Building Code Options to Reduce Flood Risk

In collaboration with EEA, DCR, and CZM, the Executive Office of Economic Development (EOED) is evaluating future opportunities to reduce flood risk and increase climate resilience through development of strong, flood-resistant construction standards. The following is a list of potential options that, if considered in the future, would mitigate flood losses and strengthen the resilience of new homes, major renovations, and developments across Massachusetts.

Please note that this is not a list of proposed amendments for the current 9th Edition of the Massachusetts State Building Code (MSBC) or the upcoming 10th Edition. This list represents a realm of possibilities for future discussion. Options were identified based primarily on their potential to provide one or both of the following benefits.

- **Reduced or avoided future flood damage.** "Future" encompasses not only FEMA's Special Flood Hazard Area (SFHA)[1] as depicted on its national Flood Insurance Rate Maps (FIRMs), but statewide climate change data predicting more frequent and severe flood events and, in turn, the expansion of flooding impacts beyond FEMA's mapped SFHA.

- **Improved administration and compliance.** Some options listed below propose no new flood-resistant standards but may ease the administration of existing standards and thereby improve compliance.

Glossary of abbreviations

ASCE 24	American Society of Civil Engineers' flood-resistant standards publication	More details
BBRS	MA Board of Building Regulations and Standards	More details
BFE	Base Flood Elevation	More details
CAZ	FEMA's Coastal A Zone	More details
CFR	Code of Federal Regulations	
CRS	FEMA's Community Rating System	More details
FIRMs	Flood Insurance Rate Maps	More details
I-Codes	International model codes developed by the International Code Council	More details
LiMWA	Limit of Moderate Wave Action	More details
MSBC	MA State Building Code	
SFHA	Special Flood Hazard Area	More details
NFIP	National Flood Insurance Program	More details

[1] *Special Flood Hazard Area* (SFHA) refers to land shown on a FEMA Flood Insurance Rate Map (FIRM) that will be inundated by the 100-year flood event, also referred to as the base flood or 1-percent annual chance flood. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

Building code opportunities

Options below are given in no particular order. All were developed from review of the draft 10th Edition of the MA State Building Code (MSBC), as presented at a meeting of the Massachusetts Board of Building Regulations and Standards (BBRS) on the December 13th, 2023. The full evaluation of these options will incorporate feedback from online engagement sessions and survey responses.

Option ID #1:	**Limit Enclosures Below Elevated Buildings** Prohibit enclosures below elevated buildings in FEMA Zone V and CAZ.
Option Type:	Design and Construction Requirements

The NFIP and the MSBC allow spaces below elevated buildings in Zone V and the CAZ to be enclosed by walls that are designed to break away under flood loads. The use of areas enclosed by walls must be limited to parking, storage, and building access. Prohibiting enclosures reduces the quantity of debris in floodwater (debris can batter other buildings and contributes to clean-up costs), and if there are no enclosures, owners illegally convert enclosures to unpermitted uses.

Option ID #2:	**Additional Elevation (Freeboard)** Additional fixed height (freeboard) over the requirements of the current MSBC (9th Edition).
Option Type:	Design and Construction Requirements

Freeboard refers to additional height above the minimum level of protection required for buildings in flood hazard areas. It provides a margin of safety for uncertainty in analytical methods used to develop flood hazard data and maps. Freeboard also provides a level of protection as future conditions lead to more severe flooding, whether caused by increased runoff due to upland development in watersheds, more intense rainfall events, or projected sea level rise. Increasing the freeboard required by the MSBC base code and would provide additional hedge against uncertainty of future increases in severity of flooding.

The NFIP minimum requirement for building elevation is the BFE. The minimum elevations specified by the 9th MSBC residential code are the BFE plus 1 foot in Zone A/AE and BFE plus 2 feet in Zone VE. The draft 10th Edition residential code (as presented on December 13th, 2023, at a meeting of BBRS) would increase these minimum elevations to BFE plus 2 feet in Zone A/AE and BFE plus 3 feet in Zone V and Coastal A Zone, thereby providing more freeboard. In contrast, no changes to minimum elevations are proposed in the 10th Edition base code, which applies to nonresidential buildings and multi-family residential buildings.

Option ID #3:	**Limit Use of Fill to Elevate Buildings** Limit use of fill to support and buildings in Zone A/AE.
Option Type:	Design and Construction Requirements

The NFIP and the 9th Edition MSBC permit use of fill to support and elevate buildings in flood zones designated Zone A/AE. However, the MSBC 10th Edition limits use of fill in those zones in the area seaward of the LiMWA if that line is delineated on FIRMs. The NFIP and MSBC do not permit use of fill to support buildings in flood zones designated Zone VE. The placement of fill in riverine floodplains, even in floodway fringe areas, reduces the ability of floodplains to store and convey floodwater, sometimes increasing water levels. Fill used to support buildings can become unstable if saturated, may be subject to erosion by moving water, and may contribute to local drainage problems. Placement of fill requires removal of trees and vegetation, may impact wetlands, interferes with infiltration of surface water, and reduces natural filtration of runoff.

Option ID #4:	**Limit Non-substantial Additions to Nonconforming Buildings** Limit non-substantial additions to nonconforming buildings.
Option Type:	Design and Construction Requirements

The NFIP does not explicitly set requirements for additions that are determined to not be substantial improvements, where the cost of the proposed addition is less than 50% of the market value of the building. However, the NFIP considers as “new” work on buildings that conformed to floodplain management requirements in effect when permits for those buildings were issued. Consequently, regardless of the cost or size of an addition, it must have the same foundation type and be elevated at least as high as the base building. The International Existing Building Code provides that work on existing buildings must not create or extend any nonconformity: new work must comply and must not make the buildings more nonconforming than they were before the work is performed. The MSBC Residential modifies the elevation requirements to make that expectation clear for dwellings in Coastal High Hazard Areas (see MSBC Section R322.3.2; the same clarification is not made in MSBC Section R322.2.2 for other flood hazard areas). The 2027 International Existing Building Code will explicitly address additions to nonconforming buildings.

The building code option to limit the size of non-substantial additions to nonconforming buildings controls investment in additions to buildings that are lower than the required elevation in effect when the additions are proposed (i.e., BFE plus 2 feet).

Option ID #5:	**Finished Floor and Local Drainage** Require 'finished floor' at or above X inches above grade or above the crown of nearest roadway to project buildings from pluvial flooding (drainage problems) outside of flood hazard areas.
Option Type:	Design and Construction Requirements

The NFIP has no requirements that apply outside of flood hazard areas shown on FEMA FIRMs, although 44 CFR Sec. 60.3(a) establishes an expectation that communities may "identify the presence" of flood hazards even when FEMA does not provide data. Two sections of the MSBC govern drainage away from building foundations. MSBC Building, Section 1804.4, requires the ground to be graded with a minimum slope of "not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet." MSBC Residential, Section R401.3, requires grading to drain surface water away from foundation walls, specifying the "grade shall fall not fewer than 6 inches within the first 10 feet" away from foundation walls. With increased rainfall intensity, some communities with relatively flat topography may experience increased stormwater flooding that could affect buildings outside of mapped flood hazard areas. Requiring the top of slabs or floor systems to be a specified number of inches above grade, or the crown of the nearest road or street, would provide some degree of protection as pluvial flooding risks increase.

Option ID #6:	**Maps of Historic Flooding or Climate Change Projections** Allow local adoption and use of flood hazard maps that depict areas affected by past flood events (historic flooding) and/or maps based on climate change projections, in addition to FEMA Flood Insurance Studies and FIRMs
Option Type:	Flood Hazard Areas

The I-Codes deliberately anticipate that some communities may have maps and studies that supplement the FEMA flood hazard information, for example to delineate areas that were not studied by FEMA, to delineate historic floods, and to delineate areas anticipated to be subject to future flooding because of changing conditions such as climate change or upper watershed development. The Massachusetts amendments to the I-Code preclude this option, which means communities are not able to apply the flood provisions of the MSBC to any floodplain other than the FEMA SFHA.

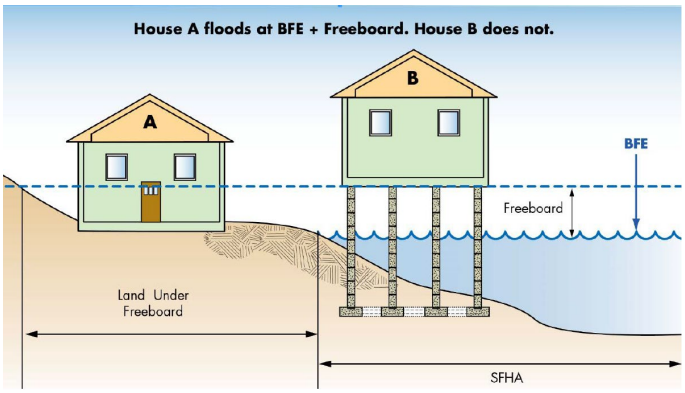
One way to allow local adoption of flood hazard information other than the FEMA studies and maps is to restore certain MSBC definitions to the I-Codes definitions and modify the codes to refer to local adoption in by-laws. This approach is used by a number of communities in Florida that have adopted or are considering adopting climate-change projection maps for regulatory purposes.

Option ID #7:	**Regulate 500-year Floodplain** Apply FEMA Zone A requirements to buildings in FEMA shaded Zone X (500-year floodplain and other areas where FEMA uses shaded Zone X), with an elevation of 2 feet either above grade or the FEMA 500-year flood elevation, whichever is higher.
Option Type:	Flood Hazard Areas

The NFIP and MSBC do not apply flood requirements to development and buildings outside of the SFHA, which is the area subject to flooding by the base flood (1 percent or 100-year flood). Some FEMA FIRMs delineate and identify areas subject to flooding by the 0.2 percent flood (500-year) as Zone X that is “shaded” (identified as Zone B on older maps). Unshaded Zone X (formerly Zone C) are areas that, based on the topography used to prepare the maps, are higher than the BFE (100-year) and the 500-year flood elevation (where the 500-year is mapped). Regulating the shaded Zone X is one way to manage future flood risk, although the deficiencies of FEMA-delineated SFHAs extend to the agency’s delineation of shaded Zone X (i.e., based on old, “backward-looking” data, with no anticipation of changes in flooding over time).

Option ID #8:	**Land Under Freeboard** Regulate the extent of land under freeboard the same as SFHAs by extending landward the elevation represented by the base flood elevation (BFE) plus one (1) foot freeboard at the outer edge of the SFHA and apply requirements to the land that is below that elevation.
Option Type:	Flood Hazard Areas

Application of the flood requirements of the MSBC stop at the outer boundary of the SFHA. On FIRMs, this is the boundary line between Zone A/AE and Zone X (shaded and unshaded). Buildings located in the SFHA must be elevated to the elevation specified in the MSBC (minimum of BFE plus 1 foot). However, buildings located just outside of the SFHA are not required to have any features intended to minimize damage in the event flooding rises higher than the BFE (see graphic below). They are permitted to be at-grade and may have basements. Thus, those buildings are not accorded the same level of protection as buildings located in the SFHA. Administering this option may require local delineation of the affected area or determining the ground elevation at proposed building sites to compare to the nearby BFEs. Note that SFHAs without BFEs would not be affected by this change.



Option ID #9:	**FEMA Certificates** Require use of FEMA Elevation Certificates and FEMA Dry Floodproofing Certificates.
Option Type:	Administrative Tools

The NFIP and the MSBC require certification of the elevation of lowest floors and require design certifications for nonresidential buildings that are designed to be dry floodproofed. Use of FEMA forms for those purposes is not required. The FEMA Elevation Certificate is designed to collect information about buildings in addition to surveyed (or measured) lowest floor elevations. That information helps local officials determine compliance, especially compliance of enclosures below elevated buildings and attached garages. Use of the FEMA Elevation Certificate may reduce some damage, to the extent that noncompliance is more readily determined before local officials issue certificates of occupancy.

The FEMA Dry Floodproofing Certificate is designed for two purposes: to certify that dry floodproofing is designed in accordance with ASCE 24 (required by the MSBC) and to certify after construction that the as-built floodproofing measures conform to the design and to certify the elevation to which the measures provide protection. Dry floodproofing is a subspecialty of structural engineering. Using the FEMA Dry Floodproofing Certificate provides local officials and owners a higher level of confidence in the design and construction of the measures.

Option ID #10:	**Non-conversation Agreements for Enclosures Under Elevated Buildings** Require non-conversion agreements for enclosures below elevated buildings in FEMA Zone V and CAZ.
Option Type:	Administrative Tools

The NFIP and the MSBC allow spaces below elevated buildings in flood hazard areas to be enclosed by walls. The use of areas enclosed by walls must be limited to parking, storage, and building access. Nonconversion agreements require permittees to sign an agreement to acknowledge the restrictions on use and agree to not modify or convert the enclosures. Illegally modifying enclosures below buildings elevated in Coastal High Hazard Areas (Zone V) and CAZs could prevent walls from breaking away as intended, which could add unanticipated flood loads to foundations. Future owners are notified of the restrictions when nonconversion agreements are required to be recorded in property records. CRS materials describe an option for applicants to acknowledge that local officials may conduct compliance inspections from time to time.

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