User’s Guide
to Technical Bulletins

Developed in Accordance with the National Flood Insurance Program

NFIP Technical Bulletin 0 / July 2019

FEMA
Comments on the Technical Bulletins should be directed to:
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Federal Insurance and Mitigation Administration (FIMA) Risk Management Directorate
Building Science Branch
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Washington, DC 20472-3020


Cover photograph: Neighborhood in New Orleans, LA, flooded by Hurricane Katrina (August 30, 2005; photo courtesy of Jocelyn Augustino).

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### Acronyms

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<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>BFE</td>
<td>base flood elevation</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>DFE</td>
<td>design flood elevation</td>
</tr>
<tr>
<td>DHS</td>
<td>Department of Homeland Security</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
</tr>
<tr>
<td>FHBM</td>
<td>Flood Hazard Boundary Map</td>
</tr>
<tr>
<td>FIMA</td>
<td>Federal Insurance and Mitigation Administration</td>
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<tr>
<td>FIRM</td>
<td>Flood Insurance Rate Map</td>
</tr>
<tr>
<td>FIS</td>
<td>Flood Insurance Study</td>
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<tr>
<td>IBC</td>
<td>International Building Code®</td>
</tr>
<tr>
<td>ICC</td>
<td>International Code Council®</td>
</tr>
<tr>
<td>I-Codes</td>
<td>International Codes®</td>
</tr>
<tr>
<td>IRC</td>
<td>International Residential Code®</td>
</tr>
<tr>
<td>NFIP</td>
<td>National Flood Insurance Program</td>
</tr>
<tr>
<td>SEI</td>
<td>Structural Engineering Institute</td>
</tr>
<tr>
<td>SFHA</td>
<td>Special Flood Hazard Area</td>
</tr>
<tr>
<td>TB</td>
<td>Technical Bulletin</td>
</tr>
</tbody>
</table>
1 Introduction and Background

Beginning in the early 1990s, the Federal Insurance and Mitigation Administration of the Federal Emergency Management Agency (FEMA) has issued 11 Technical Bulletins that provide guidance on interpreting, enforcing, and complying with the minimum building performance requirements in the National Flood Insurance Program (NFIP) regulations (Title 44 of the Code of Federal Regulations [CFR] Parts 59 and 60). These requirements are intended to reduce the loss of life and property as well as the economic and social hardships that can result from flooding.

The NFIP is a Federal program established by the National Flood Insurance Act of 1968, as amended (42 U.S. Code §§ 4011 et seq.). The primary purposes of the Act are to:

- Better indemnify individuals for flood losses through insurance
- Reduce future flood damage through State and community floodplain management regulations
- Reduce Federal expenditures for disaster assistance and flood control

To participate in the NFIP, communities must adopt and enforce floodplain management regulations that meet or exceed NFIP floodplain management requirements. Owners of property located in communities that participate can purchase NFIP flood insurance as a protection against the financial impact of flood losses.

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**NFIP REQUIREMENTS AND HIGHER REGULATORY STANDARDS**

**State and Local Requirements.** State or local requirements that are more stringent than the minimum requirements of the NFIP take precedence. The Technical Bulletins and other FEMA publications provide guidance on the minimum requirements of the NFIP and describe best practices. Design professionals, builders, and property owners should contact local officials to determine whether more restrictive provisions apply to buildings or sites in question. All other applicable requirements of the State or local building codes must also be met.

**Substantial Improvement and Substantial Damage.** As part of issuing permits, local officials must review not only proposals for new construction but also for work on existing buildings to determine whether the work constitutes Substantial Improvement or repair of Substantial Damage. If the work is determined to constitute Substantial Improvement or repair of Substantial Damage, the buildings must be brought into compliance with the NFIP requirements for new construction. Some communities modify the definitions of Substantial Improvement and/or Substantial Damage to be more restrictive than the NFIP minimum requirements. For more information on Substantial Improvement and Substantial Damage, see FEMA P-758, *Substantial Improvement/Substantial Damage Desk Reference* (2010), and FEMA 213, *Answers to Questions About Substantially Improved/Substantially Damaged Buildings* (2018).

**Higher Building Elevation Requirements.** Some communities require that buildings be elevated above the NFIP minimum requirement. The additional elevation is called freeboard. Design professionals, builders, and property owners should check with local officials to determine whether a community has freeboard requirements. References to building elevations in this Technical Bulletin should be construed as references to the community’s elevation requirement in areas where freeboard is required.
The NFIP floodplain management regulations, contained in 44 CFR § 60.3, include minimum building performance criteria that apply to (1) new construction, (2) work determined to be Substantial Improvement such as improvements, alterations, and additions, and (3) the repair of buildings determined to have incurred Substantial Damage and that are in Special Flood Hazard Areas (SFHAs).

1.1 Intended Audience

The Technical Bulletins are intended for use primarily by State and local officials who are responsible for interpreting and enforcing the NFIP floodplain management regulations.

The Technical Bulletins may also be used by design professionals (e.g., architects, engineers), contractors, building owners and operators, planners, and other interested stakeholders to help understand and comply with NFIP floodplain management requirements. Using the information in the Technical Bulletins will improve the design and construction of buildings, including their utility systems, that are in floodprone areas, thereby reducing the potential for damage and increasing building and community resilience.

1.2 Purpose of Technical Bulletins

The Technical Bulletins provide specific FEMA guidance for State and local floodplain management officials on complying with the NFIP’s minimum floodplain management criteria. While the primary focus of the Technical Bulletins is on how to meet the minimum NFIP floodplain management requirements, they also include information on:

- Recommended best practices for reducing flood losses
- Considerations related to NFIP flood insurance rates
- Building codes and standards

Additional information on how to use the Technical Bulletins is provided in Section 2.

1.3 Synopses of Technical Bulletins (as of June 2019)

<table>
<thead>
<tr>
<th>TB No.</th>
<th>Title (Date)</th>
<th>Synopsis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>User’s Guide to Technical Bulletins (2019)</td>
<td>Introduction and background for the TBs, including the intended audience, purpose, and synopses of available TBs; how to use the TBs; crosswalk of NFIP regulations and the TBs; key concepts and requirements used in the TBs; key terms and useful resources; supplemental information, including how to obtain copies of the TBs; FEMA Headquarters and Regional Office locations; and a key word/subject index for the TBs.</td>
</tr>
<tr>
<td>TB No.</td>
<td>Title (Date)</td>
<td>Synopsis</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Elevator Installation for Buildings Located in Special Flood Hazard Areas (2019)</td>
<td>Guidance on the NFIP requirements for elevator machinery and equipment that serve buildings and on the installation of elevators below the BFE in SFHAs (both Zones A and V).</td>
</tr>
<tr>
<td>8</td>
<td>Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas (2019)</td>
<td>Why maintaining the load paths in buildings is important and the important role that the proper corrosion protection of metal connectors and fasteners has in ensuring that buildings in coastal areas are adequately anchored and connected to resist floods and high wind events.</td>
</tr>
<tr>
<td>10</td>
<td>Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding (2001)</td>
<td>Regulatory and technical guidance on ensuring that the construction of the following buildings are reasonably safe from flooding: buildings with various types of foundations, including basements, in areas that have been proposed to be removed from the SFHA through the placement of fill and in areas near the SFHA.</td>
</tr>
<tr>
<td>11</td>
<td>Crawlspace Construction for Buildings Located in Special Flood Hazard Areas (2001)</td>
<td>Interim guidance on minimum NFIP requirements and best practices for crawlspace construction, including requirements for below-grade crawlspace construction that may extend 1 or 2 feet below grade.</td>
</tr>
</tbody>
</table>

BFE = base flood elevation  
FEMA = Federal Emergency Management Agency  
NFIP = National Flood Insurance Program  
SFHA = Special Flood Hazard Area  
TB = Technical Bulletin
1.4 Organization of Technical Bulletin 0 – User’s Guide to Technical Bulletins

This User’s Guide to Technical Bulletins contains:

- Information on how to use the Technical Bulletins
- Crosswalk of the NFIP regulations and the Technical Bulletins
- Key concepts and requirements in the Technical Bulletins
- Glossary of acronyms and key terms
- How to obtain copies of Technical Bulletins and submit comments
- FEMA Headquarters and Regional office contact information
- Index of key words and subjects in the Technical Bulletins
- References and resources

2 How to Use the Technical Bulletins

FEMA revises or develops new Technical Bulletins as needed to provide guidance to State and local officials, design professionals, contractors, building owners and operators, planners, and other interested stakeholders to help them comply with NFIP floodplain management requirements.

The Technical Bulletins are focused on minimum NFIP floodplain management criteria. They also provide guidance on best practices for floodplain management and flood hazard-resistant construction, building codes and standards, and NFIP flood insurance considerations.

2.1 Minimum NFIP Floodplain Management Criteria

To participate in the NFIP, communities must adopt regulations that meet or exceed the minimum requirements in 44 CFR § 60.3. The Technical Bulletins provide specific FEMA guidance on complying with minimum NFIP floodplain management requirements. If a community chooses not to use the methods or implement the measures that are described in the Technical Bulletins, the community must demonstrate how it is meeting the requirements of 44 CFR § 60.3.

In addition to the community’s responsibility to ensure specific building requirements are met, such as elevating or dry floodproofing buildings,
elevating or otherwise protecting utilities, and installing openings in enclosure walls, communities are also required to review development proposals “to determine whether such proposals will be reasonably safe from flooding” (44 CFR § 60.3(a)(4)).

To participate in the NFIP, all communities must adopt a resolution or ordinance that expresses a “commitment to recognize and evaluate flood hazards in all official actions and to take such other official action as reasonably necessary to carry out the objectives of the program” (44 CFR § 59.22(a)(8)). This is in addition to the general requirement that communities “take into account flood hazards to the extent that they are known in all official actions relating to land management and use” (44 CFR § 60.1(c)).

### 2.2 Best Practices

Some of the best practices for floodplain management and flood hazard-resistant construction that are described in the Technical Bulletins are recommendations for increasing hazard resistance in buildings and their utility systems and for reducing the loss of life and property and economic and social hardships.

FEMA strongly encourages that these best practices be:

- Incorporated into State or community floodplain management ordinances or building codes
- Implemented by designers, builders, or other stakeholders to reduce risk and improve resilience
- Used to potentially lower NFIP flood insurance premiums

Many of these best practices are based on field-verified data including data from decades of post-disaster building performance assessments.

**EXAMPLE OF A BEST PRACTICE FROM TECHNICAL BULLETIN 2, FLOOD DAMAGE-RESISTANT MATERIALS REQUIREMENTS**

If the lowest floor of a building is elevated higher than the BFE, which is common when the owner wants a full story of elevation to accommodate parking under the building, FEMA recommends that flood damage-resistant materials also be used up to the level of the lowest floor to reduce damage in these areas should flooding exceed the BFE.
2.3 Building Codes and Standards

In addition to complying with the NFIP requirements, all new construction, Substantial Improvements, and repair of Substantial Damage must comply with the applicable building codes and standards that have been adopted and that are enforced by States and communities. Building codes govern the design, construction, alteration, and maintenance of structures. They specify the minimum requirements to adequately safeguard the health, safety, and welfare of building occupants. Rather than create and maintain their own building codes, most States and local jurisdictions adopt the International Codes® (I-Codes®), which are a family of model building codes published by the International Code Council® (ICC®).

I-Codes include the International Residential Code® (IRC®), International Building Code® (IBC®), International Existing Building Code® (IEBC®), and codes that govern the installation of mechanical, plumbing, fuel gas service, and other aspects of building construction. Provisions in State- and community-adopted building codes can vary from these model codes, so coordination with local building officials is necessary to confirm which requirements apply within a given jurisdiction.

The IBC applies to all applicable buildings and structures whereas the scope of the IRC is limited to one- and two-family dwellings and townhomes not more than three stories above grade plane. The IBC can be used to design dwellings, but it is used primarily for buildings and structures other than dwellings within the IRC scope. The flood provisions in the IBC are included by reference to ASCE 24, Flood Resistant Design and Construction, a standard developed by the American Society of Civil Engineers (ASCE).

FEMA has deemed that the latest published editions of the I-Codes meet or exceed NFIP requirements for buildings and structures. Excerpts of the flood provisions of the I-Codes are available on FEMA’s Building Code Resource webpage (http://www.fema.gov/building-code-resources).

The joint ICC and FEMA publication Reducing Flood Losses Through the International Codes: Coordinating Building Codes and Floodplain Management Regulations, 4th Edition (2014) recommends that communities coordinate the administration of floodplain management provisions and building codes. Differences in requirements between the regulatory tools can lead to inconsistencies or confusion when administering and enforcing requirements for development in floodprone areas.
2.4 NFIP Flood Insurance Considerations

Each Technical Bulletin addresses NFIP flood insurance considerations related to the topic of the Technical Bulletin. The following stakeholders should be aware of these considerations:

- Local officials, designers, builders, and other stakeholders
- Property owners who are concerned about the impact of design and construction decisions on their NFIP flood insurance premiums

NFIP flood insurance premiums are based on factors that include, but are not limited to, flood risk zone, elevation of the lowest floor above or below the BFE, type of building and foundation, the number of floors, and whether there is a basement or enclosure below the elevated building.

The Technical Bulletins address situations in which a compliant building might still be subject to higher NFIP flood insurance premiums. As only one example, Technical Bulletin 3, Non-Residential Floodproofing – Requirements and Certification for Buildings Located in Special Flood Hazard Areas, notes that the minimum NFIP requirements allow a new or Substantially Improved non-residential building in Zone A to have a lowest floor below the BFE, provided that the building has been designed, constructed, and certified to be floodproofed and meets established criteria. However, while the building needs to be protected only to the BFE for floodplain management purposes, freeboard is considered for NFIP flood insurance rating purposes. Because of the additional risk associated with any floodproofed building, for NFIP flood insurance rating, 1 foot is subtracted from the elevation to which a building has been floodproofed. Therefore, to receive an NFIP insurance rating based on the BFE, the building must be floodproofed to an elevation of at least 1 foot above the BFE.

3 Crosswalk of NFIP Regulations and Technical Bulletins

Table 2 is a crosswalk of select NFIP regulations and the Technical Bulletins that provide guidance on them. The table is intended to be a general guide to the Technical Bulletins; it does not include all of the NFIP regulations. See the index in Section 7 for more information on where to find guidance in the Technical Bulletins on specific NFIP regulations.
### Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applies to All Flood Zones</strong></td>
<td></td>
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</tbody>
</table>
| 44 CFR § 60.3(a)(3) | **Technical Bulletin 1**  
*Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas* | Flood openings in foundation walls and walls of enclosures relieve hydrostatic loads, helping to meet the basic performance requirement to prevent flotation, collapse, or lateral movement due to flood forces. |
| | **Technical Bulletin 2**  
*Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas* | Typical construction materials are classified as acceptable or unacceptable for use below the BFE. Using acceptable materials improves resistance to flood damage. |
| | **Technical Bulletin 3**  
*Non-Residential Floodproofing — Requirements and Certification for Buildings Located in Special Flood Hazard Areas* | When designed to account for base flood loads, dry floodproofed buildings meet the basic performance requirement to be constructed using methods and practices that minimize flood damage. |
| | **Technical Bulletin 4**  
*Elevator Installation for Buildings Located in Special Flood Hazard Areas* | Installing elevators and associated equipment above the BFE prevents water from entering or accumulating within most elevator components during conditions of flooding. |
| | **Technical Bulletin 5**  
*Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas* | Obstructions that divert or obstruct the free flow of floodwater below elevated buildings in Zone V could impose additional flood loads on foundation systems or adjacent buildings. |
| | **Technical Bulletin 6**  
*Below-Grade Parking Requirements for Buildings Located in Special Flood Hazard Areas* | Non-residential buildings in Zone A may have dry flood-proofed, below-grade parking garages, provided the building and garage are designed to account for flood loads. |
| | **Technical Bulletin 7**  
*Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas* | Measures known as “wet floodproofing” may be used for specific types of buildings, including detached garages, storage buildings, some agricultural buildings, and buildings that meet the definition for functionally dependent use. Wet floodproofing reduces hydrostatic loads on buildings by allowing floodwater to enter. |
### Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (continued)

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
</tr>
</thead>
</table>
| **44 CFR § 60.3(a)(3) (cont.)** | **Technical Bulletin 8**  
Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas | Corrosion protection for metal fasteners and connectors in buildings in coastal areas is important in helping to ensure that the buildings are adequately anchored and connected to resist flood loads. In buildings that are exposed to moisture and airborne salt, protecting metal connectors and fasteners from corrosion helps prevent structural failure. |
| | **Technical Bulletin 9**  
Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas | Walls designed to break away under flood loads help to prevent the walls from obstructing the floodwater and to minimize the transfer of flood and wave loads to the foundations of elevated buildings. |
| | **Technical Bulletin 10**  
Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding | Residual flood hazards may exist on sites proposed to be modified by placement of compacted earthen fill material and are subject to the requirement to be reasonably safe from flooding. |
| | **Technical Bulletin 11**  
Crawlspace Construction for Buildings Located in Special Flood Hazard Areas | The ground or floor inside certain crawlspace foundations may be below grade if specific limitations are met including, but not limited to, flood velocities, perimeter wall height, and depth below grade. |

### Applies to All Zone A

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
</tr>
</thead>
</table>
| **44 CFR § 60.3(c)(2)**  
Require that all new construction and substantial improvements of residential structures within Zones A1 30, AE, and AH zones on the community's FIRM have the lowest floor (including basement) elevated to or above the base flood level. | **Technical Bulletin 10**  
Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding | The requirement that the lowest floor, including basement, of new and Substantially Improved residential buildings in Zone A be at or above the BFE may be met by elevating buildings on compacted earthen fill material. |
| | **Technical Bulletin 11**  
Crawlspace Construction for Buildings Located in Special Flood Hazard Areas | Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade. |
Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (continued)

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
</tr>
</thead>
</table>
| 44 CFR § 60.3(c)(3) | Technical Bulletin 3  
Non-Residential Floodproofing – Requirements and Certification for Buildings Located in Special Flood Hazard Areas | Numerous planning and engineering considerations factor into whether dry floodproofing is a viable option. Dry floodproofing features include watertight closures, walls and floors that are adequately reinforced to withstand floodwater pressures and impact forces generated by floating debris, use of membranes and sealants, installation of pumps, and utility protection. |
| | Technical Bulletin 6  
Below-Grade Parking Requirements for Buildings Located in Special Flood Hazard Areas | Below-grade parking garages are permitted beneath non-residential buildings in Zone A if the parking garage is dry floodproofed. |
| | Technical Bulletin 10  
Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding | The requirement that the lowest floor, including a basement, of new and Substantially Improved non-residential buildings in Zone A be at or above the BFE may be met by elevating buildings on compacted earthen fill material. |
| | Technical Bulletin 11  
Crawlspace Construction for Buildings Located in Special Flood Hazard Areas | Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade. |
| 44 CFR § 60.3(c)(4) | Technical Bulletin 3  
Non-Residential Floodproofing – Requirements and Certification for Buildings Located in Special Flood Hazard Areas | A Floodproofing Certificate for Non-Residential Structures has been developed by FEMA for use in the certification of non-residential floodproofing designs. The certificate contains information on the building and details of the floodproofing design. |
### NFIP Regulation

#### 44 CFR § 60.3(c)(5)

Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria: A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

**Technical Bulletin 1**

**Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas**

- Flood openings in foundation walls and walls of enclosures relieve hydrostatic loads, helping to meet the basic performance requirement to prevent flotation, collapse, or lateral movement due to flood forces.
- Proper design, selection, and installation of flood openings help meet the basic performance requirement to automatically equalize hydrostatic flood forces on exterior walls and prevent flotation, collapse, or lateral movement due to flood forces.

**Technical Bulletin 7**

**Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas**

- Measures known as “wet floodproofing” may be used for specific types of buildings, including detached garages, storage buildings, some agricultural buildings, and buildings that meet the definition for functionally dependent use. Wet floodproofing reduces hydrostatic loads on buildings by allowing floodwater to enter.

**Technical Bulletin 11**

**Crawlspace Construction for Buildings Located in Special Flood Hazard Areas**

- Crawlspaces, including below-grade crawlspaces, are treated as enclosures below elevated buildings. Below-grade crawlspaces may be permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.

### Applies to Zone AO

#### 44 CFR § 60.3(c)(7)

Require within any AO zone on the community’s FIRM that all new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community’s FIRM (at least two feet if no depth number is specified).

**Technical Bulletin 10**

**Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding**

- Placing the lowest floor, including basement, of new and substantially improved residential buildings in Zone A at or above the BFE may be accomplished by elevating buildings on compacted earthen fill material.

**Technical Bulletin 11**

**Crawlspace Construction for Buildings Located in Special Flood Hazard Areas**

- Although technically basements, below-grade crawlspaces are permitted if communities modify local regulations to explicitly allow below-grade crawlspaces with specific limitations including, but not limited to, flood velocities, perimeter wall height, and depth below grade.
### Table 2: Crosswalk of NFIP Regulations, Technical Bulletins, and Key Concepts (continued)

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
</tr>
</thead>
</table>
| 44 CFR § 60.3(c)(8) | **Technical Bulletin 3**  
Non-Residential Floodproofing — Requirements and Certification for Buildings Located in Special Flood Hazard Areas | Numerous planning and engineering considerations factor into whether dry floodproofing is a viable option. Dry floodproofing features include watertight closures, walls and floors that are adequately reinforced to withstand base floodwater pressures and impact forces generated by floating debris, use of membranes and sealants, installation of pumps, and utility protection. |
| 44 CFR § 60.3(e)(4) | **Technical Bulletin 5**  
Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas | Free-of-obstruction requirements apply to areas below the BFE and below the lowest horizontal structural member of the lowest floor of buildings in Zone V. These elevation and foundation requirements apply to structurally attached decks, detached garages, and restroom buildings/comfort stations. |
| | **Technical Bulletin 8**  
Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas | Where buildings are exposed to moisture and airborne salt, corrosion of light gauge metal connectors and fasteners contributes to the loss of load path. Corrosion protection for metal fasteners and connectors in buildings in coastal areas is important in helping to ensure that the buildings are adequately anchored to resist flotation, collapse, and lateral movement due to the combined effects of wind and water loads acting simultaneously on all building components. |

**Applies to All Zone V**

<table>
<thead>
<tr>
<th>NFIP Regulation</th>
<th>Technical Bulletin Relevant to the NFIP Regulation</th>
<th>Key Concepts in the NFIP Regulations Covered in the Technical Bulletins</th>
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</thead>
<tbody>
<tr>
<td>44 CFR § 60.3(c)(8)</td>
<td>Require within any AO zone on the community's FIRM that all new construction or substantial improvements of nonresidential structures (i) have the lowest floor (including basement) elevated above the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or (ii) together with attendant utility and sanitary facilities, be completely floodproofed to that [base flood] level to meet the floodproofing standard specified in paragraph 60.3(c)(3)(ii).</td>
<td></td>
</tr>
<tr>
<td>44 CFR § 60.3(e)(4)</td>
<td></td>
<td>Below-grade parking garages are permitted beneath nonresidential buildings in Zone A if the parking garage is dry floodproofed.</td>
</tr>
</tbody>
</table>
44 CFR § 60.3(e)(5) Provide that all new construction and substantial improvements within Zones V1-30, VE, and V on the community’s FIRM have the space below the lowest floor either free of obstruction or constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or supporting foundation system. For the purposes of this section, a breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. Use of breakaway walls which exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by local or State codes) may be permitted only if a registered professional engineer or architect certifies that the designs proposed meet the following conditions: (i) Breakaway wall collapse shall result from a water load less than that which would occur during the base flood; and (ii) The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). Water loading values used shall be those associated with the base flood. Wind loading values used shall be those required by applicable State or local building standards. Such enclosed space shall be usable solely for parking of vehicles, building access, or storage.

Technical Bulletin 5 Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas Obstructions that divert or obstruct the free flow of floodwater below elevated buildings in Zone V could impose additional flood loads on foundation systems or adjacent buildings. Measures that allow the free flow of floodwater below elevated buildings in Zone V include ensuring that certain features satisfy the free-of-obstruction requirement (e.g., access stairs and ramps, decks, elevators, service equipment, foundation bracing, grade beams, shear walls, slabs, accessory structures, fences and privacy walls, fill, septic systems, comfort stations, swimming pools and spas).

Technical Bulletin 9 Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas Walls designed to break away under flood loads help to prevent the walls from obstructing the floodwater and to minimize the transfer of flood and wave loads to the foundations of elevated buildings.
4 Key Concepts and Requirements for Structures

Users of the Technical Bulletins should have a basic understanding of the following key concepts:

- Special Flood Hazard Areas (SFHAs)
- Lowest floor, enclosure, and basement
- Substantial Improvement and Substantial Damage
- Open foundations in Zone V

These concepts underlie the requirements that are critical in determining compliance with minimum NFIP floodplain management criteria. Most of these concepts and other key terms used in NFIP regulations are defined in Sections 4 and 5.

4.1 Special Flood Hazard Areas

The SFHA is the land area in the floodplain subject to flooding by the base flood. SFHAs are shown on FIRMs prepared by FEMA as Zones A and V. The base flood is the flood that has a 1 percent chance of being equaled or exceeded in any given year (commonly called the “100 year flood”). FIRMs also show Zone X, which are areas outside the SFHA.

In communities that participate in the NFIP, the minimum floodplain management requirements govern development in SFHAs, including buildings and other structures, subdivisions, new and replacement water supply systems, and new and replacement sanitary sewage systems. Floodplain management requirements for buildings and other structures can differ depending on the flood zone in which a structure is located.

Figure 1 shows the typical flood zones from coastal and riverine flood sources. The criteria for construction in Zones V, VE, and V1-V30, which are collectively referred to as Zone V or Coastal High Hazard Areas, are generally more stringent than in Zones A, AE, A1–A30, AR, AO, and AH, which are collectively referred to as Zone A. Zone A exists in both coastal and riverine flood source environments.

**Zone A.** In SFHAs identified as Zone A (Zones A, AE, A1–A30, AR, AO, and AH), the principal source of flooding is runoff from rainfall, snowmelt, or coastal storms when the potential base flood wave height is less than 3.0 feet. Zone A has minimum requirements that specify the elevation of the lowest floor, including the basement, in relation to the BFE or depth of the base flood. Specific requirements apply to fully enclosed areas below the lowest floor.
**COASTAL A ZONE**

Since 2009, coastal flood studies have examined wave conditions in Zone A. Based on the studies, FEMA delineates an informational line called the Limit of Moderate Wave Action (LiMWA) on FIRMs where wave heights in Zone A are expected to be 1.5 feet or greater during base flood conditions. See Figure 1.

FEMA uses the term “Coastal A Zone” to refer to areas seaward of the LiMWA and landward of the Zone V boundary or landward of the shoreline where Zone V is not identified. The term refers to some areas identified as Zone A that are subject to flooding from a coastal or tidal source. However, Coastal A Zones are not identified on FIRMs, and the NFIP regulations for development in SFHAs and the NFIP regulations that govern the identification of SFHAs on maps do not use the term “Coastal A Zone.”

The NFIP floodplain management requirements regulate areas identified as Coastal A Zones to Zone A standards. FEMA’s Community Rating System awards credits to communities that regulate Coastal A Zones to Zone V standards. The latest editions of the I-Codes and ASCE 24 require buildings in Coastal A Zones to meet Zone V requirements; FEMA guidance, best practices, and FEMA Mitigation Assessment Team reports support this requirement.

**Zone V.** Zone V (Zones V, VE, and V1-V30), also called Coastal High Hazard Areas, extends from offshore to the inland limit of a primary frontal dune along an open coast, and any other area subject to high-velocity wave action from storms or tsunamis where the potential base flood wave height is 3.0 feet or more. Zone V has minimum requirements pertaining to the siting of buildings, elevation of the lowest horizontal structural member of the lowest floor in relation to the BFE, foundation design, enclosures below the lowest floor, and alterations of sand dunes and mangrove stands.

**Zone X.** Zone X identifies areas outside the SFHA. Zone X (shaded) identifies two areas of moderate flood hazard: (1) areas subject to inundation by the flood that has a 0.2 percent chance of being equaled or exceeded during any given year (commonly called the “500-year flood”) and (2) areas protected by accredited levee systems. Zone X (unshaded) identifies areas of minimal flood hazard, which are outside the 500-year floodplain. The NFIP floodplain management requirements do not apply in Zone X.

**Example of Criteria Difference.** An example of a difference in criteria for Zone A and Zone V is where the lowest floor is measured (see Figure 2):
• In Zone A, the lowest floor (including basement) of a structure must be elevated to or above the BFE.
• In Zone V, the bottom of the lowest horizontal structural member of the lowest floor of a structure (excluding pilings or columns) must be elevated to or above the BFE.

![Figure 2: Lowest floor reference point for Zone A (at top of lowest floor) versus Zone V (at bottom of lowest horizontal structural member of lowest floor)]

4.2 Lowest Floor, Enclosure, and Basement

Under the NFIP:

• The **lowest floor** is defined as “the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building’s lowest floor; Provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of § 60.3” (44 CFR § 59.1).

• An **enclosure** is an area below the lowest floor that is enclosed on all sides by walls.

• A **basement** is defined as “any area of the building having its floor subgrade (below ground level) on all sides” (44 CFR § 59.1).

4.3 Substantial Improvement and Substantial Damage

The repair or improvement of buildings presents an opportunity to reduce future flood damage to the structures and to improve their resilience. Local floodplain management regulations based on the NFIP and building codes contain requirements that apply not only to new structures but also to buildings with proposed Substantial Improvements or repair of Substantial Damage (described below).

As part of issuing permits, local officials must review not only proposals for new construction but also for work on existing buildings to determine whether the work constitutes Substantial Improvement or repair of Substantial Damage. If the work is determined to constitute Substantial Improvement or repair of Substantial Damage, the buildings must be brought into compliance with the NFIP requirements for new construction, including the requirement that the lowest floor be elevated to or above the BFE. Meeting this requirement can also be accomplished by demolishing the building followed by constructing a new building that meets the NFIP requirements on the same site or by relocating the building to outside the SFHA. More information on Substantial Improvement and Substantial Damage can be found in FEMA

**Substantial Improvement** is defined in 44 CFR § 59.1 as:

... Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the “start of construction” of the improvement. This term includes structures which have incurred “substantial damage,” regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or

2. Any alteration of a “historic structure,” provided that the alteration will not preclude the structure’s designation as a “historic structure.”

**Substantial Damage** is defined in 44 CFR § 59.1 as “damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.” Substantial Damage can have any cause, not just flooding.

Some communities modify the definitions of Substantial Improvement and Substantial Damage requirements in one of two ways: (1) adopting a lower threshold than 50 percent (e.g., 40 percent, 30 percent) or (2) tracking costs of improvements and costs of repairs over a specific period, referred to as “cumulative Substantial Improvement.”

### 4.4 Open Foundations in Zone V

Coastal waves and flooding can exert strong hydrodynamic forces on any building element that is exposed to waves or the flow of water. Therefore, open foundation systems that offer minimal resistance to waves and floodwaters passing beneath elevated buildings (e.g., pile and column foundations) are required in Zone V.

The NFIP requires that all new construction and Substantially Improved buildings in Zone V be elevated to or above the BFE on open foundations (pilings, columns, and sometimes shear walls) that allow floodwater and waves to pass beneath the elevated structure. The NFIP further requires that areas below elevated structures remain free of obstructions that would prevent the free flow of coastal floodwater and waves during a base flood event.
# 5 Acronyms and Key Terms

The acronyms and key terms that are used in the Technical Bulletins are defined in Sections 5.1 and 5.2, respectively.

## 5.1 Acronyms Used in the Technical Bulletins

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act</td>
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<tr>
<td>AF&amp;PA</td>
<td>American Forest &amp; Paper Association</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>AWC</td>
<td>American Wood Council</td>
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<tr>
<td>BFE</td>
<td>base flood elevation</td>
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<tr>
<td>CAZ</td>
<td>Coastal A Zone</td>
</tr>
<tr>
<td>CCA</td>
<td>chromated copper arsenate</td>
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<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CMU</td>
<td>concrete masonry unit</td>
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<tr>
<td>DFE</td>
<td>design flood elevation</td>
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<tr>
<td>EIFS</td>
<td>Exterior Insulation Finishing System</td>
</tr>
<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
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<tr>
<td>FHBM</td>
<td>Flood Hazard Boundary Map</td>
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<tr>
<td>FIA</td>
<td>Federal Insurance Administration</td>
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<tr>
<td>FIMA</td>
<td>Federal Insurance and Mitigation Administration</td>
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<tr>
<td>FIRM</td>
<td>Flood Insurance Rate Map</td>
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<tr>
<td>FIS</td>
<td>Flood Insurance Study</td>
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<tr>
<td>IBC</td>
<td>International Building Code</td>
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<tr>
<td>ICC</td>
<td>International Code Council</td>
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<td>ICC-ES</td>
<td>ICC Evaluation Service</td>
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<tr>
<td>I-Codes</td>
<td>International Codes</td>
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<tr>
<td>IEBC</td>
<td>International Existing Building Code</td>
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<tr>
<td>IMOA</td>
<td>International Molybdenum Association</td>
</tr>
<tr>
<td>IRC</td>
<td>International Residential Code</td>
</tr>
<tr>
<td>LAG</td>
<td>lowest adjacent grade</td>
</tr>
<tr>
<td>LHS</td>
<td>lowest horizontal structural member</td>
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<tr>
<td>LiMWA</td>
<td>Limit of Moderate Wave Action</td>
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<tr>
<td>LOMC</td>
<td>Letter of Map Change</td>
</tr>
<tr>
<td>LOMR-F</td>
<td>Letter of Map Revision based on fill</td>
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<tr>
<td>MAT</td>
<td>Mitigation Assessment Team</td>
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<tr>
<td>MRL</td>
<td>machine room-less traction elevators</td>
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<td>MSJC</td>
<td>Masonry Standard Joint Committee</td>
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<tr>
<td>NDS</td>
<td>National Design Specification</td>
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<tr>
<td>NEMA</td>
<td>National Emergency Management Agency; National Electrical Manufacturers Association</td>
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<tr>
<td>NFIP</td>
<td>National Flood Insurance Program</td>
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<td>NFPA</td>
<td>National Fire Protection Association</td>
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<tr>
<td>NGVD</td>
<td>National Geodetic Vertical Datum</td>
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<tr>
<td>oz/ft²</td>
<td>ounces per square foot</td>
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<tr>
<td>PFD</td>
<td>primary frontal dune</td>
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<tr>
<td>PWF</td>
<td>Permanent Wood Foundation</td>
</tr>
<tr>
<td>SBX/DOT</td>
<td>sodium borate disodium octaborate tetrahydrate</td>
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<tr>
<td>SEI</td>
<td>Structural Engineering Institute</td>
</tr>
<tr>
<td>SFHA</td>
<td>Special Flood Hazard Area</td>
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<tr>
<td>SFIP</td>
<td>Standard Flood Insurance Policy</td>
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<tr>
<td>SSPC</td>
<td>Society for Protective Coatings</td>
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<tr>
<td>TB</td>
<td>Technical Bulletin</td>
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<tr>
<td>TPI</td>
<td>Truss Plate Institute</td>
</tr>
<tr>
<td>USACE</td>
<td>U.S. Army Corps of Engineers</td>
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<tr>
<td>VPL</td>
<td>vertical platform lift</td>
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<tr>
<td>WTCA</td>
<td>Wood Truss Council of America</td>
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</table>
5.2 Glossary of Terms Used in Technical Bulletins

The quoted material from ASCE 24-14 in this glossary is used with permission.

Accessory (or appurtenant) structure. “Structure which is on the same parcel of property as the principal structure to be insured and the use of which is incidental to the use of the principal structure” (44 CFR § 59.1). Detached garages used for parking of vehicles and limited storage and small sheds used for limited storage are considered accessory structures.

Area of special flood hazard. “Land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year. The area may be designated as Zone A on the Flood Hazard Boundary Map (FHBM). After detailed ratemaking has been completed in preparation for publication of the flood insurance rate map, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, or V1 30, VE, or V. For purposes of these regulations, the term ‘special flood hazard area’ is synonymous in meaning with the phrase ‘area of special flood hazard’ ” (44 CFR § 59.1).

Base flood. “Flood having a one percent chance of being equaled or exceeded in any given year” (44 CFR § 59.1).

Base flood elevation (BFE). The computed elevation to which floodwater is anticipated to rise during the base flood, including wave height, relative to the datum specified on the Flood Insurance Rate Map. The BFE is shown on the FIRM for Zones AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1–A30, V1–V30, and VE. For Zones AR/AH and AR/AO, a depth of flooding is provided for the 1 percent annual chance event. SFHAs without BFEs are identified on FIRMs as Zone A or Zone V. When BFEs are not identified, communities must obtain, review and reasonably use any BFE data available from a Federal, State, or other source.

Basement. “Area of the building having its floor subgrade (below ground level) on all sides” (44 CFR § 59.1). NFIP regulations do not allow basements to extend below the BFE except in dry-floodproofed, non-residential buildings.

Breakaway wall. “A wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or supporting foundation system” (44 CFR § 59.1)

Coastal A Zone. “Area within a special flood hazard area, landward of a V Zone or landward of an open coast without mapped V Zones. In a Coastal A Zone, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding. During the base flood conditions, the potential for breaking wave heights shall be greater than or equal to 1.5 feet. The inland limit of the Coastal A Zone is (1) the Limit of Moderate Wave Action if delineated on a FIRM, or (2) designated by the authority having jurisdiction” (ASCE 24-14).
Coastal High Hazard Area. “An area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources” (44 CFR § 59.1). The coastal high hazard area is shown on a FIRM or other flood hazard map as Zone V, VO, VE, or V1-V30.

Community. “Any State or area or political subdivision thereof, or any Indian tribe or authorized tribal organization, or Alaska Native village or authorized native organization, which has authority to adopt and enforce floodplain management regulations for the areas within its jurisdiction” (44 CFR § 59.1).

Design flood. “The flood associated with the greater of the following two areas: (1) area within a floodplain subject to a 1% or greater chance of flooding in any year, or (2) area designated as a flood hazard area on a community’s flood hazard map or otherwise legally designated” (ASCE 24-14).

Design flood elevation (DFE). “Elevation of the design flood, including wave height, relative to the datum specified on the community’s flood hazard map” (ASCE 24-14). In areas designated as Zone AO, the design flood elevation is the elevation of the highest existing grade of the building’s perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth is not specified on the map, the depth is taken as equal to 2 feet. The DFE is the locally adopted regulatory flood elevation. If a community regulates based on the FIRM, the DFE is identical to the BFE. If a community chooses to regulate based on a different flood hazard map, a lower frequency flood, or adds freeboard, the DFE must be at least as high as the BFE.

Detailing. Design practice of using structural and architectural drawings and specifications to arrange, configure, and connect structural and nonstructural building components of a building system. Design details convey to the contractor exactly how the structural and nonstructural components of a building should be built.

Development. “Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials” (44 CFR § 59.1).

Elevation Certificate. An NFIP administrative tool used to document elevation and other information necessary to determine compliance with a community’s floodplain management requirements, determine proper insurance premium rates, or support requests for Letters of Map Change (LOMCs).

Enclosure or enclosed area. Area below an elevated building and enclosed by walls on all sides. The NFIP does not explicitly define “enclosure,” but it is mentioned in the definition of “lowest floor.” Enclosures may be formed by foundation perimeter walls (crawlspace), framed walls, or breakaway walls. Also defined in ASCE 24-14 as the “confined area below the DFE, formed by walls on all sides of the enclosed space.”

Existing construction (may also be referred to as existing construction/structures). For the purposes of determining flood insurance rates, structures for which the “start of construction” commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. “Existing construction” may also be referred to as “existing structures” (44 CFR § 59.1). Also defined in ASCE 24-14 as “any structure for which the start of construction commenced before the effective date of the first floodplain management code, ordinance, or standard adopted by the authority having jurisdiction.”
Flood Hazard Boundary Map (FHBM). “Official map of a community, issued by the Federal Insurance Administrator, where the boundaries of the flood, mudslide (i.e., mudflow) related erosion areas having special hazards have been designated as Zones A, M and/or E” (44 CFR § 59.1).

Flood Insurance Rate Map (FIRM). “Official map of a community, on which … [FEMA] has delineated both the special hazard areas and the risk premium zones applicable to the community” (44 CFR § 59.1).

Flood Insurance Study (FIS) (flood elevation study). “An examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards” (44 CFR § 59.1). The FIS is the official report provided by FEMA that contains the FIRM, the Flood Boundary and Floodway Map (if applicable), the water surface elevations of the base flood, and supporting technical data.

Floodplain or flood-prone area. “Any land area susceptible to being inundated by water from any source” (44 CFR § 59.1).

Floodproofing, dry. “Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents” (44 CFR § 59.1). Referred to simply as “flood proofing” in 44 CFR § 59.1. Further defined in ASCE 24-14 as “a combination of measures that results in a structure, including the attendant utilities and equipment, being water tight, with all elements substantially impermeable and with structural components having the capacity to resist flood loads.”

Floodproofing, wet. “Floodproofing method that relies on the use of flood damage-resistant materials and construction techniques in areas of a structure that are below the elevation required by this standard by intentionally allowing those areas to flood” (ASCE 24-14). The NFIP does not define wet floodproofing. Wet floodproofing measures allow areas to flood in such a way that damage to a structure and its contents is minimized by using specific design, construction, and planning measures outlined in Technical Bulletin 7, Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas.

Floodproofing Certificate. An NFIP administrative tool that documents certification by a registered professional engineer or architect that the design and methods of construction of a nonresidential building are in accordance with accepted practices for meeting a community’s floodplain management requirements for floodproofing. This documentation is required for both floodplain management requirements and NFIP flood insurance rating purposes.

Flow diversion. Change in the course of flood flow when it encounters an object or structure. Diversion can be accompanied by an increase in the local flood level and/or flood velocity when the blockage is large relative to the area through which the flow would otherwise pass.

Hydrodynamic loads. “Loads imposed on an object [such as a building or foundation element] by water flowing against and around it” (ASCE 24-14). Examples are positive frontal pressure against the structure, drag effect along the sides, and negative pressure on the downstream side. The magnitude of hydrodynamic load varies as a function of the square of velocity and other factors.
Hydrostatic loads. “Loads imposed on an object [or a surface, such as a wall or floor slab] by a standing mass of water” (ASCE 24-14). Hydrostatic loads can be caused by slowly moving masses of water. Hydrostatic load increases as water depth increases.

Limit of Moderate Wave Action (LiMWA). “The inland limit of the area affected by [breaking] waves greater than 1.5 feet” (FEMA Procedure Memorandum No. 50). FEMA began delineating the LiMWA on coastal FIRMs in 2009.

Lowest floor. Lowest floor of the lowest enclosed area of a building, including basement. An unfinished or flood-resistant enclosure that is used solely for parking of vehicles, building access, or storage in an area other than a basement area is not considered a building’s lowest floor, provided the enclosure is built in compliance with applicable requirements.

Net open area. Permanently open area of a non-engineered flood opening.

New construction (may also be referred to as new construction/structures). “… For floodplain management purposes, new construction means structures for which the start of construction commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures” (44 CFR § 59.1). Further defined in ASCE 24-14 as “structures for which the start of construction commenced on or after the effective date of the first floodplain management code, regulation, ordinance, or standard adopted by the authority having jurisdiction, including any subsequent improvements to such structures. New construction includes work determined to be substantial improvement.”

Opening, engineered. Opening used to meet the requirement in 44 CFR § 60.3(c)(5) that is “certified by a registered professional engineer or architect” for meeting the requirement in 44 CFR § 60.3(c)(5) to “be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.”

Opening, non-engineered. Opening used to meet the prescriptive requirement in 44 CFR § 60.3(c)(5) to provide “a total net area of not less than one square inch for every square foot of enclosed area subject to flooding.”

Primary frontal dune. “A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope” (44 CFR § 59.1).

Registered design professional. Individual who is registered or licensed to practice his or her design profession (e.g., architect, engineer, land surveyor) as defined by the statutory requirements of the professional registration laws of the State or jurisdiction in which a project is to be constructed.

Special Flood Hazard Area (SFHA). Referred to as “area of special flood hazard.” “Land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year. The area may be designated as Zone A on the FHBM. After detailed ratemaking has been completed in preparation of publication of the flood insurance rate map, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/ AE, AR/AO, AR/AH, AR/A, VO, or V1-30, VE, or V. For purposes of these regulations, the term ‘special flood hazard area’ is synonymous in meaning with the phrase ‘area of special flood hazard’” (44 CFR § 59.1).
Standard residential garage door. A door, typically up to 18 feet wide by up to 8 feet tall, intended for use in a residential garage for vehicular access and normally expected to be operated less than 1,500 cycles per year.

Structure. For floodplain management purposes, “a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home” (44 CFR § 59.1).

Substantial Damage. “Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred” (44 CFR § 59.1).

Substantial Improvement. Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the “start of construction” of the improvement. This term includes structures that have incurred “substantial damage,” regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or

2. Any alteration of a “historic structure,” provided that the alteration will not preclude the structure’s continued designation as a “historic structure” (44 CFR § 59.1).

Variance. “Grant of relief by a community from the terms of a flood plain management regulation” (44 CFR § 59.1).

Wave reflection. Return or redirection of a wave striking an object.

Wave runup. “Rush of wave water running up a slope or structure” (ASCE 24-14). Wave runup occurs as waves break and run up beaches, sloping surfaces, and vertical surfaces.
6 Supplemental Information

6.1 How to Obtain Technical Bulletins


Order Technical Bulletins at no charge from the FEMA Publications Warehouse by:

- Calling 1-800-480-2520, Monday through Friday between 8 a.m. and 5 p.m. Eastern
- Faxing a request to 1-719-948-9724
- Sending an email to FEMApubs@gpo.gov

6.2 How to Submit Comments on the Technical Bulletins

FEMA welcomes your comments and recommendations on the Technical Bulletins and may include, for example:

- Requests for clarifications of the guidance in the Technical Bulletins
- Requests for additional guidance
- Recommendations for new Technical Bulletins

Send your comments to:

DHS/FEMA
ATTN: Federal Insurance and Mitigation Administration, Risk Management Directorate – Building Science Branch
400 C Street, S.W., Sixth Floor
Washington, DC 20472-3020

6.3 How to Get More Information

For questions on any of the Technical Bulletins, email the Building Science Helpline at FEMA-buildingsciencehelp@fema.dhs.gov or call 1-866-927-2104.

For additional guidance on NFIP regulatory requirements, contact your NFIP State Coordinating Agency (www.floods.org) or the FEMA Regional office in your Region (see Section 6.4).

6.4 FEMA Regional Offices

The locations of FEMA Headquarters and the 10 FEMA Regional Offices are shown in Figure 3, and addresses and telephone numbers are listed in Table 3. Staff members of the FEMA Regional Offices for your area can provide you with more information about the NFIP and Technical Bulletins.
Figure 3: Locations of FEMA Headquarters and 10 FEMA Regional Offices

- American Samoa
- Commonwealth of the Northern Mariana Islands
- Federated States of Micronesia
- Guam
- Republic of the Marshall Islands

- Boston
- Bothell
- Chicago
- Denver
- Kansas City
- Denton
- Atlanta
- New York
- Philadelphia
- Washington, DC
- Puerto Rico
- Virgin Islands
Table 3: FEMA Headquarters and Regional Office Contact Information

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<tr>
<th>HQ / Region</th>
<th>States/Territories</th>
<th>Address</th>
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<tr>
<td>FEMA / FIMA Headquarters</td>
<td>—</td>
<td>400 C Street, S.W. Washington, DC 20472-3020</td>
<td>202-646-2500 800-621-FEMA (3362) TTY: 800-462-7585</td>
</tr>
<tr>
<td>Region I</td>
<td>Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont</td>
<td>99 High Street</td>
<td>877-336-2734</td>
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<tr>
<td>Region II</td>
<td>New Jersey, New York, Puerto Rico, Virgin Islands</td>
<td>One World Trade Center 52nd Floor New York, NY 10007-0101</td>
<td>212-680-3600</td>
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<tr>
<td>Region III</td>
<td>Washington, D.C., Delaware, Maryland, Pennsylvania, Virginia, West Virginia</td>
<td>615 Chestnut Street One Independence Mall, 6th Floor Philadelphia, PA 19106-4404</td>
<td>215-931-5500</td>
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<tr>
<td>Region IV</td>
<td>Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee</td>
<td>3003 Chamblee Tucker Road Atlanta, GA 30341-4112</td>
<td>770-220-5200</td>
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<tr>
<td>Region V</td>
<td>Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin</td>
<td>536 South Clark Street, Sixth Floor Chicago, IL 60605-1521</td>
<td>312-408-5500</td>
</tr>
<tr>
<td>Region VI</td>
<td>Arkansas, Louisiana, New Mexico, Oklahoma, Texas</td>
<td>Federal Regional Center 800 North Loop 288 Denton, TX 76209-3698</td>
<td>940-898-5399</td>
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<tr>
<td>Region VII</td>
<td>Iowa, Kansas, Missouri, Nebraska</td>
<td>9221 Ward Parkway, Suite 300 Kansas City, MO 64114-3372</td>
<td>816-283-7061</td>
</tr>
<tr>
<td>Region VIII</td>
<td>Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming</td>
<td>Denver Federal Center Building 710, Box 25267 Denver, CO 80255-0267</td>
<td>303-235-4800</td>
</tr>
<tr>
<td>Region X</td>
<td>Alaska, Idaho, Oregon, Washington</td>
<td>Federal Regional Center 130 228th Street, SW Bothell, WA 98021-8627</td>
<td>425-487-4600</td>
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8.1 References


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<td>ASCE 24-05</td>
<td><em>Flood Resistant Design and Construction</em></td>
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<td><em>Protecting Manufactured Homes from Floods and Other Hazards</em></td>
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<td>FEMA P-550</td>
<td><em>Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations</em></td>
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<td>FEMA P-762</td>
<td><em>Local Officials Guide for Coastal Construction</em></td>
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<td>FEMA P 499</td>
<td><em>Home Builder’s Guide to Coastal Construction Technical Fact Sheet Series</em></td>
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<td><em>Substantial Improvement / Substantial Damage Desk Reference</em></td>
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<td><em>Mitigation Assessment Team Report: Hurricane Sandy in New Jersey and New York</em></td>
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<td>FEMA P-312</td>
<td><em>Homeowner’s Guide to Retrofitting, 3rd Edition</em></td>
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<td>Protecting Building Utilities from Flood Damage</td>
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<td>Answers to Questions About Substantially Improved/ Substantially Damaged Buildings</td>
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<td>Non-Residential Floodproofing – Requirements and Certification for Buildings Located in Special Flood Hazard Areas</td>
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<td>Corrosion Protection for Metal Connectors and Fasteners in Coastal Areas</td>
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<td>Design and Construction Guidance for Breakaway Walls Below Elevated Buildings in Coastal High Hazard Areas</td>
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<td>FEMA (cont.)</td>
<td>2001</td>
<td>NFIP TB 10</td>
<td>Ensuring that Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding</td>
<td><a href="http://www.fema.gov/nfip-technical-bulletins">www.fema.gov/nfip-technical-bulletins</a></td>
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<td>Crawlspace Construction for Buildings Located in Special Flood Hazard Areas</td>
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<td>Mitigation Assessment Team (MAT) Reports and Recovery Advisories (RAs)</td>
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NFIP = National Flood Insurance Program
SEI = Structural Engineering Institute
TB = Technical Bulletin