



Boston Coastal Flood Resilience Zoning Overlay

Virtual Public Meetings: January 13 & 15, 2021



**boston planning &
development agency**

Coastal Flood Resilience Zoning Overlay



boston planning & development agency

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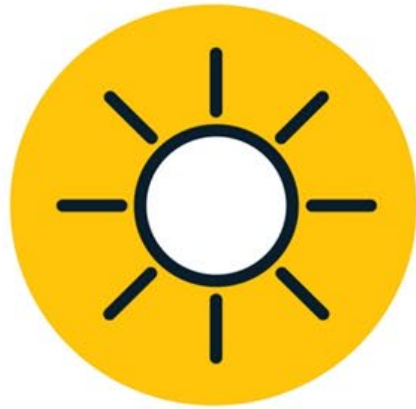
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Climate Ready Boston

**EXTREME
TEMPERATURES**



HEAT

**EXTREME
PRECIPITATION**



**STORMWATER
FLOODING**

SEA LEVEL RISE



**COASTAL & RIVERINE
FLOODING**

**COASTAL
STORMS**



Climate Ready Vulnerability Assessment

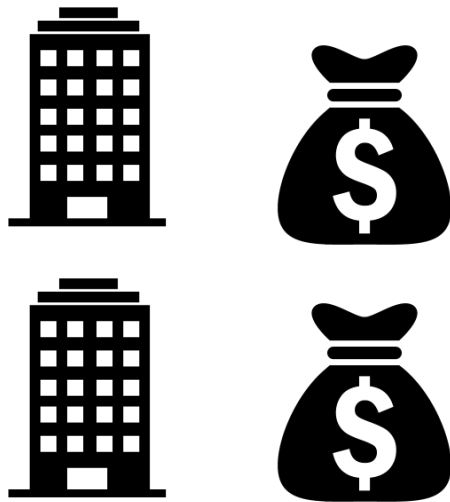
People and Buildings Exposed to a 1% Flood Risk

Boston is the world's **8th most vulnerable city** to financial loss from sea level rise, and **4th** in the US.

18,000
PEOPLE

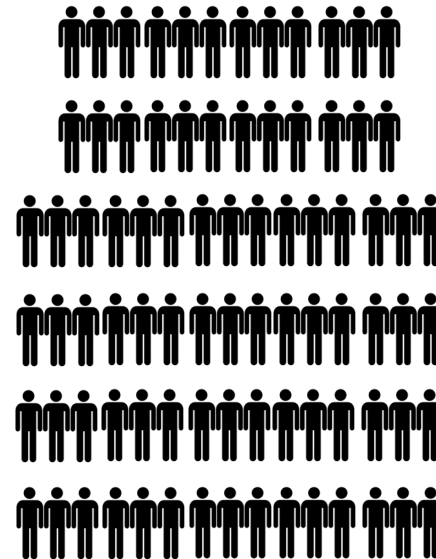


2,000 BUILDINGS
(Worth \$20B)

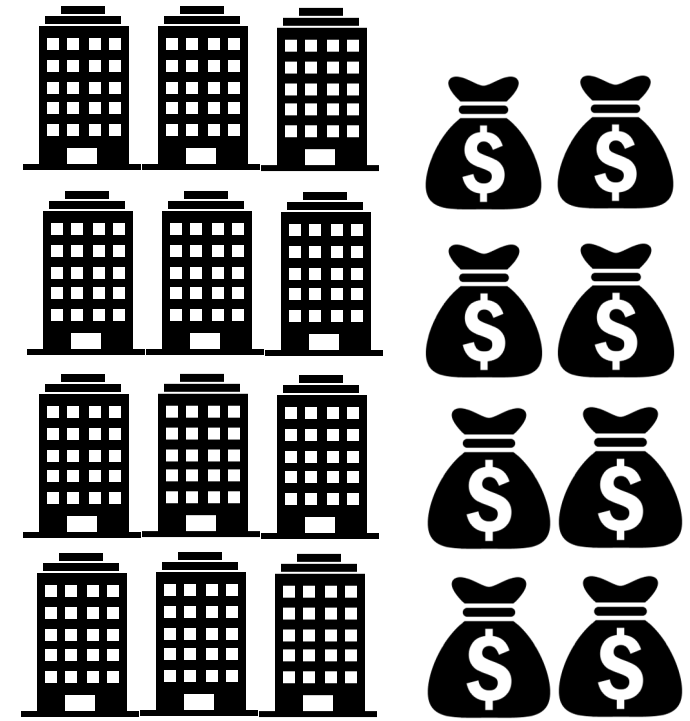


2030+

85,000
PEOPLE



12,000 BUILDINGS
(Worth \$85B)



2070+

Climate Ready Resilience Initiatives



UPDATED CLIMATE PROJECTIONS

Ensure that decision making in Boston is informed by the latest Boston-specific climate projections.



PREPARED AND CONNECTED COMMUNITIES

Support educated, connected communities in pursuing operational preparedness, adaptation planning, and emergency response.



RESILIENT INFRASTRUCTURE

Prepare the infrastructure systems that support life in Boston for future climate conditions and create new resilient systems.



ADAPTED BUILDINGS

Create a regulatory environment and financial and other tools to promote new and existing buildings that are climate ready.



PROTECTED SHORES

Reduce Boston's risk of coastal and riverine flooding through both nature-based and hard-engineered flood defenses.

Coastal Resilience Design Guidelines & Zoning - Objectives



Zoning

- Protect against risks to life safety and property damage, and conserve the value of land and buildings.
- Ensure existing zoning does not inhibit resilient design and upgrades.
- Specific zoning definitions, dimensional and use provisions to facilitate resilience.



Guidelines Document

- Provide specific design direction on implementing resilience measures for new construction and retrofits.
- Illustrate flood protection measures in Boston context.
- Guide development in Zoning Overlay

Coastal Resilience Design Guidelines & Zoning - Process

Advisory + Outreach

- *City progress presentations*
- *Advisory Groups / Focus Groups*
- *Community Forums and Consensus Building*

Zoning Research + Recommendations

- *Precedents: National and Regional*
- *Research potential conflicts*
- *Relationships w/ Art. 80 Design Rev.*

Design Guidelines Development

- *Research resiliency best practices (FEMA, local, national)*
- *Identify primary building typologies*
- *Develop illustrative case studies for new construction and retrofits*



Design Guidelines



Zoning



Coastal Resilience Design Guidelines

Guidelines - Resilient Design Principles

Use Resiliency Best Practices

Proposed designs / renovations should incorporate best practices and standards to reduce or eliminate coastal flood risk or damage resulting from future climate conditions.

Generate Co-benefits

Wherever feasible, proposed flood resiliency upgrades should also enhance a building's energy efficiency, greenhouse gas reduction potential, and passive survivability.

Enhance the Public Realm

Resilient measures should be designed to not to diminish the pedestrian environment to the greatest extent possible by supporting pedestrian connections and enhancing the character of the Overlay parcels.

Relate to District Scale Solutions

Enhancements at a plot level should not worsen risk at adjacent parcels or restrict future implementation of larger coastal resilience district plans, and, to the extent feasible, should support the resiliency goals and implementation of district coastal resilience plans.

Guidelines

Coastal Resilience Design Guidelines

II. Design Guidelines | Building Form | Building Envelope and Access | **Building Systems** | District-scale Strategies | Supporting Strategies

Protect Critical Systems

Building utility systems, including electrical and mechanical equipment, should be protected from flood risk to avoid costly damage, safety risks, and loss of habitability and other critical building functions during a flood event. This should be among the highest priority resilience actions for property owners.

For all new construction and substantial improvements, electrical, heating, ventilation, plumbing and air-conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding. These systems and equipment include:

Mechanical

- Boilers and furnaces
- Air-handlers, condenser units, and heat pumps
- Ductwork and piping
- Fuel storage tanks
- Water heaters
- Fire-suppression sprinkler controls
- Elevator machine rooms

Electrical

- Electrical panels and switchgear
- Backup generators
- Alarm controls and components
- Service wiring and receptacles
- Building management systems
- Telecommunications equipment
- Electric and gas meters
- Utility shut-off switches

With proper planning, new buildings can easily accommodate the protection of critical systems by locating equipment in upper floors or in a mechanical penthouse. For renovation projects, the three main types of protection are elevation, relocation, and protection in place.

- Elevate:** Outdoor equipment or ground floor equipment located in spaces with high ceilings can usually be elevated on pedestals or platforms to bring the systems above the flood elevation.
- Relocate:** Depending on the available space within an existing building, service equipment from a basement or other area below the flood level can be relocated to an upper floor to bring the equipment and distribution systems above the flood elevation.
- Protect in place:** When elevating and relocating are not practical or feasible, the last option to increase the resilience of critical systems is to protect them in place. This includes elevating to the greatest extent

Applicability

Project Scale Non-Art. 80 renovations and new construction, Art. 80 renovations and new construction

possible and dry floodproofing with low floodwalls and shields and with anchors and tie downs to prevent flotation.

Sustainability Co-benefits Considerations

- When replacing equipment, choosing high-efficiency models can reduce energy use, utility bills, and emissions of greenhouse gases and other pollution. It also reduces strain on the energy grid, making the whole system more resilient. This is exemplified in the case of replacing an old sub-grade furnace with a more fuel-efficient electric heat pump system, located above the SLR-DFE.
- Electrification of heating systems, in combination with choosing clean sources of electricity and implementing energy efficiency improvements, will support Boston's efforts to achieve carbon neutrality.

Cost and Insurance Considerations:

\$ \$\$ \$\$\$ \$\$\$\$

- In FEMA V zones, elevating mechanical equipment is required for NFIP premium reduction.
- Relocating/Replacing critical utilities is also an opportunity to upgrade and increase the energy efficiency of a building's systems, which may lead to a reduction in annual utility costs.

Additional Resources

- FEMA 348: Protecting Building Utilities From Flood Damage
- FEMA P-312, Homeowner's Guide to Retrofitting
- A Better City Report, Enhancing Resilience in Boston: A Guide for Large Buildings and Institutions
- FEMA Recovery Advisory 2: Reducing Flood Effects in Critical Facilities

City of Boston Flood Resilience Design Guidelines

Technical Considerations

Repair and Replacement
Use natural cycles of repair and replacement as opportunities to improve the flood resilience of building utility systems and equipment. For example, replacing an old furnace in the basement with a more compact mini-split heat pump can improve efficiency, reduce fossil fuel use, and make relocating or elevating heating and cooling systems more feasible in space-constrained buildings.

Energy Audits
Building owners should conduct an energy audit to identify opportunities for improvements in energy efficiency to coincide with resilience upgrades. This is not only limited to replacing old equipment with higher-efficiency models. An energy audit can reveal how upgrades to the building envelope can reduce heating and cooling loads, which can result in equipment down-sizing in addition to added efficiency.

Utility Coordination
Coordinate with the local utility company when planning modifications to the placement of electric and/or gas meters.

Protecting in Place
If protecting in place is the most feasible option, watertight walls and shields are most practical when flood depths are less than 3'. Utilize a watertight closure panel if a flood wall is too high to step-over. Utilize anchors and tie-downs to hold equipment in place.

Elevating Equipment
When relocating or elevating MEP systems, consider horizontal and vertical clearances for routine maintenance; venting requirements for combustion equipment; drain pans for equipment containing water storage to prevent leakage; and provisions to prevent equipment from freezing.

Coastal Resilience Design Guidelines



Detached two-family



Triple decker



Attached townhouse



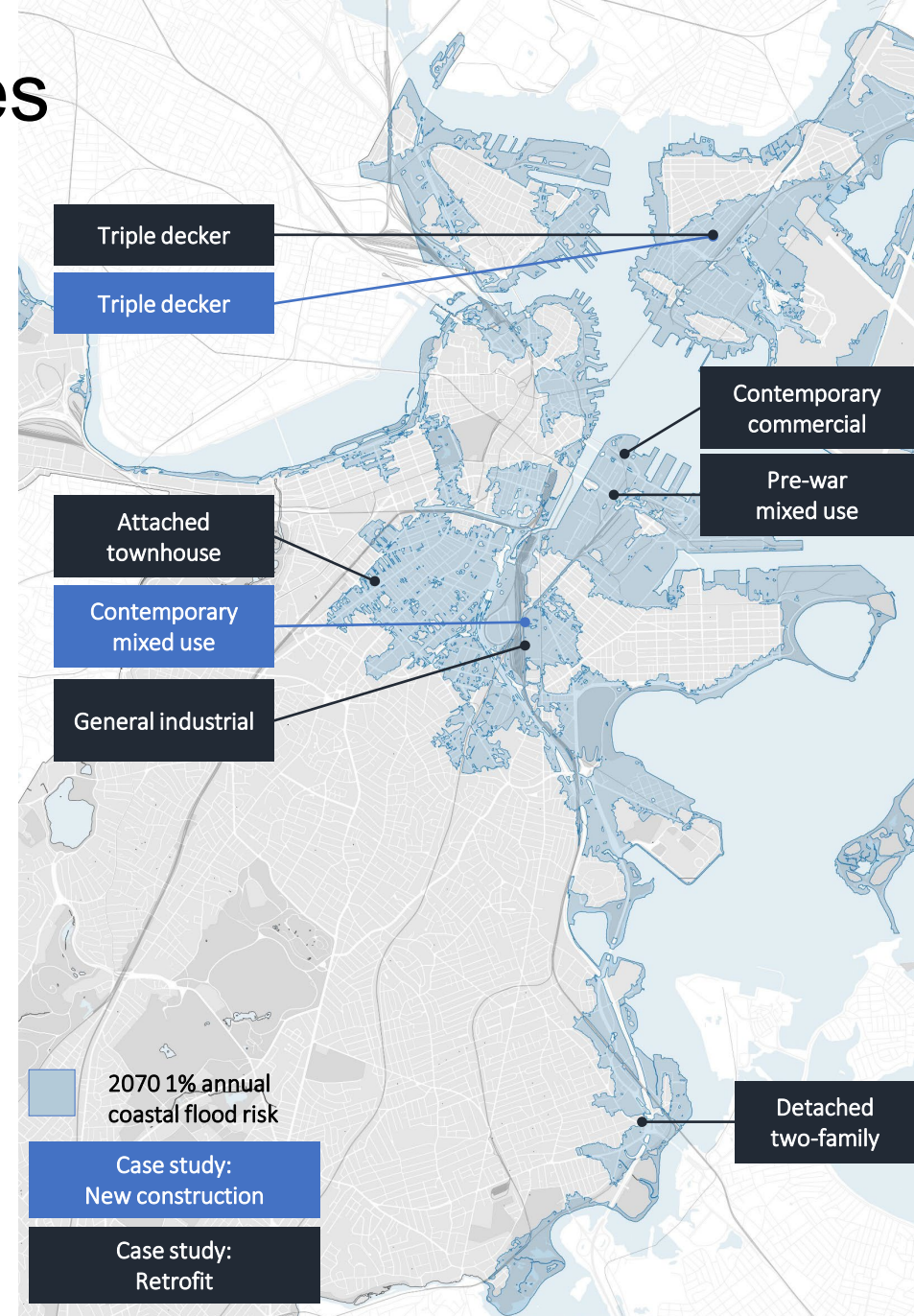
Pre-war mixed use



General industrial



Contemporary commercial



Coastal Resilience Design Guidelines

III. Case Studies | Alterations and Renovations | New Construction

Triple-decker

Existing Conditions

One of the most prevalent building types in Boston, triple-deckers are commonly found in the Overlay neighborhoods of East Boston, South Boston, Dorchester, and Charlestown. They are typically free-standing, three-story wood structures commonly supported on fieldstone and brick foundations, with bay windows and covered stoops facing the sidewalk and tiered decks facing the rear yard.

Case Study Location

Sea Level Rise Conditions	
SLR-BFE	19.50' BCB
SLR-DFE	20.50' BCB
FEMA BFE	17.46' BCB

Building Characteristics	
Grade elevation	approx. 15.56' BCB
Lowest occupiable floor	approx. 18.76' BCB
Cellar elevation	10.10' BCB
Critical systems location	Basement
Construction type	Wood frame
Year built	Late 19th-early 20th century
Stories	3
Units	3
Sidewalk width	10'
Zoning district	Three-Family Residential

Other Neighborhoods: Dorchester, Charlestown

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City of Boston Flood Resilience Design Guidelines

Long-term Strategy

Supporting Strategies

Enhanced Envelope

Conduct energy audit and blower door tests to identify air leaks.
Install blown-in cellulose insulation to wall cavities; add roof insulation outboard of deck.
Upgrade windows to low-e, low-U-factor casement windows.

Cool roofing mitigates overheating by reducing roof temperatures.
Consider envelope upgrades in conjunction with replacing critical systems for resilience. A better envelope can result in down-sized HVAC systems that are less expensive to operate.

On-Site Energy Generation

Install islandable, grid-connected solar PV system on the roof.

Building Envelope and Access

Wet Floodproof

Install flood vents at foundation walls in order for water to enter and balance hydrostatic forces.
Use saltwater-damage-resistant materials below SLR-DFE.
Eliminate any habitable spaces below SLR-DFE. Limit uses below SLR-DFE to parking, access, and storage.

Building Form

Elevate Building on Extended Foundation Walls

Abandon basement and fill it to the lowest adjacent grade.
Elevate building such that first occupiable floor is above SLR-DFE. Extend foundation walls.
When filling basement, consider structure and envelope to prevent wicking of moisture up into building after flooding.

Building Systems

Protect Critical Systems

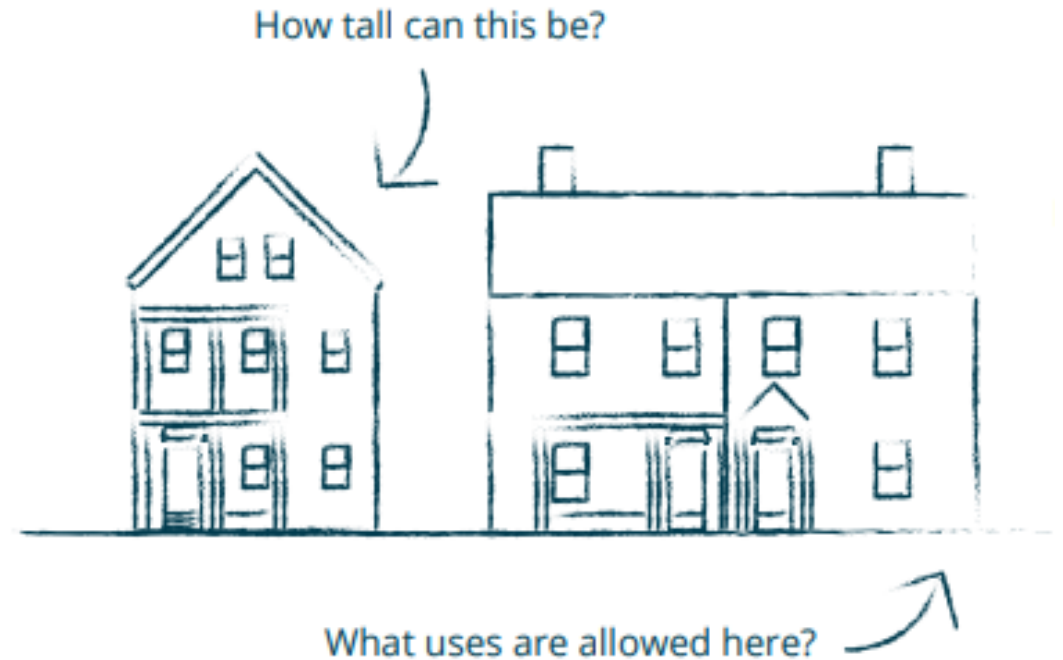
Locate water heater and critical systems above the SLR-DFE.
Upgrade heating to high-efficiency mini-split heat pump system with equipment located outside and above the SLR-DFE.

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Coastal Flood Resilience Zoning Overlay

How Does Zoning Work?

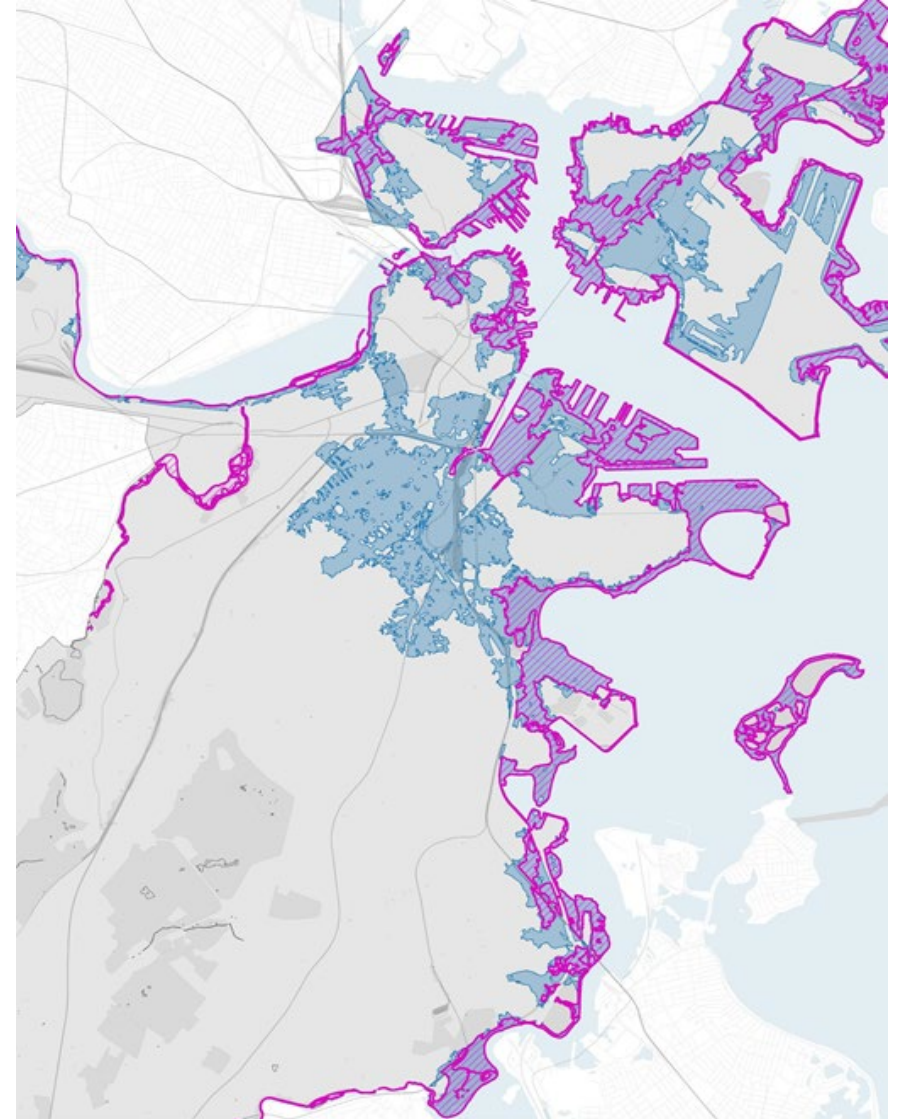
- Purpose to preserve health, safety & orderly development
- Governs height, mass, setbacks, open space, parking, floor area and uses
- Advances City planning & policy (*IB2030 & Climate Ready Boston*)
- Does not include building materials & methods (*State Building Code*)



Coastal Flood Resilience Zoning Overlay

What is a Zoning Overlay?

- “Overlays” a single or multiple zoning districts, and base zoning
- Generally more restrictive and governs provisions of overlain districts
- Advances land use, design and use policies



Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-1 Purpose & Objectives

- Promote resilient planning & design
- Provide consistent review standards
- Maximize benefits of resilience investments
- Promote co-benefits of sustainable design
- Advance resilient design best practice
- Encourage resilient design that responds to Boston’s building types, individual buildings, district scale plans and the public realm

Use Resiliency Best Practices

Proposed designs / renovations should incorporate best practices and standards to reduce or eliminate coastal flood risk or damage resulting from future climate conditions.

Enhance the Public Realm

Resilient measures should be designed to not to diminish the pedestrian environment to the greatest extent possible by supporting pedestrian connections and enhancing the character of the Overlay parcels.

Generate Co-benefits

Wherever feasible, proposed flood resiliency upgrades should also enhance a building’s energy efficiency, greenhouse gas reduction potential, and passive survivability.

Guidelines

Relate to District Scale Solutions

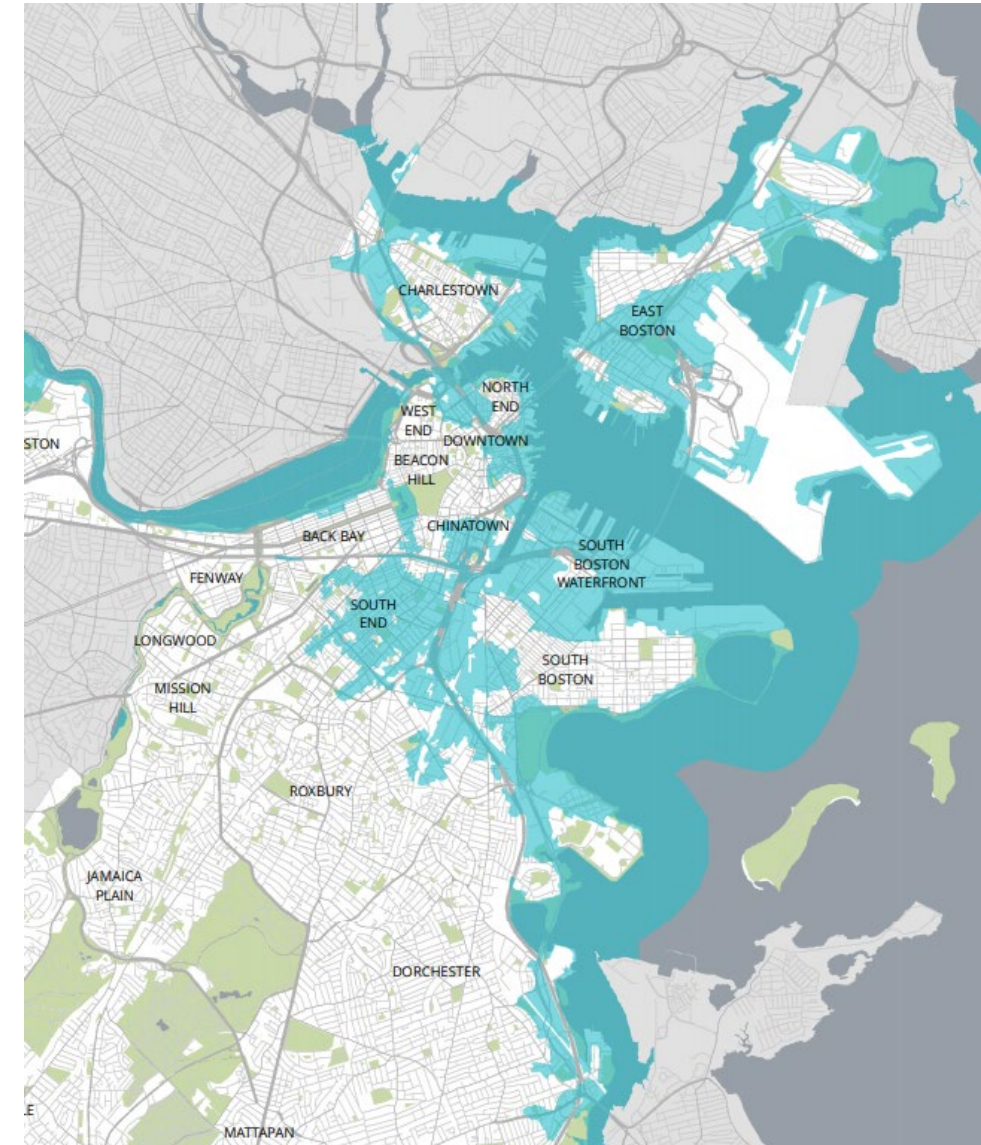
Enhancements at a plot level should not worsen risk at adjacent parcels or restrict future implementation of larger coastal resilience district plans, and, to the extent feasible, should support the resiliency goals and implementation of district coastal resilience plans.

Section 25A-2 Definitions

Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-3 Establishment of Overlay & Boundaries

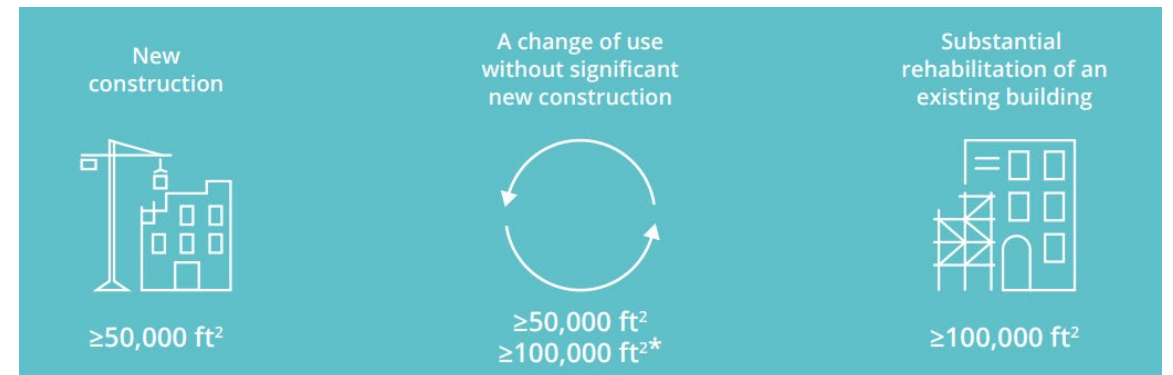
- Physical Boundaries
 - Overlay Map – Appendix A
 - *1% Chance Storm Event, also referred to as the “100-year storm”, is the area that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year.*
 - *40 Inches of Sea Level Rise, includes sea level rise as well as land subsidence and is anticipated sometime between 2070 and 2100. Based upon Boston Harbor – Flood Risk Model and Boston Research Advisory Group probability analysis.*
- Interpretation of Boundaries



Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-4 Applicability

- Projects Subject to CFROD
 - Additional Gross Floor Area
 - 20,000+ SF
 - 10,000+ SF in Harborpark
 - Additional Units
 - 15+ dwelling units
 - Change in Use
 - 50,000 SF+; 100,000 SF Downtown
 - Substantial Rehabilitation
 - 100,000 SF+
- Exempt Projects
- Election to Comply



Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-5 Zoning in Effect; Conflicting Provisions

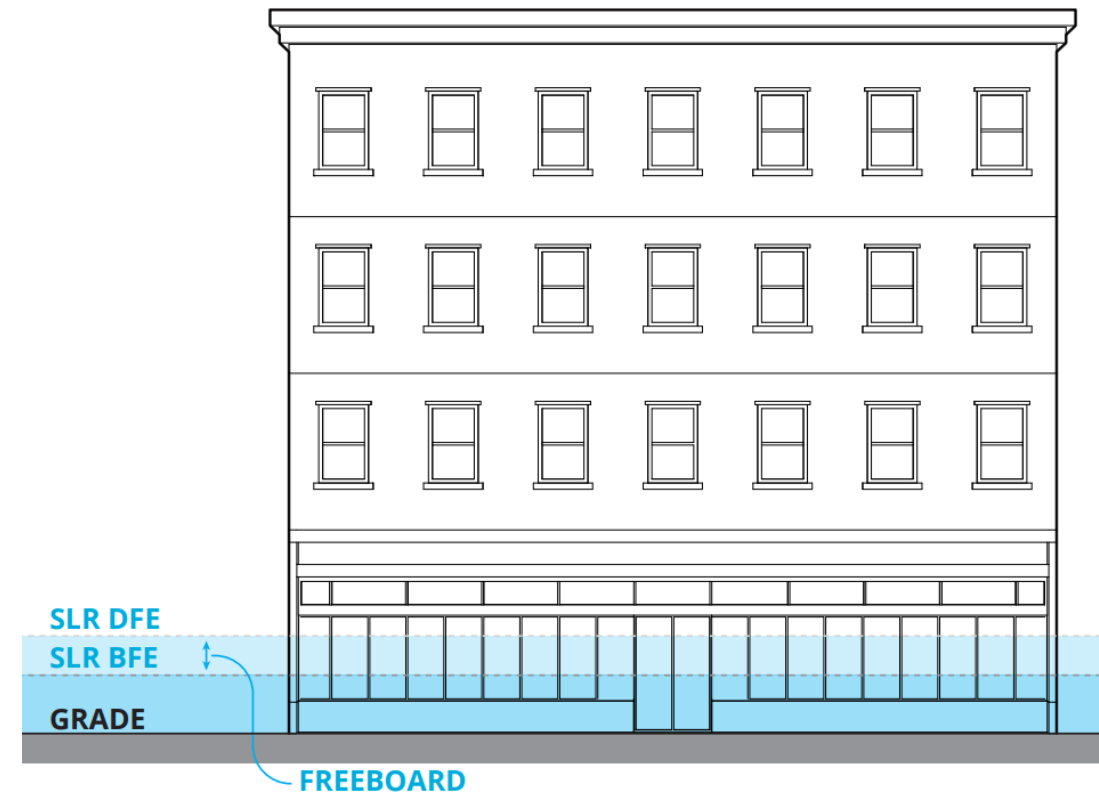
- Relationship to Underlying Zoning
- Relationship to Planned Development Areas & Institutional Master Plans
- Relationship to Municipal Harbor Plans and Designated Port Areas

Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations

1. Regulations for All Uses & Structures

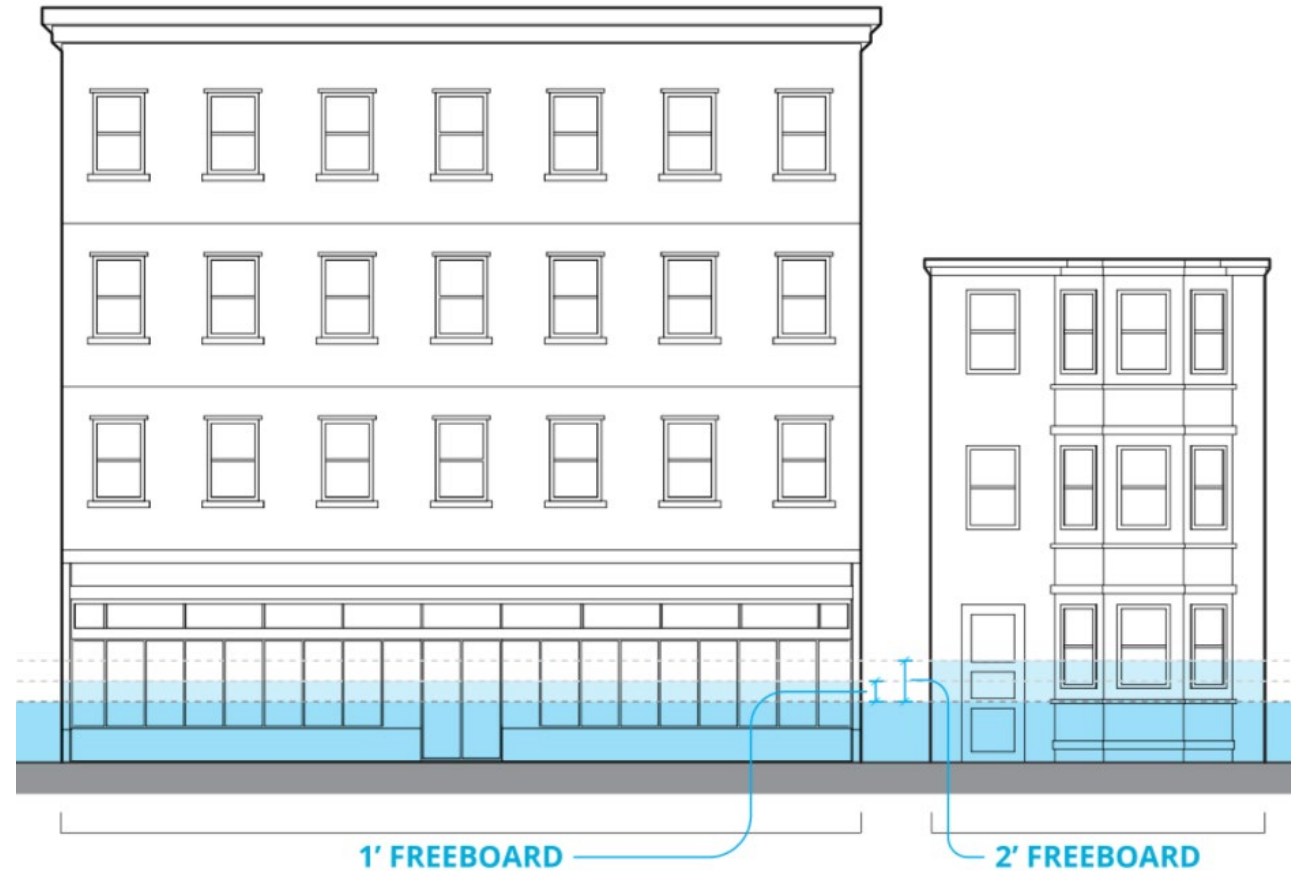
- Essential Facilities & High Risk Structures
 - Allowed become Conditional
- Minimum Sea Level Rise Design Flood Elevation
SLR-DFE: the minimum elevation of the lowest occupiable floor for residential uses or dry flood-proofing for non-residential uses.
- $SLR-DFE = \text{Base Flood Elevation} + \text{Freeboard}$
 - *Sea Level Rise Base Flood Elevation - top of water elevation projected with the 2070 1% chance storm event with 40-inches of sea level rise.*
 - *Freeboard – a margin of safety, or a buffer above the SLR Base Flood Elevation*



Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations - continued

- Minimum Sea Level Rise Design Flood Elevation = SLR Base Flood Elevation + Freeboard
 - 2-foot Freeboard:
 - FEMA Velocity Zones
 - Residential Use
 - Essential Facility & High Risk Structures
 - 1-foot Freeboard:
 - All other uses

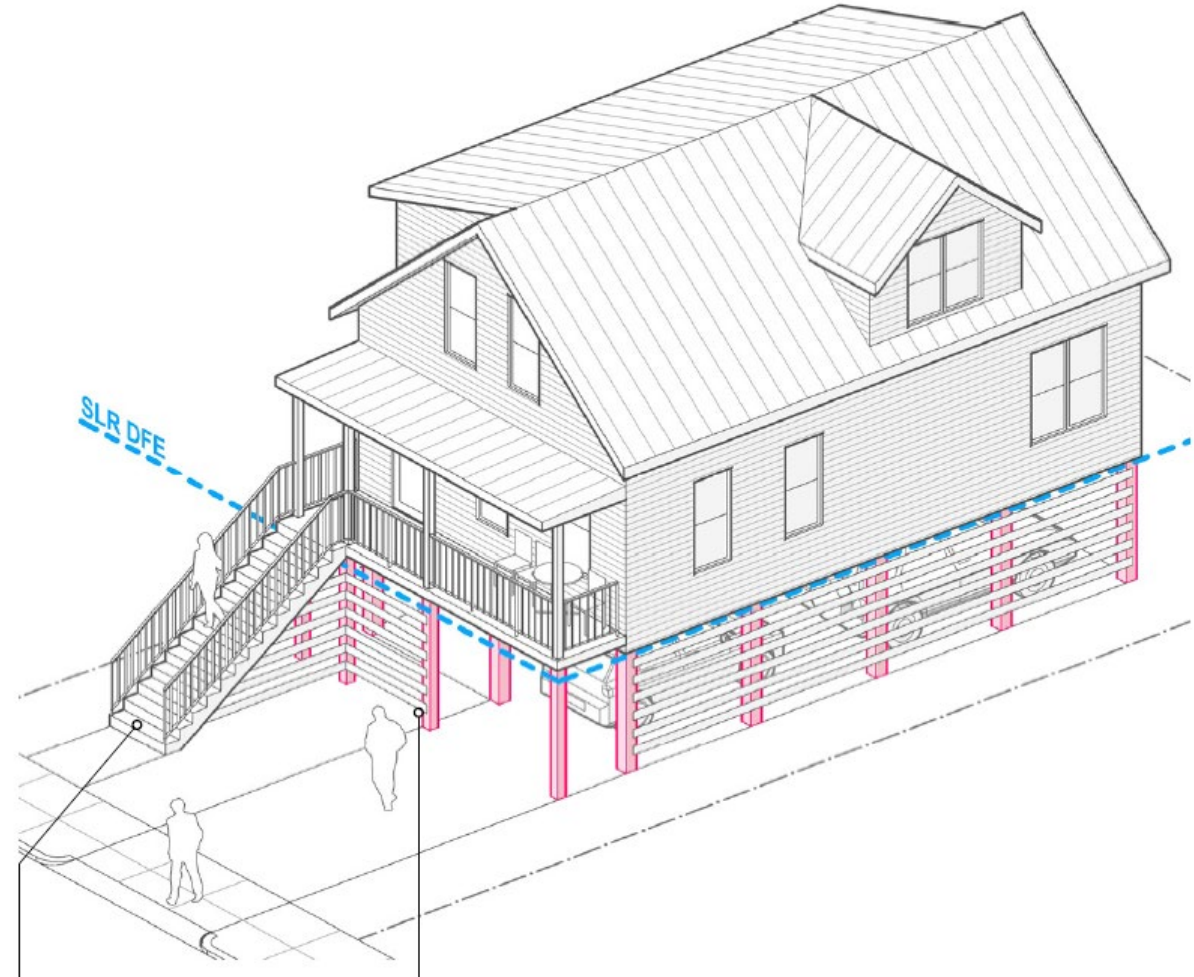


Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations - continued

1. Regulations for All Uses & Structures

- Limitations on Use of Space Below Sea Level Rise Design Flood Elevation
 - Allowed Uses:
 - Access or vertical circulation
 - Flood prevention measures
 - Storage
 - Parking accessory to non-resi uses
 - Temporary uses
 - Conditional Uses:
 - Allowed non-residential uses become Conditional
 - Forbidden Uses

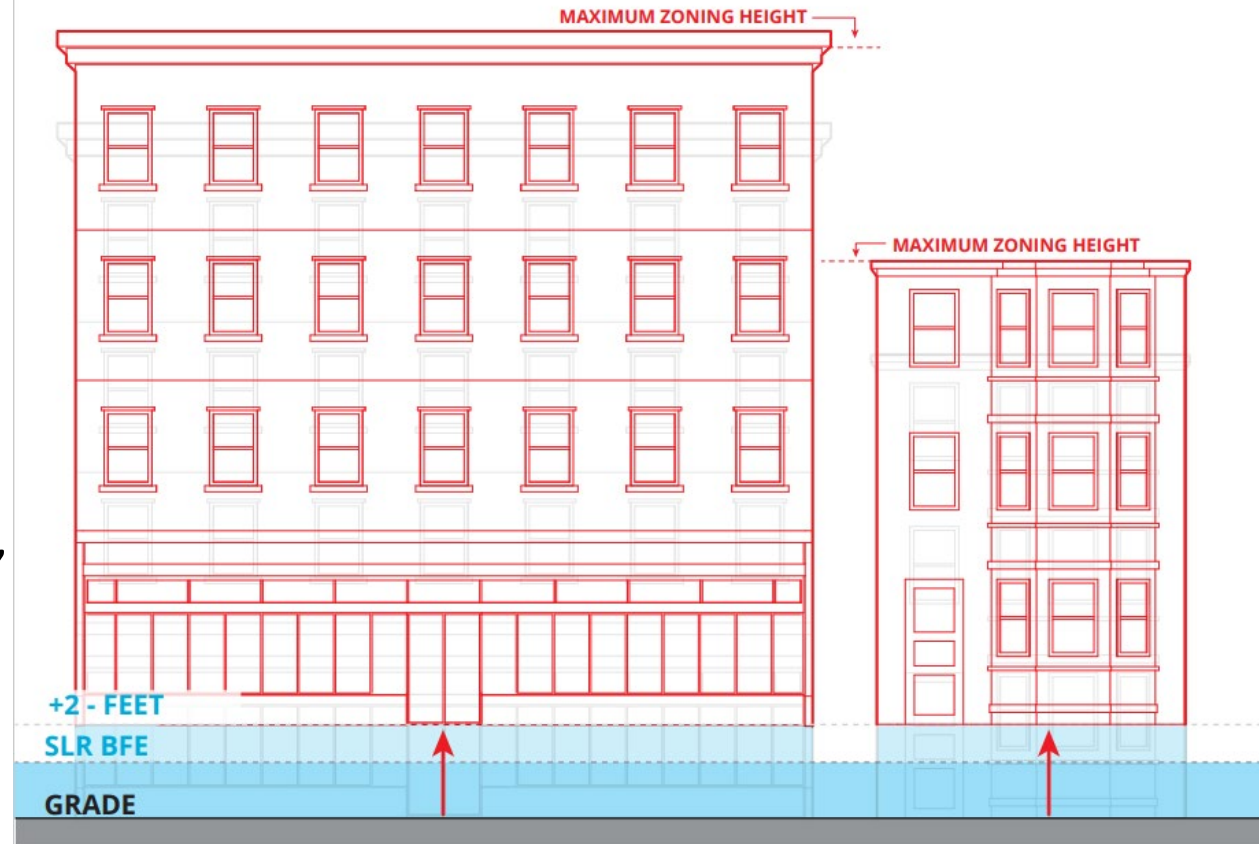


Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations - continued

2. Regulations for Proposed Projects Subject to Resilience Review

- Measurement of Dimensions:
 - Building height: measured from the higher of grade, or SLR-BFE + 2-feet, with max of SLR-BFE + 5-feet

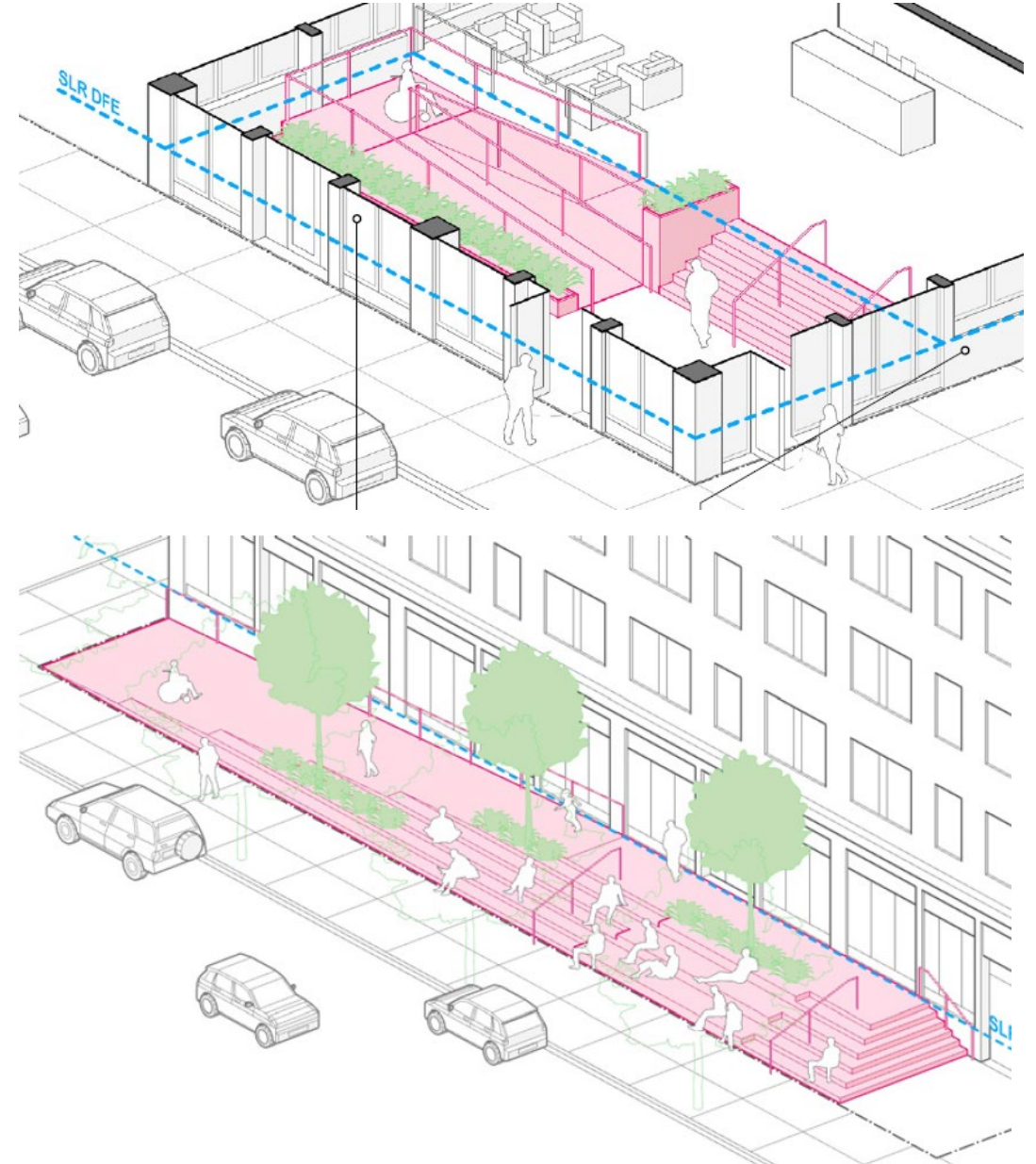


Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations - continued

2. Regulations for Proposed Projects Subject to Resilience Review

- Measurement of Dimensions:
 - Gross Floor Area exclusions:
 - Vertical circulation
 - Flood protection measures
 - Lot Coverage/Open Space exclusions:
 - Vertical circulation
 - Structures for mechanicals

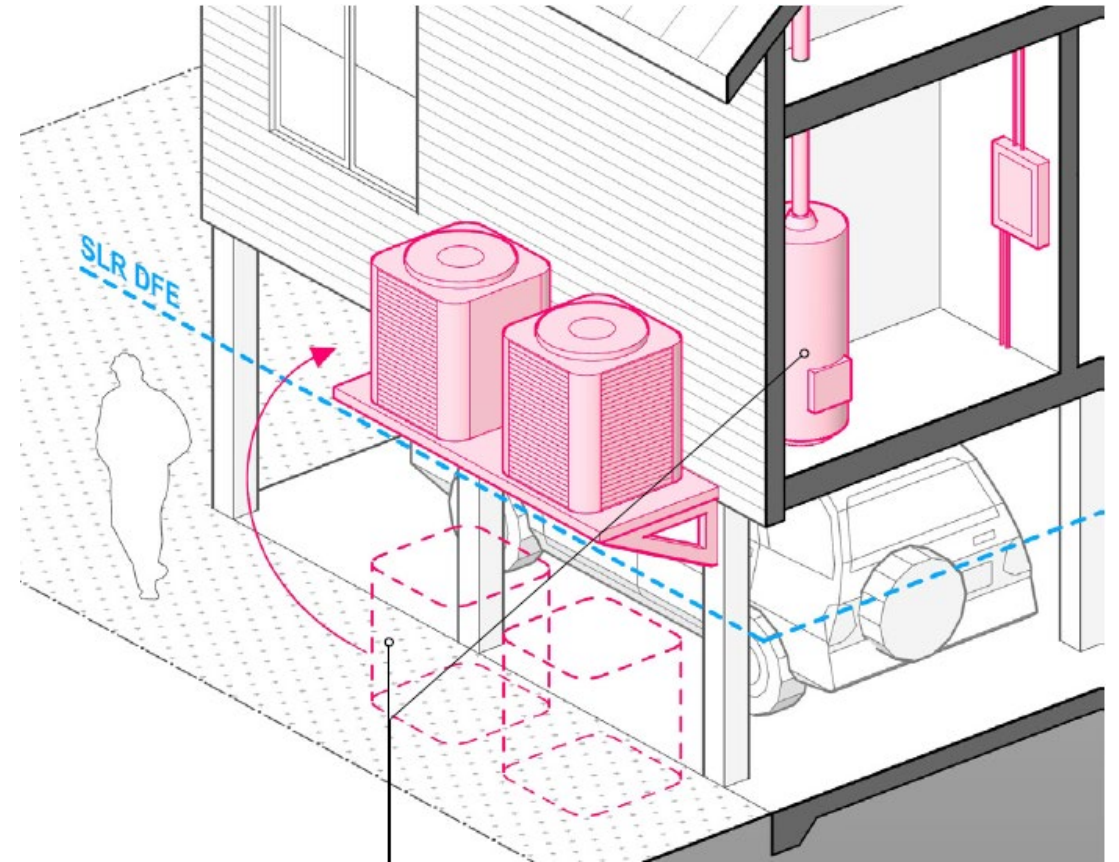


Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-6 Use & Dimensional Regulations - continued

2. Regulations for Proposed Projects Subject to Resilience Review

- Front, Rear & Side Yards:
 - Allowance for areas used for vertical circulation
- Rear & Side Yards;
 - Allowance for structures for mechanicals above SLR-DFE
- Primary Entrance
 - May be located on side street or side yard



Coastal Flood Resilience Zoning Overlay – Article 25A

Section 25A-7 Resilience Review

- Article 80 Large & Small Project Review
- Resilience Review Standards
- Appendices
 - Appendix A – Overlay Map
 - Appendix B – Definitions
 - Appendix C – Essential Facilities & High Risk Structures

Updates to Existing Zoning Articles

- Article 3-1A – Special Purpose Overlay Districts
- Article 80 – Development Review and Approval

Questions & Comments

- You may provide questions and comments in two ways:



Through the **Q&A tab** at the bottom of your screen; or



You can **raise your hand** and we will take your questions in the order that hands were raised.



Next Steps

- Public Meeting January 15th, 10 AM – 12 PM (same material)
- Comment Deadline: February 12, 2021
- Post Final Version of Article 25A
- BPDA Board
- Zoning Commission



Thank You!

For more information visit:, please visit the
“Flood Resilience Building Guidelines & Zoning
Overlay District” webpage:
<https://bit.ly/BPDAfloodresilience>

Please submit comments on the draft CFRD
to: chris.busch@boston.gov



**boston planning &
development agency**