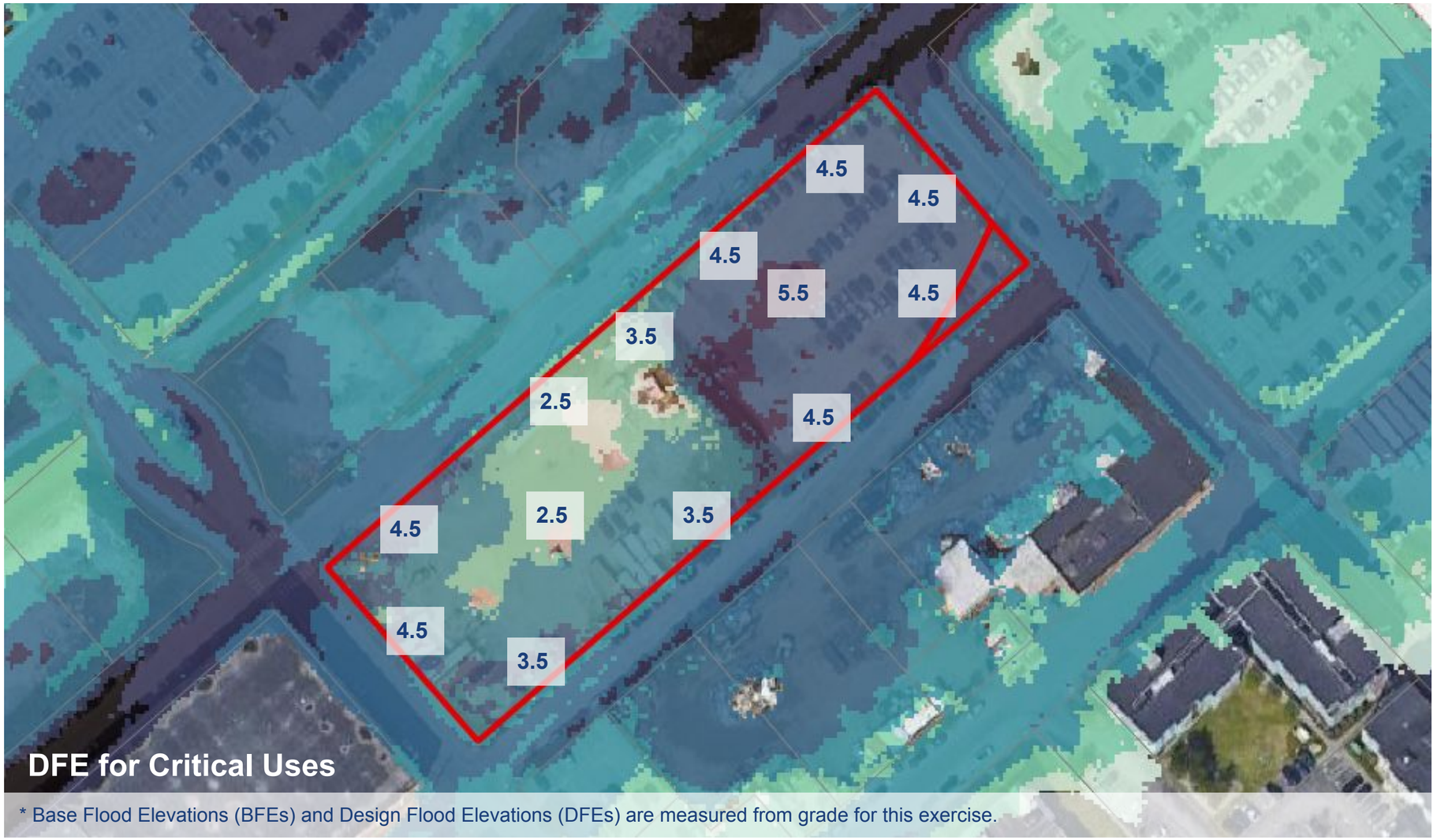
Critical uses would need to be located at DFE-SLR, or one foot minimum above the BFE-SLR. **This would be approximately 3.5-5.5 ft. above existing grade.**

Non-critical uses would need to be located no lower than 2’ below BFE-SLR , or **approximately 0-2.5 ft. above existing grade.**

Projected Flood Depth

Assumptions: 100yr flood, 3.9’ SLR

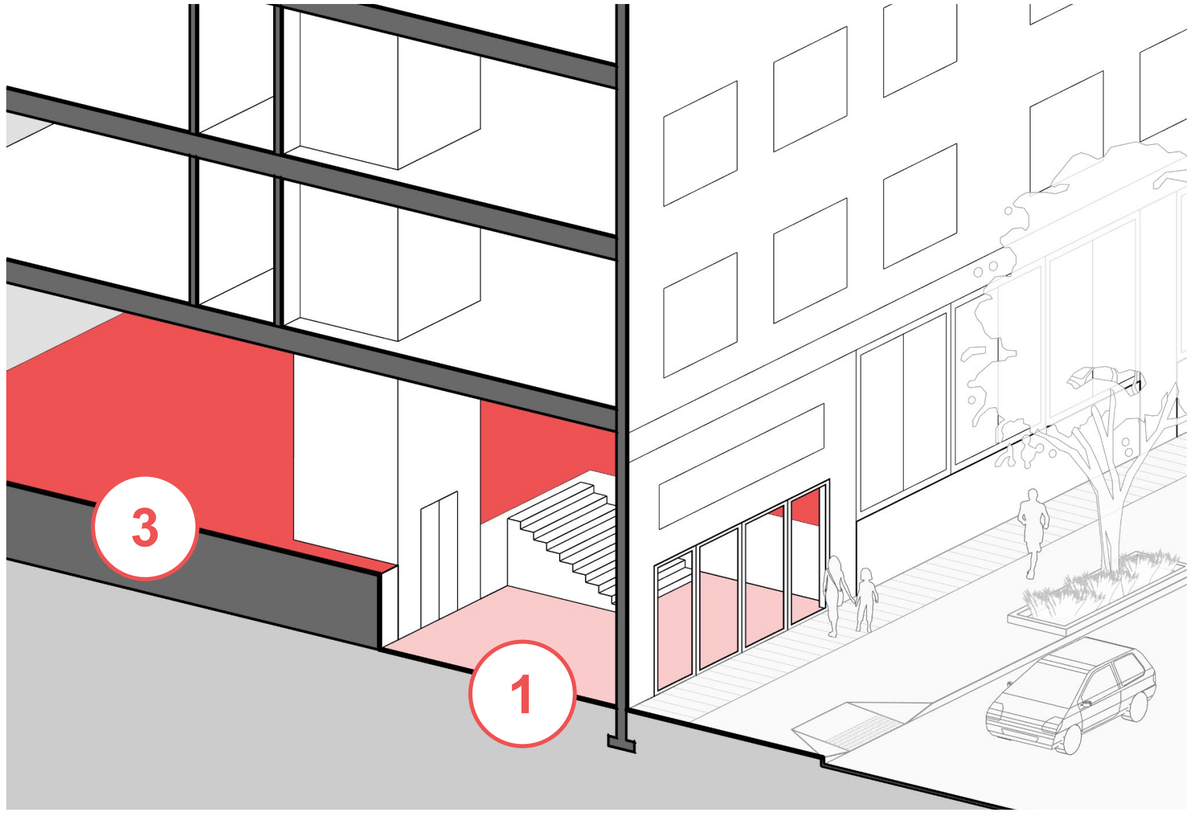
- 1’ or less
- 1’ to 2’
- 2’ to 3’
- 3’ to 4’
- 4’ to 5’
- 5’ or more



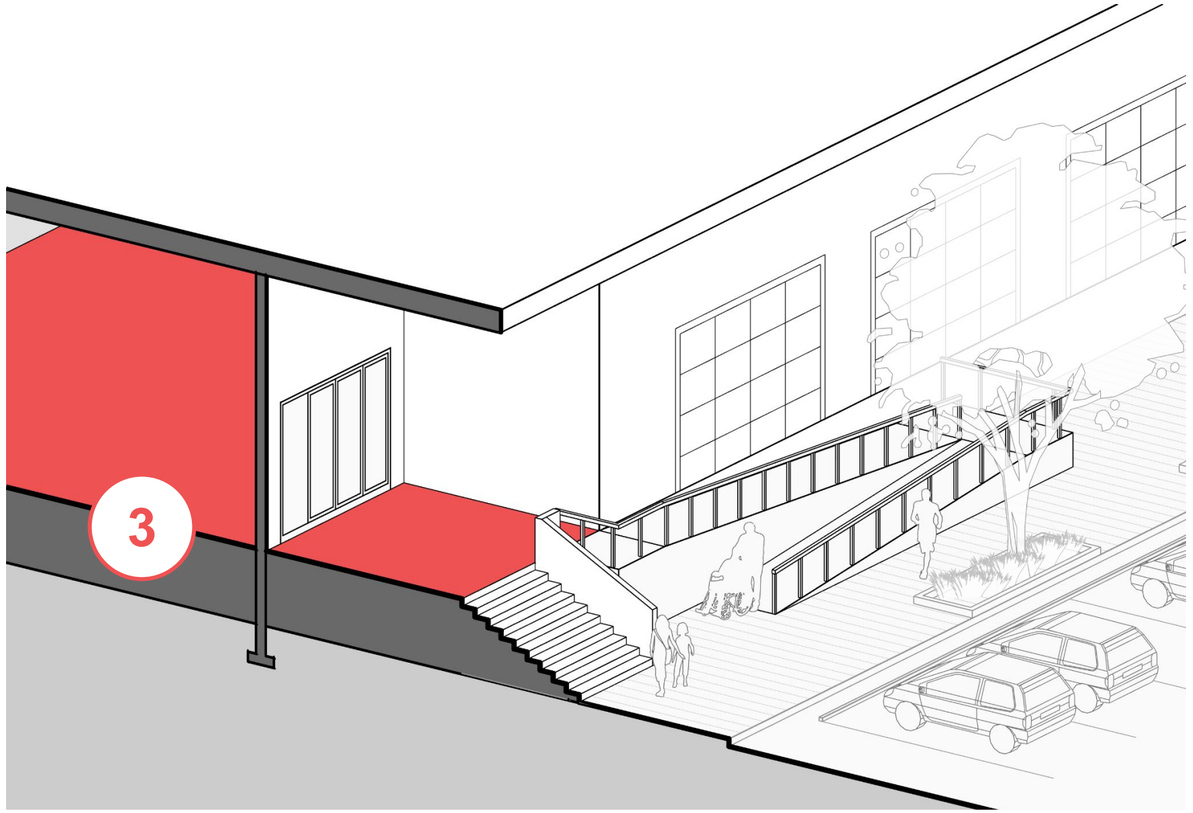
* Base Flood Elevations (BFEs) and Design Flood Elevations (DFEs) are measured from grade for this exercise.

Case Study Visualizations

Design Flood Elevation* for **Critical Uses =** 5.0’ from grade



Multi-Story Example
Interior lobbies can negotiate the elevation change from grade to the DFE.

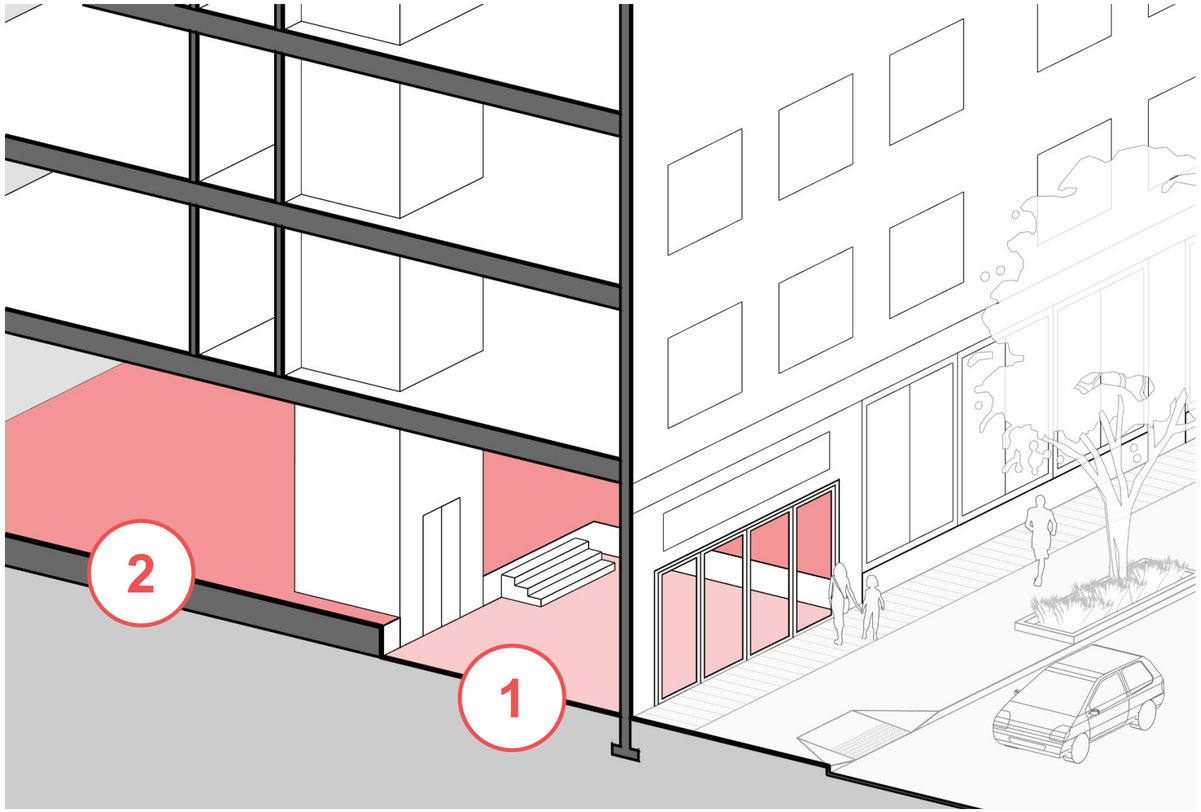


Single-Story Example
Exterior stairs and ramps to a shared entry platform can negotiate the elevation change from grade to the DFE.

* Base Flood Elevations (BFEs) and Design Flood Elevations (DFEs) are measured from grade for this exercise.

Case Study Visualizations

Design Flood Elevation* for **Non-Critical Uses** = 2.0’ from grade



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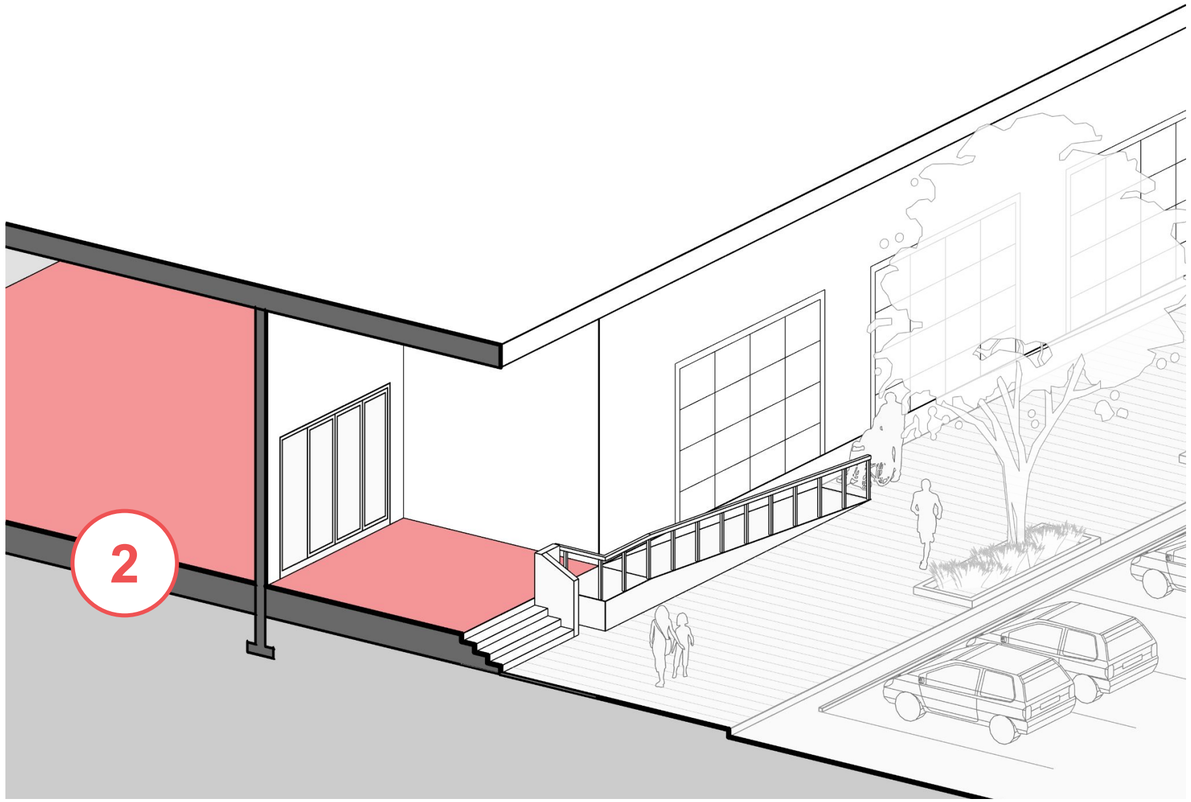

Single-Story Example
Exterior stairs and ramps to a shared entry platform can negotiate the elevation change from grade to the DFE.

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Case Studies

How can we effectively transition to elevated ground floor levels?

***Intermed Building on Marginal Way**, transitions are handled interior to the building, with a first floor lobby and parking.*

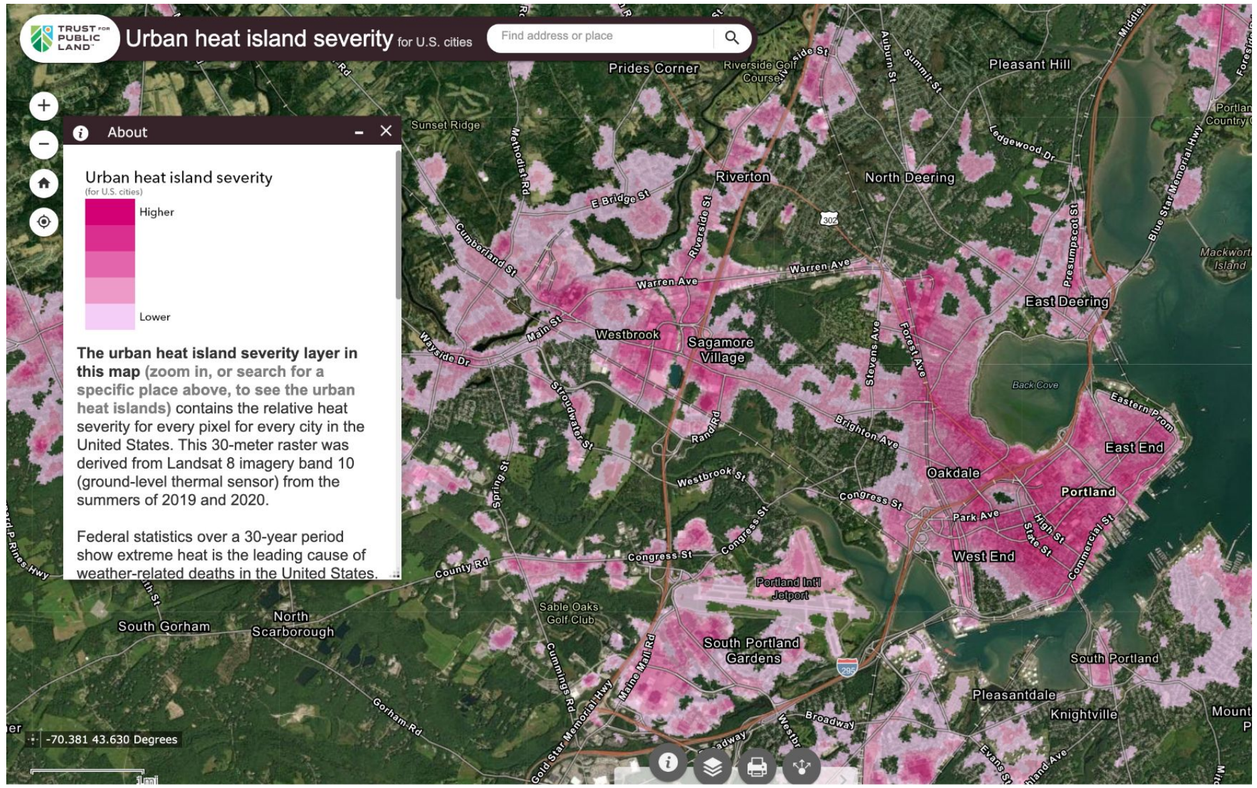
***Bayside Example**, Coffee by Design*

***Boston Example**, Whole Foods*

***Boston Example**, this shows a lobby entrance at grade, and an elevated (+2.5ft) outdoor seating area.*

***Boston Example**, this building shows a ramp that allows visitors and residents to circulate up to the lobby level (+2ft) before entering the building.*

How are high heat and stormwater being addressed?



High Heat Approach

1. **Tree Canopy in Parking Areas**
2. **Landscape/Hardscape**
3. **Building & Roof**

Stormwater Approach

1. **Simplify thresholds** across all development types (i.e. redevelopment & new development) and manage connections to existing system
2. **Increase natural resource protections**
3. **Establish simple standards for smaller residential projects**

Challenges & Considerations

1. Developing tools for different
   - Neighborhood contexts
   - Socioeconomic differences
   - Infrastructure needs
   - Public and private properties

2. Creating regulatory requirements that don’t discourage private investment that furthers other goals

3. Existing vulnerabilities remain for residents, businesses, built environment

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utile

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