CLIMATE RESILIENT LANDUSE: A Primer for Local Governments

November 23rd, 2020

12:30pm-2:00pm

MAPC
METROPOLITAN AREA PLANNING COUNCIL
Smart Growth & Regional Collaboration

MVP
Municipal Vulnerability Preparedness

Today's Agenda

- Overview of Agenda
- Climate Change Impacts in Metro Boston
- Introduction to Climate Resilient Land Use
- MAPC's Resilient Land Use Guidebook
- Breakouts: Small group discussions
- Report backs and wrap-up

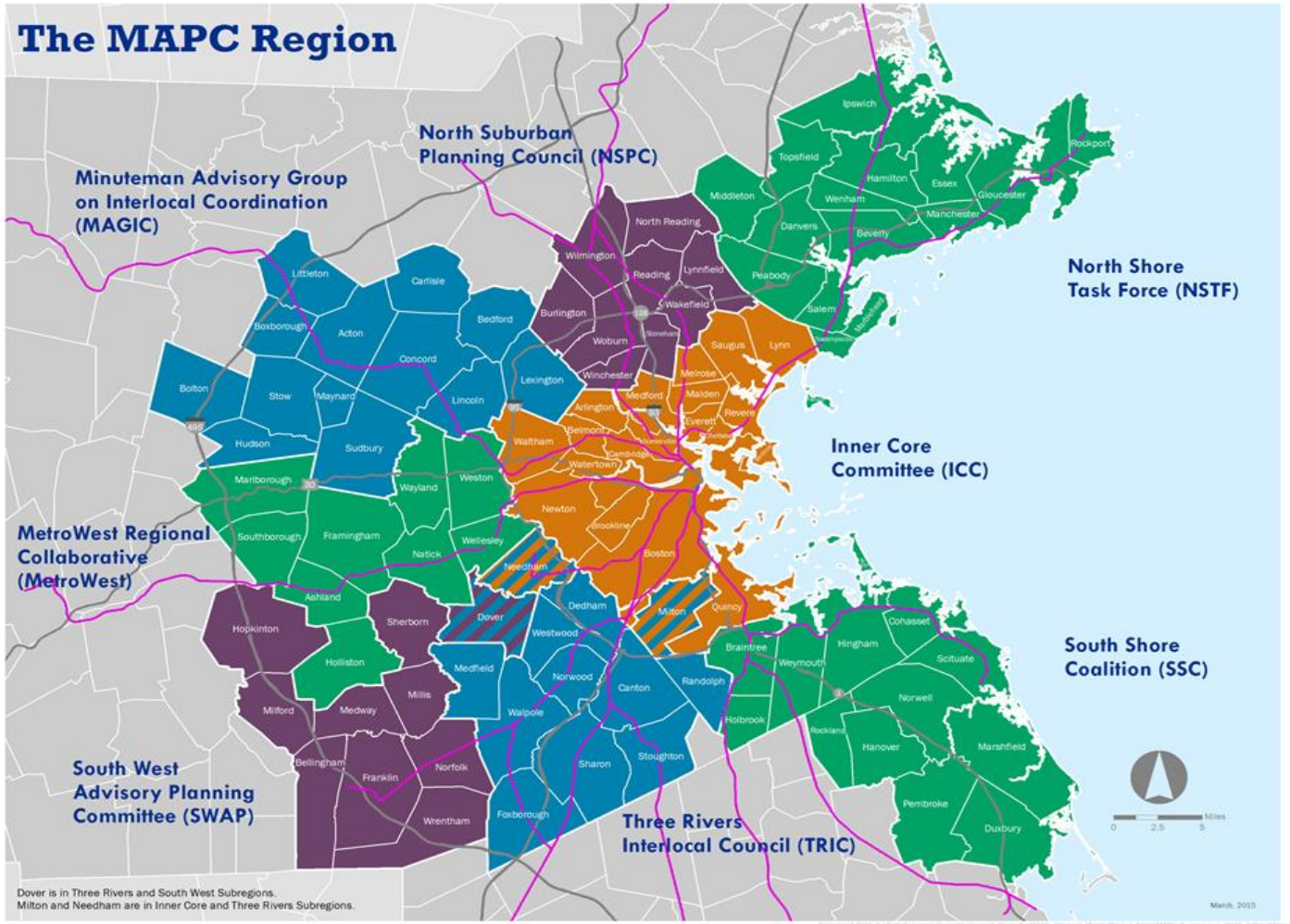
Metropolitan Area Planning Council (MAPC)

101 municipalities

1,440 square miles

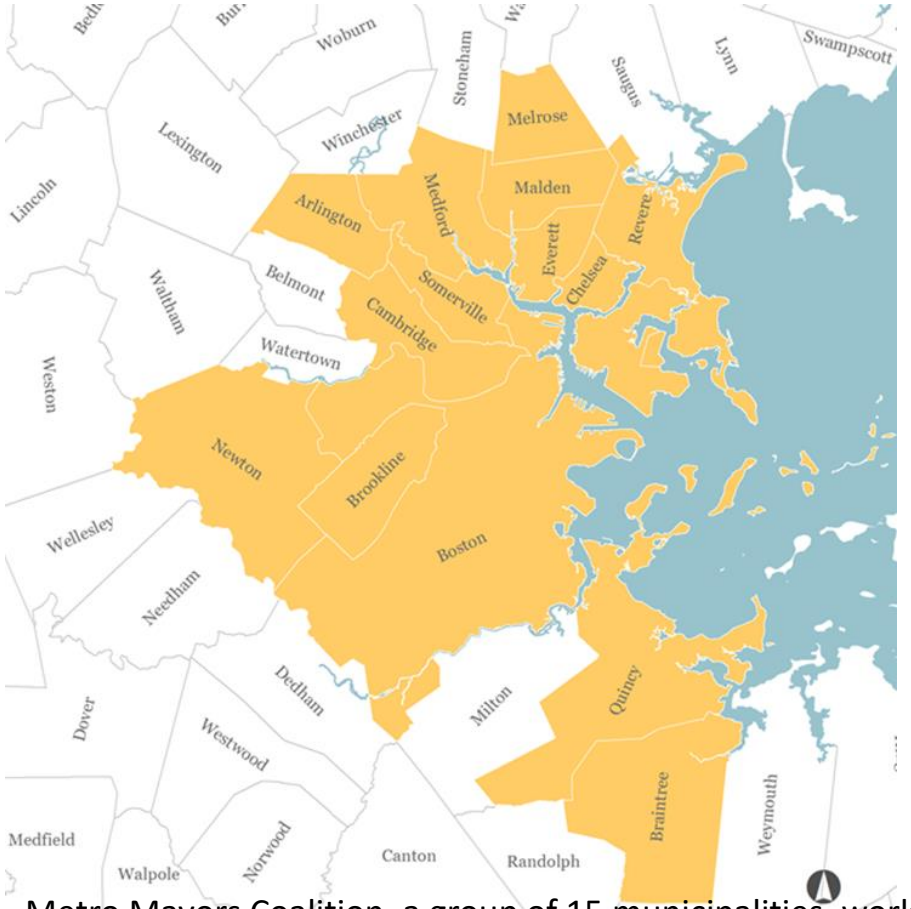
Nearly **3.2 million** residents

1.8 million jobs (2010 Census)



Municipal Vulnerability Preparedness (MVP) Action Grant

- MVP program of the Office of Energy and Environmental Affairs (EEA).
- Metro Mayors Coalition, with Winthrop as lead applicant.
- ~$99,000 for project.
- Developing tools and resources for climate resilient land use planning and zoning.



Metro Mayors Coalition, a group of 15 municipalities, work together on issues of regional importance, including climate preparedness and climate mitigation.

Today's Presenters

Anne Herbst, Senior Regional Environmental Planner

Courtney Lewis, Regional Land Use Planner II

Sasha Shyduroff, Clean Energy and Climate Planner II

REGIONAL CLIMATE IMPACTS

Photo credit: Mystic River, March 2010 David Mussina

Climate Impacts in Metro Boston

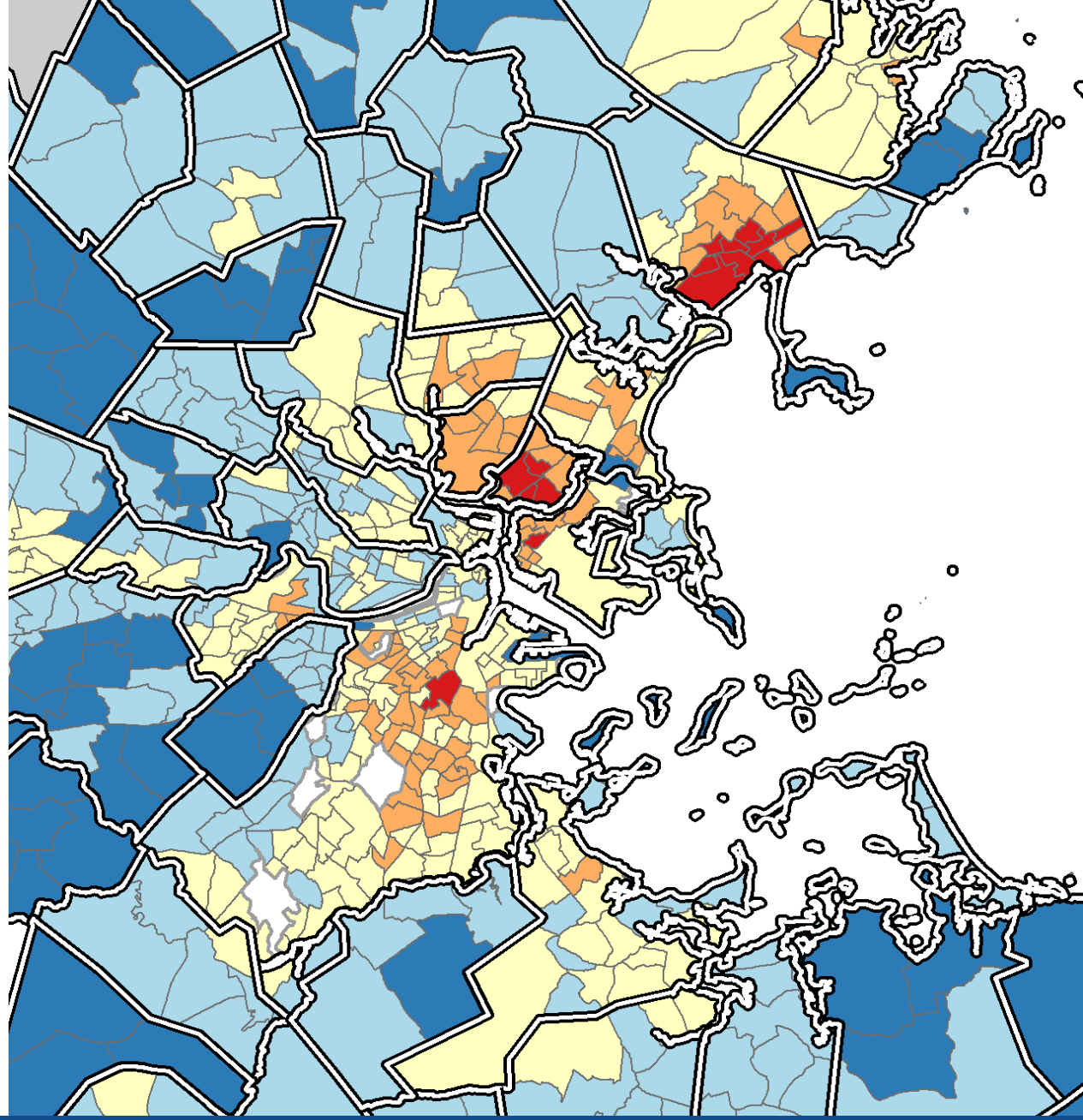
Extreme Heat

Changes in Precipitation

Coastal Flooding

Increase in Extreme Temperatures and Heat

- Existing areas of high land surface temperature and vulnerable populations are concentrated in the urbanized inner core.
- Highest heat vulnerability in 7 of 101 MAPC municipalities: Chelsea, Everett, Lynn, Revere, Boston, Malden, and Framingham.
- Extreme heat (days over 90 will increase from 4 days historically to 14-32 by 2050).



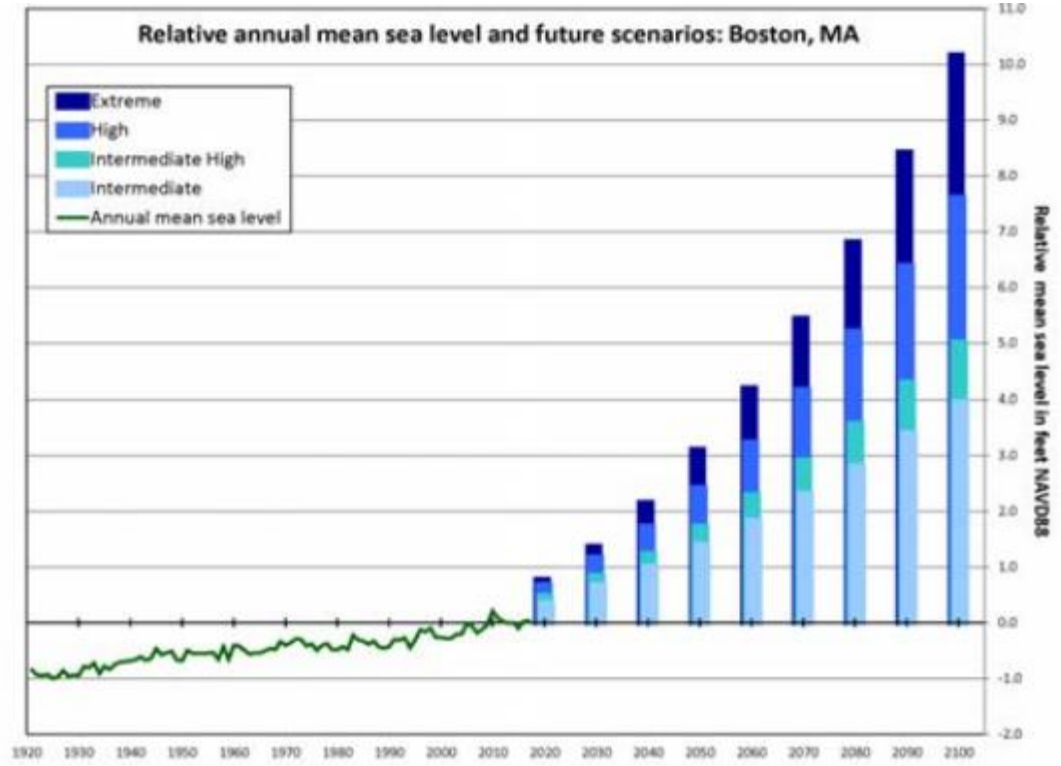
Changes in Precipitation

- Cycle between drought and extreme precipitation.
- Increase of intense rainstorms, including deluges and downpours (several inches of rain within a 24-hour period).
- Late winter/early spring rainstorms and ice storms.
- Exacerbated by increases in impervious surfaces in urban areas and outdated stormwater drainage systems.

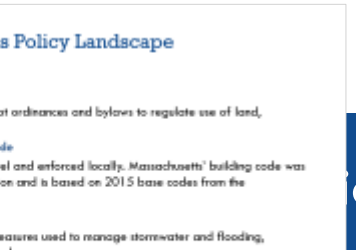
Images: March 2010 rainstorms impact the region Top: Quincy Bottom: Green Line in Newton. Source: Boston.com

Coastal Flooding

- Increase in frequency and intensity of storm surge and storm events.
- Increase in chronic flooding due to Sea Level Rise (SLR).
  - 1.3ft-3.1ft by 2050
  - 4ft-10.5ft by 2100
- Increase in erosion of coastline.



Source: resilient MA, 2018


s Policy Landscape

t ordinances and bylaws to regulate use of land,

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el and enforced locally. Massachusetts' building code was on and is based on 2015 base codes from the

easures used to manage stormwater and flooding,

CLIMATE RESILIENT LAND USE PLANNING

Why address climate change impacts through land use planning and zoning?

Opportunities:

1. **Align with Master Plan:** helps ensure that climate impacts are considered in the context of community planning, economic development, and other local priorities.
2. **Building for full life-cycle of the property:** Residential and commercial buildings built today will last for decades to come.
3. **Coordinate with Municipal Interventions:** As municipalities invest in climate resilience on public property and right of way, coordinating with private property will be key.
4. **Neighborhood scale solutions:** zoning allows for targeted approach to localized climate impacts including flooding and heat islands.
5. **Remove barriers:** in the zoning code that currently prevent or make it difficult for property owners to make their property more resilient.
6. **Incentives to act:** Ways to incentivize or require private property owners and developers to act on climate change and prepare and adapt their proporty.
7. **Protects financial investment and value:** It is likely that the real estate market will "catch up" with climate in the coming decades.

Why address climate change impacts through land use planning and zoning?

Limitations:

1. **Does not address existing buildings:** Primarily addresses new construction and deep retrofits.
2. **Lack of local control over building code:** Municipalities have limited control over the building code because it is adopted at the State level.
3. **May be difficult to regionalize policies:** Since ever municipality is responsible for own planning and zoning, it may be difficult to address regional concerns or streamline/coordinate across municipalities.

Massachusetts Policy Landscape

- **MGL 40A. Zoning**
  - gives cities and towns authority to adopt ordinances and bylaws to regulate use of land, buildings, and structures.
- **780 CMR Massachusetts State Building Code**
  - Building code adopted at the State level and enforced locally. Massachusetts' building code was last updated in 2018 for it's Ninth Edition and is based on 2015 base codes from the International Code Council (ICC)
- **310 CMR_10.00 Wetlands Protection Act**
  - Wetlands and waterways protection measures used to manage stormwater and flooding, improve water quality and sequester carbon.
    - **Adopted Statewide and enforced locally through Wetlands Protection Bylaw/Ordinance** through the permitting authority of the Conservation Commission to protect the Town/City's shores, wetlands, and land subject to flooding.

Trends in Climate Resilient Land Use Tools

"Land Use Tools" are the policies, ordinances, bylaws, and guidelines that are used to shape development through incentives or mandates/requirements.

Land Use Tool 1: Green Factors Ordinance

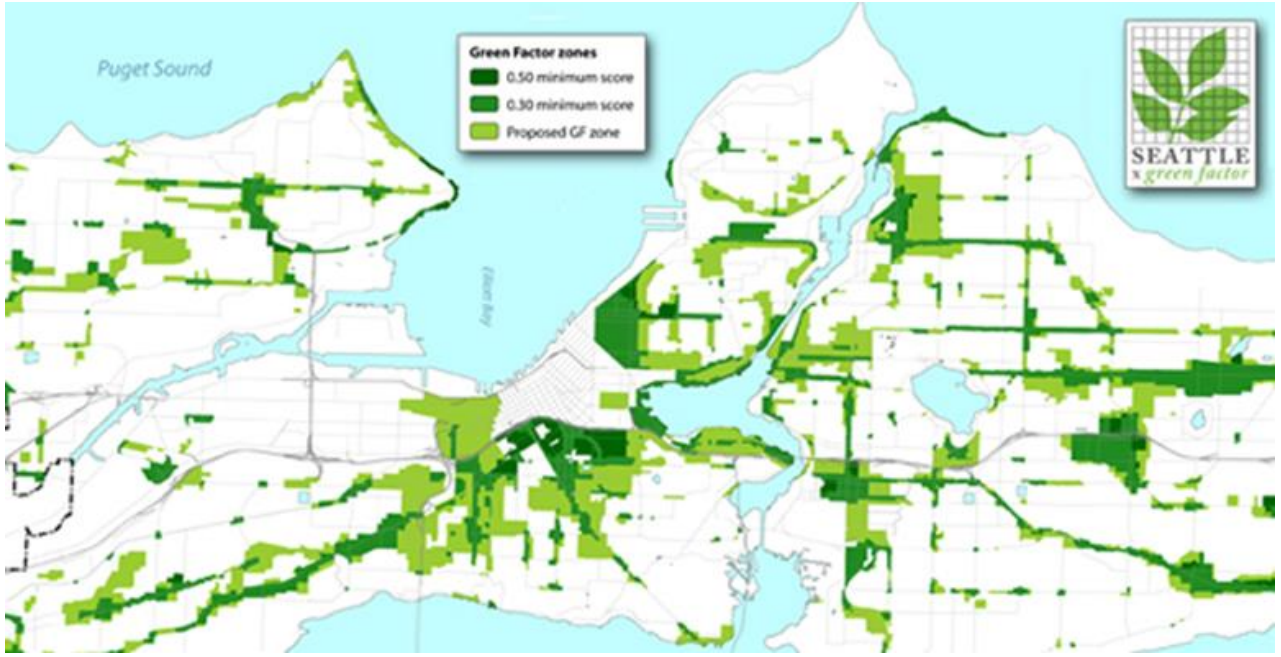


Image: https://www.seattle.gov/sdci/codes/codes-we-enforce-(a-z)/seattle-green-factor

Using zoning, provide a slate of voluntary or mandatory green landscape and infrastructure design choices across several categories to encourage climate-resilient design and development and incentivize participation.

Examples:

- **Norfolk, VA Resilient Quotient**
- **Somerville, MA Green Score**
- **Seattle, WA Green Factor**

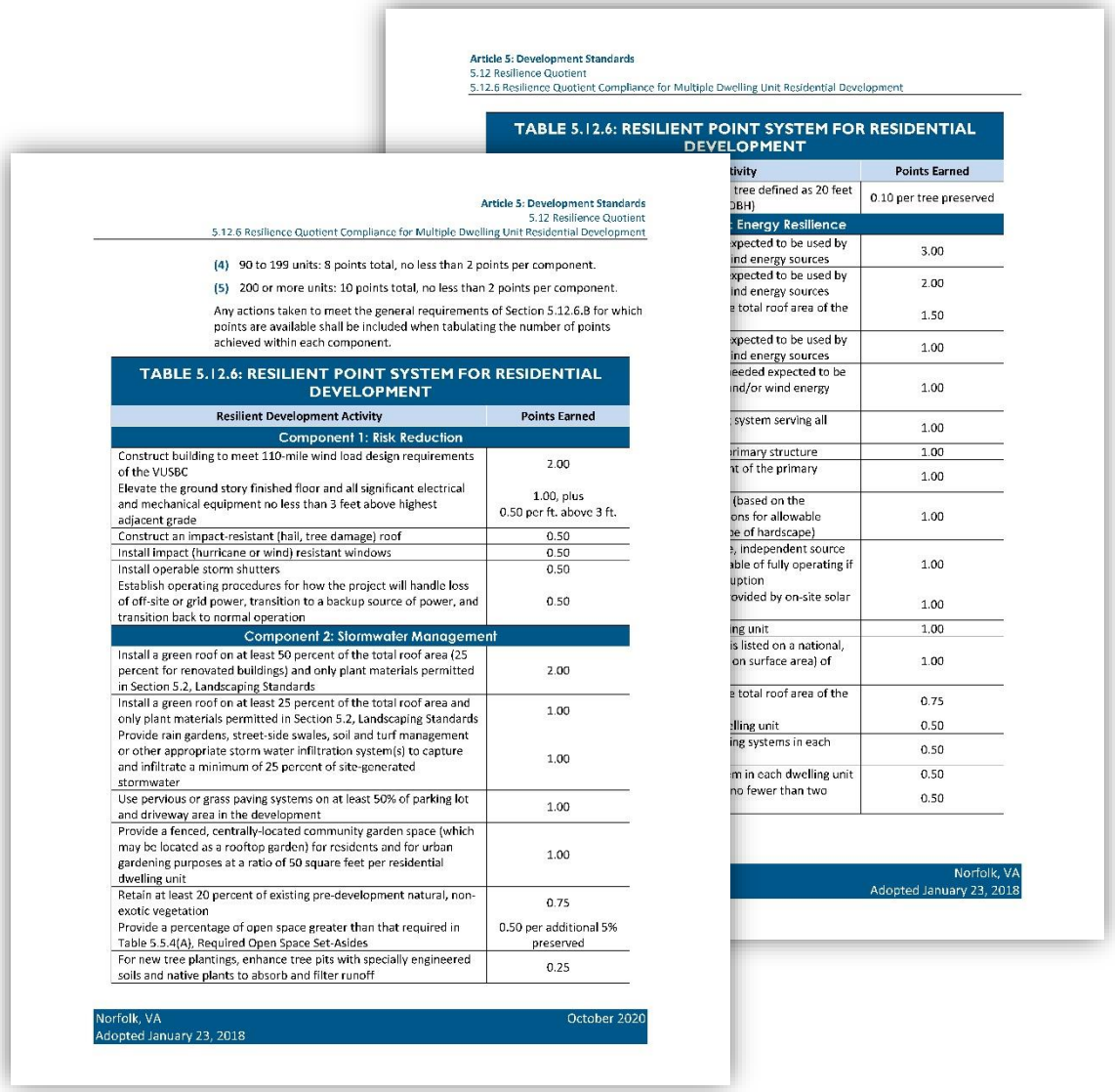
Norfolk, VA

Resilience Quotient System

- Points-based system under the City's zoning that "promotes resilient measures for flood risk reduction, stormwater management, and energy resilience."

- This development standard applies to residential and non-residential buildings, with different parameters for each category

https://www.norfolkva.gov/norfolkzoningordinance/Content/Norfolk-ZO/5_12_Resilience_Quotient.htm



Article 5: Development Standards
5.12 Resilience Quotient
5.12.6 Resilience Quotient Compliance for Multiple Dwelling Unit Residential Development

(4) 90 to 199 units: 8 points total, no less than 2 points per component.

(5) 200 or more units: 10 points total, no less than 2 points per component.

Any actions taken to meet the general requirements of Section 5.12.6.B for which points are available shall be included when tabulating the number of points achieved within each component.

TABLE 5.12.6: RESILIENT POINT SYSTEM FOR RESIDENTIAL DEVELOPMENT

Resilient Development Activity	Points Earned
Component 1: Risk Reduction	
Construct building to meet 110-mile wind load design requirements of the VUSBC	2.00
Elevate the ground story finished floor and all significant electrical and mechanical equipment no less than 3 feet above highest adjacent grade	1.00, plus 0.50 per ft. above 3 ft.
Construct an impact-resistant (hail, tree damage) roof	0.50
Install impact (hurricane or wind) resistant windows	0.50
Install operable storm shutters	0.50
Establish operating procedures for how the project will handle loss of off-site or grid power, transition to a backup source of power, and transition back to normal operation	0.50
Component 2: Stormwater Management	
Install a green roof on at least 50 percent of the total roof area (25 percent for renovated buildings) and only plant materials permitted in Section 5.2, Landscaping Standards	2.00
Install a green roof on at least 25 percent of the total roof area and only plant materials permitted in Section 5.2, Landscaping Standards	1.00
Provide rain gardens, street-side swales, soil and turf management or other appropriate storm water infiltration system(s) to capture and infiltrate a minimum of 25 percent of site-generated stormwater	1.00
Use pervious or grass paving systems on at least 50% of parking lot and driveway area in the development	1.00
Provide a fenced, centrally-located community garden space (which may be located as a rooftop garden) for residents and for urban gardening purposes at a ratio of 50 square feet per residential dwelling unit	1.00
Retain at least 20 percent of existing pre-development natural, non-exotic vegetation	0.75
Provide a percentage of open space greater than that required in Table 5.5.4(A), Required Open Space Set-Asides	0.50 per additional 5% preserved
For new tree plantings, enhance tree pits with specially engineered soils and native plants to absorb and filter runoff	0.25

Norfolk, VA
Adopted January 23, 2018
October 2020

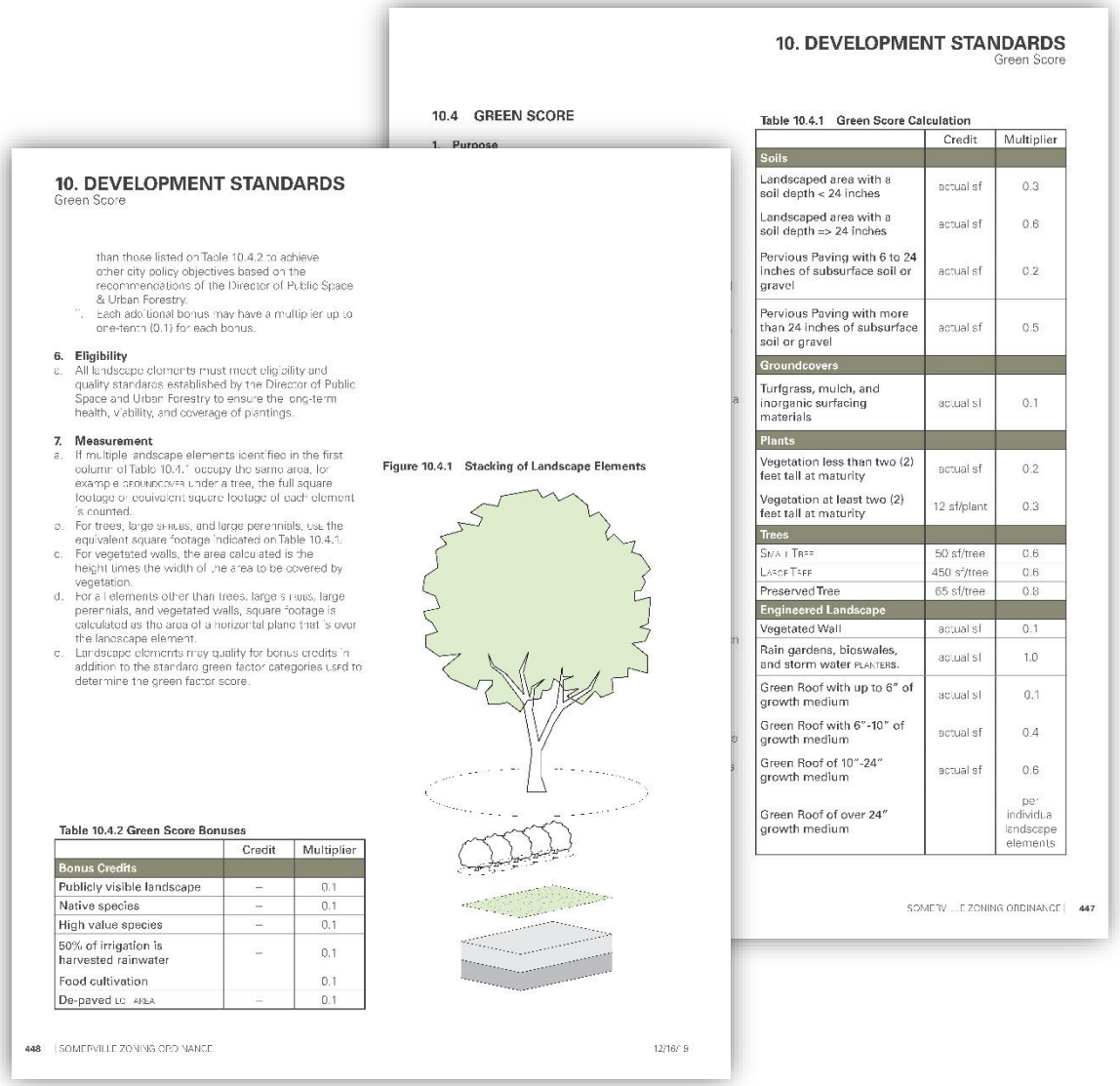
Somerville, MA

Green Score

- A performance-based environmental landscape standard.

- The Green Score helps "manage storm water, filter pollutants, reduce urban heat island, provide habitat, sequester carbon dioxide, and improve air quality" *(Section 10.4, page 447)*.

https://library.municode.com/ma/somerville/ordinances/zoning_ordinances?nodeId=1007172



10. DEVELOPMENT STANDARDS
Green Score

10.4 GREEN SCORE

Table 10.4.1 Green Score Calculation

	Credit	Multiplier
Soils		
Landscaped area with a soil depth < 24 inches	actual sf	0.3
Landscaped area with a soil depth => 24 inches	actual sf	0.6
Pervious Paving with 6 to 24 inches of subsurface soil or gravel	actual sf	0.2
Pervious Paving with more than 24 inches of subsurface soil or gravel	actual sf	0.5
Groundcovers		
Turfgrass, mulch, and inorganic surfacing materials	actual sf	0.1
Plants		
Vegetation less than two (2) feet tall at maturity	actual sf	0.2
Vegetation at least two (2) feet tall at maturity	12 sf/plant	0.3
Trees		
SMALL TREE	50 sf/tree	0.6
LARGE TREE	450 sf/tree	0.6
Preserved Tree	65 sf/tree	0.8
Engineered Landscape		
Vegetated Wall	actual sf	0.1
Rain gardens, bioswales, and storm water PLANTERS.	actual sf	1.0
Green Roof with up to 6" of growth medium	actual sf	0.1
Green Roof with 6"-10" of growth medium	actual sf	0.4
Green Roof of 10"-24" growth medium	actual sf	0.6
Green Roof of over 24" growth medium		per individual landscape elements

SOMERVILLE ZONING ORDINANCE | 447

10. DEVELOPMENT STANDARDS
Green Score

than those listed on Table 10.4.2 to achieve other city policy objectives based on the recommendations of the Director of Public Space & Urban Forestry.

Each additional bonus may have a multiplier up to one-tenth (0.1) for each bonus.

6. Eligibility

a. All landscape elements must meet eligibility and quality standards established by the Director of Public Space and Urban Forestry to ensure the long-term health, viability, and coverage of plantings.

7. Measurement

a. If multiple landscape elements identified in the first column of Table 10.4.1 occupy the same area, for example groundcover under a tree, the full square footage or equivalent square footage of each element is counted.

b. For trees, large shrubs, and large perennials, use the equivalent square footage indicated on Table 10.4.1.

c. For vegetated walls, the area calculated is the height times the width of the area to be covered by vegetation.

d. For all elements other than trees, large shrubs, large perennials, and vegetated walls, square footage is calculated as the area of a horizontal plane that is over the landscape element.

e. Landscape elements may qualify for bonus credits in addition to the standard green factor categories used to determine the green factor score.

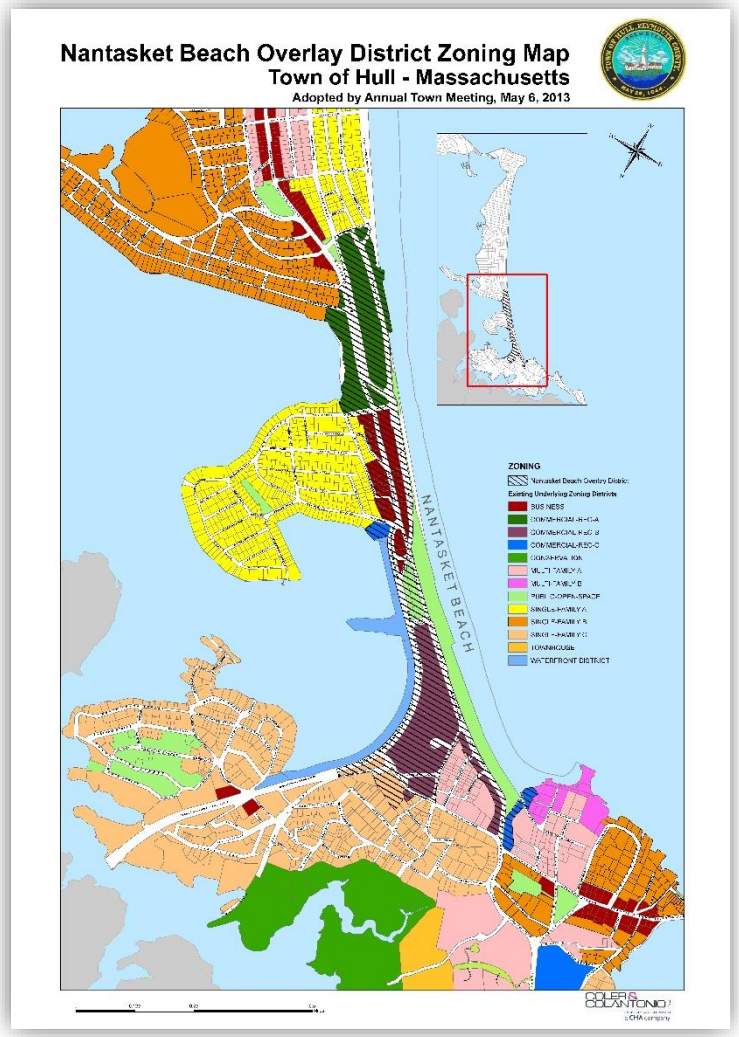
Figure 10.4.1 Stacking of Landscape Elements

Table 10.4.2 Green Score Bonuses

	Credit	Multiplier
Bonus Credits		
Publicly visible landscape	–	0.1
Native species	–	0.1
High value species	–	0.1
50% of irrigation is harvested rainwater	–	0.1
Food cultivation		0.1
De-paved to AREA	–	0.1

448 | SOMERVILLE ZONING ORDINANCE 12/16/19

Land Use Tool 2: Adopt a Resilient Overlay District



By adopting or updating an overlay district municipalities can target resilience improvements in the areas most vulnerable to flooding and thereby protect against loss of life and property.

The Massachusetts Office of Coastal Zone Management advises municipalities to take a "No Adverse Impact" approach by clearly establishing the regulatory goal of preventing harm and protecting against loss of life or property

Examples:

- **Oak Bluffs, MA Floodplain Overlay District**
- **Hull, MA Nantasket Beach Overlay District**

Oak Bluffs, MA

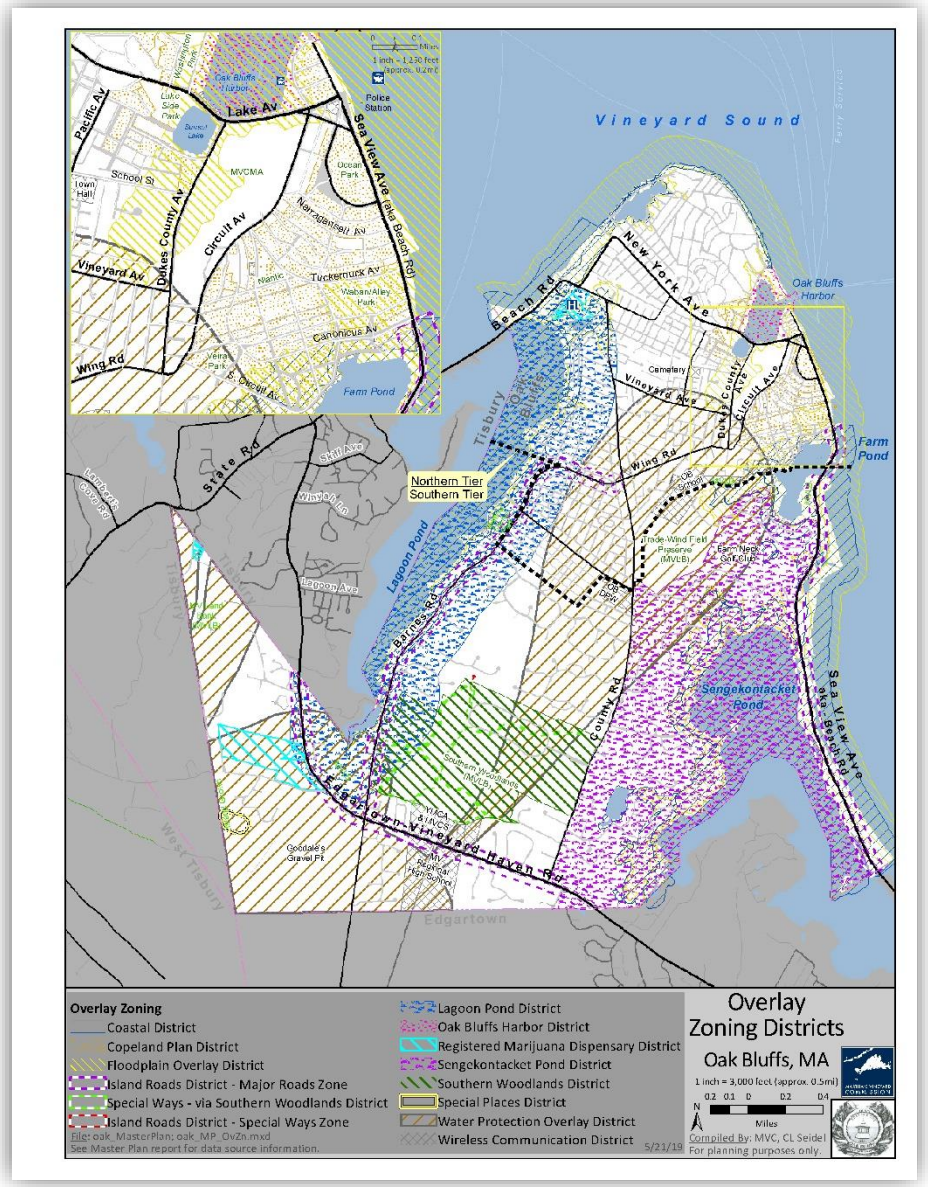
Floodplain Overlay District

- The Floodplain Overlay District limits development in areas subject to flooding, storms, erosion, and sea level rise.

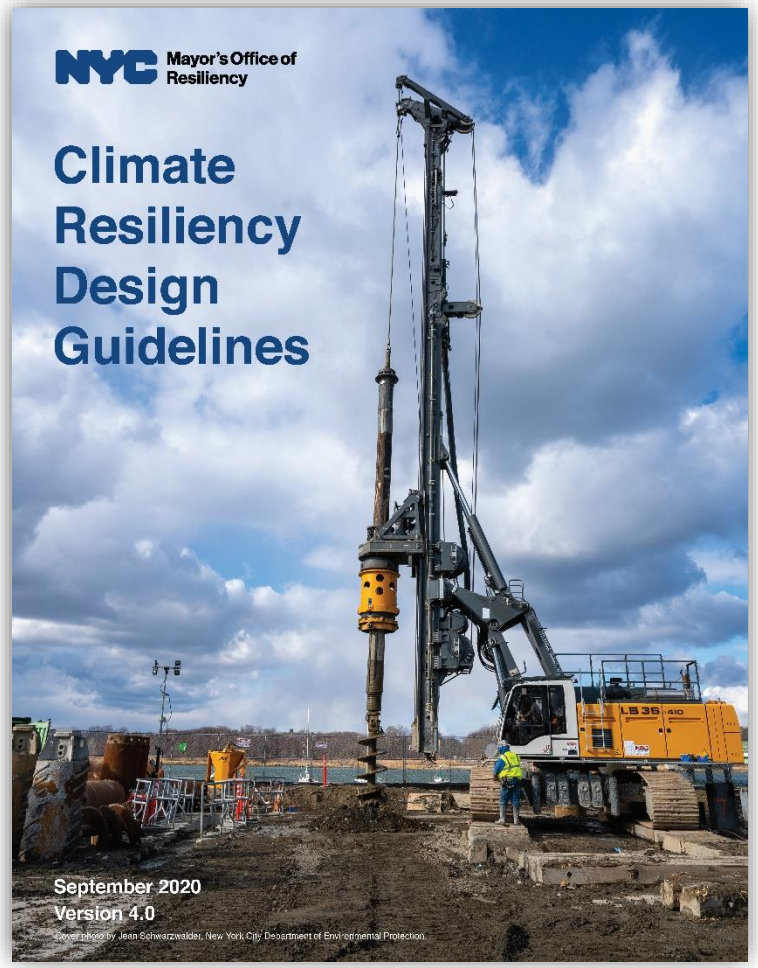
- The overlay limits by-right permitted uses for public access activities, repair of existing foundations, and repair of existing structures, provided they are not substantial improvements or reconstruction.

- Other uses are allowed with a Special Permit from the Zoning Board of Appeals, as long as they meet special conditions and safeguards.

https://www.mass.gov/files/documents/2016/08/sm/oak-bluffs-bylaw.pdf



Land Use Tool 3: Design Guidelines



Design guidelines act as recommendations to help educate and inform property owners and developers of best and emerging practices, and they should be leveraged to make buildings more climate-resilient.

While voluntary, resilient design guidelines would provide valuable education and awareness for owners and developers.

Design guidelines cannot prescribe types of materials or other elements that are regulated by the building code in Massachusetts.

Examples:

- **Boston, MA Coastal Flood Resilience Design Guidelines**
- **New York, NY Climate Resiliency Design Guidelines**
- **Watertown, MA Design Guidelines + Standards**

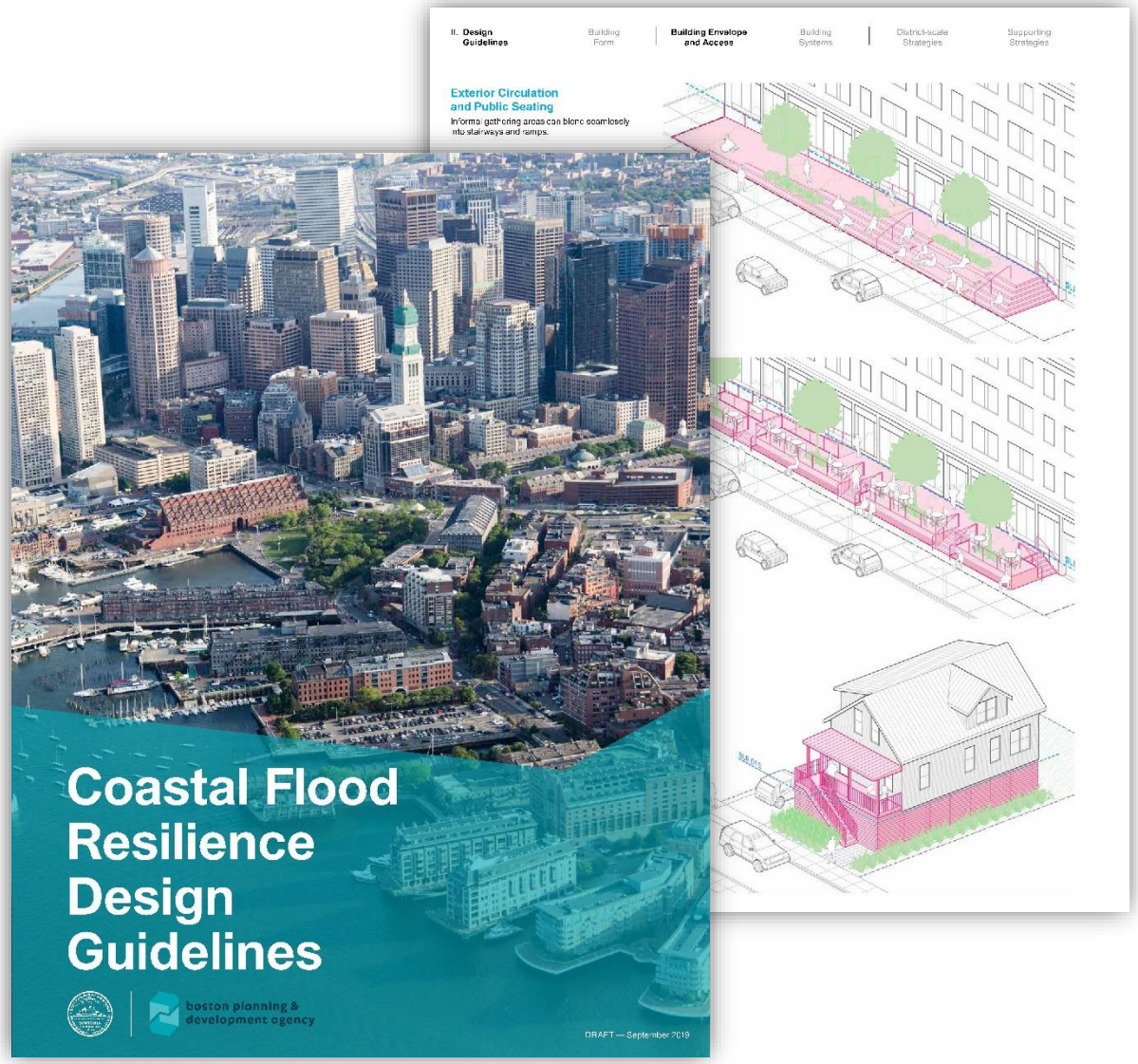
Boston, MA

Coastal Flood Resilience Design Guidelines

- The City of Boston recently adopted guidelines to help property owners and developers make informed decisions about flood protection for existing buildings and new construction.

- They provide building-scale solutions and recommendations on a variety of building typologies common in Boston.

http://www.bostonplans.org/getattachment/d1114318-1b95-487c-bc36-682f8594e8b2



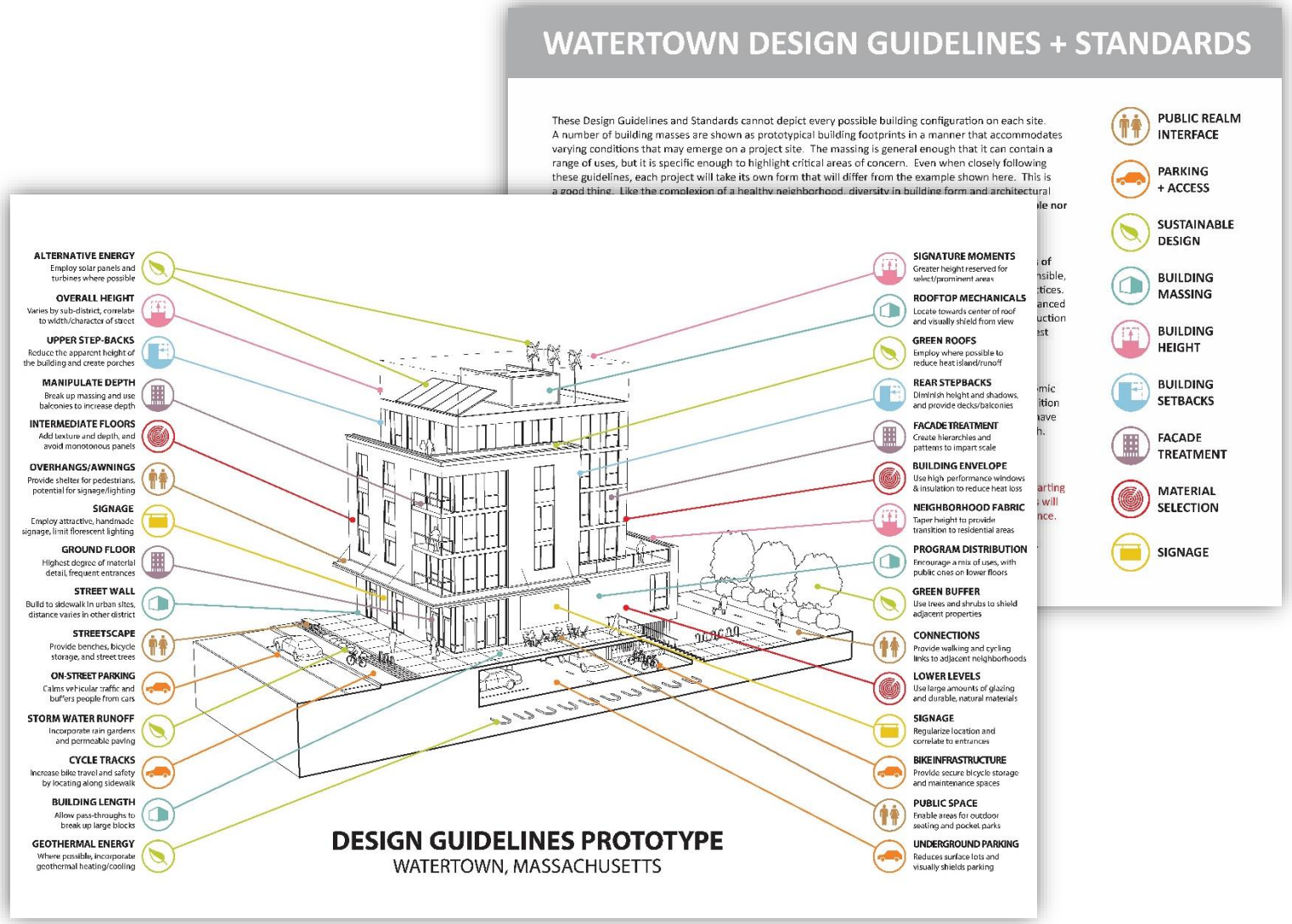
Watertown, MA

Design Guidelines + Standards

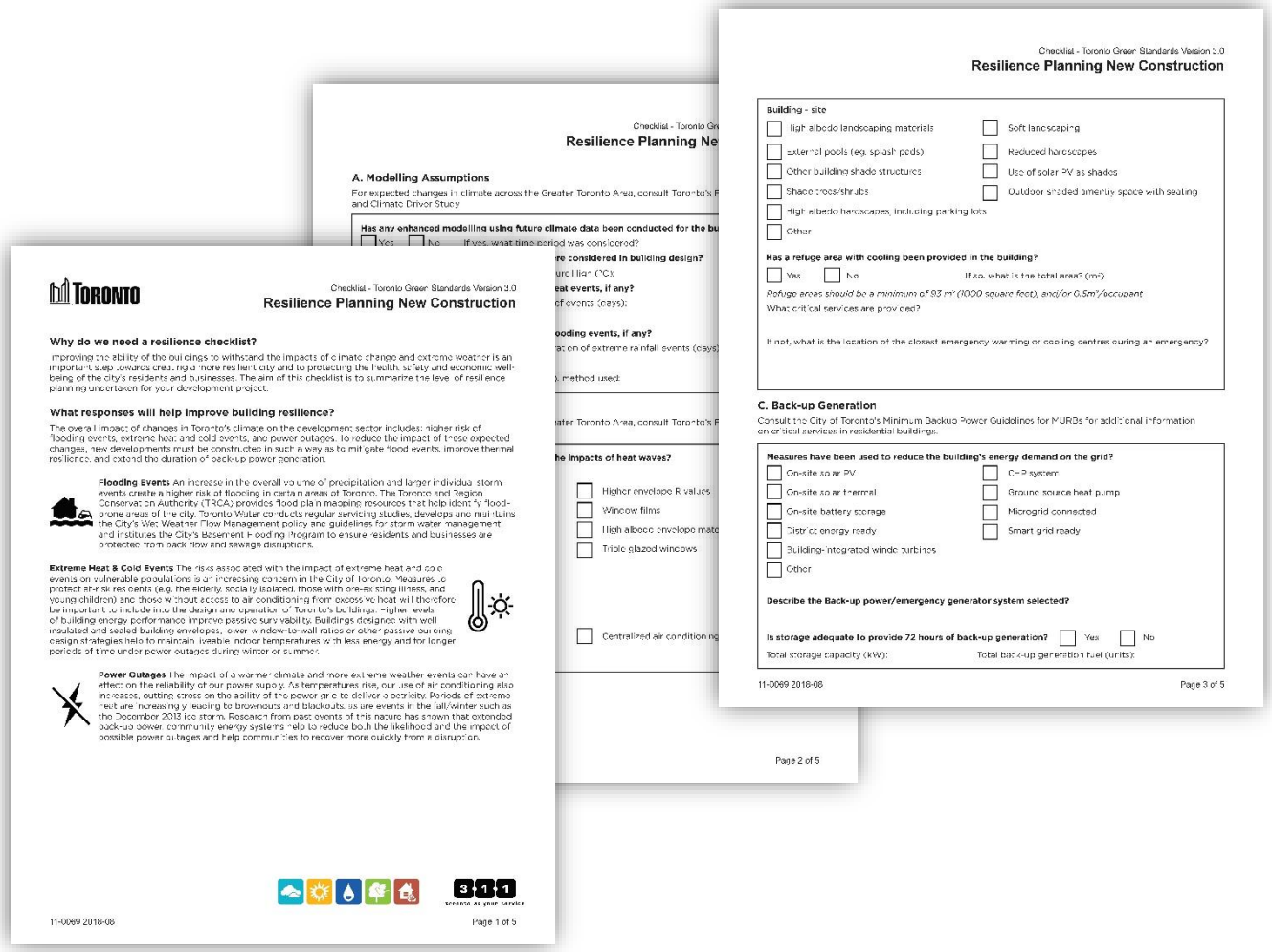
- After the adoption of the Comprehensive Master Plan, Watertown also adopted Design Guidelines and Standards for infill development and larger scale, mixed-used use buildings

- The design guidelines offer nine categories to consider as part of design including Sustainable Design

https://www.watertown-ma.gov/831/Design-Standards-Guidelines-2014-15



Land Use Tool 4: Resilience Checklist



A resilience checklist is an educational tool used to require developers and property owners to consider different climate impacts to their project/property as part of the site plan review process.

It should be noted that the checklist does not typically require a developer or property owner to change course or provide solutions for items that they consider.

Examples:

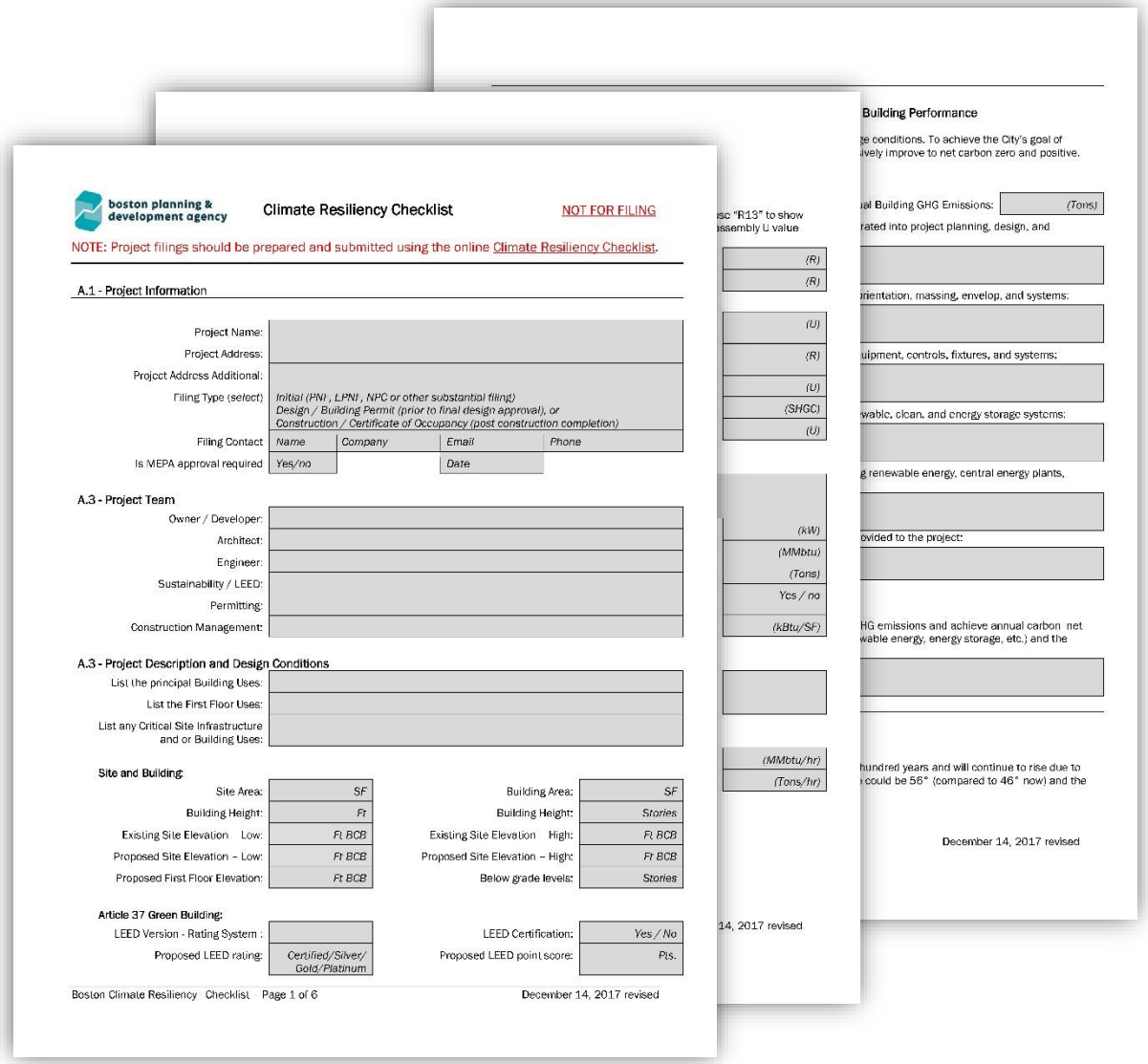
- **Boston, MA Climate Resilience Checklist**
- **Toronto, ON Green Standards**

Boston, MA

Climate Resilience Checklist

- Under Article 80 of its zoning code, the City requires property developers with projects over 50,000 square feet, in Planned Development Areas, or as part of an Institutional Master Plan to demonstrate utilization of the checklist during the review process.
- The checklist obligates developers to consider climate impacts to projects, but does not require action to be take

http://www.bostonplans.org/getattachment/5d668310-ffd1-4104-98fa-eef30424a9b3



boston planning & development agency

Climate Resiliency Checklist NOT FOR FILING

NOTE: Project filings should be prepared and submitted using the online Climate Resiliency Checklist.

A.1 - Project Information

Project Name:
Project Address:
Project Address Additional:
Filing Type (select): Initial (PNF, LPNF, NPC or other substantial filing) / Design / Building Permit (prior to final design approval), or / Construction / Certificate of Occupancy (post construction completion)
Filing Contact: Name | Company | Email | Phone
Is MEPA approval required: Yes/no | Date

A.3 - Project Team

Owner / Developer:
Architect:
Engineer:
Sustainability / LEED:
Permitting:
Construction Management:

A.3 - Project Description and Design Conditions

List the principal Building Uses:
List the First Floor Uses:
List any Critical Site Infrastructure and or Building Uses:

Site and Building:

Site Area:	SF	Building Area:	SF
Building Height:	Ft	Building Height:	Stories
Existing Site Elevation Low:	Ft BCB	Existing Site Elevation High:	Ft BCB
Proposed Site Elevation – Low:	Ft BCB	Proposed Site Elevation – High:	Ft BCB
Proposed First Floor Elevation:	Ft BCB	Below grade levels:	Stories

Article 37 Green Building:

LEED Version - Rating System :		LEED Certification:	Yes / No
Proposed LEED rating:	Certified/Silver/ Gold/Platinum	Proposed LEED point score:	Pts.

Boston Climate Resiliency Checklist Page 1 of 6 December 14, 2017 revised

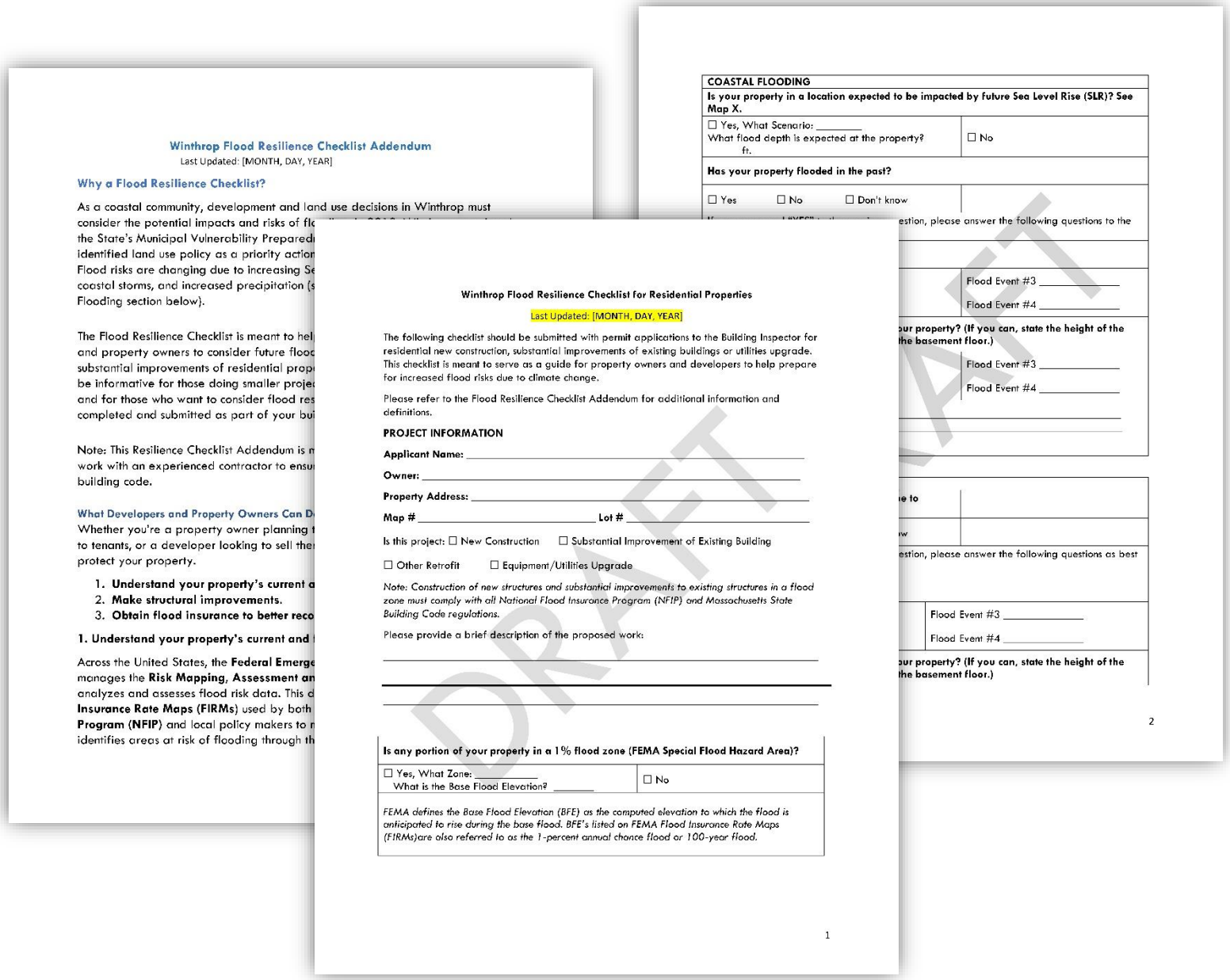
Building Performance

December 14, 2017 revised

Winthrop, MA

Climate Resilience Checklist

- The checklist is meant to help developers and property owners consider current and future flood risks for new construction and substantial improvements of residential property.
    - Current and future flood risk
    - Structural improvements, site considerations, flood insurance
    - Addendum
    - Flood Hazard Area Mapping Tool
- The checklist is intended to be submitted as part of the building permit process



Winthrop Flood Resilience Checklist Addendum

Last Updated: [MONTH, DAY, YEAR]

Why a Flood Resilience Checklist?

Winthrop Flood Resilience Checklist for Residential Properties

Last Updated: [MONTH, DAY, YEAR]

The following checklist should be submitted with permit applications to the Building Inspector for residential new construction, substantial improvements of existing buildings or utilities upgrade. This checklist is meant to serve as a guide for property owners and developers to help prepare for increased flood risks due to climate change.

Please refer to the Flood Resilience Checklist Addendum for additional information and definitions.

PROJECT INFORMATION

Applicant Name: _____

Owner: _____

Property Address: _____

Map # _____ Lot # _____

Is this project: ☐ New Construction ☐ Substantial Improvement of Existing Building

☐ Other Retrofit ☐ Equipment/Utilities Upgrade

Note: Construction of new structures and substantial improvements to existing structures in a flood zone must comply with all National Flood Insurance Program (NFIP) and Massachusetts State Building Code regulations.

Please provide a brief description of the proposed work:

Is any portion of your property in a 1% flood zone (FEMA Special Flood Hazard Area)?	
☐ Yes, What Zone: _____ What is the Base Flood Elevation? _____	☐ No
FEMA defines the Base Flood Elevation (BFE) as the computed elevation to which the flood is anticipated to rise during the base flood. BFE's listed on FEMA Flood Insurance Rate Maps (FIRMs)are also referred to as the 1-percent annual chance flood or 100-year flood.	

1

COASTAL FLOODING

Is your property in a location expected to be impacted by future Sea Level Rise (SLR)? See Map X.	
☐ Yes, What Scenario: _____ What flood depth is expected at the property? ft.	☐ No
Has your property flooded in the past?	
☐ Yes ☐ No ☐ Don't know	

Flood Event #3 _____

Flood Event #4 _____

2

DRAFT

Type of Tool	Things to Consider
Green Factor or Green Score Ordinance	• Create incentives for Green Infrastructure; Must be adopted into zoning code.
Resilience Checklist for New Development and Retrofits	• Education tool that can be a good first step; usually in permitting or site-plan review.
Update Existing Floodplain Bylaw	• May be easier to update existing bylaw than create a new bylaw or overlay.
Adopting additional Flood Resilience District/Overlay	• Allows for targeted approach to areas of increased flooding; Requires update to zoning code.
Adopt Resilient Design Guidelines	• While not a zoning change, will still need to go through lengthy approval process.

LOCAL REGULATORY STRATEGIES

- Inland flooding
- Coastal flooding
- Heat
- Drought

Braintree, March 2010

Hull, April 2007

Ipswich River, 2016

Inland Flooding Strategies

Image: Winchester, MA.
Source: Boston.Com

- Overlay district that prohibits development (Stow)
- Special Permit for construction in the Floodplain Overlay (Ashland)
- Expand Floodplain Overlay Districts (Newton, Braintree)
- Expand Land Subject to Flooding (LSF) wetlands jurisdiction to the 500-year flood (Millis); adopt buffer to LSF (many)
- Require 110% compensatory storage for fill in city floodplain (Newton)
- Adopt climate resilience wetlands regulations (Arlington)
- Expand wetlands jurisdiction to areas projected to flood in the next 50 years (Boston)
- SW regs apply to disturbances of 500 sq. ft. and require infiltration of 2” x impervious surfaces (Dedham)
- Update stormwater standards to NOAA 14 or Cornell (many)

Design Storm Standards

TP40 1961 Massachusetts

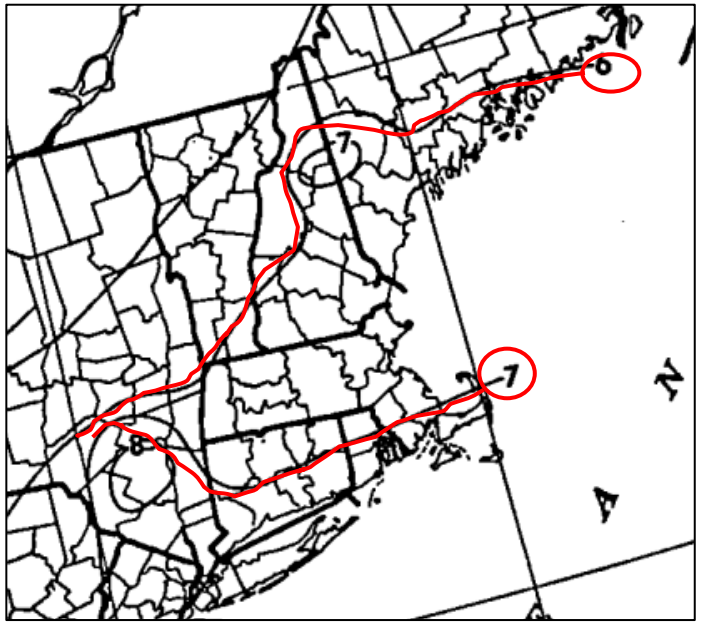
2 year/24-hour storm: Approx. 3.25”
10 year/24-hour storm: Approx. 4.5”
100 year/24-hour storm: Approx. 6.5”

NOAA 14 Newton - Current

2 year/24-hour storm: 3.26”
10 year/24-hour storm: 5.13”
100 year/24-hour storm: 8.11”

NOAA 14 Plus Newton - DEP Proposal

2 year/24 hour: Approx. 3.61”
10 year/24 hour: Approx. 5.73”
100 year/24 hour: Approx. 10.26”



TP40 – 100-year storm

PDS-based precipitation frequency estimates with 90% confidence intervals

Duration	Average recurrence interval (years)							
	1	2	5	10	25	50	100	20
24-hr	2.63 (2.14-3.23)	3.26 (2.65-4.01)	4.28 (3.47-5.29)	5.13 (4.13-6.37)	6.30 (4.90-8.26)	7.16 (5.46-9.63)	8.11 (6.01-11.4)	9.2 (6.38-

NOAA 14 – Newton MA

10.26 = 11.4 x .9

Coastal Flooding Strategies

Image: Storm surge in Hull, MA.
Source: A. Herbst.

- Overlay district encourages resilient development (Hull, Saugus)
- Overlay district restricts development (Scituate, Gloucester, Chatham)
- Site plan review requires consideration of sea level rise (Hull)
- Zoning height limit relief to achieve base flood/freeboard (Hull, Scituate)
- Expand wetlands jurisdiction to 100 buffer to LSCSF (Revere, Kingston) to storm of record (Duxbury, Kingston)
- Sea level rise included in LSCSF standards (Duxbury, Kington, Hingham)
- New structures, impermeable paving, new and expanded septic prohibited in V zones (Hingham, Duxbury); Also in AO zones (Duxbury)

Drought Strategies

Image: Dow Brook Reservoir
Source: Gordon Harris.

- New water users must retrofit existing buildings to provide 2:1 savings (Weymouth)
- Require analysis of cost savings and implementation of water conservation strategies (Natick)
- Require installation of ultra low flow toilets and laundry (Sharon)
- Wetlands regulations limit lawns and restrict irrigation (Medway and Sharon)
- Water use restrictions apply to private wells (Wenham and Topsfield)
- Prohibit use of public water supply for irrigation systems (Scituate, Pembroke)
- Automatic irrigations systems must have moisture sensors and timing device to comply with water use restrictions (Concord)

Extreme Heat Strategies

- Two shade trees required for every 5 parking lot spaces (Bedford, Somerville)
- Trees in setback area are protected, prohibition on removal extends to 12 months before building permit, removal requires replanting or payment to town fund (Concord)
- Landscape regulations protect trees, tree canopy, and encourage shading structures, paving, and pedestrians (Maynard)
- Wetlands permit required for tree removal in resource areas and buffers (Bedford)

Source: Boston.com

Design Review Standards

Watertown

- Environmental Performance: “highest sustainable and ecological principles”
- Landscaping for SW retention and GW recharge, use of drought-tolerant, non-invasive species
- Parking areas to use permeable paving for GW recharge, shared parking encouraged
- Parking lots landscaped islands below grade for SW capture where feasible
- Rooftop photovoltaic assessment required
- LED Silver certifiable (4,000 sq/ft) to address heat islands, renewable energy, water use.

Somerville

- Development on steep slopes requires a special permit to address runoff and erosion
- Stormwater reuse and green roofs encouraged
- Solar reflectance requirements for roofs and parking areas

DISCUSSION: SMALL GROUP BREAKOUTS

Discussion Questions:

1. In what ways has your municipality used land use planning or zoning to address climate directly or indirectly?

2. What have you been most inspired by after hearing these presentations? What climate impacts would you most like to address through land use planning and zoning?

3. What have been some of the barriers/ challenges to addressing climate resilience through land use planning and zoning?

4. What tools and resources do you need?

Report Backs and Synthesis

Thank You!

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