



5 Investigating Regulatory Requirements

States and communities throughout the United States enforce regulatory requirements that determine where and how buildings may be sited, designed, and constructed. These requirements include those associated with regulatory programs established by Federal and State statutes and locally adopted floodplain management ordinances, building codes, subdivision regulations, and other land use ordinances and laws. Applicable regulatory programs include the NFIP, which is intended to reduce the loss of life and damage caused by natural hazards, and programs established to protect wetlands and other wildlife habitat, which seek to minimize degradation of the environment. In addition, States and communities enforce requirements aimed specifically at the regulation of construction along the shorelines of oceans, bays, and lakes.

Federal, State, and local regulatory requirements can have a significant effect on the siting, design, construction, and cost of buildings. Therefore, designers, property owners, and builders engaged in residential construction projects in the coastal environment should conduct a thorough investigation to identify all regulations that may affect their properties and projects.



CROSS REFERENCE

For resources that augment the guidance and other information in this Manual, see the Residential Coastal Construction Web site (<http://www.fema.gov/rebuild/mat/fema55.shtm>).

5.1 Land Use Regulations

State and local governments establish regulations governing the development and use of land within their jurisdictions. The goal of these land use regulations is generally to promote sound physical, social, and economic development. The regulations take many forms—zoning and floodplain management ordinances, subdivision regulations, utility codes, impact fees, historic preservation requirements, and environmental regulations—and they are often incorporated into and implemented under comprehensive or master plans developed by local jurisdictions in coordination with their State governments and under State statutory authority.

With land use regulations, communities can prohibit or restrict development in specified areas. They can also establish requirements for lot size, clearing and grading, and drainage, as well as the siting of buildings, floodplain management, construction of access roads, installation of utility lines, planting of vegetative cover, and other aspects of the land development and building construction processes. Land use regulations enacted and enforced by State and local governments across the country vary in content and complexity according to the needs and concerns of individual jurisdictions; therefore, it is beyond the scope of this Manual to list or describe specific regulations. However, such regulations can have a significant effect on the construction and improvement of residential and other types of buildings in both coastal and non-coastal areas. Therefore, designers, builders, and property owners must be aware of the regulations that apply to their projects.

The best sources of information about land use regulations are State and local planning, land management, economic development, building code, floodplain management, and community affairs officials. Professional organizations such as the American Planning Association (APA) and its State chapters are also excellent sources of information. Community officials may be interested in several APA projects and guidance publications (described on the APA Web site at <http://www.planning.org>):

- *Subdivision Design in Flood Hazard Areas* (Morris 1997), APA Planning Advisory Service Report Number 473. This report provides information and guidance on subdivision design appropriate for SFHAs and includes several examples of State and local subdivision requirements in coastal flood hazard areas. The report was prepared under a cooperative agreement with FEMA.
- *Growing Smart Legislative Guidebook* (APA 2002). Growing Smart is a major initiative launched by the APA in 1994 to examine statutory reform under the philosophy that there is no “one-size-fits-all” approach. The guidebook contains model planning statutes and commentary that highlight key issues in their use for State and local planning agencies. Chapter 7 of the guidebook includes a model “Natural Hazards Element” for incorporation into local government comprehensive plans.
- *Planning for Post-Disaster Recovery and Reconstruction* (Schwab et al. 1998), APA Planning Advisory Service Report Number 483/484. This report provides guidance regarding all hazards for local planners.



WARNING

Designers and floodplain managers are cautioned that major natural hazard events can change shoreline locations, ground elevations, and site conditions. Information developed for the area **before** a significant event, including data shown on FIRMs and associated development regulations, may provide less-than-base flood protection **after** the event. Extreme care should be taken in siting and designing residential buildings in post-disaster situations.

It includes a model ordinance for regulating hazard areas and includes case studies for five hazard scenarios (flood, hurricane, wildfire, earthquake, and tornado). The report includes the model “Natural Hazards Element” from the *Growing Smart Legislative Guidebook* that can be incorporated into local comprehensive plans. The report was prepared under a cooperative agreement with FEMA.

- *Hazard Mitigation: Integrating Best Practices into Planning* (Schwab 2010), APA Planning Advisory Service Report Number 560. This report introduces hazard mitigation as a critical area of practice for planners. It provides guidance on how to integrate hazard mitigation strategies into planning activities and shows where hazard mitigation can fit into zoning and subdivision codes. The report was prepared by APA and supported by FEMA.

5.1.1 Coastal Barrier Resource Areas and Other Protected Areas

The CBRA of 1982 was enacted to protect vulnerable coastal barriers from development; minimize the loss of life; reduce expenditures of Federal revenues; and protect fish, wildlife, and other natural resources. This law established the Coastal Barrier Resources System (CBRS), which is managed by the U.S. Department of the Interior (DOI), U.S. Fish and Wildlife Service. The law restricts Federal expenditures and financial assistance that could encourage development of coastal barriers. The CBRA does not prohibit privately financed development; however, it does prohibit most new Federal financial assistance, including Federally offered flood insurance, in areas within the CBRS (also referred to as CBRA areas). Flood insurance may not be sold for buildings in the CBRS that were constructed or substantially improved after October 1, 1983. The financial risk of building in these areas is transferred from Federal taxpayers directly to those who choose to live in or invest in these areas.



NOTE

Additional information about CBRS regulations and areas included in the CBRS is available at the U.S. Fish and Wildlife Service Web site at http://www.fws.gov/habitatconservation/coastal_barrier.html.

The Coastal Barrier Improvement Act (CBIA), passed in 1991, tripled the size of the CBRS to over 1.1 million acres. The CBIA also designated *otherwise protected areas (OPA)* that include lands that are under some form of public ownership. The CBIA prohibits the issuance of flood insurance on buildings constructed or substantially improved after November 16, 1991, for the areas added to the CBRS, including OPAs. An exception is made to allow insurance for buildings located in OPAs that are used in a manner consistent with the purpose for which the area is protected. Examples include research buildings, buildings that support the operation of a wildlife refuge, and similar buildings. CBRS boundaries are shown on a series of maps produced by DOI.



NOTE

Any building within a CBRS area that is constructed or substantially improved after October 1, 1983, or the date of designation for areas added to the system in 1991, is not eligible for Federal flood insurance or other Federal financial assistance. The same restriction applies to substantially damaged buildings in a CBRS area that are repaired or renovated after those dates. However, all buildings within the CBRS must still comply with the NFIP siting, design, and construction requirements in their communities.

OPA designations discourage development of privately owned inholdings and add a layer of Federal protection to coastal barriers already held for conservation or recreation, such as national wildlife refuges, national parks and seashores, State

and county parks, and land owned by private groups for conservation or recreational purposes. The CBRS currently includes 271 OPAs, which add up to approximately 1.8 million acres of land and associated aquatic habitat.

FEMA shows approximate CBRS boundaries on FIRMs so that insurance agents and underwriters may determine eligibility for flood insurance coverage. Before constructing a new building, substantially improving an existing building, or repairing a substantially damaged building, the designer or property owner should review the FIRM to determine whether the property is located near or within CBRS or OPA boundaries. In situations where the FIRM does not allow for a definitive determination, the designer or property owner should request a determination from the U.S. Fish and Wildlife Service based on the DOI maps.

5.1.2 Coastal Zone Management Regulations

The CZMA of 1972 encourages adoption of coastal zone policies by U.S. coastal States in partnership with the Federal Government. CZMA regulations have been adopted by 28 of the 30 coastal States and the five island territories. For current information concerning the status of State and national CZM programs, refer to the Web site of the NOAA, National Ocean Service, Office of Ocean and Coastal Resource Management, at <http://coastalmanagement.noaa.gov/programs/czm.html>.

Each State's CZM program contains provisions to:

- Protect natural resources
- Manage development in high hazard areas
- Manage development to achieve quality coastal waters
- Give development priority to coastal-dependent uses
- Establish orderly processes for the siting of major facilities
- Locate new commercial and industrial development in or adjacent to existing developed areas
- Provide public access for recreation
- Redevelop urban waterfronts and ports, and preserve and restore historic, cultural, and aesthetic coastal features
- Simplify and expedite governmental decision-making actions
- Coordinate State and Federal actions
- Give adequate consideration to the views of Federal agencies
- Ensure that the public and local government have a say in coastal decision-making
- Comprehensively plan for and manage living marine resources

Coastal zone regulations vary greatly. Many States, such as Washington, Oregon, and Hawaii, provide guidelines for development while leaving the enactment of specific regulatory requirements up to county and local governments.

Most State CZM regulations control construction seaward of a defined boundary line, such as a dune or road. Many States, though not all, regulate or prohibit construction seaward of a second line based on

erosion. Some of these lines are updated when new erosion mapping becomes available; lines that follow physical features such as dune lines are not fixed and “float” as the physical feature shifts over time. Examples of other types of State coastal regulations include requirements concerning the placement or prohibition of shore protection structures and the protection of dunes.

Some States not only control new construction, but also regulate renovations and repairs of substantially damaged buildings to a greater degree than required by the NFIP. These regulations help limit future damage in coastal areas by requiring that older buildings be brought up to current standards when they are renovated or repaired.

In addition to regulating the construction of buildings near the coast, many jurisdictions regulate the construction of accessory structures, roads and infrastructure, and other development-related activities.

5.2 National Flood Insurance Program

The NFIP, which is administered by FEMA, is a voluntary program with the goals of reducing the loss of life and damage caused by flooding, helping victims recover from floods, and promoting an equitable distribution of costs among those who are protected by flood insurance and the general public. The NFIP operates through a partnership between the Federal Government and individual communities such as States, counties, parishes, and incorporated cities, towns, townships, boroughs, and villages. Participation in the NFIP is voluntary. Lower cost, federally backed flood insurance is made available to property owners and renters in participating communities. In return, each community adopts and enforces a floodplain management ordinance or law that meets or exceeds the minimum requirements of the NFIP for new construction, substantial improvement of existing buildings, and repairs of substantially damaged buildings.

As part of administering the NFIP, FEMA conducts flood hazard studies and provides each community with FIRM and FIS reports, which together present flood hazard information, including the boundaries of the SFHA—the area subject to inundation by the flood that has a 1 percent chance of being equaled or exceeded in any given year—BFEs, and flood insurance zones. FEMA also provides State and local agencies with technical assistance and funding in support of flood hazard mitigation.

Unless the community as a whole practices adequate flood hazard mitigation, the potential for loss will not be reduced significantly. Discussed below is a history of the NFIP, and some components of the NFIP that allow for community-wide mitigation: FEMA flood hazard studies, minimum regulatory requirements enforced by communities participating in the NFIP, and the NFIP CRS program.



TERMINOLOGY

SUBSTANTIAL IMPROVEMENT:

Improvement of a building (such as reconstruction, rehabilitation, or addition) is considered a substantial improvement if its cost equals or exceeds 50 percent of the market value of the building before the start of construction of the improvement.

SUBSTANTIAL DAMAGE:

Damage to a building (regardless of the cause) is considered substantial damage if the cost of restoring the building to its before-damage condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

5.2.1 History of the NFIP

Congress created the NFIP in 1968 when it passed the National Flood Insurance Act. The primary purposes of the Act are to:

- Indemnify individuals for flood losses through insurance
- Reduce future flood losses through floodplain management regulations
- Reduce Federal expenditures for disaster assistance and flood control



CROSS REFERENCE

For additional information on the NFIP and its mapping products, see Section 3.6.

FEMA is prohibited from providing flood insurance to a community under the 1968 Act if a community does not adopt and enforce floodplain management regulations that meet or exceed the floodplain management criteria established in accordance with Section 1361(c) of the 1968 Act.

Subsidizing flood insurance for existing buildings was not incentive enough for communities to voluntarily participate in the NFIP. The same held true for individuals purchasing flood insurance. In 1973, Congress passed the Flood Disaster Protection Act. The 1973 Act prohibits Federal agencies from providing financial assistance for acquisition or construction of buildings in a SFHA in a community that does not participate in the NFIP. Certain disaster assistance for these non-participating communities is also prohibited. Another key provision of the 1973 Act was the “Mandatory Flood Insurance Purchase Requirement,” which requires federally insured or regulated lenders to require flood insurance on all grants and loans for buildings purchased or constructed in the SFHA.

To further the efforts of the NFIP, Congress amended the 1968 and 1973 Acts with the National Flood Insurance Reform Act in 1994. The 1994 Act: (1) increased the amount of flood insurance coverage allowed to be purchased, (2) codified the NFIP CRS, (3) added the Increased Cost of Compliance coverage for individual property owners who had to comply with floodplain management regulations, (4) established the Flood Mitigation Assistance grant program to assist States and communities to develop mitigation plans and implement measures to reduce future flood damage to structures, and (5) added a requirement that FEMA assess its flood hazard map inventory at least once every 5 years. Congress amended the 1994 Act with the Flood Insurance Reform Act of 2004. The 2004 Act established the Repetitive Flood Claims and Severe Repetitive Loss grant programs to reduce or eliminate future losses to properties in the NFIP.

5.2.2 FEMA Flood Hazard Studies

To provide communities with the information needed to enact and enforce floodplain management ordinances or laws consistent with the requirements of the NFIP, FEMA conducts flood hazard studies for communities throughout the United States and publishes the results in FIRMs and FIS reports.

The information provided by FIS reports and FIRMs includes the names and locations of flooding sources; the sizes and frequencies of past floods; the limits of the SFHA in areas subject to riverine, lacustrine, and coastal flooding; flood insurance zone



CROSS REFERENCE

For an explanation of how BFEs, flood zones, and LiMWAs are determined for coastal flood hazard areas and how they affect coastal construction, see Section 3.6.

designations; and BFE contours throughout the SFHA. FIRMs in coastal areas may also show the LiMWA. Communities can use the information provided in FIS reports and FIRMs to manage SFHA development. At the same time, FEMA uses the FIS and FIRMs to establish insurance premiums for houses and other buildings. The information pertaining to the BFE and the flood zone at the building site are of particular importance for a coastal construction project.

5.2.3 Minimum Regulatory Requirements

The floodplain management ordinances or laws adopted by communities that participate in the NFIP must meet or exceed the minimum NFIP regulatory requirements set forth at Title 44 of the Code of Federal Regulations (CFR) Section 60.3 (44 CFR § 60.3). Community floodplain management regulations include requirements in the SFHA that apply to new construction, substantially improved buildings, and substantially damaged buildings in both Zone A and Zone V. Additional requirements apply to new subdivisions and other development in the SFHA.

The minimum NFIP requirements for new construction, substantially improved, and substantially damaged buildings affect the type of foundation that can be used, establishes the required height of the lowest floor to or above the BFE, establishes the criteria for the installation of building utility systems, requires the use of flood damage-resistant materials, and limits the use of the area below the lowest floor. In recognition of the greater hazard posed by breaking waves 3 feet high or higher, FEMA has established minimum NFIP regulatory requirements for Zone V buildings that are more stringent than the minimum requirements for Zone A buildings. Therefore, the location of a building in relation to the Zone A/Zone V boundary on a FIRM can affect the design of the building. In that regard, it is important to note that if a building or other structure has any portion of its foundation in Zone V, it must be built to comply with Zone V requirements.

The following sections summarize the minimum NFIP requirements (for the exact wording of the regulations, refer to 44 CFR § 60.3): Section 5.2.3.1 describes the minimum requirements that apply throughout the SFHA. Sections 5.2.3.2 and 5.2.3.3 describe requirements specific to Zone A and Zone V, respectively.

5.2.3.1 Minimum Requirements in All SFHAs

The minimum NFIP floodplain management requirements for all SFHAs affect buildings, subdivisions and other new development, new and replacement water supply systems, and new and replacement sanitary sewage systems. These requirements, set forth at 44 CFR § 60.3(a) and (b), are summarized in Table 5-1.



WARNING

Communities participating in the NFIP are encouraged to adopt and enforce floodplain management ordinances or laws more stringent than the minimum requirements of the NFIP regulations. For example, some States and communities require that buildings be elevated above rather than simply to the BFE. The additional elevation is referred to as freeboard (see Figure 5-4). Check with local floodplain managers and building officials concerning such requirements.



WARNING

The guidance in this Manual was not specifically developed for manufactured housing. For NFIP requirements concerning manufactured housing, refer to 44 CFR Section 60.3 and FEMA P-85, *Protecting Manufactured Homes from Flood and Other Hazards, A Multi-Hazard Foundation and Installation Guide* (FEMA 2009a).

Table 5-1. General NFIP Requirements

Activity	General NFIP Requirement in All SFHAs
<p>New Construction, Substantial Improvement, and Repair of Substantially Damaged Buildings</p>	<ul style="list-style-type: none"> • Communities shall require permits for development in SFHAs and shall review permit applications to determine whether proposed building sites will be reasonably safe from flooding. • Buildings shall be designed (or modified) and anchored to prevent flotation, collapse, and lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. • Buildings shall be constructed with materials resistant to flood damage. • Buildings shall be constructed with methods and practices that minimize flood damage. • Buildings shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located to prevent water from entering or accumulating within their components during flooding. • Communities shall obtain and reasonably use any BFE and floodway data available from other sources for SFHAs for which the FIRM does not provide BFEs or floodways.
<p>New Subdivisions and Other New Developments</p>	<ul style="list-style-type: none"> • Communities shall review proposals for subdivisions and other new developments to determine whether such proposals will be consistent with the need to minimize flood damage within flood-prone area. • Proposals for new subdivisions and other new developments greater than 50 lots or 5 acres, whichever is less, and for which BFEs are not shown on the effective FIRM shall include BFE data. • Public utilities and facilities, such as sewer, gas, electrical, and water systems for new subdivisions and other new developments shall be located and constructed to minimize or eliminate flood damage. • Adequate drainage shall be provided for new subdivisions and new developments to reduce exposure to flood hazards.
<p>New and Replacement Water Supply Systems</p>	<ul style="list-style-type: none"> • New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems.
<p>New and Replacement Sanitary Sewage Systems</p>	<ul style="list-style-type: none"> • New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters. • On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

Floodplain management regulations apply to new construction, substantially improved buildings, and substantially damaged buildings located within the SFHA. FEMA has two resources to assist State and local officials with NFIP requirements: FEMA P-758, *Substantial Improvement/Substantial Damage (SI/SD) Desk Reference* (FEMA 2010a) and the FEMA P-784 *Substantial Damage Estimator (SDE)* software (FEMA 2010b). FEMA P-758 is intended to be used by local officials responsible for administering local codes and ordinances, including requirements related to substantial improvement and substantial damage. It also is intended for State officials who provide NFIP technical assistance to communities. FEMA P-758 provides practical guidance and suggested procedures to implement the NFIP requirements for substantial improvement and repair of substantial damage.

The SDE software was developed to assist State and local officials in determining substantial damage in accordance with a local floodplain management ordinance meeting the requirements of the NFIP. Data collected during the evaluation process and entered into the SDE software provides an inventory of potentially substantially damaged buildings, including both residential and non-residential structures. For more information, consult the local floodplain management official in the area where the building is being constructed. FEMA 213, *Answers to Questions About Substantially Damaged Buildings* (FEMA 1991; currently being updated as of the publication of this Manual) provides answers to commonly asked questions about substantial improvement and substantial damage.



WARNING

In addition to the floodplain management requirements discussed in this Manual, the NFIP regulations include requirements specific to floodplains along rivers and streams. Because this Manual focuses on the construction of residential buildings in coastal areas, it does not discuss these additional requirements. For more information about these requirements, consult local floodplain management officials. Also refer to FEMA 259, *Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures* (FEMA 2011).

5.2.3.2 Additional Minimum Requirements for Buildings in Zone A

The additional minimum requirements specific to buildings in Zones AE, A1–A30, AO, and A pertain to the elevation of the lowest floor, including basement, in relation to the BFE or the depth of the base flood, and to the enclosed areas below the lowest floor. Note that these requirements are the same for Coastal A Zones and Zone A.

Building Elevation in Zones AE and A1–A30

The top of the lowest floor, including the basement floor, of all new construction, substantially improved, and substantially damaged buildings must be at or above the BFE.

The lowest floors of buildings in Zones AE, A1–A30, and A must be at or above the BFE. Foundation walls below the BFE must have openings that allow the entry of flood waters so that interior and exterior hydrostatic pressures can equalize. Note that some damage is likely to be sustained if building construction meets only the minimum NFIP requirements because the structure under the top of the lowest floor will be inundated during the base flood.

Building Elevation in Zone A

FIRMs do not show BFEs in SFHAs designated Zone A (i.e., unnumbered Zone A) because detailed flood hazard studies in those areas have not been performed. The lowest floors of buildings in Zone A must be elevated to or above the BFE whenever BFE data are available from other sources. The IBC and IRC both authorize the local official to require an applicant to use BFE data from other sources or to determine the BFE. If no BFE data are available, communities must ensure that buildings are constructed with methods and practices that minimize flood damage.

Building Elevation in Zone AO

Zone AO designates areas where flooding is characterized by shallow depths (averaging 1–3 feet) and/or unpredictable flow paths. In Zone AO, the top of the lowest floor, including the basement floor, of all new construction, substantially improved, and substantially damaged buildings must be above the highest grade adjacent to the building by at least the depth of flooding in feet shown on the FIRM. For example, if the flood depth shown on the FIRM is 3 feet, the top of the lowest floor must be at least 3 feet above the highest grade adjacent to the building. If no depth is shown on the FIRM, the minimum required height above the highest adjacent grade is 2 feet.

Enclosures Below the Lowest Floor in Zones AE, A1–A30, AO, and A

Enclosed space below the lowest floors of new construction, substantially improved, and substantially damaged buildings may be used only for parking of vehicles, access to the building, or storage. The walls of such areas must have openings designed to allow the automatic entry and exit of flood waters so that interior and exterior hydrostatic pressures equalize during flood events. To satisfy this requirement, non-engineered openings may be used to provide a total net open area of 1 square inch per square foot of enclosure. Designs for engineered openings must be certified by a registered professional engineer or architect as providing the required performance (see Section 2.6.2 of ASCE 24, *Flood Resistant Design and Construction*). The installation of openings must meet the following ASCE 24 criteria:

1. Each enclosed area must have openings.
2. There must be a minimum of two openings on different sides of each enclosed area, and
3. The bottom of each opening must be no more than 1 foot above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.

For more information about openings requirements for the walls of enclosures below the lowest floors of buildings in Zone A, refer to FEMA NFIP Technical Bulletin 1, *Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings in Special Flood Hazard Areas in accordance with the National Flood Insurance Program* (FEMA 2008d).



WARNING

Even waves less than 3 feet high can impose large loads on foundation walls. This Manual recommends that buildings in the Coastal A Zone be designed and constructed to meet Zone V requirements (see Section 5.4.2 and Chapter 11).



WARNING

Flood vents must be unobstructed in order to perform as intended. For example, flood vents backed with interior gypsum board finish do not allow for the automatic entry and exit of flood waters.

5.2.3.3 Additional Minimum Requirements for Buildings in Zone V

The additional minimum requirements enforced by participating communities regarding new construction, substantially improved buildings, and substantially damaged buildings in Zones VE, V1–V30, and V pertain to the siting of the building, the elevation of the lowest floor in relation to the BFE, the foundation design, enclosures below the lowest floor, and alterations of sand dunes and mangrove stands (refer to 44 CFR § 60.3(e)).

Siting

All new construction must be located landward of the reach of mean high tide (i.e., the mean high water line). In addition, manmade alterations of sand dunes or mangrove stands are prohibited if those alterations would increase potential flood damage. Removing sand or vegetation from, or otherwise altering, a sand dune or removing mangroves may increase potential flood damage; therefore, such actions must not be carried out without the prior study and approval from a local floodplain official.

Building Elevation

All new construction, substantially improved, and substantially damaged buildings must be elevated on pilings, posts, piers, or columns so that the bottom of the lowest horizontal structural member of the lowest floor (excluding the vertical foundation members) is at or above the BFE. In Zone V, buildings must be elevated on an open foundation (e.g., pilings, posts, piers, or columns).

Foundation Design

The piling or column foundations for all new construction, substantially improved, and substantially damaged buildings, as well as the buildings attached to the foundations, must be anchored to resist flotation, collapse, and lateral movement due to the effects of wind and water loads acting simultaneously on all components of the building. A registered engineer or architect must develop or review the structural design, construction specifications, and plans for construction and must certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the building elevation and foundation design standards described above.

In addition, erosion control structures and other structures such as bulkheads, seawalls, and retaining walls may not be attached to the building or its foundation.



CROSS REFERENCE

For more information about enclosures, the use of space below the lowest floor, and breakaway walls, refer to Section 8.5.8, 8.5.10, 12.4, and 13.1.10 of this Manual and to the following FEMA NFIP Technical Bulletins:

- *Design and Construction Guidance for Breakaway Walls Below Elevated Buildings Located in Coastal High Hazard Areas in accordance with the National Flood Insurance Program, Technical Bulletin 9 (FEMA 2008a)*
- *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program, Technical Bulletin 2 (FEMA 2008b)*
- *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas in accordance with the National Flood Insurance Program, Technical Bulletin 5 (FEMA 2008c)*



NOTE

For more information about the use of fill in Zone V, refer to *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas in accordance with the National Flood Insurance Program, FEMA NFIP Technical Bulletin 5 (FEMA 2008c)*.

Use of Fill

Fill may not be used for the structural support of any building within Zones VE, V1–V30, and V. Minor grading and the placement of minor quantities of fill is permitted for landscaping and drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways. Fill may be used in Zone V for minor landscaping and site drainage purposes (consult local officials for specific guidance or requirements).

Space Below the BFE

The space below all new construction, substantially improved, and substantially damaged buildings must either be free of obstructions or enclosed only by non-supporting breakaway walls, open wood latticework, or insect screening intended to collapse under water loads without causing collapse, displacement, or other structural damage to the elevated portion of the building or the supporting foundation system. Furthermore, NFIP requirements specify permitted uses below the BFE, use of flood damage-resistant materials below

SUBSTANTIAL IMPROVEMENT AND SUBSTANTIAL DAMAGE

Designers working on existing buildings should check with local officials early in the design process to find out if the proposed work is likely to trigger substantial improvement requirements. Local officials must review proposals to improve structures that are located in mapped SFHAs to determine whether the proposed work will be considered substantial improvement or repair of substantial damage.

The determination is based on comparing the cost of the improvement (or cost to repair a damaged building to its pre-damage condition) to the market value of the building before the improvement (or before the damage occurred). If the cost equals or exceeds 50 percent of the market value, the building must be brought into compliance with NFIP requirements based on its location in the flood zone and its occupancy.

The requirements apply to buildings in all SFHAs. The requirements that apply in Zone V (and those recommended for Coastal A Zones) require that substantially improved and substantially damaged buildings:

- Be elevated on open foundations (pilings or columns)
- Be elevated so that the bottom of the lowest horizontal structural member of the lowest floor is at or above the BFE
- Have the foundation anchored to resist flotation, collapse, and lateral movement due to the effects of wind and water loads acting simultaneously on all building components
- Have the area beneath the elevated building free of obstructions
- Have utility and building service equipment elevated above the BFE
- Have the walls of enclosures below the elevated building designed to break away under base flood conditions without transferring loads to the foundation
- Use flood damage-resistant materials below the BFE

Work on a post-FIRM building cannot be allowed if it would make the building noncompliant with the requirements in place at the time the building was originally constructed.

If a property owner decides to demolish an existing building and rebuild on the same site, the work is considered new construction and all requirements for new construction must be met.

SUBSTANTIAL IMPROVEMENT AND SUBSTANTIAL DAMAGE (concluded)

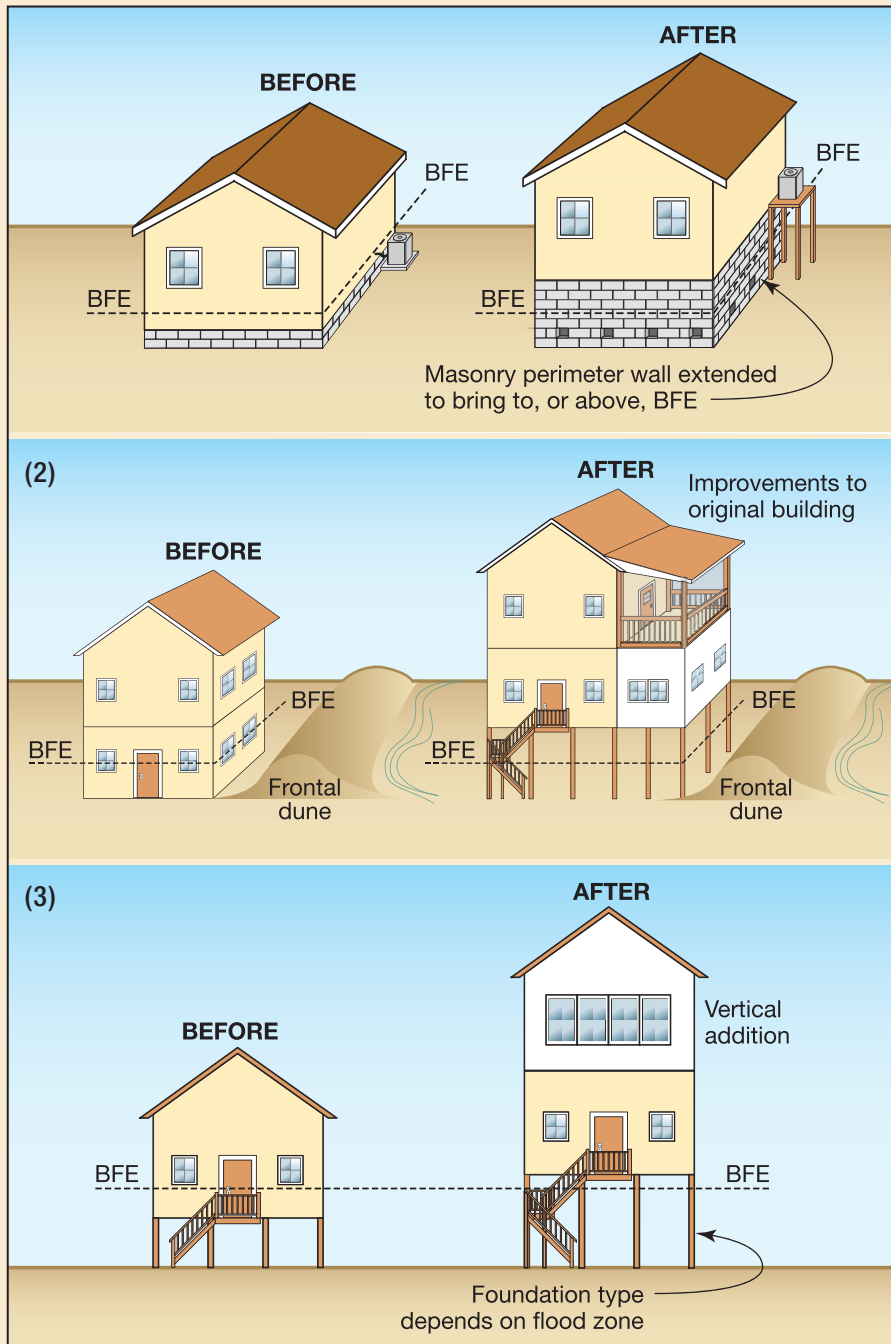


Figure above (top to bottom): Substantial improvement triggered by (1) rehabilitation with no increase in footprint to a home in Zone A (top)—building must be brought into compliance with the NFIP, (2) lateral addition to a home in Zone V (middle)—both the addition and the original building must be brought into compliance with the NFIP, and (3) vertical addition (either new upper or lower floor, bottom figure)—in this case, the whole building must be brought into compliance with the NFIP.

SOURCE: FEMA P-758 (2010a)

the BFE (see NFIP Technical Bulletin 2, FEMA 2008b), and placement of mechanical/utility equipment below the BFE. Compliance with these requirements for the space below the BFE will minimize flood damage. This has been confirmed by post-damage assessments of buildings following disaster events. Failure to comply with these requirements violates the local floodplain management ordinance and NFIP regulations, and can lead to higher flood insurance premiums and uninsured losses.

The current NFIP regulatory requirements regarding breakaway walls are set forth at 44 CFR § 60.3(e)(5). The regulations specify a design safe loading resistance for breakaway walls of not less than 10 pounds per square foot and not more than 20 pounds per square foot. However, the regulations also provide guidance for the use of alternative designs that do not meet the specified loading requirements. In general, breakaway walls built according to such designs are permitted if a registered engineer or architect certifies that the walls will collapse under a water load less than that of the base flood and that the elevated portion of the building and supporting foundation system will not be subject to collapse, displacement, or other structural damage due to the simultaneous effects of wind and water loads on all components of the building. Additional requirements apply to the use of an enclosed area below the lowest floor—it may be used only for parking, building access, or storage and it must be constructed of flood damage-resistant materials.

The current NFIP regulations do not provide specifications or other detailed guidance for the design and construction of alternative types of breakaway walls. However, the results of research conducted for FEMA and the National Science Foundation by North Carolina State University and Oregon State University, including full-scale tests of breakaway wall panels, provide the basis for prescriptive criteria for the design and construction of breakaway wall panels that do not meet the requirement for a loading resistance of 10 to 20 pounds per square foot. These criteria are presented in the NFIP Technical Bulletin 9 (FEMA 2008a). The criteria address breakaway wall construction materials, including wood framing, light-gauge steel framing, and masonry; attachment of the walls to floors and foundation members; utility lines; wall coverings such as interior and exterior sheathing, siding, and stucco; and other design and construction issues. In addition, the bulletin describes the results of the testing. The test results are described in greater detail in *Behavior of Breakaway Walls Subjected to Wave Forces: Analytical and Experimental Studies* (Tung et al. 1999).

5.2.4 Community Rating System

Although a participating community's floodplain management ordinance or law must, at a minimum, meet the requirements of the NFIP regulations, FEMA encourages communities to establish additional or more stringent requirements as they see fit. In 1990, to provide incentives for communities to adopt more stringent requirements, FEMA established the NFIP CRS, a program through which FEMA encourages and recognizes community floodplain management activities that exceed the minimum NFIP requirements. Under the CRS, flood insurance premiums within participating communities are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: (1) reducing flood losses, (2) facilitating accurate insurance ratings, and (3) promoting awareness of the importance of flood insurance.



WARNING

Although the NFIP regulations permit below-BFE enclosures that meet the criteria presented here, many communities may have adopted ordinances that prohibit all such enclosures or that establish more stringent criteria, such as an enclosure size limitation. Check with local officials about such requirements.

Through the CRS, a community is awarded credit points for carrying out floodplain management activities in the areas of public information, mapping and regulations, flood damage reduction, and flood preparedness. The number of points awarded determines the community's CRS class (from 1 to 10), which, in turn, determines the community's discount in flood insurance premiums for structures within and outside the SFHA. Participation in the CRS is voluntary; any community compliant with the rules and regulations of the NFIP may apply for a CRS classification. In addition to helping communities obtain insurance premium discounts, the CRS promotes floodplain management activities that help save lives, reduce property damage, and promote sustainable, more livable communities.

5.3 Building Codes and Standards

Many States and communities regulate the construction of buildings by adopting and enforcing building codes. Building codes set forth minimum requirements for structural design, materials, fire safety, exits, natural hazard mitigation, sanitary facilities, light and ventilation, environmental control, fire protection, and energy conservation. The purpose of a code is to establish the minimum acceptable requirements necessary for protecting the public health, safety, and welfare in the built environment. Building codes apply primarily to new construction, but may also apply to existing buildings that are being repaired, altered, or added to and when a building is undergoing a change of occupancy as defined by the code.

Numerous standards related to design and construction practices and construction materials are incorporated into a building code by reference rather than by inclusion of all of the text of the standard in the code. For example, ASCE 7 is a reference standard for both the IBC and IRC, where applicable provisions of ASCE 7 are enacted by reference, in lieu of directly incorporating text of ASCE 7 into the IBC and IRC.

Most locally adopted building codes in the United States are based on model building codes. Examples of model building codes are the series of codes promulgated by the International Code Council (ICC) including:

- *International Building Code (IBC)*, (ICC 2012a)
- *International Residential Code for One- and Two-Family Dwellings (IRC)*, (ICC 2012b)



NOTE

As of May 1, 2010, 1,138 communities throughout the United States were receiving flood insurance premium discounts through the CRS as a result of implementing local mitigation, outreach, and educational activities that exceed the minimum NFIP requirements. For more information about the CRS, contact the State NFIP Coordinating Agency or the appropriate FEMA Regional Office (listed on the FEMA Residential Coastal Construction Web page).



NOTE

The adoption and enforcement of building codes and standards is not consistent across the United States. Codes and standards in some States and communities may be more restrictive than those in others. In addition, some communities have not adopted a building code. In communities where building codes have not been adopted or where the existing codes are not applied to one- and two-family residential buildings, design professionals, contractors, and others engaged in the design and construction of coastal residential buildings are encouraged to follow the requirements of a model building code and the best practices presented in this Manual.

- *International Existing Building Code* (IEBC) (ICC 2012c)
- *International Mechanical Code* (IMC) (2012d)
- *International Plumbing Code* (IPC) (2012e)
- *International Private Sewage Disposal Code* (IPSDC) (2012f)
- *International Fuel Gas Code* (IFGC) (2012g)
- *International Fire Code* (IFC) (2012h)

Provisions of the IBC and IRC are the model building codes of most interest for this Manual because they address primary requirements for design and construction of coastal residential buildings and because of their wide-spread use in the United States. The National Fire Protection Association's NFPA 5000 (NFPA 2012), *Building Construction and Safety Code*, is used by some jurisdictions instead of the IBC and IRC.

While model codes are widely used, States and local jurisdictions often incorporate amendments and revisions to meet specific needs. Variations in code provisions from one State or jurisdiction to the next, coupled with potential code revisions, make it imperative that the designer work with local officials to identify applicable codes, standards, and construction requirements.

Even in cases where amendments are minimal and where the commonly used model codes are adopted, questions often arise regarding the applicability of IBC and IRC code provisions to the design of residential buildings. As stated in the scoping language of the 2009 IBC (ICC 2009a):

Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the International Residential Code.

Therefore, primary guidance for regulatory requirements for the design and construction of buildings of interest in this Manual (e.g., one-and two-family detached dwellings) are based on the requirements specified in the IRC.

Generally, construction of residential buildings under the IRC need not involve a registered design professional, unless required by State law for the jurisdiction where the building is constructed. However, the building designer should be aware that engineered design is broadly permitted in the IRC and applicable even for a building structure with requirements contained entirely within the IRC, as stated in Section R301.1.3 (ICC 2009b):

Engineered design in accordance with the International Building Code is permitted for all buildings and structures, and parts thereof, included in the scope of this code.



NOTE

When the 2000 I-Codes were first published, many components of the NFIP were not included. After freeboard requirements were added to the 2006 I-Codes, NFIP requirements were represented in the minimum requirements of building codes. By referencing ASCE 24, the I-Codes include some requirements more restrictive than the NFIP.



NOTE

Provisions of the IBC, IRC, IMC, IPC, IPSDC, IFGC, IFC and NFPA 5000 are consistent with applicable provisions of NFIP regulations.

In certain cases and most coastal areas, however, the IRC requires structural elements to be “designed in accordance with accepted engineering practice.” For example, engineered design of structural elements which fall outside the scope of requirements in the IRC such as building systems of excessive weight, elements of excessive length or height, or products not specifically addressed in the IRC is required. IRC Section R322.3.6 requires that construction documents be prepared and sealed by a registered design professional, and include documentation that the design and methods of construction to be used meet the applicable criteria of the IRC.

Buildings in regions of high wind, seismic, snow, and flood hazards as well as building elements outside of the range of limitations in the IRC require design beyond the IRC prescriptive provisions as follows:

- **Wind.** Buildings located where the basic wind speed equals or exceeds 110 miles per hour or where the IRC indicates special design for wind is required (wind speed triggers for the hurricane-prone region are based on mapped wind speeds in the 2012 IRC).
- **Seismic.** Buildings located in Seismic Design Category E.
- **Snow.** Buildings in regions with ground snow loads greater than 70 pounds per square foot.
- **Flood.** Buildings and structures constructed in whole or in part in coastal high hazard areas (including Zone V).

In addition to provisions of the IBC, applicable standards specifically recognized as accepted engineering practice for wind design within the IRC are: American Forest and Paper Association (AF&PA), *Wood Frame Construction Manual for One- and Two-Family Dwellings* (AF&PA 2012); ICC 600, *Standard for Residential Construction in High-Wind Regions* (ICC 2008a); ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures* (ASCE 2010); and American Iron and Steel Institute (AISI), *Standard for Cold-Formed Steel Framing—Prescriptive Method For One- and Two-Family Dwellings with Supplement 2* (AISI 2007). For flood, ASCE 24-05, *Flood Resistant Design and Construction* (ASCE 2005), is specifically recognized within the IRC as an alternative to the flood design provisions of the IRC.

Engineered design requirements within both the IRC and IBC recognize ASCE 7 as the standard reference for minimum design loads due to hazards such as wind, flood, and seismic. As a result, within this Manual, provisions of ASCE 7 are used extensively for determination of minimum loads in accordance with engineered design requirements of the codes. For many portions of the Pacific, Great Lakes, and New England coasts, construction will generally fall within the prescriptive limits of the 2012 IRC and not require engineered design.



NOTE

The 2012 IRC replaces the previous basic wind speed map, Figure R301.2(4), with three new figures.

- Figure R301.2(4)A presents a new map of basic wind speeds based on the ASCE 7-10 wind map data but converted to allowable-stress design (ASD) levels.
- Figure R301.2(4)B provides shaded regions that indicate where wind speeds equal or exceed the scope of the IRC and use of recognized standards for wind design is required.
- Figure R301.2(4)C indicates where the openings of buildings must be protected from wind-borne debris in accordance with ASTM E1996.

Wind speed maps and triggers in the 2012 IRC are on an ASD basis, while wind speed maps and triggers in ASCE 7-10 are on a strength basis.

5.4 Best Practices for Exceeding Minimum NFIP Regulatory Requirements

This section presents best practices for exceeding NFIP minimum requirements. These best practices address the significant hazards present in Coastal A Zone and Zone V and are aimed at increasing the ability of coastal residential buildings to withstand natural hazard events. Refer to Section 5.2 for the minimum requirements of the NFIP regulations concerning buildings in Zone A and Zone V.

Table 5-2 in Section 5.4.3 summarizes the NFIP requirements and the best practices of this Manual regarding buildings in Zone A, Coastal A Zone, and Zone V.

5.4.1 Zone A

This Manual includes discussion of best practices for the design and construction of buildings in areas subject to coastal flooding, but focuses on Zone V and the Coastal A Zone (the portion of Zone A seaward of the LiMWA). However, development in the portion of Zone A landward of the LiMWA can benefit from many of the Zone V and Coastal A Zone design and construction practices included in this Manual. Designers seeking guidance regarding good practice for the design and construction of such buildings should consult local floodplain management, building, or code officials. Additional guidance can be found in FEMA 259, *Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures* (FEMA 2011); the IBC (ICC 2012a) and IRC (ICC 2012b); and the FEMA NFIP Technical Bulletins (available at <http://www.fema.gov/plan/prevent/floodplain/techbul.shtm>). This Manual recommends the provisions of ASCE 24 as best practices. These include, but are not limited to, the addition of freeboard in elevation requirements in Zone A (Figure 5-1).

5.4.2 Coastal A Zone and Zone V

As explained in Chapters 1 and 3 of this Manual, the NFIP regulations do not differentiate between the Coastal A Zone and the portion of Zone A that is landward of the LiMWA. Because Coastal A Zones may be subject to the types of hazards present in Zone V, such as wave effects, velocity flows, erosion, scour, and high winds, this Manual recommends that buildings in Coastal A Zones meet the NFIP regulatory requirements for Zone V buildings (i.e., the performance requirements concerning resistance to flotation, collapse, and lateral movement and the prescriptive requirements concerning elevation, foundation type, engineering certification of design and construction, enclosures below the lowest floor, and use of structural fill—see Section 5.2.3.3).

To provide a greater level of protection against the hazards in Coastal A Zone and Zone V, this Manual recommends the following as good practice for the siting, design, and construction of buildings in those zones:

- The building should be located landward of both the long-term erosion setback and the limit of base flood storm erosion, rather than simply landward of the reach of mean high tide.
- The bottom of the lowest horizontal structural member should be elevated above, rather than to, the BFE (i.e., provide freeboard—see Figure 5-2[b]).

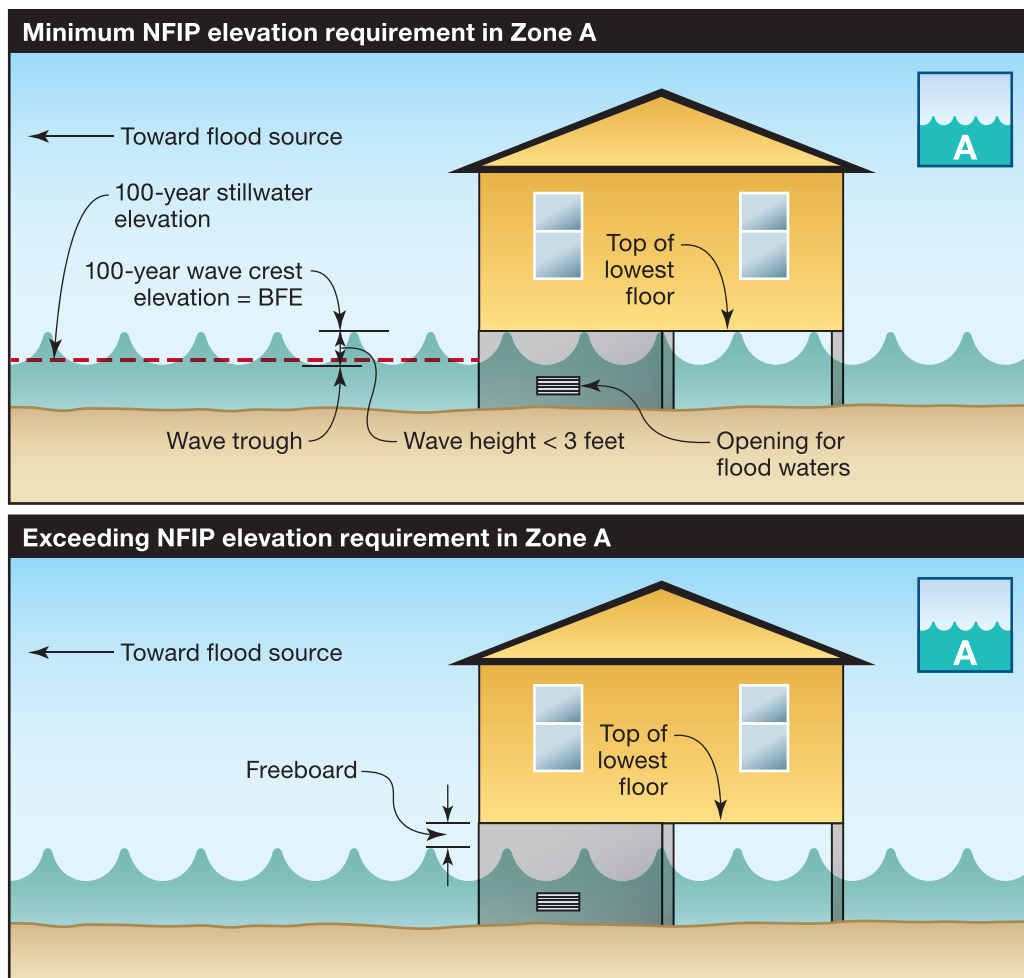


Figure 5-1. Recommended elevation for buildings in Zone A compared to minimum requirements

- Open latticework, screening, or louvers should be used in lieu of breakaway walls in the space below the lowest floor, or, at a minimum, the use of solid breakaway walls should be minimized.
- In Zone V, the lowest horizontal structural member should be oriented perpendicular to the expected wave crest.

5.4.3 Summary

Table 5-2 summarizes NFIP regulatory requirements for Zone V, Coastal A Zone, and Zone A, and best practices for exceeding the requirements. These requirements and recommendations are in addition to the minimum building code requirements.

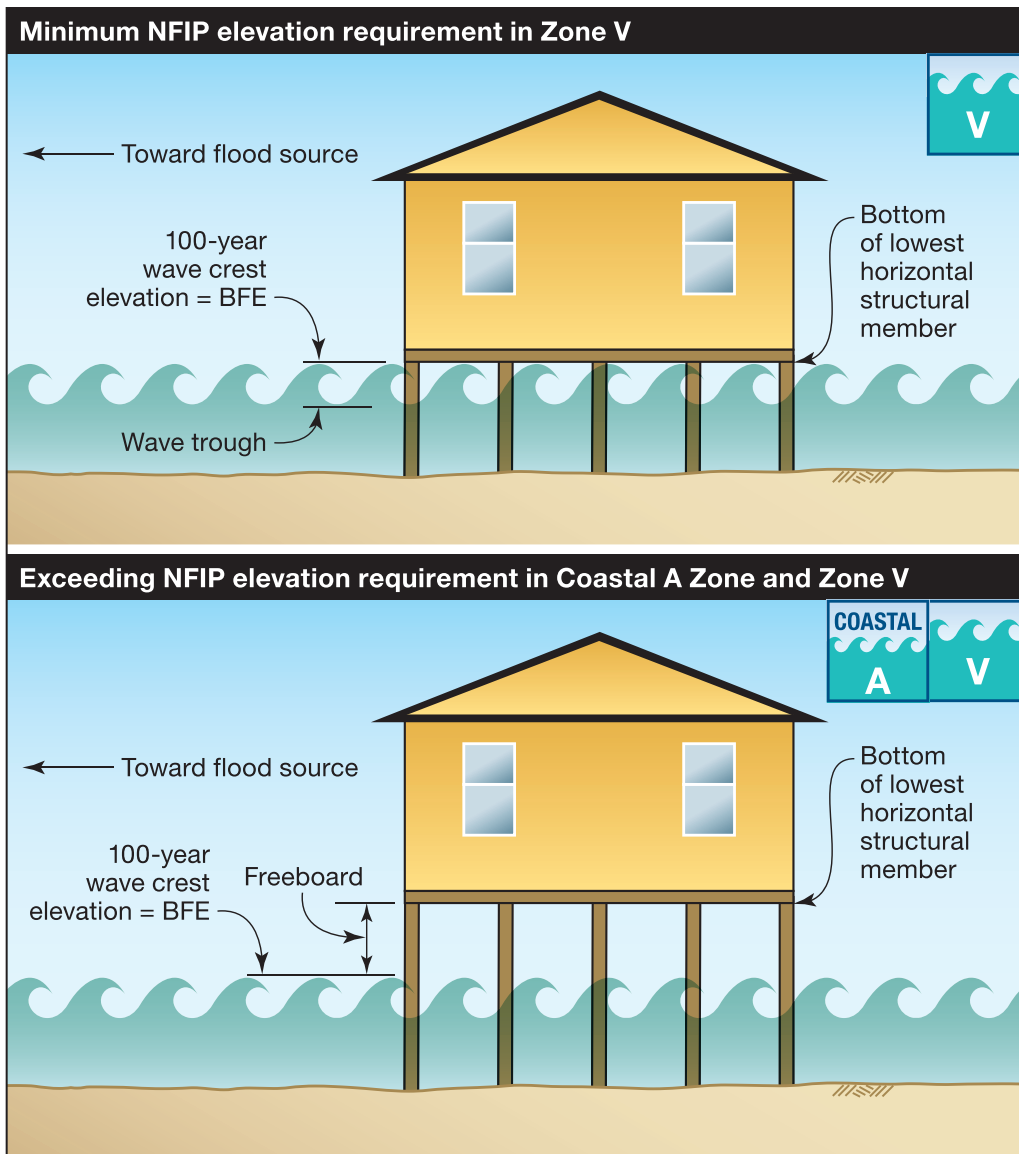


Figure 5-2. Recommended elevation for buildings in Coastal A Zone and Zone V compared to minimum requirements

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements




Zone V 		Coastal A Zone 		Zone A 		
Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference	
GENERAL REQUIREMENTS						
Siting	<p>Recommendation: Define and evaluate vulnerability to all coastal hazards, including short- and long-term erosion, and site building as far landward as possible.</p> <p>Requirement: New construction is landward of the reach of mean high tide. Manmade alterations of sand dunes and mangrove stands that increase potential flood damage are prohibited.</p>	<p>NFIP: 60.3(e)(3), 60.3(e)(7)</p> <p>IRC: R322.3.1</p> <p>IBC: App. G401.2, App. G103.7</p> <p>ASCE 24: 4.3</p> <p>FEMA P-55: 2.3.2, Ch. 4, 7.5.1</p> <p>FEMA P-499: 2.1, 2.2</p>	<p>Recommendation: Follow Zone V recommendations and requirements.</p> <p>Requirement: Buildings governed by IRC – meet Zone A requirements (unless authority having jurisdiction has adopted ASCE 24 for buildings governed by IRC). Buildings governed by IBC – follow Zone V requirements.</p>	<p>IBC: 1804.4</p> <p>ASCE 24: 4.3</p> <p>FEMA P-55: 2.3.2, Ch. 4</p> <p>FEMA P-499: 2.1, 2.2</p>	<p>Recommendation: Site building outside of SFHA or on highest and most stable part of lot.</p> <p>Requirement: For floodways, fill is permitted only if it has been demonstrated that the fill will not result in any increase in flood levels during the base flood.</p>	<p>NFIP: 60.3(d)(3)</p> <p>IRC: R301.2.4, R322.1, R322.1.4.2</p> <p>IBC: 1612.3.4, 1804.4, App. G 103.5, App. G 401.1</p> <p>ASCE 24: 2.2</p> <p>FEMA P-55: 2.3.2, Ch. 4</p>
Design and Construction	<p>Recommendation: Redundant and continuous load paths should be employed to transfer all loads to the ground. Designs should explicitly account for all design loads and conditions.</p> <p>Requirement: Building and foundation must be designed, constructed, and adequately anchored to prevent flotation, collapse, and lateral movement due to simultaneous wind and flood loads, including the effects of buoyancy.</p>	<p>NFIP: 60.3(a)(3)(i), 60.3(e)(4)</p> <p>IRC: R301.1, R301.2.4, R322.1, R322.3.3</p> <p>IBC: 1603.1.7, 1604, 1605.2.2, 1605.3.1.2, 1612</p> <p>ASCE 7: Ch. 5</p> <p>ASCE 24: 1.5, Ch. 4</p> <p>FEMA P-55: 2.3.3, 2.3.4, 5.4.2, Ch. 8, 9.1, 9.2</p> <p>FEMA P-499: 3.1, 3.2, 3.3, 3.4, 4.1, 4.3</p> <p>Other: FEMA P-550</p>	<p>Recommendation: Follow Zone V recommendations and requirements.</p> <p>Requirement: Building and foundation must be designed, constructed, and adequately anchored to prevent flotation, collapse, and lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.</p>	<p>NFIP: 60.3(a)(3)(i)</p> <p>IRC: R301.1, R301.2.4, R322.1.2, R322.2</p> <p>IBC: 1603.1.7, 1604, 1605.2.2, 1605.3.1.2, 1612</p> <p>ASCE 7: Ch. 5</p> <p>ASCE 24: 1.5, Ch. 4</p> <p>FEMA P-55: 2.3.3, 2.3.4, 5.4.2, Ch. 8, 9.1, 9.2</p> <p>FEMA P-499: 3.1, 3.2, 3.3, 3.4, 3.5, 4.2, 4.2, 4.3</p> <p>Other: FEMA P-550</p>	<p>Recommendation: Follow ASCE 24 requirements.</p> <p>Requirement: Building and foundation must be designed, constructed, and adequately anchored to prevent flotation, collapse, and lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.</p>	<p>NFIP: 60.3(a)(3)(i)</p> <p>IRC: R301.1, R301.2.4, R322.1.2, R322.2</p> <p>IBC: 1603.1.7, 1604, 1605.2.2, 1605.3.1.2, 1612</p> <p>ASCE 7: Ch. 5</p> <p>ASCE 24: 1.5, 2.2</p> <p>FEMA P-55: 2.3.3, 2.3.4, 5.4.1, Ch. 8, 9.1, 9.2</p> <p>Other: FEMA P-550</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




	Zone V 		Coastal A Zone 		Zone A 	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Flood Damage-Resistant Materials	<p>Recommendation: Consider use of flood damage-resistant materials above BFE.</p> <p>Requirement: Structural and nonstructural building materials below the DFE must be flood damage-resistant.</p>	<p>NFIP: 60.3(a)(3)(ii)</p> <p>IRC: R322.1.8</p> <p>IBC: 801.5, 1403.5</p> <p>ASCE 24: Ch. 5</p> <p>FEMA P-55: 5.2.3.1, 9.4</p> <p>FEMA P-499: 1.7, 1.8, 4.3</p> <p>Other: FEMA TB-2 and TB-8</p>	<p>Recommendation: Follow Zone V recommendations and requirements.</p> <p>Requirement: Structural and nonstructural building materials below the DFE must be flood damage-resistant.</p>	<p>NFIP: 60.3(a)(3)(ii)</p> <p>IRC: R322.1.8</p> <p>IBC: 801.5, 1403.5</p> <p>ASCE 24: Ch. 5</p> <p>FEMA P-55: 5.2.3.1, 9.4</p> <p>FEMA P-499: 1.7, 1.8, 4.3</p> <p>Other: FEMA TB-2 and TB-8</p>	<p>Recommendation: Follow Zone V recommendations and requirements.</p> <p>Requirement: Structural and nonstructural building materials below the DFE must be flood damage-resistant.</p>	<p>NFIP: 60.3(a)(3)(ii)</p> <p>IRC: R322.1.8</p> <p>IBC: 801.5,1403.5</p> <p>ASCE 24: Ch. 5</p> <p>FEMA P-55: 5.2.3.1, 9.4</p> <p>FEMA P-499: 1.7, 1.8</p> <p>Other: FEMA TB-2 and TB-8</p>
Free of Obstructions	<p>Recommendation: Use lattice, insect screening, or louvers instead of solid breakaway walls.</p> <p>Requirement: Open foundation required. The space below the lowest floor must be free of obstructions, or constructed with non-supporting breakaway walls, open lattice, or insect screening. Obstructions include any building element, equipment, or other fixed objects that can transfer flood loads to the foundation, or that can cause floodwaters or waves to be deflected into the building.</p>	<p>NFIP: 60.3(e)(5)</p> <p>IRC: R322.3.3</p> <p>IBC: 1612.4</p> <p>ASCE 24: 4.5.1</p> <p>FEMA P-55: 5.2.3.3, 7.6.1.1.6, Table 7-3, Table 7-4, 10.5, 10.6</p> <p>FEMA P-499: 1.2, 3.1, 8.1</p> <p>Other: FEMA TB- 5</p>	<p>Recommendation: Follow Zone V recommendation and requirement.</p> <p>Requirement: No limitations are imposed on obstructions below elevated floors unless the design is governed by IBC/ASCE 24 (in which case the space below the lowest floor must be free of obstructions).</p>	<p>IBC: 1612.4</p> <p>ASCE 24: 4.5.1</p> <p>FEMA P-55: 5.2.3.3, 7.6.1.1.6, 10.5, 10.6</p> <p>FEMA P-499: 1.2, 3.1, 8.1</p> <p>Other: FEMA TB-5</p>	<p>Recommendation: If riverine flood velocities are high or large debris load is anticipated, open foundations are recommended.</p> <p>Requirement: None</p>	<p>FEMA P-55: 10.7, 10.9</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




Zone V 		Coastal A Zone 		Zone A 		
Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference	
ELEVATION						
Lowest Floor Elevation^(c)	<p>Recommendation: See Freeboard (additional height above required lowest floor elevation).</p> <p>Requirement:</p> <ul style="list-style-type: none"> • NFIP: Bottom of the lowest horizontal structural member (LHSM)^(d) of the lowest floor must be at or above the BFE. • IRC: Bottom of LHSM must be (a) at or above DFE if LHSM is parallel to direction of wave approach; or (b) at or above BFE plus 1 foot or DFE, whichever is higher, if LHSM is perpendicular to the direction of wave approach. • IBC/ASCE 24: Elevation based on orientation of LHSM and structure category. 	<p>NFIP: 60.3(e)(4)</p> <p>IRC: R322.3.2, R332.1.5</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 4.4</p> <p>FEMA P-55: 5.2.3</p> <p>FEMA P-499: 1.4</p>	<p>Recommendation: See Freeboard (additional height above required lowest floor elevation).</p> <p>Requirement:</p> <ul style="list-style-type: none"> • NFIP: Top of floor must be at or above BFE. • IRC: Same as Zone A, plus 1 foot, if the LiMWA is delineated. • IBC/ASCE 24: Same as Zone V. 	<p>NFIP: 60.3(c)(2)</p> <p>IRC: R322.2.1, R322.1.5</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 4.4</p> <p>FEMA P-55: 5.2.3</p> <p>FEMA P-499: 1.4</p>	<p>Recommendation: See Freeboard (additional height above required lowest floor elevation).</p> <p>Requirement: Top of floor must be at or above BFE.</p>	<p>NFIP: 60.3(c)(2)</p> <p>IRC: R322.2.1, R322.1.5</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 2.3</p> <p>FEMA P-55: 5.2.3</p> <p>FEMA P-499: 1.4</p>
Freeboard (additional height above required Lowest Floor Elevation)^(c)	<p>Recommendation: Elevate buildings higher than the required lowest floor elevation to provide more protection against flood damage and to reduce the cost of Federal flood insurance.</p> <p>Requirement: See Lowest Floor Elevation</p>	<p>IRC: R322.3.2</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 4.4</p> <p>FEMA P-55: 2.3.3, 5.4.2, 6.2.1, 7.5.2 (text box)</p> <p>FEMA P-499: 1.6</p> <p>Other: NFIP Evaluation Study</p>	<p>Recommendation: Elevating building higher than the required lowest floor elevation provides more protection against flood damage and reduces the cost of Federal flood insurance.</p> <p>Requirement: See Lowest Floor Elevation</p>	<p>IRC: R322.2.1</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 4.4</p> <p>FEMA P-55: 2.3.3, 5.4.2, 6.2.1, 7.5.2 (text box)</p> <p>FEMA P-499: 1.6</p> <p>Other: NFIP Evaluation Study</p>	<p>Recommendation: Elevating buildings higher than the required lowest floor elevation provides more protection against flood damage and reduces the cost of Federal flood insurance.</p> <p>Requirement: See Lowest Floor Elevation</p>	<p>IBC: 1612.4</p> <p>ASCE 24: 1.5.2, 2.3</p> <p>FEMA P-55: 2.3.3, 5.4.1, 6.2.1, 7.5.2 (text box)</p> <p>FEMA P-499: 1.6</p> <p>Other: NFIP Evaluation Study</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




Zone V 		Coastal A Zone 		Zone A 		
Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference	
FOUNDATION						
Open Foundation	<p>Recommendation: Follow requirement.</p> <p>Requirement: Open foundations (pilings or columns) are required.</p>	<p>NFIP: 60.3(e)(4)</p> <p>IRC: R322.3.3, R401.1</p> <p>IBC: 1612.4</p> <p>ASCE 24: 1.5.3, 4.5</p> <p>FEMA P-55: 2.3.3, 5.2.3, 10.2, 10.3</p> <p>FEMA P-499: 3.1, 3.2, 3.3, 3.4</p> <p>Other: FEMA P-550</p>	<p>Recommendation: Follow Zone V requirement.</p> <p>Requirement:^(e) Not required unless the design is governed by IBC/ASCE 24 (in which case an open foundation is required).</p>	<p>IBC: 1612.4</p> <p>ASCE 24: 1.5.3, 4.5</p> <p>FEMA P-55: 2.3.3, 5.2.3, 10.2, 10.3</p> <p>FEMA P-499: 3.1, 3.2, 3.3, 3.4, 3.5</p> <p>Other: FEMA P-550</p>	<p>Recommendation: If riverine flood velocities are high or large debris load is anticipated, open foundations are recommended.</p> <p>Requirement: None^(e)</p>	<p>IBC: 1612.4</p> <p>ASCE 24: 1.5.3, 2.4, 2.5</p> <p>FEMA P-55: 2.3.3, 5.2.3, 10.2, 10.3</p> <p>FEMA P-499: 3.5</p> <p>Other: FEMA P-550</p>
Solid Foundation Walls (including walls forming crawlspace, and stemwall foundations)	Not Permitted	<p>NFIP: 60.3(e)(4)</p> <p>IRC: R322.3.3</p> <p>FEMA P-55: 5.2.3.3, 7.6.1.1.6, 10.2, 10.3</p> <p>FEMA P-499: 3.1, 3.5</p> <p>Other: FEMA TB-5, FEMA P-550</p>	<p>Recommendation: Use open foundations.</p> <p>Requirement:^(e)</p> <ul style="list-style-type: none"> • NFIP: Solid foundation walls are required to have flood openings. • IRC: Wall height is limited, unless designed. • IBC/ASCE 24: Solid foundation walls are not permitted if design is governed by IBC/ASCE 24. 	<p>NFIP: 60.3(c)(5)</p> <p>IRC: R322.2.2, R322.2.3</p> <p>IBC: 1612.4</p> <p>FEMA P-55: 10.2, 10.3, 10.8</p> <p>FEMA P-499: 3.1, 3.5</p> <p>Other: FEMA P-550, FEMA TB-1</p>	<p>Recommendation: If velocities are high or debris load is anticipated, open foundations are recommended in lieu of elevation on solid walls.</p> <p>Requirement:^(e)</p> <ul style="list-style-type: none"> • NFIP: Solid foundation walls are required to have flood openings. • IRC: Wall height is limited, unless designed; walls are required to have flood openings. • IBC/ASCE 24: Solid foundation walls are required to have flood openings. 	<p>NFIP: 60.3(c)(5)</p> <p>IRC: R322.2.2, R322.2.3</p> <p>IBC: 1612.4</p> <p>ASCE 24: 2.6</p> <p>FEMA P-55: 10.2, 10.3, 10.8</p> <p>FEMA P-499: 3.1, 3.5</p> <p>Other: FEMA P-550, FEMA TB-1</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




	 Zone V		 Coastal A Zone		 Zone A	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Structural Fill (including slab-on-grade foundation)	Not Permitted	NFIP: 60.3(e)(6) IRC: R322.3.2 IBC: 1612.4, 1804.4, App. G401.2 ASCE 24: 4.5.4 FEMA P-55: 5.2.3.3	Recommendation: Use open foundations. Requirement: If structural fill is used, compaction is necessary to meet requirements for stability during the base flood.	NFIP: 60.3(a)(3)(i) IRC: R322.1.2, R506 IBC: 1612.4, 1804.4 ASCE 24: 4.5.4 FEMA P-55: 10.3.1	Recommendation: If velocities are high or debris load is anticipated, open foundations are recommended in lieu of elevation on fill. Requirement: If structural fill is used, compaction is necessary to meet requirements for stability during the base flood.	NFIP: 60.3(a)(3)(i) IRC: R322.1.2, R506 IBC: 1612.4, 1804.4, App. G 401.1 ASCE 24: 2.4 FEMA P-55: 10.3.1
ENCLOSURES BELOW ELEVATED BUILDINGS						
Use of Enclosed Areas Below Elevated Lowest Floor^(f)	Recommendation: Minimize use of enclosed areas to reduce damage to stored contents, and to reduce flood-borne debris. Avoid storage of damageable items and hazardous materials. Requirement: Enclosures are permitted only for parking of vehicles, building access, and storage.	NFIP: 60.3(e)(5) IRC: R322.3.5 IBC: 1612.4 ASCE 24: 4.6 FEMA P-55: 5.2.3.3 FEMA P-499: 8.1	Recommendation: Follow Zone V recommendations and requirements. Requirement: Enclosures are permitted only for parking of vehicles, building access, and storage.	NFIP: 60.3(c)(5) IRC: R322.2.2 IBC: 1612.4 ASCE 24: 4.6 FEMA P-55: 5.2.3.2 FEMA P-499: 8.1	Recommendation: Avoid storage of damageable items and hazardous materials in flood-prone spaces. Requirement: Enclosures are permitted only for parking of vehicles, building access, and storage.	NFIP: 60.3(c)(5) IRC: R322.2.2 IBC: 1612.4 ASCE 24: 2.6 FEMA P-55: 5.2.3.2
Walls of Enclosures^(g)	Recommendation: Enclose areas with lattice, insect screening or louvers. Use flood openings to minimize collapse of solid breakaway walls under flood loads less than base flood loads.	NFIP: 60.3(e)(5) IRC: R322.3.4 IBC: 1612.4 ASCE 24: 4.6 FEMA P-55: 2.3.5, 5.2.3.2	Recommendation: Follow Zone V recommendations and requirements. Requirement: Solid foundation wall enclosures and solid breakaway wall enclosures must have flood openings.	NFIP: 60.3(c)(5) IRC: R322.2.2 IBC: 1612.4 ASCE 24: 4.6 FEMA P-55: 2.3.5, 5.2.3.2, 7.6.1.1.5	Recommendation: Follow requirement. Requirement: Walls of enclosures must have flood openings.	NFIP: 60.3(c)(5) IRC: R322.2.2 IBC: 1612.4 ASCE 24: 2.6 FEMA P-55: 2.3.5, 5.2.3.2, 7.6.1.1.5

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




Zone V 		Coastal A Zone 		Zone A 		
Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference	
Walls of Enclosures^(g) (continued)	Requirement: Walls must be designed to collapse (break away) under flood loads to allow free passage of floodwaters without damaging the structure or supporting foundation system. Utilities and equipment must not be mounted on or pass through breakaway walls.	FEMA P-499: 8.1 Other: FEMA TB-9		FEMA P-499: 3.1, 3.5, 8.1 Other: FEMA TB-1 and TB-9	FEMA P-499: 3.1, 3.5 Other: FEMA TB-1	
UTILITIES						
Electrical, Heating, Ventilation, Plumbing and Air Conditioning Equipment	Recommendation: Locate equipment on the landward side of building, and/or behind structural element. Requirement: Utilities and equipment must be located (elevated) and designed to prevent flood waters from entering and accumulating in components during flooding.	NFIP: 60.3(a)(3) (iv) IRC: R322.1.6, RM1301.1.1, RM1401.5, RM1601.4.9, RM1701.2, RM2001.4, RM2201.6, RG2404.7, RP2601.3, RP2602.2, RP2705.1, RP2101.5 IBC: 1403.5, 1403.6, 1612.4 ASCE 24: Ch. 7 FEMA P-55: Ch. 12 FEMA P-499: 8.3 Other: FEMA P-348, FEMA TB-5	Recommendation: Follow the Zone V recommendation and requirements. Requirement: Utilities and equipment must be located (elevated) and designed to prevent flood waters from entering and accumulating in components during flooding.	NFIP: 60.3(a)(3) (iv) IRC: R322.1.6, RM1301.1.1, RM1401.5, RM1601.4.9, RM1701.2, RM2001.4, RM2201.6, RG2404.7, RP2601.3, RP2602.2, RP2705.1, RP2101.5 IBC: 1403.5, 1612.4 ASCE 24: Ch. 7 FEMA P-55: Ch. 12 FEMA P-499: 8.3 Other: FEMA P-348, FEMA TB-5	Recommendation: Locate equipment on the landward or downstream side of building, and/or behind structural element. Requirement: Utilities and equipment must be located (elevated) and designed to prevent flood waters from entering and accumulating in components during flooding.	NFIP: 60.3(a)(3) (iv) IRC: R322.1.6, RM1301.1.1, RM1401.5, RM1601.4.9, RM1701.2, RM2001.4, RM2201.6, RG2404.7, RP2601.3, RP2602.2, RP2705.1, RP2101.5 IBC: 1403.5, 1612.4 ASCE 24: Ch. 7 FEMA P-55: Ch. 12 FEMA P-499: 8.3 Other: FEMA P-348

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




	 Zone V		 Coastal A Zone		 Zone A	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Water Supply and Sanitary Sewerage Systems	<p>Recommendation: Install shutoff valves to isolate water and sewer lines that extend into flood-prone areas.</p> <p>Requirement: Systems must be designed to minimize or eliminate infiltration of floodwaters into systems. Sanitary sewerage systems must be located to avoid impairment or contamination during flooding.</p>	<p>NFIP: 60.3(a)(5), 60.3(a)(6)</p> <p>IRC: R322.1.7, RP2602.2, RP3001.3</p> <p>IBC: App. G401.3, App. G401.4, App. G701</p> <p>ASCE 24: 7.3</p> <p>FEMA P-55: Ch. 12</p> <p>FEMA P-499: 8.3</p> <p>Other: FEMA P-348, FEMA TB-5</p>	<p>Recommendation: Follow Zone V recommendation.</p> <p>Requirement: Systems must be designed to minimize or eliminate infiltration of floodwaters into systems. Sanitary sewerage systems must be located to avoid impairment or contamination during flooding.</p>	<p>NFIP: 60.3(a)(5), 60.3(a)(6)</p> <p>IRC: R322.1.7, RP2602.2, RP3001.3</p> <p>IBC: App. G401.3, App. G401.4, App. G701</p> <p>ASCE 24: 7.3</p> <p>FEMA P-55: Ch. 12</p> <p>FEMA P-499: 8.3</p> <p>Other: FEMA P-348, FEMA TB-5</p>	<p>Recommendation: Follow requirement.</p> <p>Requirement: Systems must be designed to minimize or eliminate infiltration of floodwaters into systems. Sanitary sewerage systems must be located to avoid impairment or contamination during flooding.</p>	<p>NFIP: 60.3(a)(5), 60.3(a)(6)</p> <p>IRC: R322.1.7, RP2602.2, RP3001.3</p> <p>IBC: App. G401.3, App. G401.4, App. G701</p> <p>ASCE 24: 7.3</p> <p>FEMA P-55: Ch. 12</p> <p>FEMA P-499: 8.3</p> <p>Other: FEMA P-348</p>
CERTIFICATION						
Design Certifications (foundations, breakaway walls, flood openings)	<p>Recommendation: Follow requirement.</p> <p>Requirement: Registered design professional must certify that the design and methods of construction are in accordance with accepted standards of practice for meeting design requirements, including design of breakaway walls if designed to fail under loads more than 20 pounds per square foot.</p>	<p>NFIP: 60.3(e)(4), 60.3(e)(5)</p> <p>IRC: R322.3.6</p> <p>IBC: 1612.5(2.2) and (2.3)</p> <p>FEMA P-55: 5.2.2.3, 5.4.2</p> <p>FEMA P-499: 1.5, 3.1, 8.1</p> <p>Other: FEMA TB-9</p>	<p>Recommendation: Follow Zone V requirement.</p>	<p>NFIP: 60.3(c)(5)</p> <p>IRC: R322.2.2(2.2)</p> <p>IBC: 1612.5(1.2)</p> <p>FEMA P-55: 5.4.2</p> <p>FEMA P-499: 1.5, 3.1, 8.1</p> <p>Other: FEMA TB-1 and TB-9</p>	<p>Recommendation: Follow requirement.</p> <p>Requirement: Registered design professional must certify performance of engineered flood openings (flood openings that do not conform to prescriptive requirement).</p>	<p>NFIP: 60.3(c)(5)</p> <p>IRC: R322.2.2(2.2)</p> <p>IBC: 1612.5(1.2)</p> <p>Other: FEMA TB-1</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




	 Zone V		 Coastal A Zone		 Zone A	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Design Certifications (foundations, breakaway walls, flood openings) (continued)			Requirement: Registered design professional must certify performance of engineered flood openings (flood openings that do not conform to prescriptive requirement). If designs are governed by IBC or ASCE 24, registered design professional must certify that the design and methods of construction are in accordance with accepted standards of practice for meeting design requirements, including design of breakaway walls if designed to fail under loads more than 20 pounds per square foot.			
Certification of Elevation	Recommendation: Surveyed elevation of the bottom of the LHSM should be submitted when that member is placed and prior to further vertical construction, and re-surveyed and submitted prior to the final inspection. Requirement: Surveyed elevation of the bottom of the LHSM must be submitted to the community (as-built).	NFIP: 60.3(b)(5), 60.3(e)(2) IRC: R109.1.3, R322.1.10 IBC: 110.3.3, 1612.5(2.1) FEMA P-499: 1.4, 8.3 Other: NFIP FMB 467-1	Recommendation: Follow Zone V recommendations and requirements. Requirement: Surveyed elevation of the lowest floor must be submitted to the community (as-built).	NFIP: 60.3(b)(5) IRC: R109.1.3, R322.1.10 IBC: 110.3.3, 1612.5(1.1) FEMA P-499: 1.4, 8.3 Other: NFIP FMB 467-1	Recommendation: Surveyed elevation of the lowest floor should be submitted upon placement and prior to further vertical construction, and re-surveyed and submitted prior to the final inspection. Requirement: Surveyed elevation of the lowest floor must be submitted to the community (as-built).	NFIP: 60.3(b)(5) IRC: R109.1.3, R322.1.10 IBC: 110.3.3, 1612.5(1.1) FEMA P-499: 1.4, 8.3 Other: NFIP FMB 467-1

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




Zone V 		Coastal A Zone 		Zone A 	
Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
OTHER					
<p>Non-Structural Fill</p> <p>Recommendation: Minimize use of non-structural fill if flow diversion, wave runup, or reflection are concerns. Non-structural fill should be similar to existing soils where possible.</p> <p>Requirement: Minor quantities can be used for site grading, landscaping and drainage, and to support parking slabs, patios, walkways and pool decks. Non-structural fill can be used for dune construction or reconstruction. Non-structural fill must not prevent the free passage of floodwater and waves beneath elevated buildings, or lead to building damage through flow diversion or wave runup or reflection.</p>	<p>NFIP: 60.3(e)(5)</p> <p>IRC:, R322.3.2</p> <p>ASCE 24: 4.5.4</p> <p>FEMA P-55: 5.2.3.3</p> <p>Other: FEMA TB-5</p>	<p>Recommendation:^(h) Follow Zone V recommendation.</p> <p>Requirement: None</p>	<p>IRC: R322.3.2</p> <p>ASCE 24: 4.5.4</p> <p>Other: FEMA TB-5</p>	<p>Recommendation: Follow requirement.</p> <p>Requirement:^(h,i) Encroachments into floodways are permitted only if it is demonstrated that the encroachment will not result in any increase in flood levels during the base flood.</p>	<p>NFIP: 60.3(d)(3)</p> <p>IRC: R301.2.4, R322.1, R322.1.4.2</p> <p>IBC: 1612.3.4, 1804.4, App. G 103.5, App. G 401.1</p> <p>ASCE 24: 2.2</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (continued)




	Zone V 		Coastal A Zone 		Zone A 	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Decks, Concrete Pads, Patios	<p>Recommendation: Decks should be built using the same foundation as the main building, or cantilevered from the main building. Decks, pads, and patios should be designed to minimize the creation of large debris in the event of failure.</p> <p>Requirement: If structurally attached to buildings, decks, concrete pads and patios must be elevated.</p>	<p>NFIP: 60.3(e)(3) IRC: R322.3.3 ASCE 24: 4.8, 9.2 FEMA P-55: 9.5 FEMA P-499: 8.2 Other: FEMA TB-5</p>	<p>Recommendation: Follow Zone V recommendations.</p> <p>Requirement: If located below the DFE, decks, concrete pads, patios and similar appurtenances must be stable under flood loads.</p>	<p>NFIP: 60.3(a)(3) ASCE 24: 4.8, 9.2 FEMA P-499: 8.2 Other: FEMA TB-5</p>	<p>Recommendation: Follow requirement.</p> <p>Requirement: If located below the DFE, decks, concrete pads, patios and similar appurtenances must be stable under flood loads.</p>	<p>NFIP: 60.3(a)(3) ASCE 24: 9.2 FEMA P-499: 8.2</p>
Swimming Pools	<p>Recommendation: Pool should be located as far landward as possible and should be oriented in such a way that flood forces are minimized.</p> <p>Requirement: Swimming pools and pool decks must be stable under flood loads and elevated, designed to break away during the design flood or be sited to remain in-ground without obstructing flow that results in damage to adjacent structures.</p>	<p>NFIP: 60.3(e)(3) IRC: R322.3.3, App. G101.2 ASCE 24: 9.5 FEMA P-55: 9.5 FEMA P-499: 8.2 Other: FEMA TB-5</p>	<p>Recommendation: Follow Zone V recommendation.</p> <p>Requirement: Swimming pools and pool decks must be stable under flood loads.</p>	<p>NFIP: 60.3(a)(3) IRC: App. G101.2 ASCE 24: 9.5 FEMA P-499: 8.2</p>	<p>Recommendation: Follow requirement.</p> <p>Requirement: Swimming pools and pool decks must be stable under flood loads.</p>	<p>NFIP: 60.3(a)(3) IRC: App. G101.2 ASCE 24: 9.5</p>

Table 5-2. Summary of NFIP Regulatory Requirements and Recommendations for Exceeding the Requirements (concluded)




	Zone V 		Coastal A Zone 		Zone A 	
	Recommendations and Requirements ^(a)	Cross Reference ^(b)	Recommendations and Requirements	Cross Reference	Recommendations and Requirements	Cross Reference
Tanks Associated with Building Utilities	<p>Recommendation: Locate above-ground tanks on the landward side of buildings and raise inlets, fill openings, and vents above the DFE. Install underground tanks below the eroded ground elevation.</p> <p>Requirement: Above-ground tanks must be elevated.</p>	<p>NFIP: 60.3(e)(3) IRC: R2201.6 IBC: App. G701 ASCE 24: 7.4.1 FEMA P-499: 8.3 Other: FEMA TB-5, FEMA P-348</p>	<p>Recommendation: Follow Zone V recommendations.</p> <p>Requirement: Tanks must be elevated or anchored to be stable under flood loads, whether above-ground or underground.</p>	<p>NFIP: 60.3(a)(3) IRC: R2201.6 IBC: App. G701 ASCE 24: 7.4.1 FEMA P-499: 8.3 Other: FEMA TB-5, FEMA P-348</p>	<p>Recommendation: Locate above-ground tanks on the landward or downstream side of buildings and raise inlets, fill openings, and vents above the DFE.</p> <p>Requirement: Tanks must be elevated or anchored to be stable under flood loads, whether above-ground or underground.</p>	<p>NFIP: 60.3(a)(3) IRC: R2201.6 IBC: App. G701 ASCE 24: 7.4.1 Other: FEMA P-348</p>
Sustainable Design	<p>Recommendation: Building for natural hazards resistance reduces the need to rebuild and is a sustainable design approach. Verify that other green building practices do not reduce the building's ability to resist flood loads or other natural hazards.</p> <p>Requirement: Meet overall NFIP performance requirements.</p>	<p>FEMA P-55: 7.7 Other: FEMA P-798, ICC 700</p>	<p>Recommendation: Follow Zone V recommendation.</p> <p>Requirement: Meet overall NFIP performance requirements.</p>	<p>FEMA P-55: 7.7 Other: FEMA P-798, ICC 700</p>	<p>Recommendation: Follow Zone V recommendation.</p> <p>Requirement: Meet overall NFIP performance requirements.</p>	<p>FEMA P-55: 7.7 Other: FEMA P-798, ICC 700</p>

Table 5-2 Notes:

- (a) Individual States and communities may enforce more stringent requirements that supersede those summarized here. **Exceeding minimum NFIP requirements will provide increased flood protection and may result in lower flood insurance premiums.**
- (b) The references in this section cite the latest available publications at the time of publication of this Manual. The specific editions of these references are:
- ASCE 7: ASCE 7-10, *Minimum Design Loads for Buildings and Other Structures*
 - ASCE 24: ASCE 24-05, *Flood Resistant Design and Construction*
 - IBC: *2012 International Building Code*. Appendix G includes provisions for flood-resistant construction. The provisions in IBC Appendix G are not mandatory unless specifically referenced in the adopting ordinance. Many States have not adopted Appendix G. Section references are the same as 2009 IBC.
 - ICC 700: *National Green Building Standard* (ICC 2008b)
 - IRC: *2012 International Residential Code for One- and Two-Family Dwellings*. Section references are the same as 2009 IRC.
 - FEMA P-55: Specific sections or chapters of this Manual; FEMA P-55, *Coastal Construction Manual* (2011)
 - FEMA P-348: 1999 Edition of FEMA P-348, *Protecting Building Utilities from Flood Damage*
 - FEMA P-499: Specific fact sheets in the 2010 edition of FEMA P-499, *Home Builder's Guide to Coastal Construction Technical Fact Sheet Series*
 - FEMA P-550: FEMA P-550, *Recommended Residential Construction for Coastal Areas* (Second Edition, 2009)
 - FEMA P-798: *Natural Hazards and Sustainability for Residential Buildings* (2010)
 - FEMA TB: Specific numbered FEMA NFIP Technical Bulletins (available at <http://www.fema.gov/plan/prevent/floodplain/techbul.shtm>)
 - NFIP: *U.S. Code of Federal Regulations* – 44 CFR § 60.3 “Flood plain management criteria for flood-prone areas.” Current as of June 30, 2011.
 - NFIP Evaluation Study: *Evaluation of the National Flood Insurance Program's Building Standards* (American Institutes for Research 2006)
 - NFIP FMB 467-1: *Floodplain Management Bulletin on the NFIP Elevation Certificate*. Note that this bulletin was published in 2004, while the Elevation Certificate (FEMA Form 81-31) has been updated since 2004, and is updated periodically.
- (c) State or community may regulate to a higher elevation (DFE).
- (d) LHSM = Lowest horizontal structural member.
- (e) Some coastal communities require open foundations in Zone A.
- (f) There are some differences between what is permitted under floodplain management regulations and what is covered by NFIP flood insurance. Building designers should be guided by floodplain management requirements, not by flood insurance policy provisions.
- (g) Some coastal communities prohibit breakaway walls and allow only open lattice or screening.
- (h) Placement of nonstructural fill adjacent to buildings in Zone AO in coastal areas is not recommended.
- (i) Some communities may allow encroachments to cause a 1-foot rise in the flood elevation, while others may allow no rise.

5.5 References

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- ASTM (ASTM International). 1996. *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes*. ASTM E1996.
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- FEMA. 1996. *Corrosion Protection for Metal Connectors in Coastal Areas for Structures Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program*. Technical Bulletin 8-96.
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- FEMA. 2008b. *Flood Damage-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas*. NFIP Technical Bulletin 2.
- FEMA. 2008c. *Free-of-Obstruction Requirements for Buildings Located in Coastal High Hazard Areas*. NFIP Technical Bulletin 5.
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- FEMA. 2010b. *The FEMA Substantial Damage Estimator (SDE)*. FEMA P-784. June.
- FEMA. 2010c. *Home Builder's Guide to Coastal Construction Technical Fact Sheet Series*. FEMA P-499. December.
- FEMA. 2010d. *Natural Hazards and Sustainability for Residential Buildings*. FEMA P-798. September.
- FEMA. 2011. *Engineering Principles and Practices for Retrofitting Flood-Prone Residential Structures*. FEMA P-259, Third Edition.
- ICC (International Code Council). 2008a. *Standard for Residential Construction in High-Wind Regions, ICC 600*. Birmingham, AL.
- ICC. 2008b. *National Green Building Standard, ICC 700*. Birmingham, AL.
- ICC. 2009a. *International Building Code*. Birmingham, AL.
- ICC. 2009b. *International Residential Code for One- and Two-Family Dwellings*. Birmingham, AL.
- ICC. 2012a. *International Building Code*. Birmingham, AL.
- ICC. 2012b. *International Residential Code for One- and Two-Family Dwellings*. Birmingham, AL.
- ICC. 2012c. *International Existing Building Code*. Birmingham, AL.
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