ReCode PORTLAND:

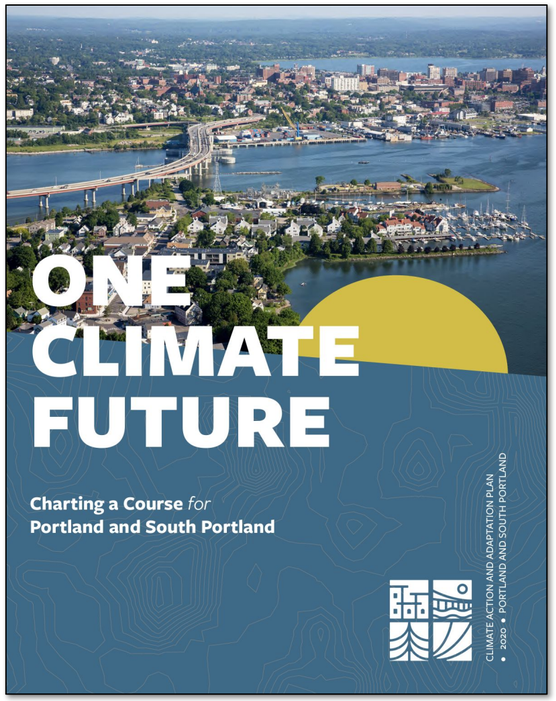
Proposed Approach to Climate Resilience Zoning

for Public Review & Feedback

Why climate resilience zoning?

Purpose & Process Overview

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

Purpose of the Climate Resilience Zoning Effort

Goal

Use local land use regulations to increase Portland's resilience to:

- **coastal flooding**
- **stormwater flooding**
- **high heat**

Key Steps

1. Take stock of the risk factors, patterns, and projections for flooding and high heat
2. Develop a shared understanding of how they map onto the city
3. Establish adaptation standards that will help to limit damage and disruption

What are we looking for from you?

We want your input on the way we're planning to approach climate challenges related to coastal flooding, high heat, and stormwater through the land use code.

Text in blue boxes with a pink stripe like this is intended to guide and orient you. **Read this first where it appears,** then move on to more detailed content.

? Questions for you to consider will be indicated with this symbol.
When you see this, add your comments.

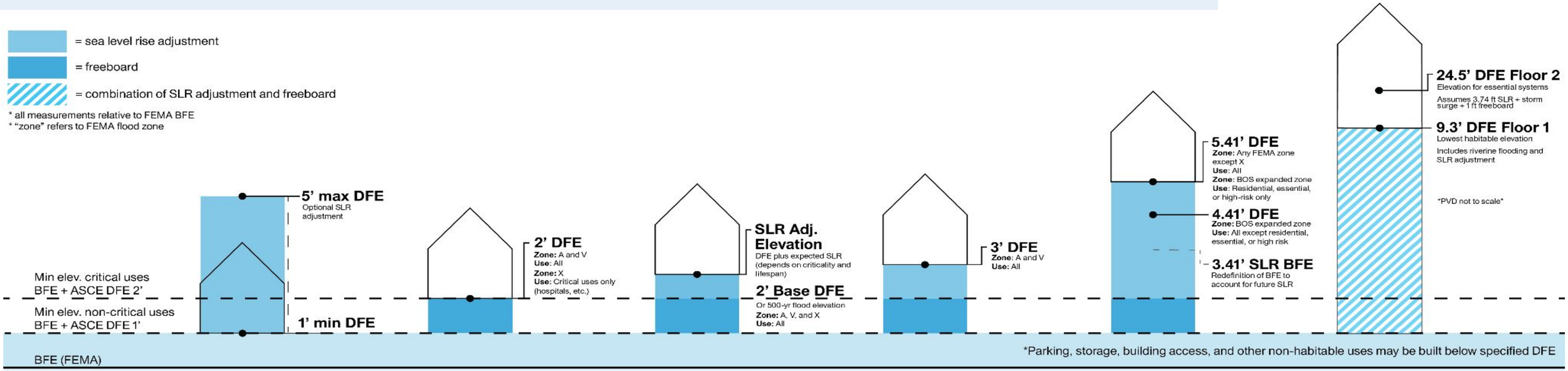
You are also welcome to add comments elsewhere and respond to comments others have left.

Who else is doing this work and how?

Precedents

Flood Resilience Zoning Case Studies

Many cities are using zoning as a tool to protect buildings from coastal flooding. The approaches vary based on the flood conditions that are unique to each place.



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

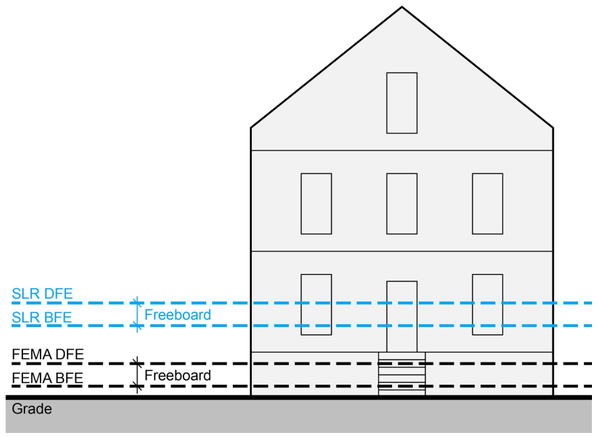
Summary: The district has two separate DFEs. The ground floor DFE addresses riverine flooding, SLR and necessary freeboard. The 2nd story DFE mitigates against flood barrier failure and SLR.

Source: Providence I-195 District Design Guidelines

Boston Case Study

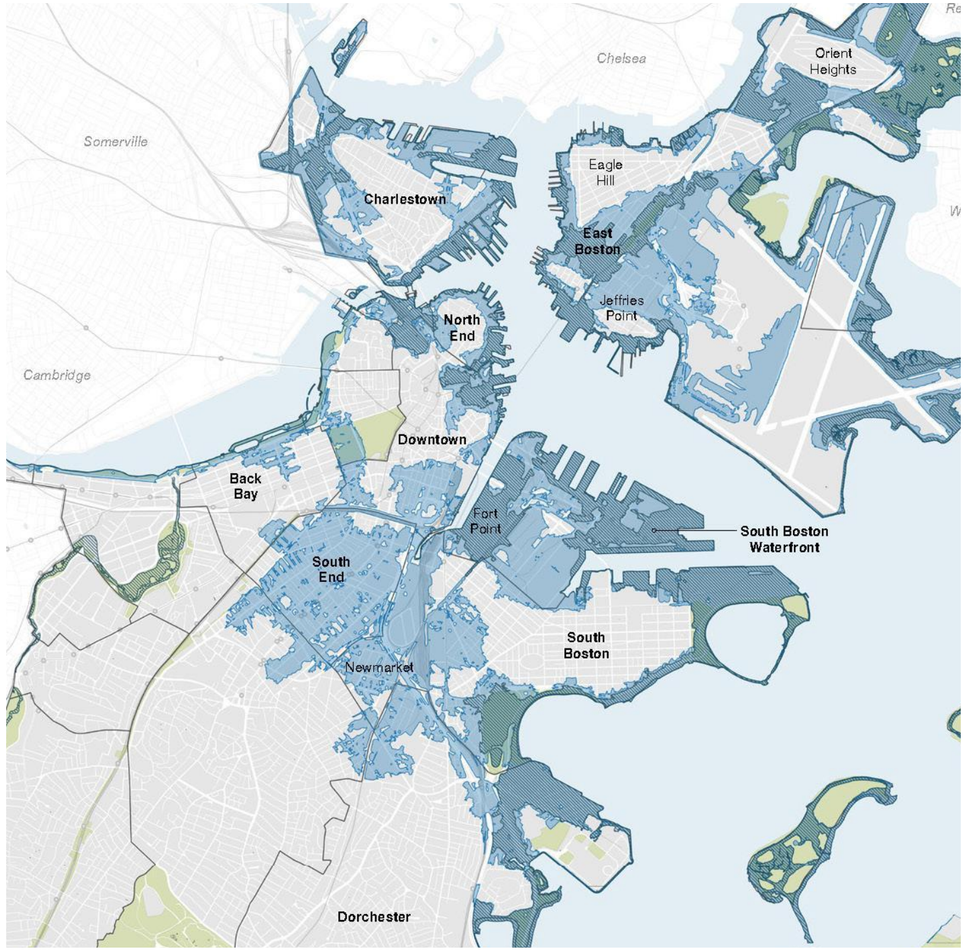
Predicted additional flood heights and extents associated with Sea Level Rise are captured in Boston's expanded Coastal Flood Overlay Zone. New development on the overlay zone is required to elevate above the anticipated water levels.

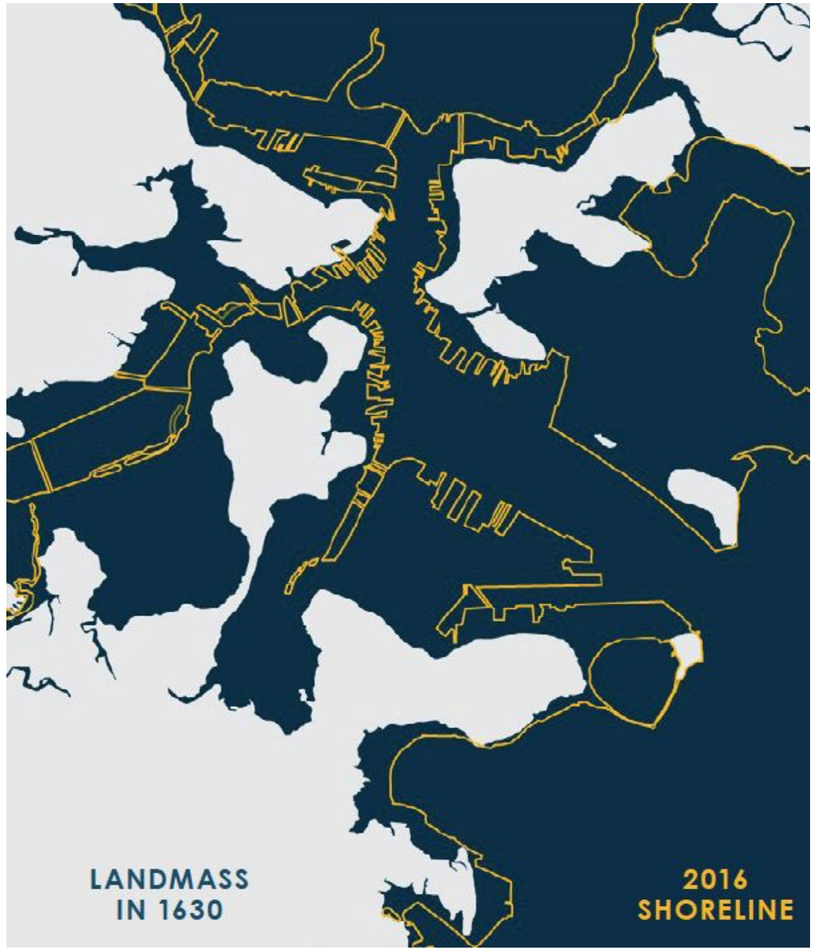
1% Annual Chance Flood - 2070s
Assumes 40" of Sea Level Rise



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



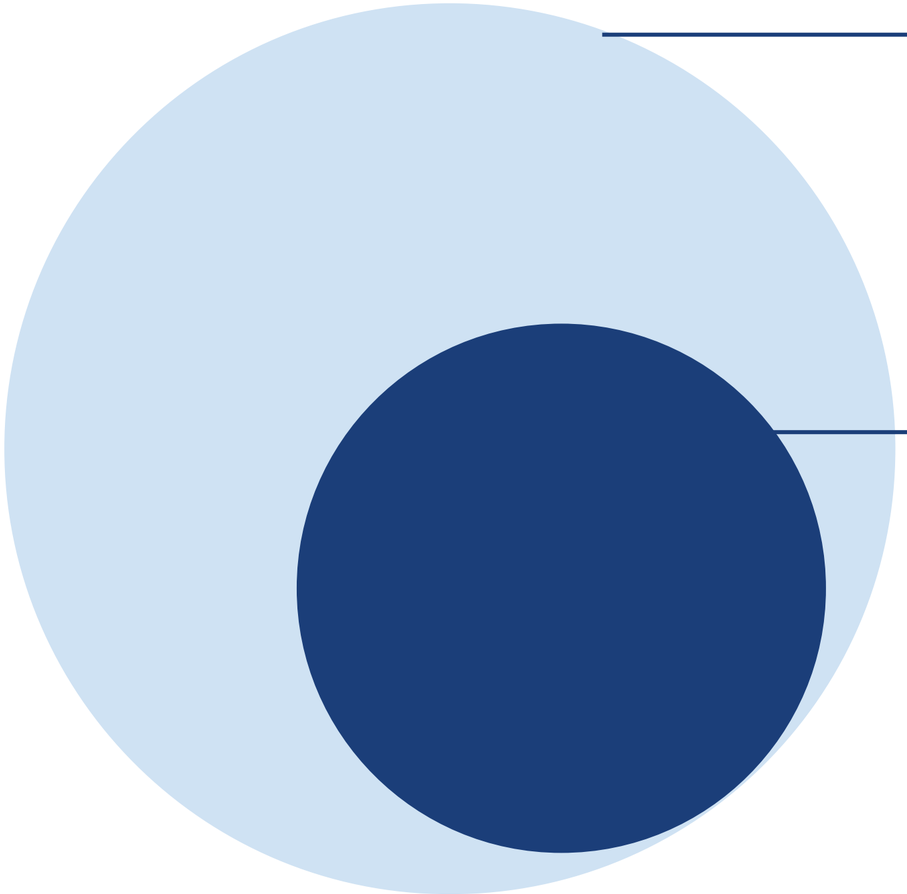


What risks are we trying to manage?

Portland Risk Factors & Approach

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

As highlighted in **One Climate Future**, coastal flooding applies to select areas of the city, while high heat and stormwater retention have citywide impacts.



Whole City

High Heat

More frequent high heat events that last longer. Areas with fewer trees and more pavement are most vulnerable and occur in most neighborhoods.

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 by expected sea level rise.

Adapted from Linnean Solutions One Climate Future Resilience Zoning Memo

Risk Factor 1: Coastal Flooding

Goals

- Plan for the impacts of sea level rise and increased storm surge
- Protect essential and critical uses by ensuring they are only built above the projected flood depth
- Provide appropriate flexibility for non-critical uses

Approach

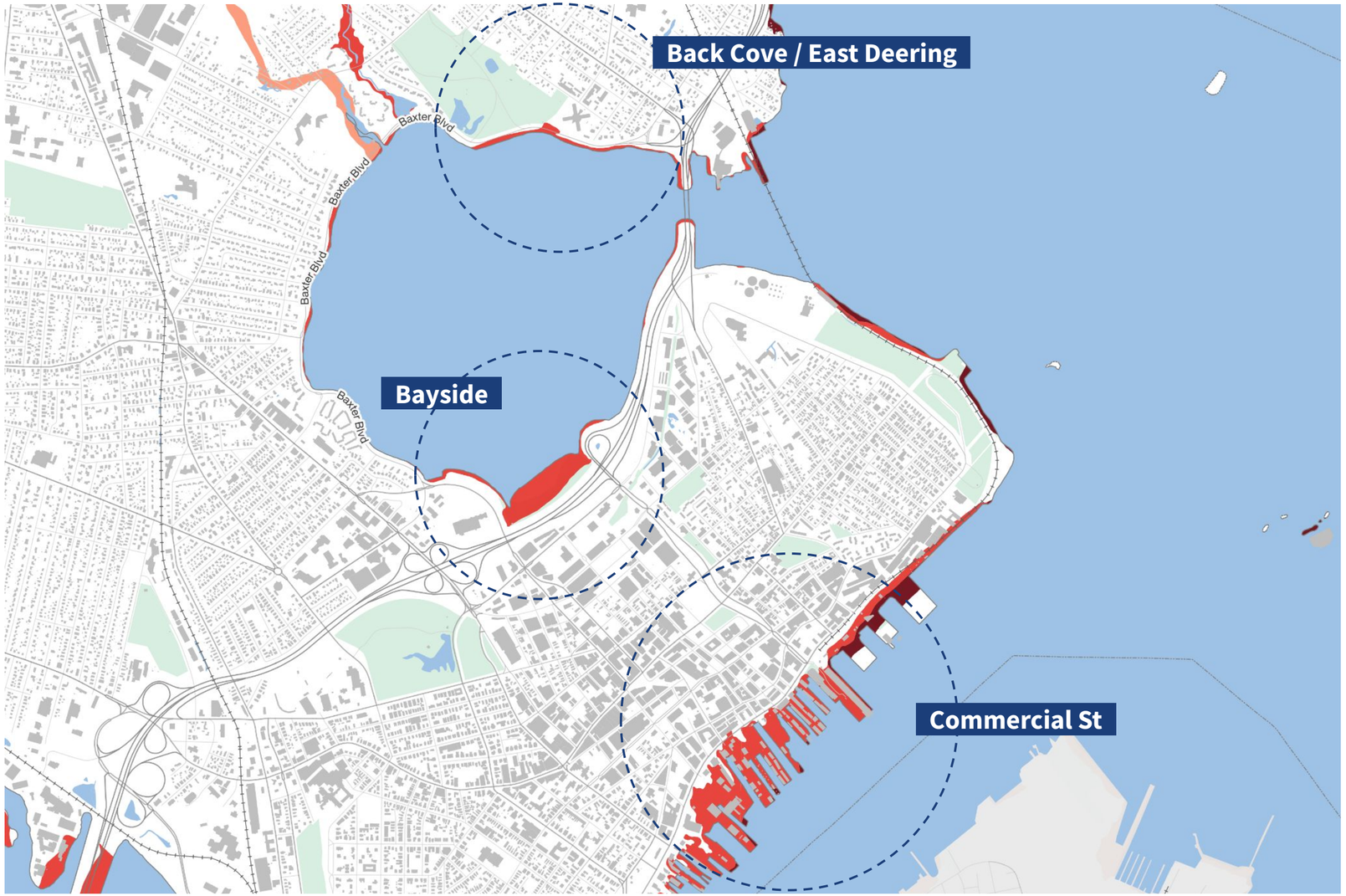
- Develop Coastal Flood Resilience Overlay Zone

Current System for Managing Flood Risk: FEMA Floodplain

Portland has a defined floodplain, but it does not account for future sea level rise.

New development in the FEMA floodplain requires that habitable areas and mechanical and life safety systems in the building be elevated above anticipated flood waters. The minimum specified floor level in a floodplain is called the **Design Flood Elevation (DFE)**

FEMA's floodplain map and required DFE are based on historical flood levels, and do not account for greater storm surges as sea levels rise.



Current FEMA Floodplain

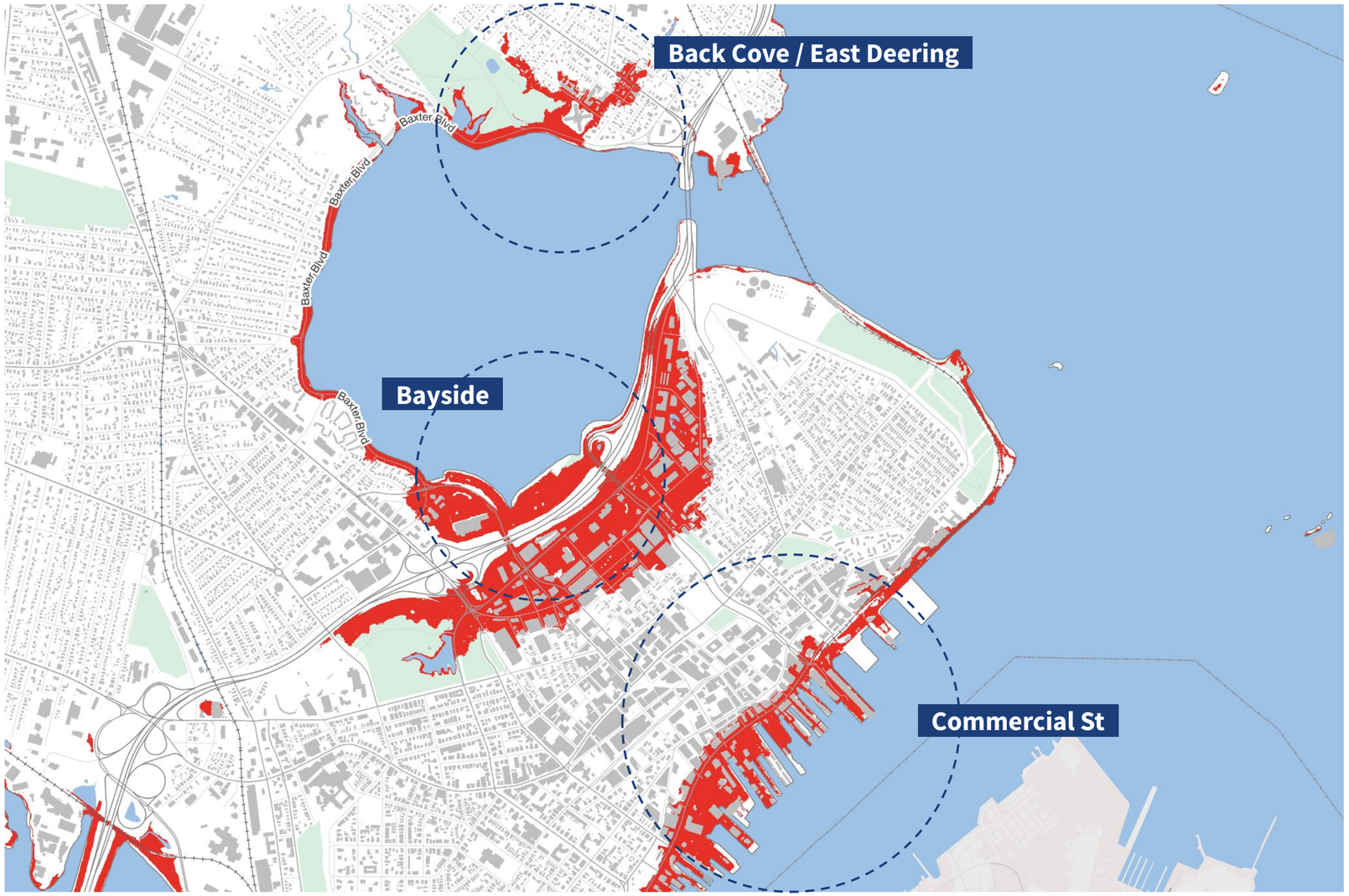
- 100 year flood zone + wave action
- 100 year flood zone
- 500 year flood zone

Modeled Flood Risk: Hydrodynamic Model

The City constructed a hydrodynamic model to simulate increased flood risks associated with sea level rise

The model estimates the extent and depth of flooding associated with a 100 year storm (a storm of an intensity with a 1% chance of occurring in any given year) in conjunction with 3.9 feet of sea level rise. NOAA has predicted that Portland will experience 3.9 ft of sea level rise in the year 2100. The model shows both the extent of the possible flooding and the water depth in particular locations.

You can explore the a map showing model outputs in more detail **here.**



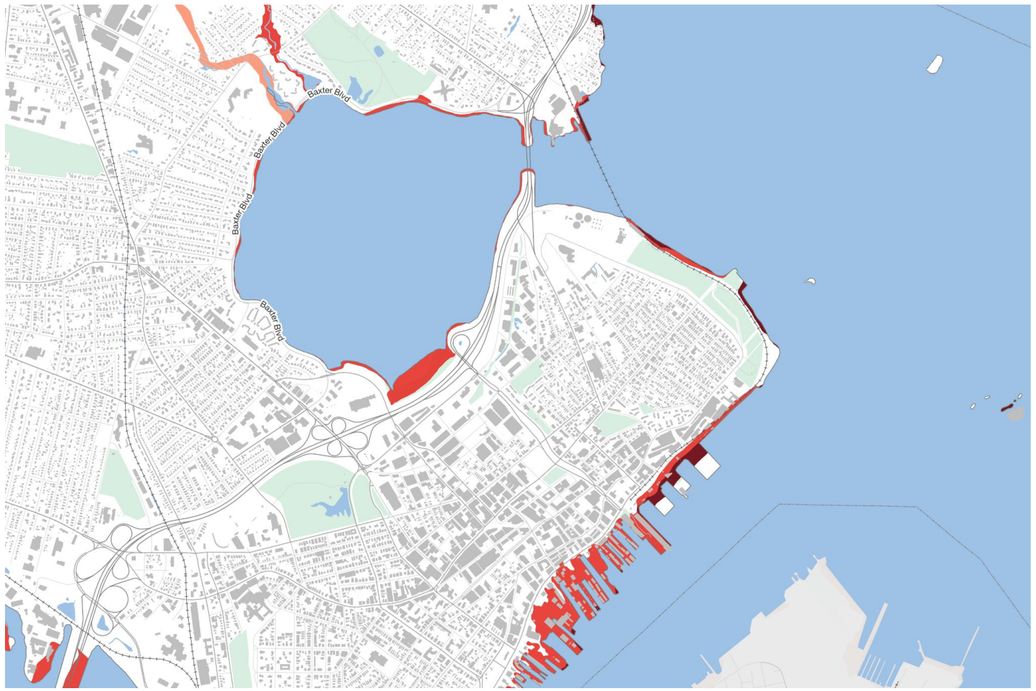
New Modeled Floodplain

100 year flood zone

FEMA vs. Model Comparison

Bayside is the area where the model differs from the FEMA floodplain most significantly, along with the waterfront and Back Cove/ East Deering.

Current FEMA Floodplain

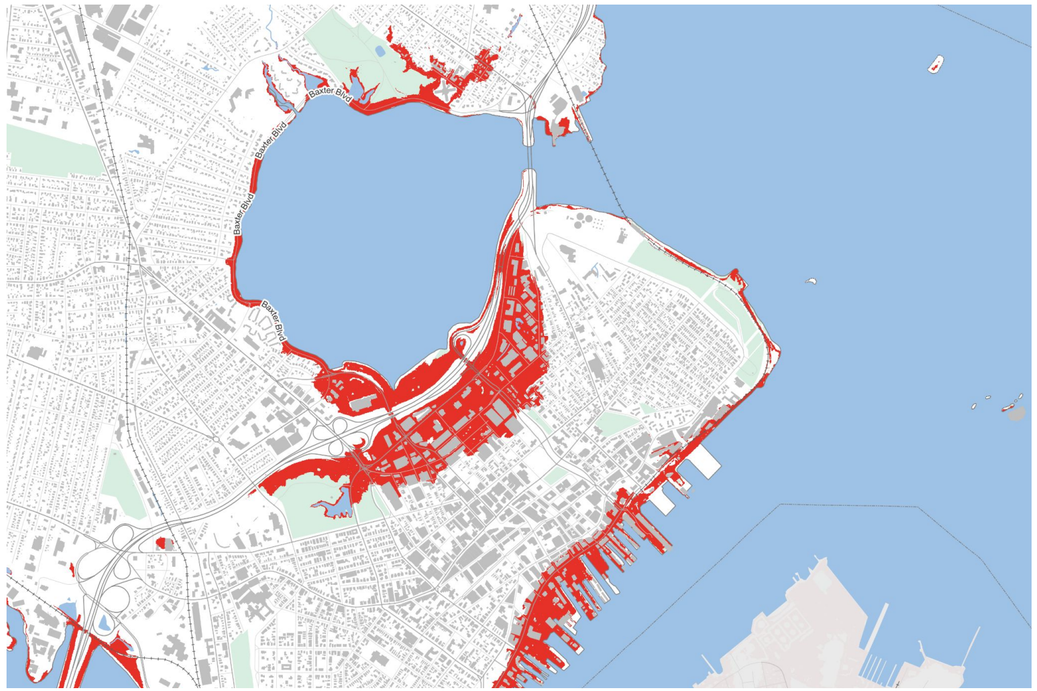


100 year flood zone + wave action

100 year flood zone

500 year flood zone

New Modeled Flood Risk (Explore the map here.)



100 year flood zone

Summary of Proposed Approach: Coastal Flood Resilience Overlay Zone (CFROZ)

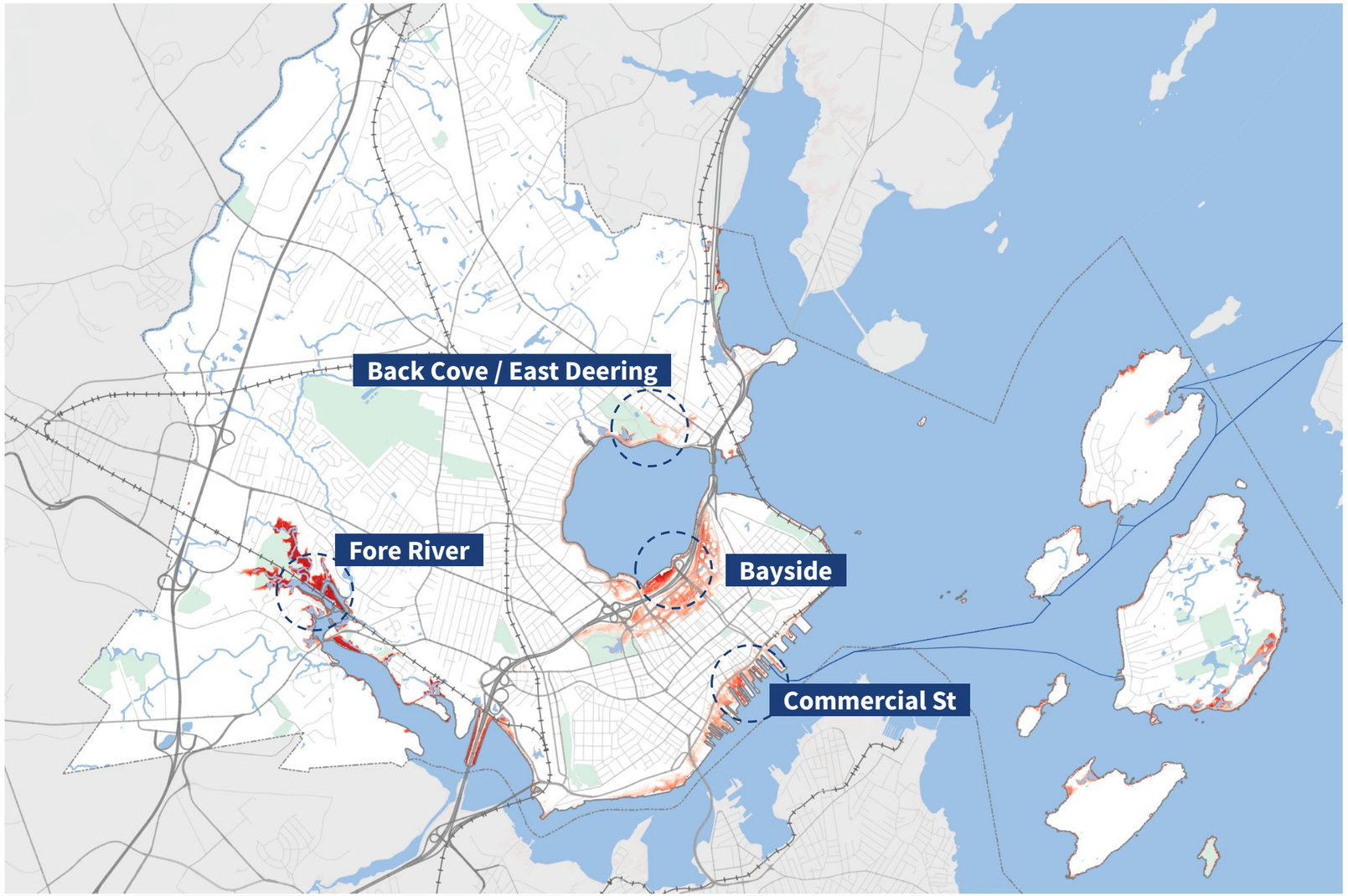
All parcels that intersect with the modeled flood scenario would be included within the overlay zone)

Requirements may include:

- A new higher Design Flood Elevation (DFE) - raising the required level ground floor uses to protect from future increases in flood height
- Increased 2nd floor heights to allow for future adaptation
- Tiered elevation requirements based on the vulnerability of the use
- Some exceptions for renovations and adaptive reuse

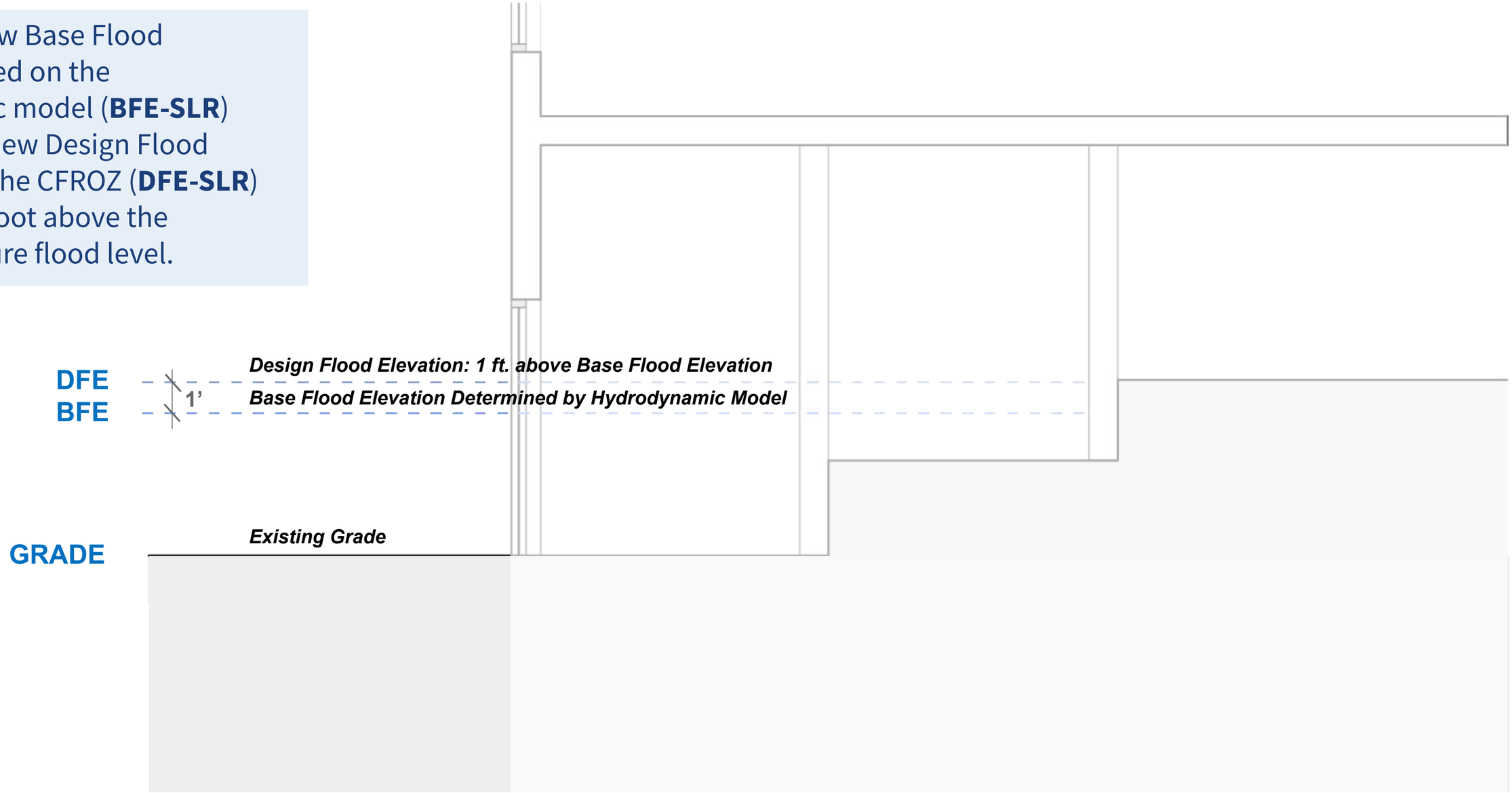
Relationship to FEMA floodplain regulation:

- CFRO would require higher standards for flood protection than FEMA
- The underlying building code requirements of building in a FEMA flood zone would still be applicable.



Proposed CFROZ Approach: Define a New Design Flood Elevation

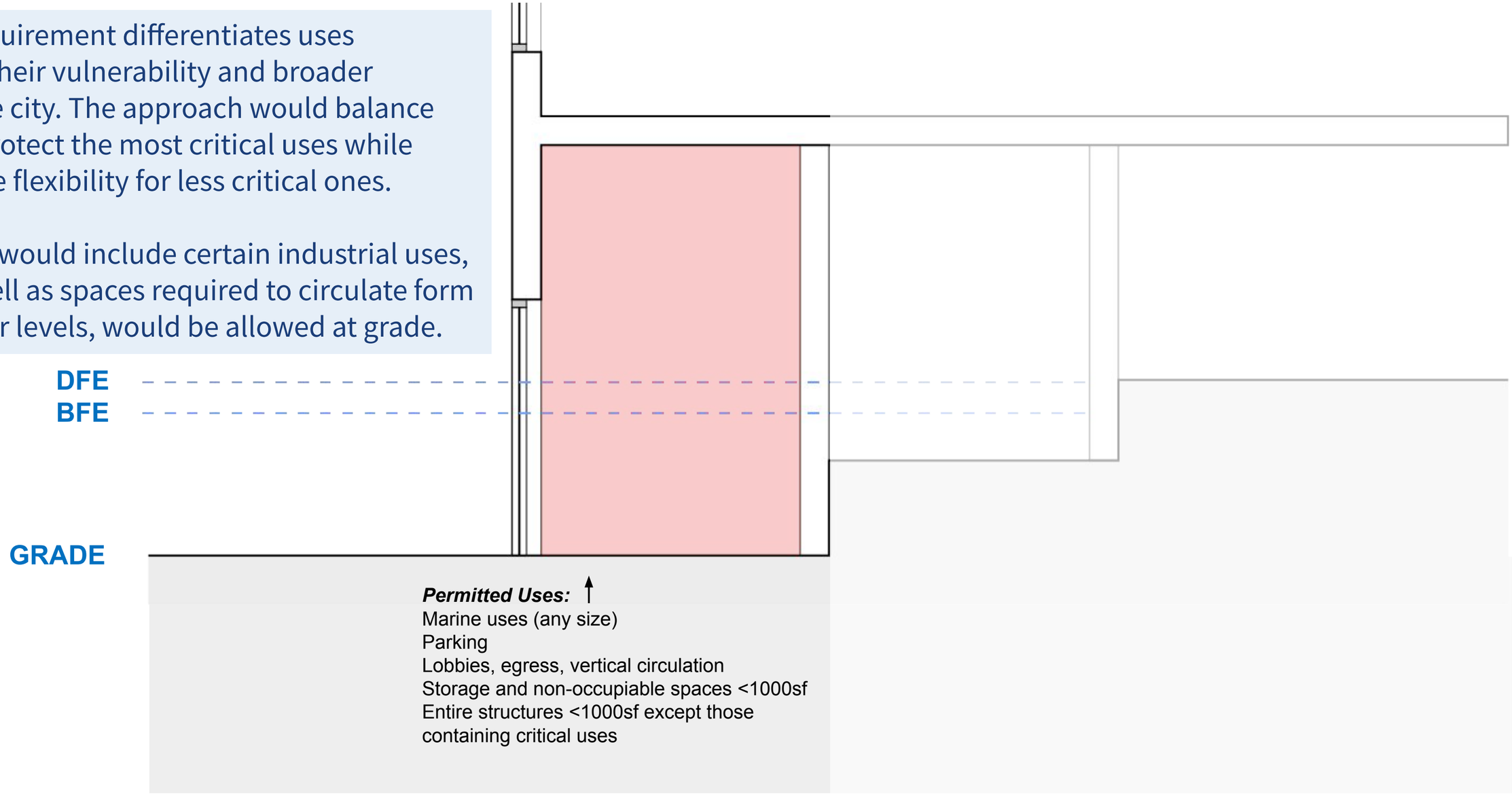
Establish a new Base Flood Elevation based on the hydrodynamic model (**BFE-SLR**) and define a new Design Flood Elevation for the CFROZ (**DFE-SLR**) which is one foot above the predicted future flood level.



Proposed CFROZ Approach: Floor Elevation Based on Use - Exempt Uses

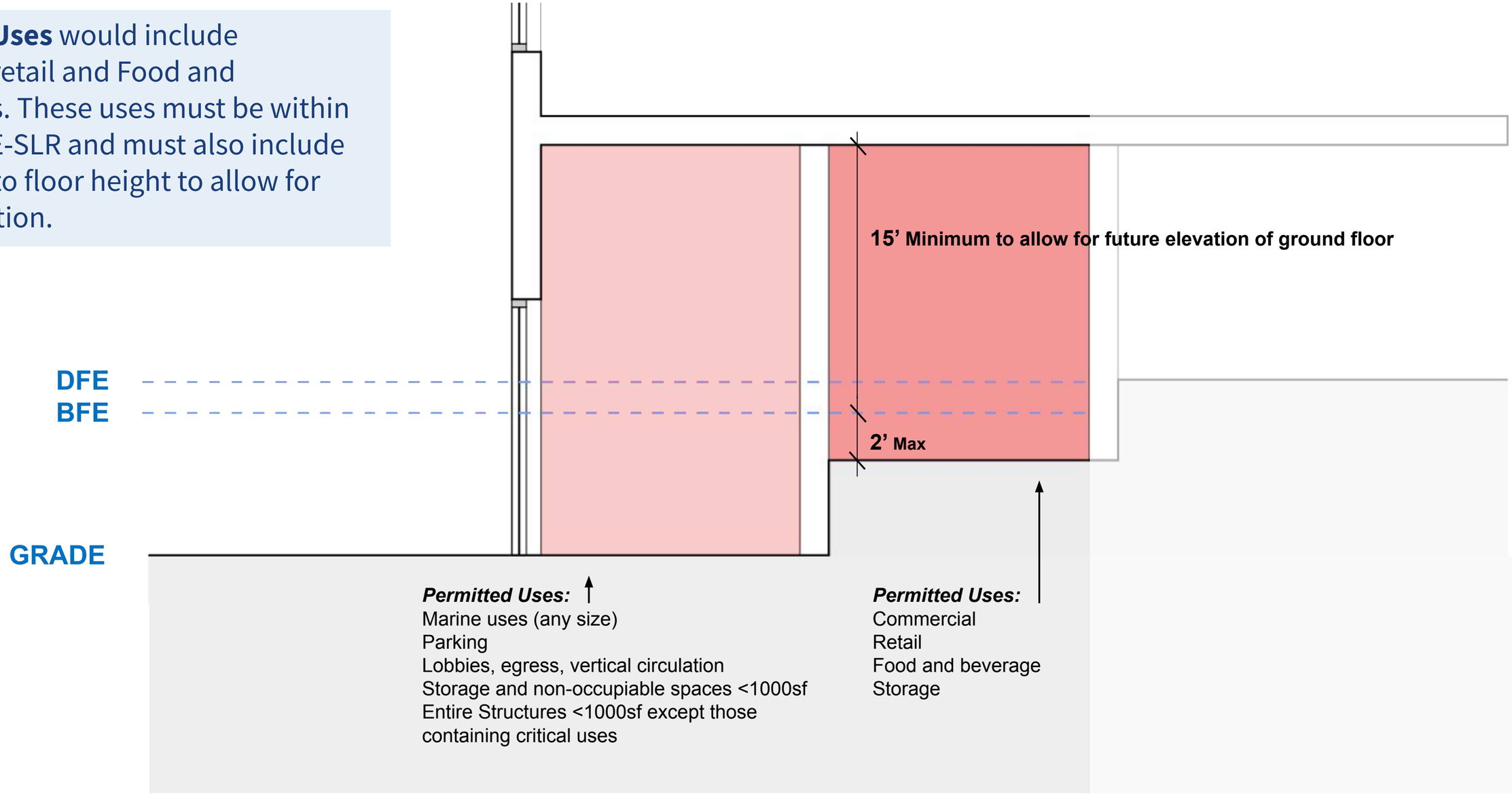
The tiered requirement differentiates uses according to their vulnerability and broader impacts to the city. The approach would balance the need to protect the most critical uses while allowing some flexibility for less critical ones.

Exempt Uses would include certain industrial uses, parking, as well as spaces required to circulate form grade to upper levels, would be allowed at grade.



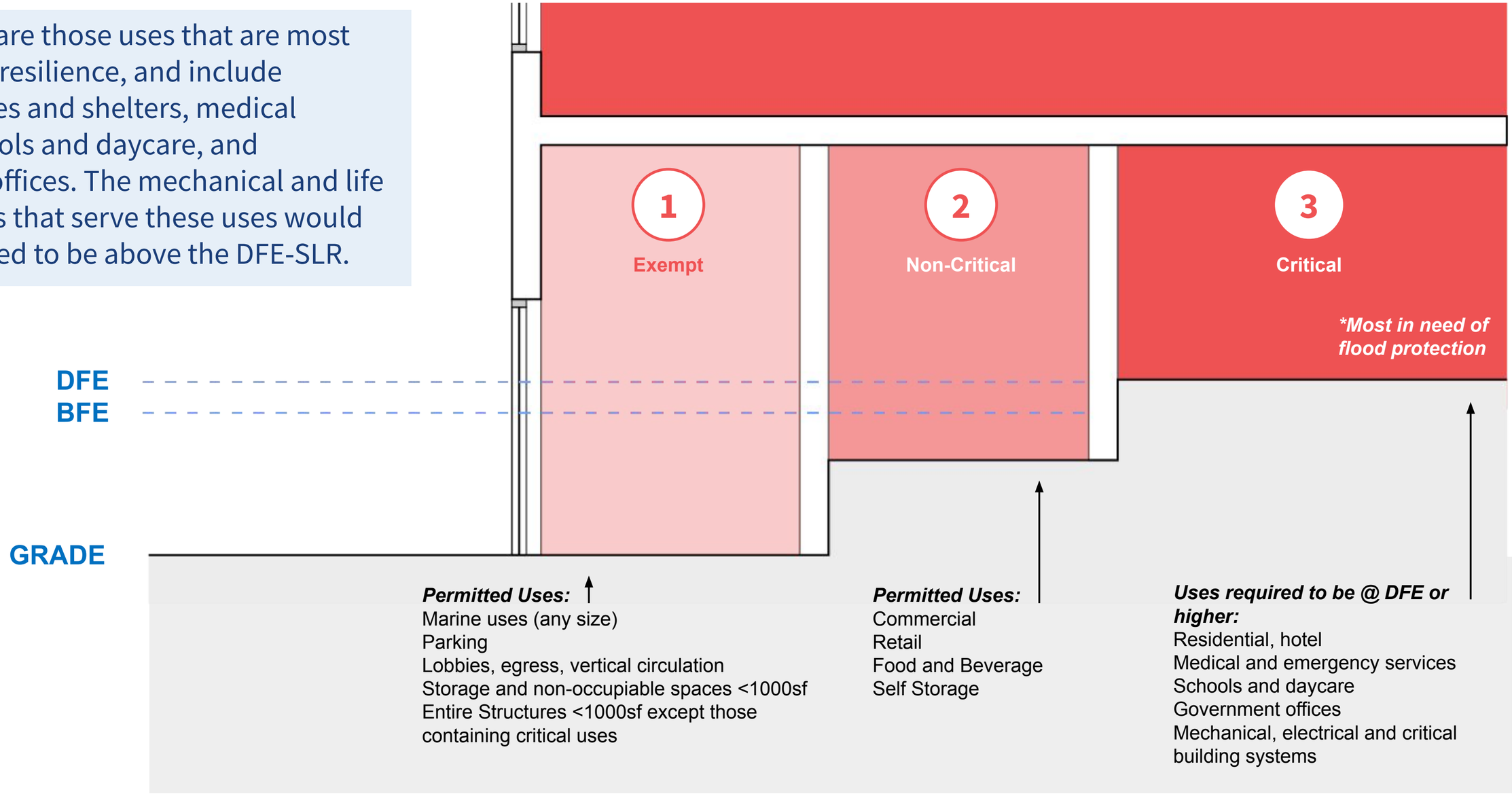
Proposed CFROZ Approach: Floor Elevation Based on Use - Non-Critical Uses

Non-Critical Uses would include Commercial, retail and Food and Beverage uses. These uses must be within 2 ft. of the BFE-SLR and must also include enough floor to floor height to allow for future adaptation.



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

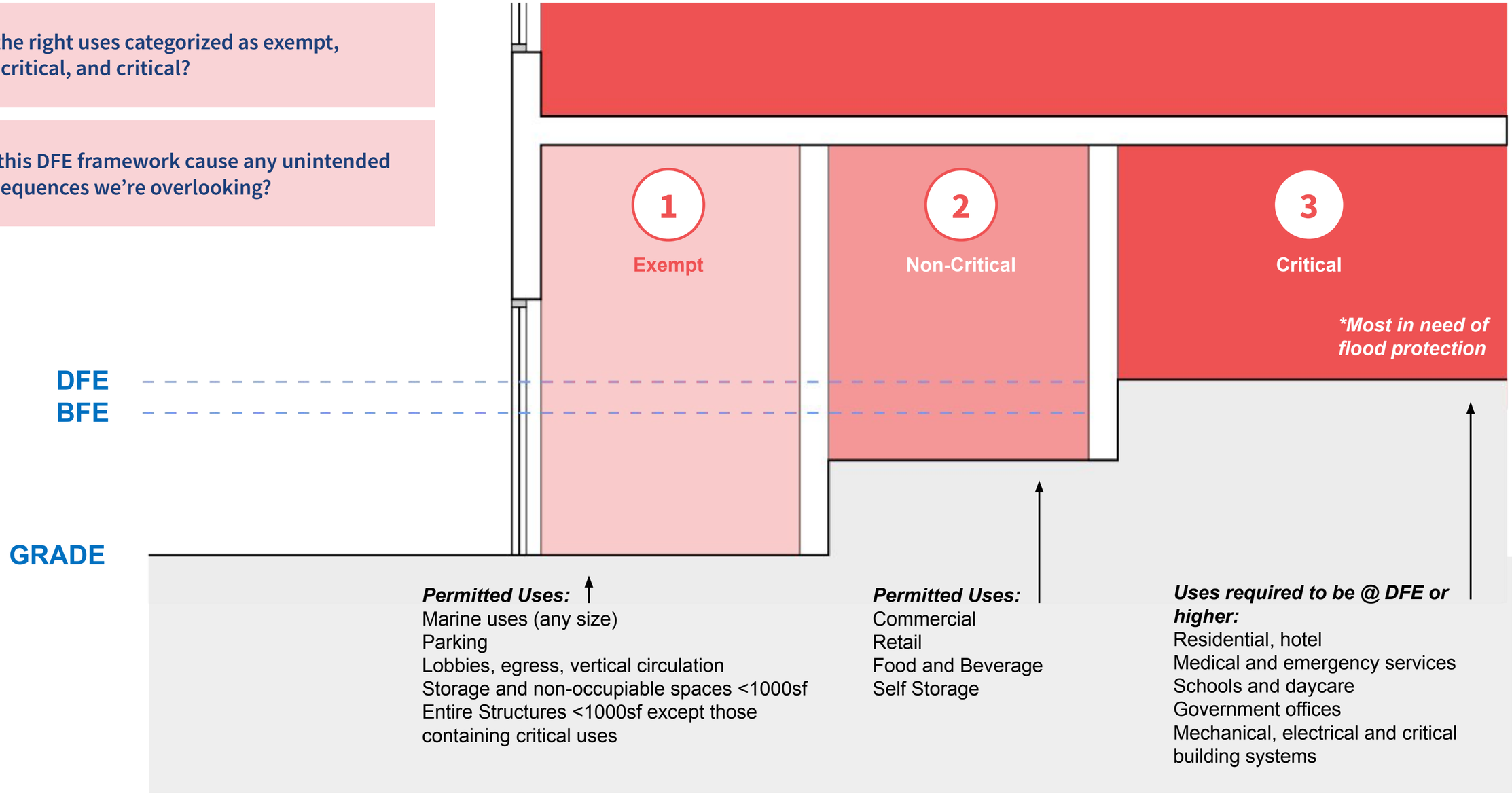
Critical Uses are those uses that are most important for resilience, and include residential uses and shelters, medical services, schools and daycare, and Government offices. The mechanical and life safety systems that serve these uses would also be required to be above the DFE-SLR.



Proposed CFROZ Approach: Define a New Design Flood Elevation

? Are the right uses categorized as exempt, non-critical, and critical?

? Will this DFE framework cause any unintended consequences we're overlooking?

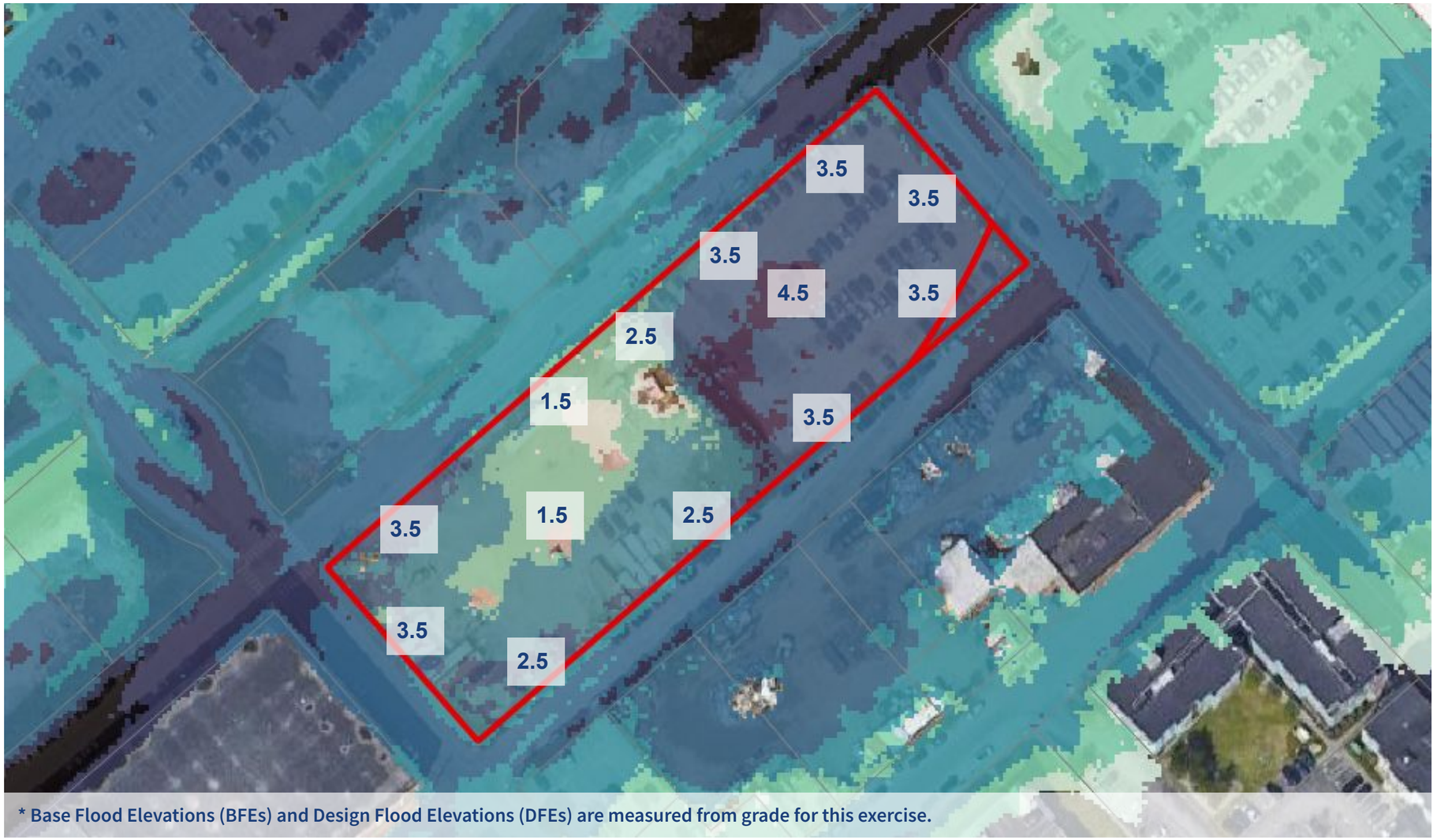


Bayside Case Study

Base Flood Elevations*

53 Kennebec St, shown here as a case study, is currently a mixture of vacant land and surface parking lots and is in the B7 zone.

Estimated flood depths above grade for this parcel **range from 1.5 - 4.5 ft.**



Projected Flood Depth

Assumptions: 100yr flood, 3.9' SLR

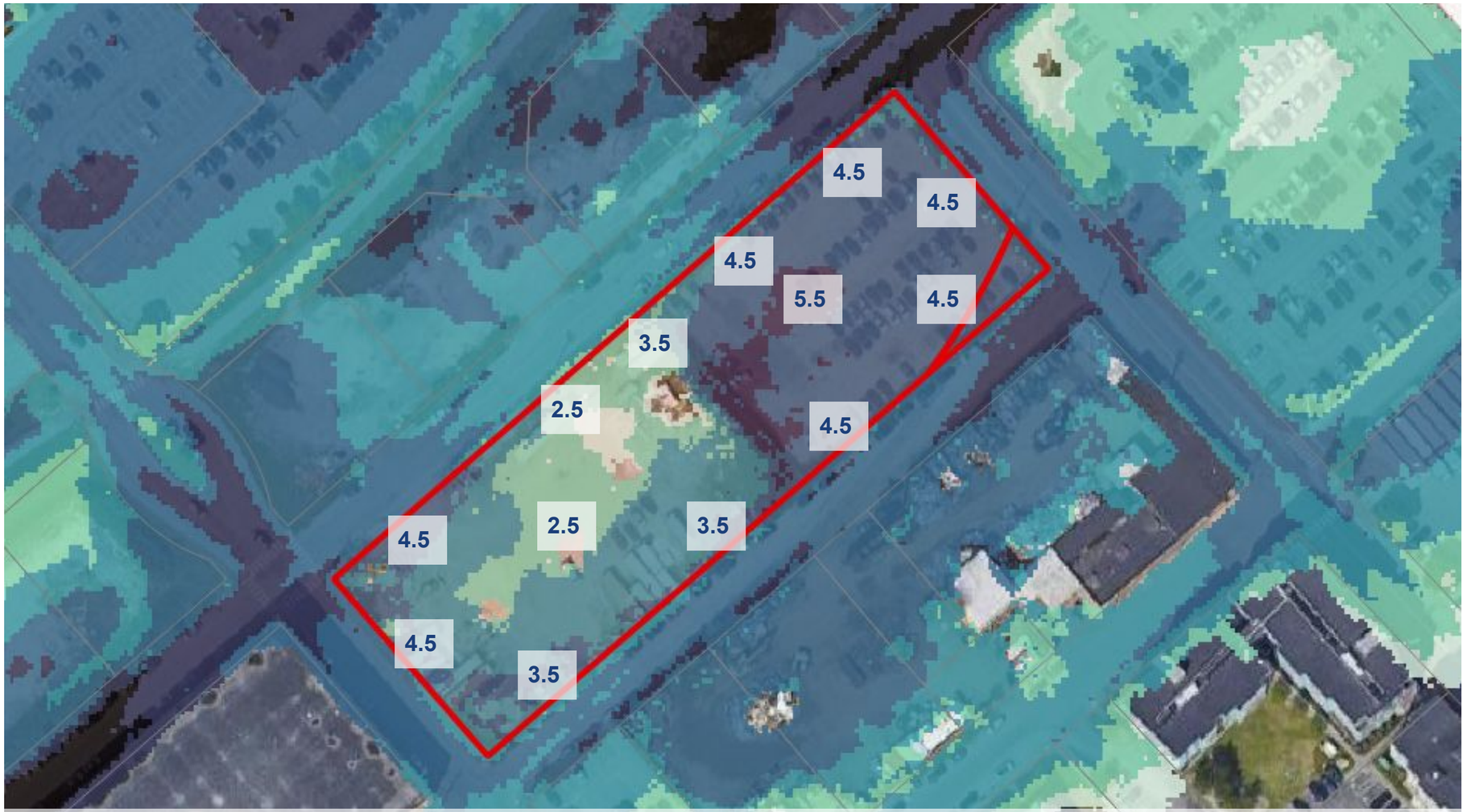
- 1' or less
- 1' to 2'
- 2' to 3'
- 3' to 4'
- 4' to 5'
- 5' or more

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

Bayside Case Study

Design Flood Elevations* for **Critical Uses**

Critical uses (residential, medical, school & daycare, government and mechanical systems) 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.**



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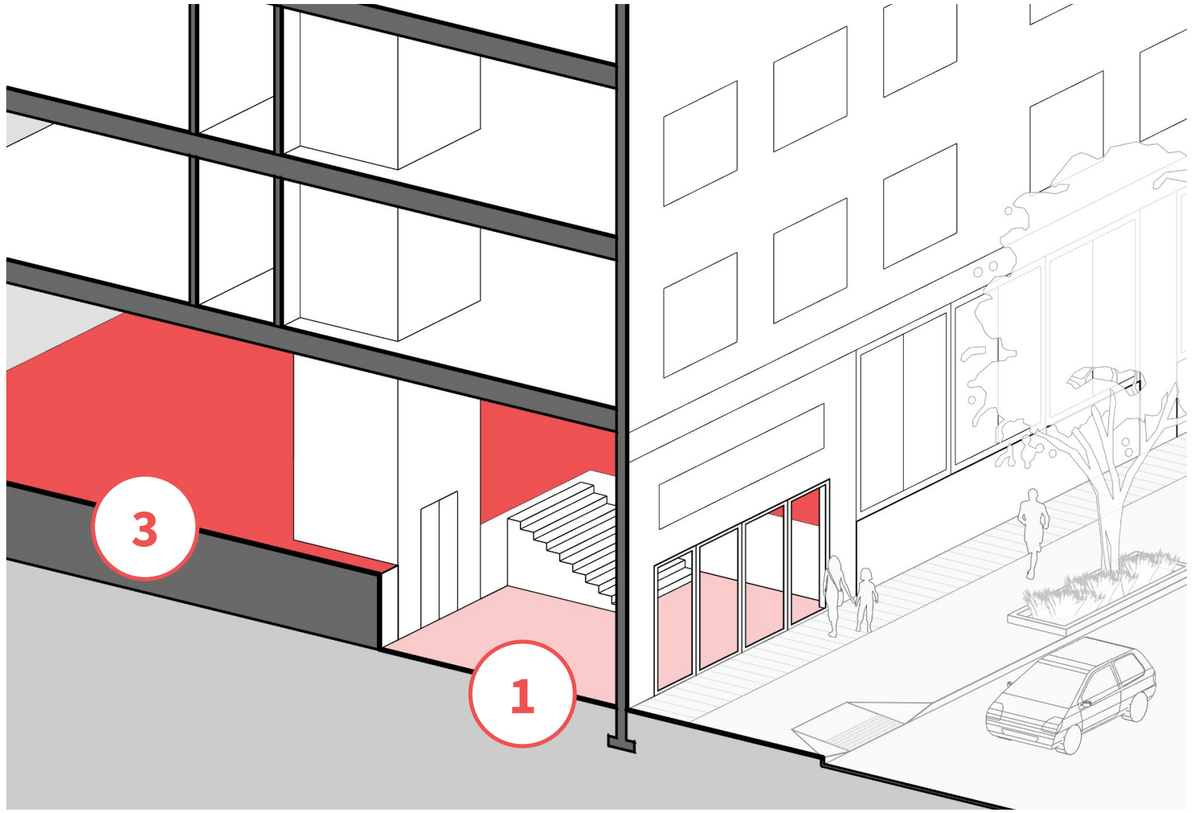
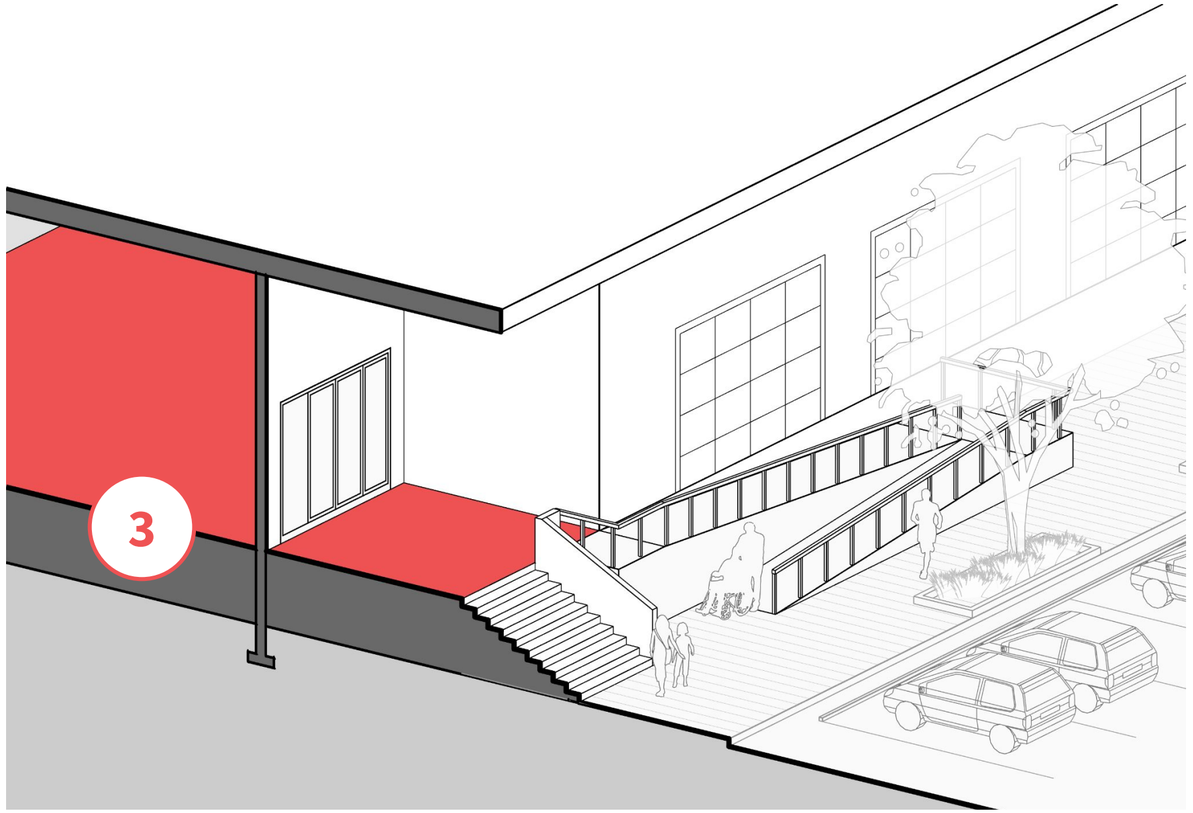
Bayside Case Study

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.

Bayside Case Study

Typical Existing Building Conditions Within the ILb Zone

Many existing buildings in the ILb zone have elevated ground floors. While they were not specifically designed to protect from flooding, they demonstrate how comfortable transitions can be designed

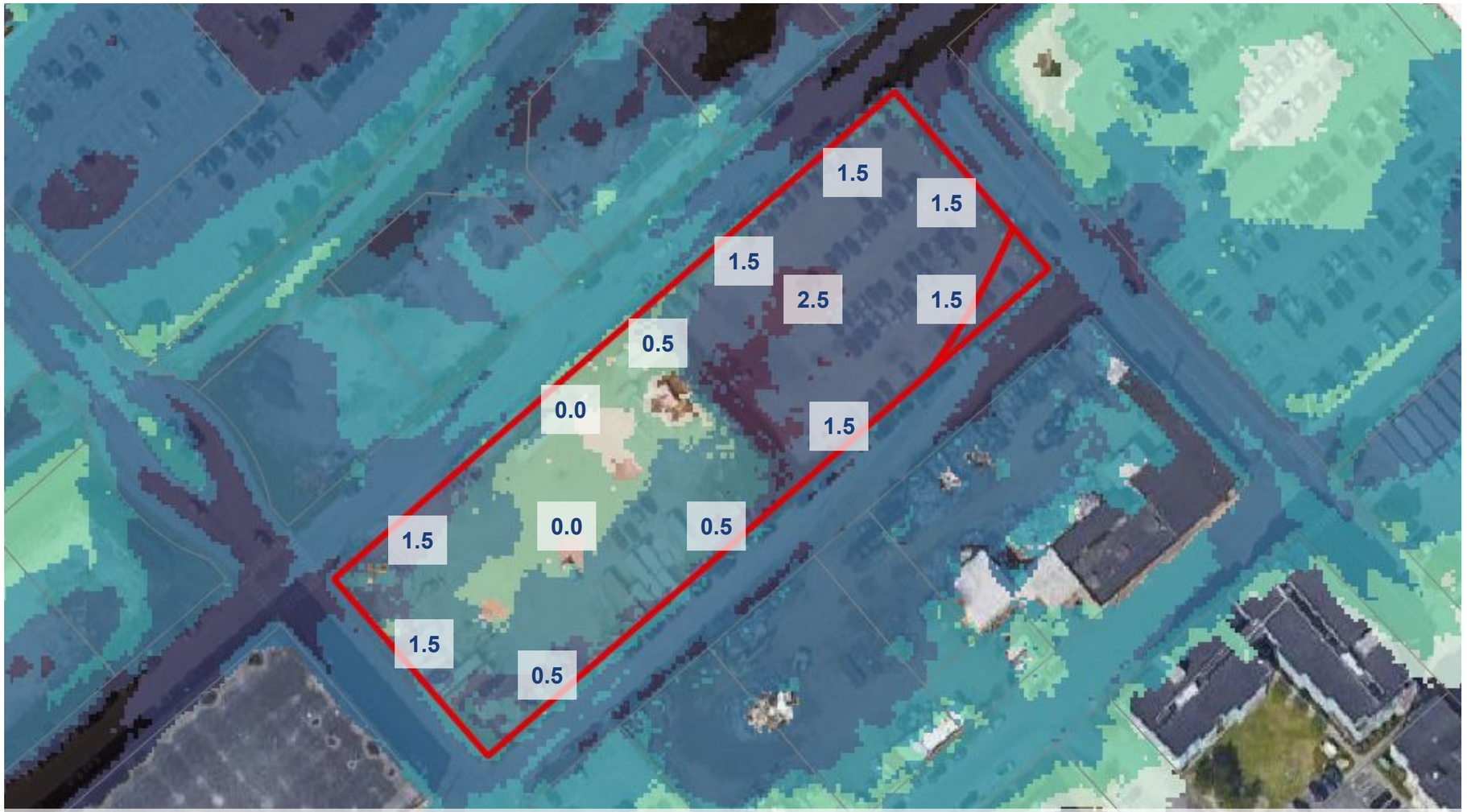
Boston Examples

Elevated ground levels can provide an opportunities to create outdoor seating and/or landscaped edges.

Bayside Case Study

Minimum Elevations* for **Non-Critical Uses**

Non-Critical Uses - Commercial, restaurant or retail, would need to be located no lower than 2’ below BFE-SLR . **This would be approximately 0-2.5 ft. above existing grade.**



Projected Flood Depth

Assumptions: 100yr flood, 3.9’ SLR

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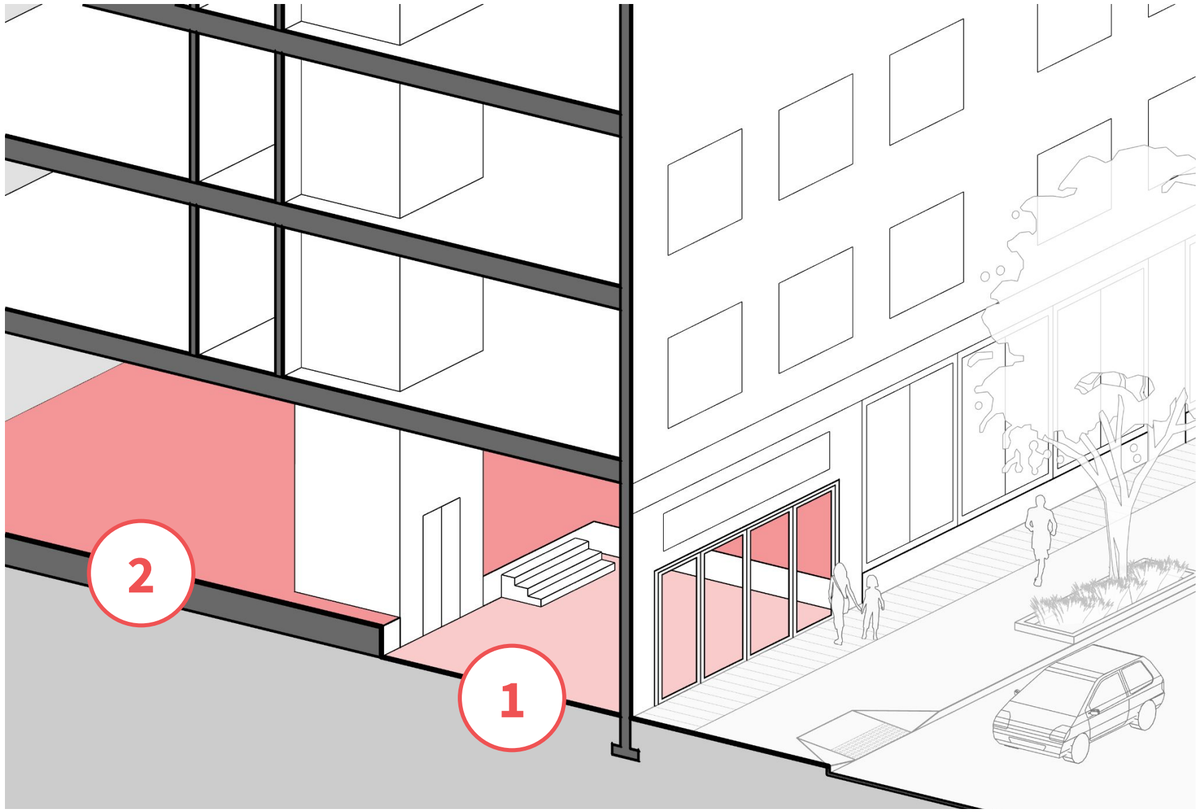
- 2’ to 3’
- 3’ to 4’
- 4’ to 5’
- 5’ or more

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

Bayside Case Study

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



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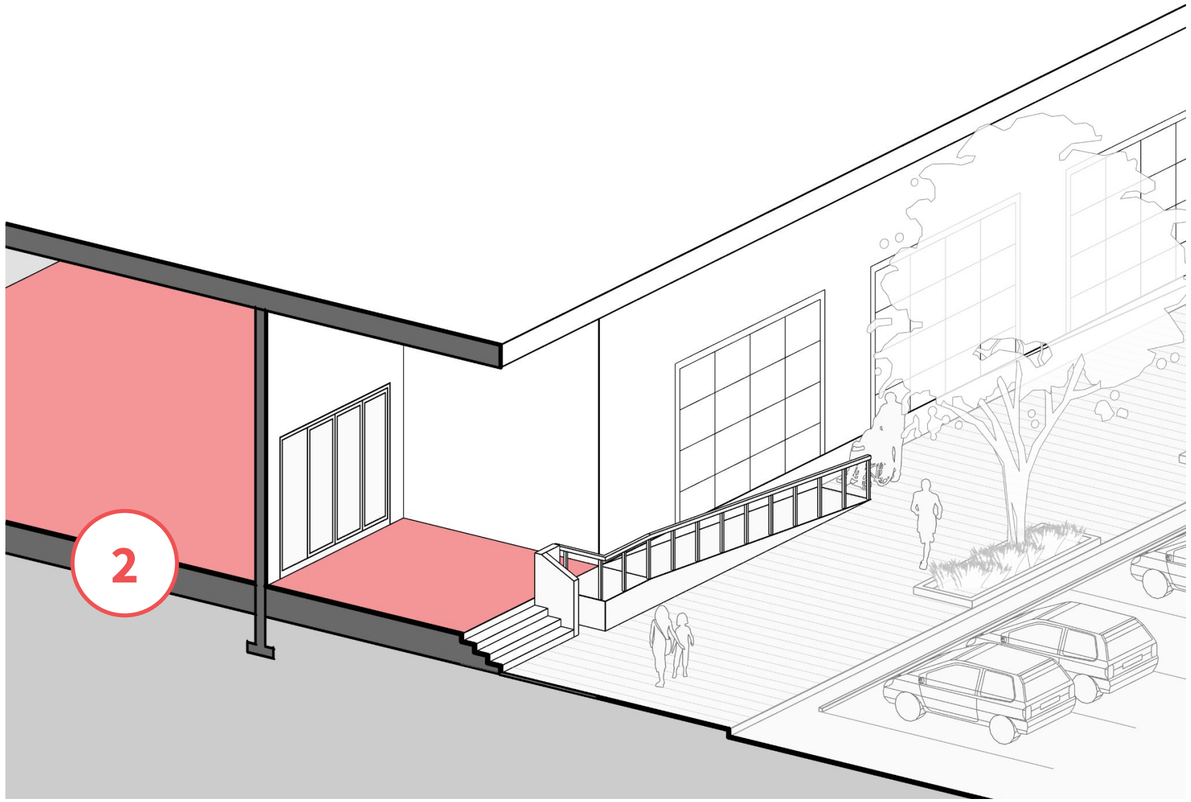


Single-Story Example
Exterior stairs and ramps to a shared entry platform can negotiate the elevation change from grade to the DFE.

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

Boston Example

Design Flood Elevation 2.5’

This example shows a lobby entrance at grade, and an elevated outdoor seating area.

Boston Example

Design Flood Elevation 2.0’

This building shows a ramp that allows visitors and residents to circulate up to the lobby level before entering the building.

?

How do you think these types of design solutions would work in a place like Bayside? Are there impacts we should consider?

Downtown Waterfront

Current FEMA regulations

The Downtown waterfront is currently within a FEMA flood zone and is subject to Federal requirements for flood-resilient structures.

Current Base Flood Elevation + 10’ AE Zone

Current zoning requires 2’ of freeboard, resulting in Design Flood Elevation requirements of approximately 3-5’ above grade on the piers

Downtown Waterfront

New Hydrodynamic Model

The CFROZ would require additional height for Design Flood Elevations for critical uses. While marine/industrial uses would be exempt, underlying FEMA requirements for wet flood proofing and other measures would still apply.

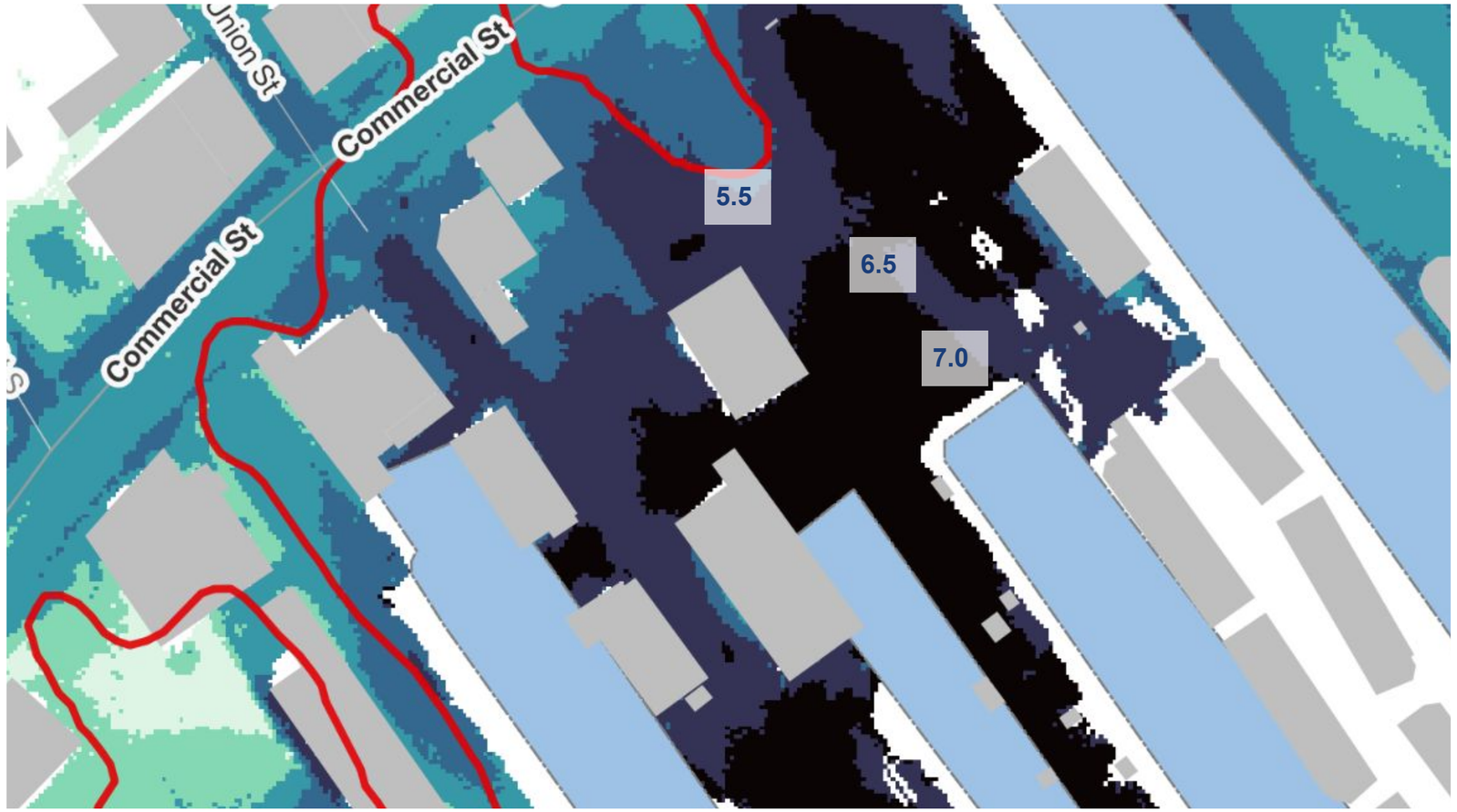
Proposed Design Flood Elevation for critical uses = New Base Flood Elevation + 1.0’ Freeboard
Resulting proposed DFE is approximately 5-7’ above the level of the piers.

— Current 100yr FEMA Floodplain

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

? How do you think the DFE framework would work with Portland’s mix of waterfront uses? Are there impacts we should consider?



Proposed Approach: Applicability of the CFROZ

What types of development activity would be subject to the CFROZ?

? **Are we setting the thresholds for the DFE requirements at the right levels?**

Type of Development	Containing Critical Uses	Containing Non-Critical Uses
New Construction	All development	All development larger than 1,000 sf
Additions	All additions larger than 1,000 sf	All additions larger than 1,000 sf
Change of Use	All portions of the building containing a critical use and the critical systems supporting that use	Exempt
Substantial Renovation without a Change of Use	All substantial renovations larger than 50,000 sf	All substantial renovations larger than 50,000 sf

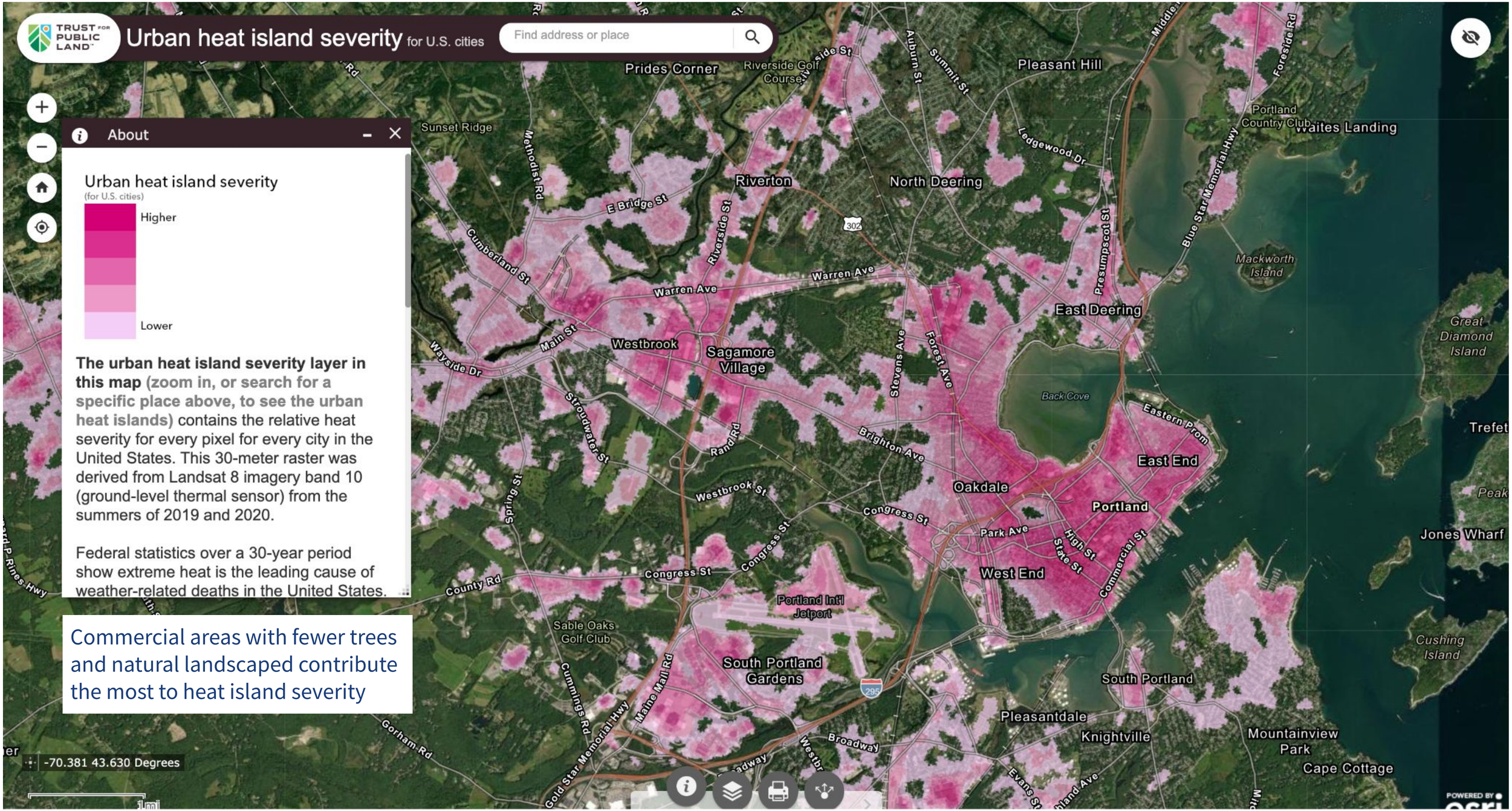
Risk Factor 2: High Heat

Goal

- Mitigate negative effects of increasingly extreme heat, especially for sites within existing heat island effect areas

Approach

- Add new standards for landscape, impervious areas, and large roof areas into site plan review


TRUST FOR PUBLIC LAND
Urban heat island severity for U.S. cities
Find address or place
About
Urban heat island severity
(for U.S. cities)
Higher
Lower
The urban heat island severity layer in this map (zoom in, or search for a specific place above, to see the urban heat islands) contains the relative heat severity for every pixel for every city in the United States. This 30-meter raster was derived from Landsat 8 imagery band 10 (ground-level thermal sensor) from the summers of 2019 and 2020.
Federal statistics over a 30-year period show extreme heat is the leading cause of weather-related deaths in the United States.
Commercial areas with fewer trees and natural landscaped contribute the most to heat island severity
-70.381 43.630 Degrees
Prides Corner
Riverside Golf Course
Pleasant Hill
Sunset Ridge
Riverton
North Deering
Portland Country Club
Waites Landing
Mackworth Island
East Deering
Great Diamond Island
Westbrook
Sagamore Village
Back Cove
East End
Oakdale
Portland
West End
Jones Wharf
Trefethen
Portland Int'l Jetport
Sable Oaks Golf Club
South Portland Gardens
South Portland
Pleasantdale
Knightville
Mountainview Park
Cape Cottage
Cushing Island
Peaks
Methodist Rd
E Bridge St
Riverside St
Cumberland St
Warren Ave
Ledgewood Dr
Presumpscot St
Blue Star Memorial Hwy
Main St
Wayside Dr
Stroudwater St
Rand Rd
Brighton Ave
Eastern Prom
Stevens Ave
Forest Ave
Spring St
Westbrook St
Congress St
Park Ave
High St
State St
Commercial St
County Rd
Maine Mail Rd
Cummings Rd
Gorham Rd
Broadway
Evans St
Foreside Rd
Auburn St
Summit St
302
295

Proposed Approach: High Heat

Portland already has measures in place for mitigating heat, including tree planting requirements in paved parking areas and along sidewalks.

The proposed approach is to refine and enhance these standards in each of these three categories:

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

Proposed Approach: High Heat

1. Enhance Requirements for Tree Canopy in Parking Areas

Continued Street Tree Requirements:

- One street tree per residential unit or one street tree per 25-35 linear feet of frontage for other uses (existing requirement to be continued)

New Proposed On-Site Requirements:

- **1 small tree for every 750sf of asphalt paving** (including parking areas and drive aisles)
  - canopy spread of at least 8’ to 15’
  - 1” caliper trunk
  - 600 cubic ft. of soil per tree

Proposed Exemptions:

- Parking areas of less than 5 parking spaces
- Areas shaded by canopies or other structures

? **Will these tree requirements have any unintended consequences we should be aware of?**

Source: *Penn State Extension, Green Parking Lots Mitigating Climate Change and Urban Heat Island, see link.*

Proposed Approach: High Heat

1. Enhance Requirements for Tree Canopy in Parking Areas

The proposed new standards relies on total amount of paved area as opposed to the number of parking spaces. This more accurately captures the impacts of both parking areas and drive aisles.

Existing Standard (2 trees/5 parking spaces)
25 Parking Spaces
10 Trees Required

Proposed Standard (1 tree/750sf)
7,560 sf bituminous concrete
10 Trees Required

Existing Standard (2 trees/5 parking spaces)
22 Parking Spaces
10 Trees Required

Proposed Standard (1 tree/750sf)
12,800 sf bituminous concrete
17 Trees Required

Proposed Approach: High Heat

2. Adopt New Standards for Landscape + Hardscape

To minimize its contribution to heat island effect, paving for pedestrian areas would be required to be generally light in color by meeting a minimum Solar Reflective Index (SRI).

Proposed Requirements:

- All paving for non-vehicular use must have either
  - Solar Reflectance Index **(SRI) of 33+ initially** and 28+ once aged 3 years
    - or -
  - Plant **1 small tree for every 750sf of asphalt paving** per prior tree canopy requirement (see previous)
- All planted landscaped areas must have a minimum of **8" soil depth and vegetative cover** to ensure long term health of plantings and their ability to protect from heat absorption.

Proposed Exemptions:

- Areas underneath awnings or other covering

*Typical concrete paving has an SRI of approximately **35-45***

? **Will these requirements have any unintended consequences we should be aware of?**

Proposed Approach: High Heat

3. Adopt New Standards for Buildings + Roofs

Dark roofing materials can also contribute to heat island effect. The proposed measures would only apply to new construction and would require new development to use “cool roof” materials.

Proposed Requirements:

- A minimum of **75% of the roof area** measured horizontally meets “cool roof” Solar Reflectance Index (SRI):
  - Roofs with a **slope less than 2:12 - SRI of 82+ (initial)** / 64+ (3-year aged)
  - Roofs with a **slope greater than 2:12 - SRI of 25+ (initial)** / 25+ (3-year aged)

Proposed Exemptions:

- Developments or additions with an aggregate **roof area less than 2,000 sf** measured horizontally
- Residential uses containing **9 units or less**
- Roof area covered by **shade structures with a Solar Reflectance Index (SRI) of 39+** (photovoltaic panels that shade the roof will be considered to meet this requirement)

? **Will these cool roof requirements have any unintended consequences we should be aware of?**

Cool Roofs are very common for larger commercial and multifamily buildings. They are already required for commercial buildings in the Maine State Energy Code.

Risk Factor 3: Stormwater

Goals

- Reduce stormwater runoff and increase on-site detention/infiltration
- Extend further protections for wetlands, riparian and riverine buffer areas, and urban impaired streams
- Design with capacity of existing infrastructure in mind

Approach

- Simplify standards and refine requirements to address key issues around storage, infiltration, and treatment

Existing Stormwater Regulations

New Development

Projects that create >1,000 square feet of impervious area or 10,000 square feet of new non-impervious developed area must:

- Detain/retain/infiltrate to match or improve pre-development flow rates for the 2-, 10-, and 25-year storm, and
- Treat ≥95% of impervious area and ≥80% of developed area

Redevelopment

Projects that create >5,000 square feet of non-roof impervious area must:

- Detain/retain/infiltrate to match or improve pre-development flow rates for the 2-, 10-, and 25-year storm, and
- Treat 50% of the redeveloped impervious area

Proposed Approach: Stormwater

Using existing site plan ordinance and *Technical Manual* to:

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**

Source: *Portland Press Herald*

Proposed Approach: Stormwater

1. Simplify Thresholds Across All Development Types + Manage Connections to Existing System

Require:

- **Same treatment for new development and redevelopment:**
  - 95% of new and non-roof redeveloped impervious area >1,000 square feet
  - 80% of new developed area
- All new connections to storm drain system to:
  - **Slow rate of stormwater runoff** from site to 0.1 cubic feet per second (CFS) for combined sewers or 0.5 CFS for separated storm drain system
  - **Detain or infiltrate 1”of rainfall** across total impervious area

Source: *University of Southern Maine*

? **Do these standards have unintended consequences we should be aware of?**

Proposed Approach: Stormwater

2. Increase Natural Resource Protections

- **Prohibit wetland fill** in Coastal Flood Resilience Overlay Zone with some exemptions for climate adaptation and **avoid wetland impacts** in other areas, if possible
- **Require wetland replacement** for ≥ 500 square feet of wetland fill.
- Require smaller residential projects to meet Urban Impaired Stream standards.

? Do these standards have unintended consequences we should be aware of?

Proposed Approach: Stormwater

3. Enhance Standards for Smaller Residential Projects

Establish new, simplified approach for smaller residential projects (<5,000 square feet of new impervious area) by:

- **Standardizing requirements** using a menu of pre-engineered options with specific design submission requirements
- **Expanding stormwater credit incentive**
- **Providing clear guidance on** appropriate **best management practices**

Source: *Rain Barrels, Jennifer C. 2013 Flickr*

? **What information would you like to know more about to make your property more resilient to stormwater impacts?**

Any last comments? Did we miss anything?

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Is there anything else you'd like to share with us after reviewing Portland's draft approach to resilience zoning?

Thank you for taking the time to review this and share your input!