

HURRICANE SANDY

IN NEW JERSEY
AND NEW YORK

F Background on the National Flood Insurance Program, the International Code Series, and Referenced Standards

This appendix contains material supplementary to Chapter 2, including summary descriptions of:

- + The National Flood Insurance Program (NFIP), including its relationship to NFIP State Coordinating Agencies, general performance requirements for buildings, minimum requirements for buildings in Zone A and Zone V, and the NFIP Community Rating System (CRS)
- + The flood provisions of the International Code Series (I-Codes) that apply to buildings and structures
- + How the NFIP and the I-Codes treat historic structures
- + American Society of Civil Engineers (ASCE), *Flood Resistant Design and Construction* (ASCE 24), a design standard referenced by the I-Codes
- + The flood provisions of the Facility Guidelines Institute (FGI) *Guidelines for Design and Construction of Health Care Facilities* (FGI Guidelines)
- + The flood provisions of the National Fire Protection Association (NFPA) *Standard for Health Care Facilities* (NFPA 99)

F.1 National Flood Insurance Program

The authorizing legislation for the NFIP is the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.). In the act, the U.S. Congress found that “a program of flood insurance can promote the public interest by encouraging sound land use by minimizing exposure of property to flood losses.” Since 1968, the act has been modified several times.

The NFIP is based on the premise that the Federal Government will make flood insurance available to communities that adopt and enforce floodplain management requirements that meet or exceed the minimum NFIP requirements.

The regulations of the NFIP are the basis for local floodplain management ordinances adopted to satisfy the requirements for participation in the NFIP. In addition, the NFIP minimum requirements are the basis for the flood-resistant design and construction requirements in model building codes and standards. When decisions result in development within flood hazard areas, application of NFIP criteria is intended to minimize exposure to floods and flood-related damage.

The most convincing evidence of the effectiveness of the NFIP minimum requirements is found in flood insurance claim payment statistics. Buildings that pre-date the NFIP requirements were generally not constructed to resist flood damage, while buildings that post-date the NFIP are designed to resist flood damage. The NFIP aggregate loss data show that buildings that meet the minimum requirements experience 80 percent less flood damage than buildings that pre-date the NFIP. Ample evidence suggests that buildings designed to higher standards that exceed the minimum requirements are even less likely to sustain damage.

HIGHER STANDARDS FOR FLOODPLAIN MANAGEMENT

FEMA encourages States and communities to adopt “higher standards” that are more protective than the NFIP minimum requirements. The most common higher standard that affects buildings is “freeboard,” a requirement to elevate buildings above the base flood elevation (BFE). However, some States do not permit local amendments to building codes, which prevent communities from requiring freeboard and other higher standards.

At the Federal level, the NFIP is managed by FEMA and has three main elements:

- + Hazard identification and mapping, in which engineering studies are conducted and flood maps and studies are prepared to delineate areas expected to be subject to flooding under certain conditions
- + Floodplain management criteria, which establish the minimum requirements for communities to adopt and apply to development in mapped flood hazard areas; the expectation is that communities will recognize hazards throughout their entire land development process
- + Flood insurance, which provides some financial protection for property owners to cover flood-related damage to buildings and contents

At the State level, each governor designates an agency or office to function as the NFIP State Coordinating Agency. The duties and responsibilities of these agencies, typically called the “NFIP State Coordinator,” are found in 44 CFR § 60.25. Common functions performed by NFIP State Coordinators include:

- + Enact, whenever necessary, legislation to enable communities to regulate development in flood hazard areas
- + Establish minimum State standards consistent with the NFIP requirements
- + Ensure coordination with other State, area-wide, and local agencies
- + Encourage and assist communities in qualifying for participation in the NFIP
- + Guide and assist communities to develop, implement, and maintain floodplain management regulations
- + Provide technical assistance to communities and the general public
- + Assist with disseminating information on flood hazards and regulatory requirements
- + Participate in training opportunities
- + Assist in delineating floodprone areas
- + Notify FEMA of problems with community programs, if such problems cannot be resolved through technical assistance

F.1.1 General Performance Requirements for Buildings

NFIP performance requirements for development in Special Flood Hazard Areas (SFHAs) are set forth in Federal regulations at 44 CFR Parts 59 and 60. The requirements apply to all types of development proposed in SFHAs. The NFIP broadly defines the term “development,” and the requirements apply to new development, new buildings and structures, Substantial Improvement of existing buildings and structures, and repair of existing buildings and structures that sustain Substantial Damage (refer to text box).

The NFIP provisions guide development to lower-risk areas by requiring compliance with performance measures to minimize exposure of new buildings and buildings that undergo major renovation or expansion (called “Substantial Improvement” or repair of “Substantial Damage”). Taken together, administration of NFIP-consistent requirements helps achieve the long-term objective of building disaster-resistant communities.

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

The NFIP's broad performance requirements for new buildings and the Substantial Improvement or repair of Substantial Damage of existing buildings in SFHAs specify that:

- + Buildings shall be designed and adequately anchored to prevent flotation, collapse, or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.
- + Building materials shall be resistant to flood damage.
- + Buildings shall be constructed by 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 so as to prevent water from entering or accumulating within the components.

Substantial Damage: Damage of any origin for which the cost to restore a damaged building to its pre-damage condition equals or exceeds 50 percent of the building's market value before the damage occurred.

Substantial Improvement: Any reconstruction, rehabilitation, addition, or other improvement of a building, the cost of which equals or exceeds 50 percent of the building's pre-improvement market value. When repairs and improvements are made simultaneously, all costs are totaled and used in the determination.

Beyond the general requirements, specific NFIP requirements for buildings are functions of the flood zone and flood characteristics that affect specific locations. Requirements for SFHAs that are designated Zone A (including AE, A, A1-30, AO, and AH) are summarized in Section F.1.2, and requirements for coastal high hazard areas that are designated Zone V (including VE and VI-30) are summarized in Section F.1.3.

F.1.2 Minimum Requirements for Buildings in Zone A

In addition to the general requirements summarized in Section F.1.1, the NFIP minimum requirements for buildings and structures located in Zone A specify the level of protection (elevation) and limitations on enclosures below elevated buildings, including crawlspaces.

Building Elevation and Foundations (Zone A). In Zone A, where FEMA designates base flood elevations (BFEs), the NFIP requirements specify that the lowest floors, including basements, of new buildings and Substantially Improved buildings must be elevated to or above the BFE. There are no limitations on the type of foundation used to elevate buildings. Buildings may be elevated on perimeter walls (crawlspaces), filled stemwalls, columns, piers, pilings, or slabs on earthen fill (for NFIP insurance purposes, wood-framed walls are not recognized as foundation walls). Non-residential buildings may be elevated or protected by dry floodproofing that protects to or above the BFE.

Lowest Floor: 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 Section 60.3 (44 CFR § 59.1).

Some SFHAs, referred to as “unnumbered A zones,” are shown without BFEs. In these areas, BFE data from other sources are to be used if available. If no data are available, the BFE may be estimated using established methods, and communities are required to ensure that buildings are constructed using methods and practices that minimize flood damage. Once the elevation or height of the lowest floor above grade is established, the remaining requirements for Zone A apply.

The Zone AO designation is used where flooding is characterized by shallow depths (averaging 1 to 3 feet) and/or unpredictable flow paths. In these areas, lowest floors, including basements, are required to be at or above the highest grade adjacent to the building plus the depth number (in feet) shown on the Flood Insurance Rate Map (FIRM). For example, if the depth number 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, the minimum required height above the highest adjacent grade is 2 feet. Once the elevation or height of the lowest floor above grade is established, the remaining requirements for Zone A apply.

Enclosures Below Elevated Buildings (Zone A). The NFIP requirements specify that areas below the lowest floors may be enclosed; however, the use of enclosures is restricted to parking of vehicles, building access, or storage.

The walls of enclosures below elevated buildings are required to have flood openings designed to allow the automatic entry and exit of floodwater so that interior and exterior hydrostatic pressures can equalize during flooding. Designs for openings must either meet a prescriptive requirement (1 square inch of net open area for every square foot of enclosed area) or be “engineered openings” that are certified by a registered design professional as meeting a specific performance expectation. The following installation specifications apply to all flood openings: (1) a minimum of two openings for each enclosure, (2) the bottom of openings no higher than 1 foot above grade (exterior grade or interior floor/grade), and (3) screens, louvers, valves, or other coverings or devices, if any, permit the automatic entry and exit of floodwater. See NFIP Technical Bulletin 1, *Openings in Foundation Walls and Walls of Enclosures* (FEMA 2008).

F.1.3 Minimum Requirements for Buildings in Zone V

In addition to the general requirements summarized in Section F.1.1, the NFIP minimum requirements for buildings and structures in Zone V specify the level of protection (elevation), type of foundation, and limitations on obstructions and enclosures below elevated buildings. Because of the greater hazard posed by breaking waves, structural designs and methods of construction are required to be developed, reviewed, and certified by a registered design professional as capable of resisting the effects of wind and flood loads acting simultaneously.

Building Elevation and Foundations (Zone V). In Zone V, the NFIP requirements specify that the bottom of the lowest horizontal structural member (excluding vertical foundation members) of the lowest floors of new buildings and Substantially Improved buildings (including buildings that have sustained Substantial Damage) are required to be at or above the BFE. Open foundations such as pilings and columns are required. The use of fill for structural support is not permitted. Concrete slabs, including patios, walkways, pool decks, and slabs used as the floor of enclosures, are required to be structurally independent or, if attached, building foundations are required to be designed to account for the added loads and effects of wave action. If structurally attached to a foundation, the presence of a concrete slab may be considered the building’s lowest floor for flood insurance rating purposes.

Obstructions and Enclosures Below Elevated Buildings (Zone V). The NFIP requirements specify that the space below the lowest floor of elevated buildings must be free of obstructions. The intent is to minimize obstructions that could interfere with the free passage of floodwater and debris underneath the buildings. The NFIP requirements specify that areas below the lowest floors may be enclosed; however, the use of enclosures is restricted to vehicle parking, building access, or storage.

Obstructions to be avoided—or minimized and constructed to meet the performance requirement—include stairs and ramps, decks and patios, equipment attached to foundation elements, foundation bracing, grade beams, shear walls, and slabs. Other site development that may create obstructions includes accessory structures, erosion control structures, fences and privacy walls, fill used for landscaping, septic systems, and swimming pools and spas. See NFIP Technical Bulletin 5, *Free-of-Obstruction Requirements* (FEMA 2008).

Walls of enclosures, if any, are required to be non-supporting breakaway walls, open wood lattice-work, or insect screening intended to collapse under wind and base flood or lesser conditions without causing structural collapse, displacement, or damage to the elevated building or supporting foundation. When walls collapse under specific lateral loads, floodwater can flow through column or pile foundations without obstruction. See NFIP Technical Bulletin 9, *Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings* (FEMA 2008).

The NFIP 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 (in almost all cases, water loads will significantly exceed the upper limit, as will most wind loads and seismic loads). Breakaway walls that do not meet those loading requirements may be used if a registered professional engineer or architect certifies that the walls will collapse under a water load less than that which would occur during 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 effects of wind and water loads acting simultaneously on all building components.

F.1.4 NFIP Community Rating System

The NFIP CRS is a voluntary incentive program that recognizes community floodplain management activities that exceed NFIP requirements. The CRS gives discounts on flood insurance premiums in communities that elect to undertake activities that support three goals: reduce flood damage to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.¹

Communities apply to the CRS and are assigned a class based on the activities they undertake. Classes range from 1 to 10, with 1 representing the most active communities with the most flood hazard-resistant practices. NFIP flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community receives a 45 percent premium discount, a Class 9 community receives a 5 percent discount, and a Class 10 community receives no discount. The CRS classes are based on 18 creditable activities organized under four categories: (1) public information, (2) mapping and regulations, (3) flood damage reduction, and (4) flood preparedness.

¹ <http://www.fema.gov/national-flood-insurance-program/community-rating-system>.

F.2 Flood Provisions of the International Code Series

FEMA has determined that the flood provisions of the 2009 and 2012 I-Codes are consistent with the NFIP requirements for buildings and structures, and communities can rely on the I-Codes to fulfill some of the requirements for participation in the NFIP.²

International Building Code (IBC). The IBC applies to all buildings and structures except one- and two-family homes (which are covered by the International Residential Code, discussed below). Individual States and communities that adopt the IBC typically exempt certain buildings from the code (typically buildings and facilities exempt from the code are specified in statutes). Chapter 1 of the IBC includes administrative provisions.

The IBC references ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, for loads that must be accounted for in building design, including wind loads, snow loads, seismic loads, and flood loads. Flood loads include hydrostatic loads, hydrodynamic loads, wave loads, and debris impact loads.

The IBC includes flood provisions in several chapters, but most are in Section 1612, Flood Loads, in Chapter 16, Structural Design (which achieves consistency with the NFIP largely through reference to ASCE 24, *Flood Resistant Design and Construction*):

- +Section 1612.1 – General requirement that buildings, including buildings that are undergoing Substantial Improvement or repair of Substantial Damage, be designed and constructed to resist the effects of flood hazards and flood loads.
- +Section 1612.2 – Definitions of terms used in the flood provisions of the code.
- +Section 1612.3 – Flood hazard areas established by the adoption of flood hazard maps, which are, at a minimum, maps prepared by FEMA, requirements that apply if design flood elevations (DFEs³)/BFEs are not noted on the adopted map, and requirements for determining impacts in riverine flood hazard areas if DFEs/BFEs are specified but floodways are not delineated.
- +Section 1612.4 – Requirement to design and construct buildings and structures in flood hazard areas in accordance with ASCE 7 (loads) and ASCE 24 (all other requirements). Technical flood requirements are part of the IBC by reference to ASCE 24 (see Section F.3).

Design Flood Elevation: The elevation of the “design flood,” including wave height, relative to the datum specified on the community’s legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation shall be 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 number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

2 FEMA prepared excerpts of the flood provisions of the 2009 and 2012 I-Codes: <http://www.fema.gov/building-science/building-code-resources>.

3 The DFE equals the BFE unless a community adopts a flood hazard map that is based on a different frequency flood or a map that shows areas subject to flooding that are not shown on FIRMs.

- +Section 1612.5 – Documentation that must be prepared and sealed by registered design professionals.

Chapter 34 of the IBC includes requirements that apply to work on existing buildings. The NFIP requires local jurisdictions to evaluate work proposed for existing buildings, especially buildings that predate a community’s participation in the NFIP. If the work on an existing building is determined to constitute Substantial Improvement or repair of Substantial Damage, the building must be brought into compliance with the requirements for new buildings in flood hazard areas. Chapter 34 includes provisions applicable to existing buildings in flood hazard areas. Separate sections contain flood requirements for additions, alterations, repairs, change of occupancy, and improvement of historic structures.

International Residential Code (IRC). The IRC is applicable to one- and two-family dwellings and most townhomes. Flood provisions are included throughout the code, but most are in Section R322, which is specific to flood hazards.

- +Section R322.1 includes requirements that apply in all flood hazard areas. The section includes the general performance statement that all buildings are to be designed, connected, and anchored to resist flotation, collapse, or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood. This section also establishes the DFE, defines the lowest floor, specifies protection of equipment, specifies requirements for water supply and sanitary sewage systems, requires use of flood damage-resistant materials, and requires submission of as-built elevation documentation.
- +Section R322.2 includes requirements for flood hazard areas other than coastal high hazard areas (Zone A). The section specifies that if the area subject to waves between 1½ and 3 feet is delineated, the area shall be designated a Coastal A Zone. Elevation requirements are specified, requiring the lowest floor to be at or above the DFE. If a Coastal A Zone is designated, the lowest floor is required to be at least 1 foot above the BFE. Limitations on enclosures below the DFE are specified and, unless designed in accordance with the code requirements for foundations, masonry wall height limits are specified as a function of wall reinforcement and wall thickness.
- +Section R322.3 includes requirements for coastal high hazard areas (Zone V). The section requires buildings to be landward of the reach of mean high tide and specifies that alteration of sand dunes and mangrove stands are not permitted unless engineering analyses demonstrate no increase in the potential for flood damage. Elevation requirements specify that the bottom of the lowest horizontal structural member, as a function of orientation with respect to the direction of wave approach, must be at or above the DFE. Limitations on enclosures and walls below the DFE are also specified, and scour and erosion must be considered in the design of foundations. The section also specifies that documentation of the design and methods of construction are to be prepared and sealed by a registered design professional.

The IRC and ASCE 24. The residential code requires homes proposed to be located in floodways (where floodwater tends to be deeper and flow faster) to be designed in accordance with ASCE 24 (see Section F.3). This requirement is intended to account for flood loads associated with flood depth and velocity in the foundation design instead of relying on the prescriptive requirements of the residential code. In addition, ASCE 24 is permitted as an alternative to the requirements in coastal high hazard areas (Zone V).

International Existing Building Code (IEBC). The scope of the existing building code includes repairs, alterations, additions, changes in occupancy, and relocated buildings. For work covered by this code, if the work constitutes Substantial Improvement (including repair of Substantial Damage), the proposed work and the existing building are to be brought into compliance with the flood-resistant design requirements for new construction. Certain historic buildings in flood hazard areas are not required to be brought into compliance if they retain their historic designation.

F.3 ASCE 24, Flood Resistant Design and Construction

ASCE 24 addresses topics pertinent to designing buildings in all flood hazard areas, including floodways, coastal high hazard areas, and other high-risk flood hazard areas, such as alluvial fans, flash flood areas, mudslide areas, erosion-prone areas, and high-velocity areas. It covers the following topics: (1) scope, definitions, structure classification, and basic requirements applicable in all flood hazard areas; (2) requirements for Zone A areas not identified as high-risk areas; (3) requirements for high-risk areas; (4) requirements for Zone V and Coastal A Zones; (5) materials; (6) dry floodproofing and wet floodproofing; (7) utilities; (8) building access; and (9) miscellaneous construction.

In some respects, ASCE 24 and the codes that reference ASCE 24 exceed or are more specific than the NFIP minimum requirements. ASCE 24-05 requirements are summarized in *Highlights of ASCE 24, Flood Resistant Design and Construction* (FEMA 2010).

Dry Floodproofing Limitations. ASCE 24 requires dry-floodproofed portions of buildings to be “substantially impermeable to the passage of floodwaters below the elevations specified ... [s]ump pumps shall be provided to remove water accumulated due to any passage of vapor and seepage of water during the flooding event.” Further, “[s]ump pumps shall not be relied upon as a means of dry floodproofing.” Although ASCE 24 does not explicitly require sump pumps to have backup power supply, the performance statement that pumps are to remove accumulated water during flood events indicates pumps are expected to have power during events.

ASCE 24 specifies the limitations listed below that apply if human intervention is required for the measures to be effective (such as removable flood shields) to be effective:

- + There should be a minimum of 12 hours of warning time, unless the community operates a flood warning system and emergency plan that provide enough time to fully implement the measures.
- + There should be a flood emergency plan, approved by the community, that includes specific elements, including where shields are stored, the method of installation, conditions that would activate implementation, maintenance of the shields and attachment devices, periodic installation practice, testing of sump pumps and other drainage measures, and inspection of materials and equipment. The emergency plan should be permanently posted in at least two conspicuous locations in the dry-floodproofed structure.

Essential and Critical Facilities. Table F-1 shows how ASCE 24 specifies building elevation requirements and floodproofing protection levels as a function of occupancy category. ASCE 24 uses the same occupancy category classification used in the IBC, which requires each building and structure to

be assigned an occupancy category. The table that shows which buildings and structures are in each of the four occupancy categories is included in *Highlights of ASCE 24, Flood Resistant Design and Construction* (FEMA 2010). Category III and Category IV include buildings that house functions generally considered to be essential and critical. For example, Category IV includes hospitals, fire and police stations, emergency operations centers, public utility facilities required in emergencies, and other structures. Category III includes most schools and most healthcare facilities.

Table F-1: Elevation and Dry Floodproofing Requirements of ASCE 24-05 for Category III and Category IV Structures

		Category III	Category IV
Elevation of lowest floor (Zone A: Table 2-1)	All Zone A not designated as Coastal A Zones: elevation of lowest floor	BFE +1 foot or DFE, whichever is higher	BFE +2 foot or DFE, whichever is higher
Elevation of bottom of lowest horizontal structural member (Zone V: Table 4-1)	All Zone V and Coastal A Zones: where the lowest horizontal structural member is parallel to direction of wave approach	BFE +1 foot or DFE, whichever is higher	BFE +1 foot or DFE, whichever is higher
	All Zone V and Coastal A Zones: where the lowest horizontal structural member is perpendicular to direction of wave approach	BFE +2 foot or DFE, whichever is higher	BFE +2 foot or DFE, whichever is higher
Dry Floodproofing of non-residential structures and non-residential portions of mixed-use buildings (Table 6-1)	All Zone A not designated as Coastal A Zones: elevation to which dry floodproofing extends	BFE +1 foot or DFE, whichever is higher	BFE +2 foot or DFE, whichever is higher
	All Zone V and Coastal A Zones: dry floodproofing not allowed	Not permitted	Not permitted

BFE = base flood elevation
 DFE = design flood elevation

F.4 Historic Structures: The NFIP and the I-Codes

The National Historic Preservation Act (NHPA) directs Federal agencies to take into account the effect of any undertaking (a federally funded or assisted project) on historic properties. “Historic property” is any district, building, structure, site, or object that is eligible for listing in the National Register of Historic Places (National Register) because the property is significant at the national, State, or local level in American history, architecture, archaeology, engineering, or culture. The National Register is maintained by the National Park Service under the U.S. Department of the Interior (DOI).

Properties 50 years and older affected by Federal agency action or by projects using Federal funds are subject to a review process to identify potential impacts on historic properties, to evaluate the impacts, and to develop a resolution for any adverse effects on historic properties.

The DOI administers a program to approve qualifying State historic preservation programs and qualifying local programs. Some DOI-approved State programs approve local historic preservation programs. Therefore, States, tribal entities, and many communities maintain their own listing of historic structures and historic districts.

The NFIP and Historic Structures. NFIP regulations define “historic structure” as any structure that is:

- a. Listed individually in the National Register of Historic Places (a listing maintained by the DOI) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;
- b. Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;
- c. Individually listed on a State inventory of historic places in States with historic preservation programs that have been approved by the Secretary of the Interior; or
- d. Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either:
 1. By an approved State program as determined by the Secretary of the Interior, or
 2. Directly by the Secretary of the Interior in States without approved programs.

HISTORIC STRUCTURES

The NFIP provides that a community may issue variances “for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure’s continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure” (44 CFR § 60.6(a)).

The NFIP specifically excludes from its definition of Substantial Improvement (see Section F.1.1) “any alteration of a ‘historic structure,’ provided that the alteration will not preclude the structure’s continued designation as a ‘historic structure.’” Thus, historic structures that are proposed to have Substantial Improvements, or that have sustained Substantial Damage, are not required to be brought into compliance with the NFIP requirements for new construction.

The I-Codes and Historic Buildings. The IBC and IEBC define “historic buildings” as buildings that are designated historic under State or local law, and do not limit local designation to local programs that are certified by a DOI-approved State program or directly by the DOI. In general, the codes state that the requirements for existing buildings related to construction, repair, alteration, addition, restoration, relocation of structures, and occupancy changes are not mandatory “where such buildings are judged by the building official to not constitute a distinct life safety hazard.”

The flood provisions of the IBC and IEBC require all existing buildings in flood hazard areas, including historic buildings, to be brought into compliance with the requirements for new construction if the buildings are to be Substantially Improved or have sustained Substantial Damage. However, the codes have exceptions so that historic buildings that meet the NFIP definition are not required to be brought into compliance. Appendix G of the IBC includes the NFIP’s provision for variances for historic structures.

Chapter 1 (administrative provisions) of the IRC specifies that building officials are to make findings when acting on applications for reconstruction, rehabilitation, addition or other improvement

of existing dwellings located in flood hazard areas. If the building official finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure before the damage has occurred or the improvement is started, the finding is to be provided to the community's board of appeals for a determination. The board of appeals then makes the determination as to whether the proposed work constitutes Substantial Improvement or repair of Substantial Damage. The IRC has no explicit provisions for historic buildings in the body of the code or in Appendix J, Existing Buildings and Structures.

F.5 Guidelines and Standards for Healthcare Facilities

Neither the guidelines for healthcare facilities produced by the Facilities Guidelines Institute (FGI) nor a standard produced by the National Fire Protection Association (NFPA) are cited in the I-Codes, although one or both are cited by some States. Both have language pertaining to healthcare facilities located in flood hazard areas.

F.5.1 FGI Guidelines for Design and Construction of Healthcare Facilities

The flood provisions of the FGI Guidelines vary greatly, from general terms that lack specific performance levels or performance criteria to specific references to floodplains defined in floodplain regulations.

- + **Section 1.1-4.3, Flood Protection.** Lists Executive Order 11988, *Floodplain Management*, as a “government regulation” that applies to healthcare facilities.
- + **Section 1.2-6.5, Provisions for Disasters.** In explanatory material, flood protection “in accordance with Executive Order 11988” is characterized as follows:
 - + “Possible flood effects should be considered when selecting and developing the site.
 - + “Insofar as possible, new facilities should not be located on designated floodplains.
 - + “Where locating a facility on a floodplain is unavoidable, consult the Corps of Engineers’ regional office for the latest applicable regulations pertaining to required flood insurance and protection measures.
 - + “Hospital helipads should be located a minimum of 3 feet above the 100-year-flood elevation on campuses constructed on designated floodplains. A path of travel above 100-year-flood elevation should be provided between hospital acute care facilities and the helipad to facilitate evacuation.”
- + **Section 1.2-6.5.1, Needs Assessment.** Specifies that in locations where there is recognized potential for hurricanes, tornadoes, flooding, earthquake, or other regional disasters, an assessment shall be conducted to consider the need to protect the life safety of all healthcare facility occupants and the potential need for continuing services following such a disaster.
- + **Section 2.1-7.1.3.1, Provisions for Disasters.** Specifies that, unless specifically approved, hospitals shall not be built in areas subject to damage or inaccessibility due to floods, and where

facilities may be subject to wind or water hazards, provisions shall be made to ensure continuous operation.

- + **Section 2.1-8.5, Communications Systems.** Contains criteria for data and voice communication, patient monitoring and alarm, nurse call, hospital information, digital imaging security, building automation, fire and life safety, and telemedicine and teleconferencing systems equipment. Telecommunications service entrance rooms are to be “located in a dry area not subject to flooding.” Technology equipment centers are to be “located above any floodplains and below the top level of the facility to deter water damage to the equipment from outside sources (e.g., roof leaks)” and, in areas prone to hurricanes or tornadoes, “located away from exterior curtain walls to prevent damage from wind and wind-driven rain.”

Emergency power provisions of the FGI Guidelines are specified by references to NFPA 99, *Standard for Health Care Facilities* (2005). From an operational standpoint, Section A1.2-6.5, Provisions for Disasters, states that special design is required to protect systems and essential building services for facilities that “must remain operational in the aftermath of a disaster” and lists as essential services “power, water, medical gas systems, and, in certain areas, air conditioning.” This section also requires that special consideration “be given to the likelihood of temporary loss of externally supplied services like power, gas, water, and communications.”

F.5.2 NFPA 99 Standard for Healthcare Facilities

The flood provisions of NFPA 99 are broad and do not specify the level of protection to be achieved nor how protection is to be provided:

- + **Section 6.4.1.1.8.1 Work Space or Room** requires emergency power systems to be located “to minimize the damage from flooding” and requires consideration of flooding “resulting from firefighting, sewer back up and similar disasters or occurrences.”
- + **Section 7.3.1.2.1.4 (G) Location Requirements and Restrictions** requires that the “entrance facility” for communication and data service equipment be located in “an area not subject to flooding.”
- + **Chapter 12 Emergency Management** contains general flood considerations, but the flood provisions are in Annex A explanatory material, which is provided only for informational purposes and, thus, is not enforceable. NFPA 99 references NFPA 110, *Standard for Emergency and Standby Power Systems* (2010), which contains more specific flood considerations and requires natural hazards to be considered when installing emergency power systems. However, like NFPA 99, the flood considerations in NFPA 110 are found only in explanatory material.

NFPA 99 specifies that emergency power systems comprise the sources that produce emergency power and the equipment that distributes and controls the emergency power. Emergency power systems are separated into three branches, each with specific requirements: the life safety branch, the critical branch, and the equipment branch.

NFPA 99 does not specify *what* electrical loads require emergency power. Those loads are specified by other codes and standards, particularly NFPA 101, *Life Safety Code* (2012), and the IBC. However,

NFPA 99 does stipulate requirements as to *how* emergency power is provided and explains limitations on *what* equipment can be supplied from emergency power sources. The intent of NFPA 99 criteria (and that of NFPA 110) is to ensure that (1) emergency power supplies are reliable and (2) essential equipment is supplied with emergency power in a fashion that does not jeopardize reliability. NFPA 99 leaves what is required to be supplied from emergency power sources to other codes, standards, and documents, although many of those other documents are non-mandatory guidance documents.