



National Flood Insurance Program (NFIP)

Floodplain Management Bulletin **Historic Structures**

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Floodplain Management Bulletin

Historic Structures

This Floodplain Management Bulletin addresses how the National Flood Insurance Program (NFIP) treats historic structures. This bulletin also identifies mitigation measures that can be taken to protect historic structures from floods. The bulletin addresses the following topics:

Introduction	2
Background on the NFIP.....	2
The NFIP and Historic Structures	3
Definition of “Historic Structures”	3
Floodplain Management Requirements that Provide Relief for Historic Structures	4
Historic Structures in the Floodway	5
New Construction and Non-contributing Structures in Historic Districts.....	6
Substantial Improvements to Existing Structures in Historic Districts	7
Flood Insurance for Historic Structures	8
Minimizing the Impacts of Flooding on Historic Structures.....	9
Protection Measures for Historic Structures	9
Hazard Mitigation Planning Can Benefit Historic Structures.....	19
Further Information	20
State and Local Mitigation Planning “How-To” Guides	20
Other Mitigation Documents	21
Comments.....	22
Ordering Information	22

Introduction

The National Flood Insurance Program (NFIP) gives special consideration to the unique value of one of our Nation's most significant resources – its historic buildings, landmarks, and sites. It does so in two ways.

First, the NFIP floodplain management regulations provide significant relief to historic structures. Historic structures do not have to meet the floodplain management requirements of the program as long as they maintain their historic structure designation. They do not have to meet the new construction, substantial improvement, or substantial damage requirements of the program. This exclusion from these requirements serves as an incentive for property owners to maintain the historic character of the designated structure (44 CFR §60.3). It may also serve as an incentive for an owner to obtain historic designation of a structure.

Secondly, a designated historic structure can obtain the benefit of subsidized flood insurance through the NFIP even if it has been substantially improved or substantially damaged so long as the building maintains its historic designation. The amount of insurance premium charged the historic structure may be considerably less than what the NFIP would charge a new non-elevated structure built at the same level. Congress requires that the NFIP charge actuarial rates for all new construction and substantially improved structures (National Flood Insurance Act of 1968, 42 U.S.C. 4015).

Although the NFIP provides relief to historic structures from having to comply with NFIP floodplain management requirements for new construction, communities and owners of historic structures should give consideration to mitigation measures that can reduce the impacts of flooding on historic structures located in Special Flood Hazard Areas (44 CFR §60.3). Mitigation measures to minimize future flood damages should be considered when historic structures are rehabilitated or are repaired following a flood or other hazard event. Qualified professionals such as architects, historic architects, and engineers who have experience in flood mitigation techniques can help identify measures that can be taken to minimize the impacts of flooding on a historic structure while maintaining the structure's historic designation.

The purpose of this floodplain management bulletin is to explain how the NFIP defines historic structure and how it gives relief to historic structures from NFIP floodplain management requirements (44 CFR §60.3). This bulletin also provides guidance on mitigation measures that can be taken to minimize the devastating effects of flooding to historic structures.

Background on the NFIP

Congress created the NFIP in 1968 to provide federally supported flood insurance coverage, which generally was not available from private companies. The NFIP is based on a mutual agreement with communities that have been identified as having Special Flood Hazard Areas. The Federal Emergency Management Agency (FEMA) will make flood insurance coverage available in a

community provided that it adopts and enforces floodplain management regulations that meet or exceed the minimum requirements of the NFIP (44 CFR §60.3). This is accomplished through local floodplain management regulations.

The NFIP minimum building and development regulations that communities must adopt require that new and substantially improved and substantially damaged residential buildings be elevated so that the lowest floor is at or above the Base Flood Elevation (BFE) determined for the site. Non-residential buildings have the option of elevation or dry floodproofing to the BFE [44 CFR §60.3(c)(2), (c)(3), and (e)(4)]. Dry floodproofing means making a building watertight, substantially impermeable to floodwaters to the BFE.

Substantial improvement means *“any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the “start of construction” of the improvement. This term includes structures which have incurred substantial damage regardless of the actual repair work performed.”*

Substantial improvement also includes the repair of buildings that have been substantially damaged. Substantial damage means *“damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.”*

In summary, structures that are “substantially improved” and “substantially damaged” must be brought into compliance with the community’s floodplain management requirements [44 CFR §60.3(c)(2), (c)(3), and (e)(4)].

The NFIP and Historic Structures

This section provides information on the NFIP definition of “historic structure” and the floodplain management requirements that will be included in community floodplain management ordinances.

Definition of “Historic Structures”

The definition section of the NFIP [Code of Federal Regulations (CFR) 44 Part 59], defines “historic structure” as *“any structure that is:*

- (1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register; (This includes structures that are determined to be eligible for listing by the Secretary of the Interior as a historic structure. A determination of “eligibility” is a decision by the Department of the Interior that a district, site, building, structure or object meets the National Register criteria for evaluation although the property is not formally listed in the National Register.)*

- (2) *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;*
- (3) *Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or*
- (4) *Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either:*
 - (a) *By an approved state program as determined by the Secretary of the Interior or*
 - (b) *Directly by the Secretary of the Interior in States without approved programs.”*

This definition was coordinated with the Department of Interior when it was added to the NFIP Regulations in 1989.

The purpose of this definition is to provide NFIP communities with criteria to distinguish between “historic structures” and the other existing buildings which remain subject to NFIP floodplain management requirements (44 CFR §60.3). While it is important to preserve historic structures and other cultural resources, it is also critical to ensure that other existing flood-prone structures are protected from flood damage when they are substantially improved or substantially damaged.

Floodplain Management Requirements that Provide Relief for Historic Structures

The NFIP floodplain management requirements contain two provisions that are intended to provide relief for “historic structures” located in Special Flood Hazard Areas:

- (1) The definition of “substantial improvement” at 44 CFR 59.1 includes the following exclusion for historic structures,
 - “Any alteration of a “historic structure”, provided that the alteration will not preclude the structure’s continued designation as an “historic structure”.*The same exemption also applies to “historic structures” that have been “substantially damaged”.

This provision exempts historic structures from the substantial improvement and substantial damage requirements of the NFIP.

- (2) The other provision of the NFIP floodplain management regulations that provides relief for “historic structures” is the variance criteria at 44 CFR 60.6(a). This provision states:
 - “Variances may be issued 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.”*

Under the variance criteria, communities can place conditions to make the building more flood resistant and minimize flood damages, but such conditions should not affect the historic

character and design of the building. *See* the section on Minimizing the Impacts of Flooding on Historic Structures for ideas on conditions that could be established to make the building more flood resistant and to minimize flood damages.

Communities have the option of using either provision for addressing the unique needs of “historic structures”. Communities should adopt only one option to address “historic structures.” Some communities have chosen to adopt an ordinance that requires variances for improvements or repairs to “historic structures” and do not exclude such improvements from the substantial improvement definition in their ordinance. Other communities include the “historic structures” exemption as part of their “substantial improvement” definition. In either case, “historic structures” can be excluded from the NFIP elevation and floodproofing requirements. Whether a community exempts a “historic structure” under the substantial improvement definition or through the variance process, the exemption of the “historic structure” from the NFIP floodplain management requirements should be documented and maintained in the community permit files.

However, if plans to substantially improve a “historic structure” or repair a substantially damaged “historic structure” would result in loss of its designation as an “historic structure”, the structure no longer qualifies for the exemption and would be required to meet the NFIP floodplain management regulations (44 CFR §60.3). This determination needs to be made in advance of issuing a permit. This provides an incentive to the property owner to maintain the structure’s historic designation rather than altering the structure in such a way that it loses its designation as a “historic structure”.

Even if a “historic structure” is exempted from the substantial improvement and substantial damage requirements, consideration should be given to mitigation measures that can reduce the impacts of future flooding. There are mitigation measures that can reduce flood damages to historic structures without affecting the structure’s historic designation. *See* the section on Minimizing the Impacts of Flooding on Historic Structures.

Historic buildings may also be subject to the local building codes. Many States and communities use the International Codes as the basis for their buildings codes. The International Codes contain provisions for addressing historic buildings in a manner consistent with the NFIP.

Historic Structures in the Floodway

The NFIP floodplain management requirements could apply to an addition to a “historic structure”, if the structure or addition is located in a floodway. The floodway includes the channel of the river and the adjacent floodplain that must be reserved in an unobstructed condition in order to discharge the base flood without increasing flood levels by more than one foot (44 CFR § 59.1, “regulatory floodway”). All structures and improvements to structures, including additions to “historic structures”, must comply with the floodway encroachment provisions of 44 CFR § 60.3(c)(10) and (d)(3) of the NFIP Regulations.

44 CFR § 60.3(c)(10) applies to rivers and streams where FEMA has established BFEs, but has not provided the community with the data necessary to designate a floodway:

Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM [Flood Insurance Rate Map], unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

§ 60.3(d)(3) applies to rivers and streams where FEMA has provided both established BFEs and provided the community with the data necessary to designate a floodway:

Prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge.

As an example, an addition, or any portion thereof, to a “historic structure” that expands the square footage of the structure beyond its footprint into the floodway must comply with the regulatory floodway criteria [44 CFR §60.3(c)(10) and (d)(3)]. These additions can obstruct flood flows and increase flood stages. Under 44 CFR § 60.3(d)(3), such an addition would be prohibited if any rise in the flood level would result from the addition. FEMA defines “any” as meaning a zero increase.

New Construction and Non-contributing Structures in Historic Districts

Generally, registered historic districts contain a mix of buildings. In addition to structures that contribute to the historic significance of the district, there will generally be structures in historic districts that have no historical significance and which do not contribute to the historic significance of a registered historic district (called “non-contributing” structures). In addition, there may be sites in these districts that are undeveloped or vacant land. Whole districts cannot be exempt from floodplain management regulations and a blanket variance cannot be issued for all land within these districts. The non-contributing structures and vacant lots in historic districts remain subject to all of the floodplain management requirements that apply to new construction and substantial improvements (44 CFR §60.3).

Some communities have argued that they should be allowed to grant variances for new buildings or for substantial improvements to non-contributing buildings in historic districts. They claim that requiring that the new structures or substantially improved structures be elevated to BFE could be harmful to the historic significance of the district. FEMA maintains that this would be contrary to the purposes of the NFIP and could result in greatly increased flood damages and, in some instance,

even result in loss of life. There are ways to elevate or floodproof new structures and substantially improve non-contributing structures so that they comply with the NFIP regulations, but that are still in harmony with the historic nature of the district. While the NFIP requires protection to the BFE, it does not specify the means (44 CFR §60.3). An architect should be able to design a new building that is both compliant with NFIP floodplain management requirements and compatible with the historic nature of the district. For example, the protection does not have to be achieved by unsightly mounds of dirt or bare pilings or other elevated foundations. The structure could be elevated on pilings or other foundation elements and the lower area then covered by an architecturally pleasing façade that will not impair the aesthetics of a historic district. The foundation could be camouflaged with landscaping, porches, or staircases (*See* the examples in latter sections of this bulletin).

The NFIP was specifically established by Congress to reduce threats to lives and the potential for damages to new construction in flood hazard areas in exchange for providing flood insurance. Exempting new construction from the NFIP elevation requirements in historic districts would be contrary to the National Flood Insurance Act of 1968, as amended, and it would create a significant flood risk to structures and to the health and safety of the population. Potentially thousands of buildings would be placed in harms way, if new or non-contributing structures are not protected.

Substantial Improvements to Existing Structures in Historic Districts

Some property owners have wanted to substantially improve a non-contributing structure in a historic district, so that it can become a contributing structure to the historical significance of the registered historic district. For example, this type of improvement could involve removal of modern additions to the building, replacement of modern siding or roofing materials with historic materials, and other actions to restore the historic nature of the structure. If the improvement is a substantial improvement to a non-contributing structure, the structure still could qualify for relief from the NFIP floodplain management requirements in the following ways (44 CFR §60.3):

- The property owner could apply through their State Historic Preservation Officer or Tribal Historic Preservation Officer for contributing status for the structure as is, prior to any improvements. If the building qualifies as “contributing to the historical significance of a registered historic district”, the community can grant a variance or exclude the improvements from the NFIP substantial improvement requirement depending on which provision the community has adopted [44 CFR §60.3(c)(2), (c)(3), and (e)(4)].
- The property owner could undertake the minimum work necessary to make the building a contributing structure, as long as the work is less than a substantial improvement. Once the structure is designated as “contributing”, any additional improvements including a substantial improvement could qualify for relief from the NFIP floodplain management requirements, so long as those improvements do not interfere with the designation as “contributing to the historical significance of a registered historic district” (44 CFR §60.3).
- If the property owner chooses to undertake a substantial improvement of the building all at once or the owner needs to undertake the substantial improvement in order for the building

to qualify as “contributing to the historical significance of a registered historic district”, the owner should contact the community for guidance on how they might qualify for relief from the NFIP substantial improvement requirement [44 CFR §60.3(c)(2), (c)(3), and (e)(4)]. In this situation, the community would have to issue a variance from the floodplain management ordinance. The community should obtain documentation for assurance that the improvements being proposed would qualify the building for “contributing” status before signing off on permits that would grant them relief under the NFIP. The owner should seek guidance from their State Historic Preservation Officer or Tribal Historic Preservation Officer on proposed improvements and on what documentation is needed to obtain preliminary approval. This information should be shared with the community.

In all cases, the property owner should discuss their proposed plans with the community and seek guidance from the State Historic Preservation Officer or Tribal Historic Preservation Officer before undertaking any improvements to make sure the proposed work would qualify the building for the designation as a contributing structure. For any of the options described above, the community should also encourage the property owner to undertake flood damage reduction measures as part of the improvement, as long as measures do not interfere with its designation as a “historic structure”.

Flood Insurance for Historic Structures

In addition to the relief from the NFIP floodplain management requirements described above, owners of “historic structures” can obtain and maintain flood insurance at subsidized rates. Flood insurance coverage is required for most mortgage loans and for obtaining Federal grants and other financial assistance. The ability to obtain flood insurance coverage is also important to ensuring that historic structures can be repaired and restored after a flood event.

The National Flood Insurance Act of 1968, as amended, requires that FEMA charge actuarial rates reflecting the flood risk to buildings built or substantially improved on or after the effective date of the initial Flood Insurance Rate Map (FIRM) for the community or after December 31, 1974, whichever is later. Actuarial rating assures that the risks associated with buildings in flood prone areas are borne by those located in such areas and not by the taxpayers at large. These buildings are referred to as Post-FIRM. The NFIP flood insurance rates are based on the degree of the flood risk. The flood insurance premium calculations take into account a number of factors including the flood risk zone shown on the FIRM, elevation of the lowest floor above or below the BFE, the type of building, the number of floors, and the existence of a basement or an enclosure. The NFIP floodplain management requirements not only are designed to protect buildings constructed in floodplains from flood damages; they also help keep flood insurance premiums affordable (44 CFR §60.3). Buildings not properly elevated will be charged a much higher flood insurance premium due to the increased flood risk. If substantially improved historic structures were not elevated and made subject to these rates, the annual insurance premiums could be many thousands of dollars a year. Allowing historic structures to continue to be insured at subsidized rates, even when they are substantially improved or substantially damaged, represents a significant financial benefit to these building owners.

Flood insurance at subsidized rates is available whether the “historic structure” is exempt from the NFIP substantial improvement requirement or is granted a variance under the variance provision. “Historic structures” are considered Pre-FIRM under the NFIP and are charged subsidized rates similar to existing structures. As long as a historic structure meets the definition of “historic structure” under the NFIP, it will not be actuarially rated (44 CFR §59.1).

If a “historic structure” is substantially improved such that it loses its historic designation without meeting the elevation requirements of the NFIP, it will be actuarially rated as a Post-FIRM structure. This can be significantly higher than the subsidized rate on a “historic structure.” Thus, the subsidized flood insurance rate on “historic structures” also serves as an incentive to maintain the historic designation of the structure.

Property owners of historic structures are encouraged to purchase NFIP flood insurance. Flood losses are not covered by homeowner’s insurance. Disaster assistance will not take care of all the financial needs, if the historic structure is damaged by flood. Even if disaster assistance is available, it is often in the form of a low-interest loan which has to be repaid, and it is only available if the President formally declares a disaster. Flood insurance compensates for all covered losses and is the best form of financial protection against the devastating effects of floods. Flood insurance policies purchased by individual property owners help them recover from flooding more quickly.

Increased Cost of Compliance (ICC) coverage is not available to a historic structure that is exempt from the floodplain management requirements if a historic structure is substantially damaged (44 CFR §60.3). ICC coverage provides for the payment of a claim for the cost to comply with State or community floodplain management laws or ordinances after a direct physical loss by floods. When a building covered by a State or community declares the building to be substantially or repetitively damaged, ICC will help pay up to \$30,000 for the cost to elevate, floodproof, demolish, or relocate the building. However, if an exemption is granted administratively through the community’s variance process, and conditions are placed in the variance requiring one of the mitigation measures that meet the local floodplain management criteria, ICC will be available if the structure is declared substantially damaged or repetitively damaged.

Minimizing the Impacts of Flooding on Historic Structures

Protection Measures for Historic Structures

The primary damage to historic buildings in a flood disaster is from immersion of building materials in floodwaters and the moving force of floodwaters that can cause structural collapse. Storm and sanitary sewer backup during flooding is also a major cause of flood damage to buildings. In addition, floods may cause a fire due to ruptured utility lines; result in the growth of mold and mildew; and lead to swelling, warping, and disintegration of materials due to prolonged presence of moisture.

Although “historic structures” are exempt from the NFIP floodplain management requirements for new and substantially improved construction, flood mitigation measures should be a consideration to minimize flood damages when rehabilitating a historic structure or repairing a damaged historic structure (44 CFR §60.3).

Rehabilitating or repairing a historic structure provides an opportunity to incorporate measures to reduce future flood damages. In addressing multiple historic structures in a historic district or a single historic structure, one of the first steps to undertake is to assess the flood risk and estimate the amount of potential flood losses. The “how-to” guides described in the Hazard Mitigation Planning Can Benefit Historic Structures section of this Bulletin can help in assessing the flood risk and the potential flood losses to historic structures. The “how-to” guides can also help in identifying, evaluating, and prioritizing possible mitigation measures that reduce flood damages.

Mitigation measures can take a variety of forms from simple low-cost improvements such as elevating utilities and mechanical equipment to structural measures such as elevation, dry floodproofing, or relocating the building to a site outside the Special Flood Hazard Area. Even the more costly measures such as elevation, dry-floodproofing, or relocation can have significant benefits relative to their cost including:

- Reduction of flood damages. The buildings may not sustain flood damages or at least those damages will be significantly less than if no mitigation measures were implemented.
- Reduction in flood insurance premiums. Buildings that are elevated to or above the BFE or relocated out of the floodplain can qualify for flood insurance at actuarial rates that are generally less expensive than even the subsidized flood insurance rates charged to existing structures.
- Long-term preservation of the building. Historic structures that are repeatedly flooded will deteriorate and eventually may have to be demolished unless they are protected from flooding. Mitigation measures can help preserve the building for future generations.

One of the challenges in mitigating the flood risk to a “historic structure” is the need to incorporate mitigation measures in such a way that the structure does not lose its historic designation. When evaluating mitigation measures for historic structures, care should be taken so that new designs and new materials do not obscure existing significant historic features. Retrofitting a historic structure to reduce flood damages can be done that it has minimal impact on the structure’s historic integrity and so that it maintains its historic designation.

A range of mitigation measures may be available for a particular historic structure. By adhering to the *Secretary of the Interior’s Standards for the Treatment of Historic Properties* and by seeking the help of an architect or engineering professional experienced in rehabilitating historic structures, a structure’s original historic setting, scale, and distinctive features can be preserved. You may want to also refer to the *Preservation Briefs* published by the National Park Service, which provide guidance on preserving, rehabilitating, and restoring historic buildings. You may also want to seek guidance from your State Historic Preservation Officer or Tribal Historic Preservation Officer.

There is a variety of relatively simple measures that can be implemented to minimize the effects of flooding. Although these measures are designed to reduce flood damages, they may not eliminate flooding altogether. Many of the techniques described below may have minimal impact on the character-defining design features of the historic structure and some are relatively inexpensive to implement. Several of these will require a design professional and licensed contractor to implement.

- Relocate contents to a safer location. For example, heirlooms and other cultural resources should be located above the BFE. At a minimum, valuable contents should be removed from flood-prone basements.
- Create positive drainage around the building. In places where ground slope against the building facade is either flat or toward the building, increase the grade immediately adjacent to the façade to achieve positive drainage away from the building. In some situations, existing masonry and concrete window wells around basement windows may need to be built up to retain the extra height of the fill.
- Protect mechanical and utility equipment. Elevating mechanical and utility equipment (including electrical, heating, ventilation, plumbing and air conditioning equipment) above the BFE can protect them from flood damage. Guidance for protecting mechanical and utility equipment from flooding can be found in the FEMA publication, *Protecting Building Utilities from Flood Damage, Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems* (FEMA 348/November 1999).
- Remove modern finished materials from basements or other areas that are floodprone. Often historic structures are constructed from materials that are relatively flood-resistant. For example, basements often had stone or rubble walls and dirt floors. These buildings often were repeatedly flooded with minimal flood damages except to building contents. In more recent years many of these areas have been finished off using modern materials that are less resistant to flood damage and building utilities added. It may be possible to wet-floodproof the building merely by removing these modern materials and restoring these areas to their original configuration.
- Use flood resistant materials below the BFE. When rehabilitating or repairing a damaged historic structure, use flood resistant materials below the BFE to improve the structure's ability to withstand flooding. Guidance for using flood resistant materials can be found in Technical Bulletin 2-93, *Flood-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Area in accordance with the National Flood Insurance Programs*.
- Fill in the basement. For historic structures with basements, a simple solution to minimize flood damage and reduce the potential for structural damage is to abandon the basement, raise any mechanical and utility equipment, and fill in the basement with sand or gravel.
- Wet floodproofing the basement. This measure allows the internal flooding of a basement. Flooding of a structure's interior is intended to counteract hydrostatic pressure on the walls, surfaces, and supports of the structure by equalizing interior and exterior water levels during a flood. Inundation also reduces the danger of buoyancy from hydrostatic uplift forces. Such measures may require alteration of a basement's design and construction, use of flood-

resistant materials, adjustment of the basement's maintenance, relocation of equipment and contents, and emergency preparedness. Guidance for wet floodproofing a basement can be found in Technical Bulletin 7-93 *Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program*.

- Install “mini”-floodwalls to protect openings, such as a window well. For low level flooding, a type of “mini”-floodwall can be used to permanently protect various types of openings. Possible materials for this use include brick, concrete block and poured concrete. They should be supported by and securely tied into a footing so that they will not be undercut by scouring and the soil under these walls should be fairly impervious to control seepage. Some form of sealant may be needed on the outside to control seepage.
- Temporary measures. Where it is not possible to use the above measures to protect a building from flooding, it may be possible to use temporary measures to reduce flood damages. Examples include sand-bagging openings, installing temporary barriers or flood shields in openings, and evacuating building contents to floors above the flood level. In order for this approach to work, one must develop an emergency plan and stock-pile the required materials ahead of time. The amount of flood warning time available for the site is critical and it must be ensured that adequate personnel are available to install the measures. Do not try to keep water out of buildings unless an engineering analysis is conducted to ensure that the walls are strong enough to withstand flood forces (hydrostatic, hydrodynamic, debris, and buoyancy).

Property owners may want to undertake more extensive mitigation measures, if there is a likelihood of significant or more frequent flood damage to the historic structure. These mitigation measures could include elevating, floodproofing, or relocating the structure to a site that is outside of the Special Flood Hazard Area. These mitigation measures are described below.

Elevation

One of the common methods of protecting flood-prone buildings is to elevate the lowest floor of a structure above the BFE (elevation of the one-percent-annual chance flood). Elevation is an effective mitigation measure, if designed and constructed appropriately to withstand flood forces. Although elevation is a practical solution for flooding problems, the flooding conditions and other hazards at the site must be carefully examined so that the most suitable technique and foundation type can be determined. There are two types of elevation to consider: (1) The entire building is lifted and placed on a new elevated foundation (columns, piers, posts, or raised foundation walls such as a crawl space). (2) In situations where it is possible to leave the exterior of the building the same, raise the interior floor of the building above the BFE. This may be an alternative for older stone buildings with high ceilings and elevated window sills.

Essentially, the steps required for elevating a building are largely the same in all cases. A cradle of steel beams is inserted under the structure; jacks are used to raise both the beams and structure to the desired height; a new elevated foundation for the house is constructed; and the structure is then lowered back onto the new foundation and reconnected. At a minimum, the foundation



Elevation of a historic residence in Mandeville, Louisiana

of the elevated structure must be able to withstand the expected loads at a site which may include hydrostatic pressure, hydrodynamic loads from velocity water and wave impacts, debris impact resulting from the flood, and buoyancy. The foundation must also be able to resist undermining by any expected erosion or scour. Therefore, the flooding characteristics and building type and condition will need to be examined to determine which type of foundation will be the most suitable.

While elevating a structure above the BFE will provide the structure the most protection, a less intrusive elevation may be desired or more feasible for a historic structure. Other protection measures, such as elevating utilities and equipment above the BFE, should be considered if elevating a historic structure to the BFE is not practicable.



Elevation of a historic residence in Mandeville, Louisiana

Elevation of a historic structure does not have to be achieved by unsightly pilings or other foundation that would impair the aesthetics of a historic district. The structure could be elevated on pilings or foundation walls and the foundation area could then be covered by an architecturally pleasing facade that is consistent with materials from the historic structure. The lower area can also be camouflaged with landscaping.

Elevation in South Carolina. 113

Calhoun Street is a 125-year old, three-story house that stands in the heart of the downtown historic district of Charleston, South Carolina. Already abandoned for several years by the time Hurricane Hugo struck in 1989, 113 Calhoun Street was in serious danger of collapse by 1997. Instead of demolishing the building, the City of Charleston donated it to the 113 Calhoun Street Foundation, a non-profit partnership formed between the South Carolina Sea Grant Consortium, Clemson University, and the City of Charleston.

Using creative design solutions the 113 Calhoun Street Foundation transformed the derelict building into an educational center. Primary funding for the initial construction was provided by FEMA, while additional support, including the donation of products and services, came from the private sector. It was determined that an elevation above the BFE would not have been appropriate for 113 Calhoun Street. Such an elevation would have raised the building more than 5 feet, which would not have been in keeping with the surrounding streetscape and character of the historic district. Instead, the organization elevated the house only one foot, undertaking a variety of other types of interior and exterior improvements to protect against hazards.

Even though it was elevated to below the BFE, the house is still protected from minor flooding events and suffers less damage in major flooding events. Improvements to the house included the following:

- Placing HVAC ductwork at ceiling level and returns above the BFE.
- Placing electrical, telephone, and computer outlets above the BFE, with no splices or connections below the BFE.



113 Calhoun at inception of project

Photo courtesy of 113 Calhoun Street Foundation.



113 Calhoun today

Photo courtesy of 113 Calhoun Street Foundation.

- Installing interior decorative wainscoting to the BFE. This wainscoting consisted of water-resistant material, and could be removed to dry after a flood event.
- Designing interior structural elements so that a continuous load path was created that minimized weak links in the building's structural system.
- Replacing the building's deteriorated original foundation of unreinforced masonry brick with a new foundation consisting of concrete footings with steel ties. This new system allowed new timbers members to be bolted to the foundation, protecting against the twisting movements and other movements caused by seismic and wind forces. Brick from the original foundation was re-used as a veneer on the new foundation.

Elevation in Belhaven, North Carolina. The Town of Belhaven, North Carolina, along the Pungo River, is subject to repeated flooding. In its last flood event, over 60 percent of the town's buildings were damaged, including most of the buildings in the National Register-listed Belhaven Historic District. In an effort to retain the town's historic and economic link to the waterfront, the decision was made to elevate the 379 buildings in place rather than relocate them to higher ground or demolish and rebuild them.

With assistance from the North Carolina State Historic Preservation Officer, plans were developed for an elevation project that would best preserve the historic character of the district. In the plan, frame buildings were raised onto concrete block foundations faced with brick veneer. Brick buildings were elevated onto



Frame building elevated on concrete block foundation faced with brick veneer. Belhaven, North Carolina.

continuous concrete block foundations, which were also faced with brick veneer. A projecting brick course was used to demarcate where the original house ended and the new foundation began. Additional guidance was drafted for preserving porches, railings, balusters, and steps, and for replacing old materials with appropriate new materials where necessary.

To prepare for the elevation project, large-format archival photographs were taken of each building that would be included in the project. These photographs provided a permanent record of the historic appearance of the district. Due to all these extra planning efforts for preserving its historic properties, the Belhaven Historic District was able to maintain its National Register status.

By the time the next flood struck Belhaven, 32 of the planned 379 houses were elevated. It is estimated that elevation of these 32 properties alone saved the town over \$1.3 million in direct and indirect damages.

Floodproofing

Another alternative is to “floodproof” the building, so that it will not sustain damage or so that damages are minimized. There are two types of floodproofing commonly called “dry-floodproofing” and “wet-floodproofing.” Dry floodproofing means making a building watertight, substantially impermeable to floodwaters. This form of floodproofing requires that the building be properly anchored to resist flotation, collapse, and lateral movement. It also may require the reinforcement of walls to withstand flood forces and impact forces generated by floating debris; the use of membranes and other sealants to reduce seepage of floodwater through walls and wall penetrations; the installation of pumps to control interior water levels; the installation of check valves to prevent entrance of floodwater or sewage flows through utilities; and the location of electrical, mechanical, utility, and other valuable vulnerable equipment and contents above the expected flood level. Dry-floodproofing must be implemented with an appropriate design by a registered professional engineer or architect. Additional guidance on dry floodproofing can be found in Technical Bulletin 3-93 *Non-Residential Floodproofing – Requirements and Certification for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program* and in *Floodproofing Non-Residential Structures* (FEMA 102/May 1986).

Wet-floodproofing allows for the flooding of a structure’s interior to equalize hydrostatic pressure on exterior walls, surfaces, and supports of the structure during a flood. Application of wet-floodproofing as a flood protection technique should be limited to specific situations in A Zones (including A, AE, A1-30, AH, AO, and AR zones).

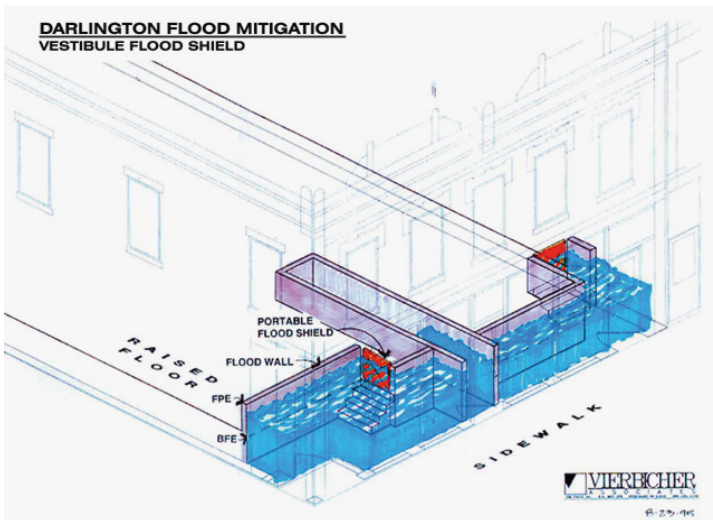
Flooding of a structure’s interior is intended to counteract hydrostatic flood forces on the exterior walls, surfaces, and supports of the structure during a flood. Inundation also reduces the danger of buoyancy from uplift forces. Use of wet floodproofing for historic structures requires careful consideration of protection techniques.

Building materials for the area that is to be wet-floodproofed should be replaced with flood resistant materials. Valuable contents should be relocated to or above the BFE. Light, portable furnishings should be able to be moved quickly and easily before a flood. Utilities and equipment should be elevated to or above the BFE or located on a platform that is above the BFE. Consideration must be given to flood duration, frequency, and depth to determine if wet-floodproofing is a viable option. For example, flood-prone basements may be modified, so that they can be flooded without damage to the building or foundation. Additional guidance on wet floodproofing can be found in Technical Bulletin 7-93 *Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program*.

Floodproofing in Wisconsin. Flooding is an ongoing part of life in the rural riverside town of Darlington, Wisconsin, having caused millions of dollars in property damage over the past decade. Following the devastating damage from the 1993 floods, the town could follow one of the three routes: do nothing and continue to suffer the periodic floods; move the central business district out of the floodplain and upset the local economy and sense of community; or do something innovative.



Restored and retrofitted buildings in Downtown Darlington, Wisconsin



To provide additional protection against floodwater, removable watertight floodgates were incorporated into the buildings

Darlington chose innovation. It found creative solutions to retain the historic charm of its nineteenth century business district, while eliminating the threat of future flood devastation.

The town took advantage of the very high ceilings common to many of the older buildings in Darlington; their height allowed first floors to be elevated out of flood danger with minimal impact to other historic features. Basements were filled with sand and gravel, floodproofing that portion of the

building most vulnerable to flooding, and all utilities were upgraded and raised. All these measures were implemented without altering the exteriors or disrupting the historic integrity of these older buildings.

These mitigation measures resulted in the successful floodproofing of the historic central business district against the 100-year flood event, as well as the revitalization of Darlington's economy.

The successful integration of historic preservation and hazard mitigation earned Darlington a Preservation Achievement Award from the State Historical Society of Wisconsin.



Floodproofing the vestibule of a storefront

Relocation

Relocation is the mitigation measure that can offer the greatest security from future flooding. Relocation involves moving the entire structure out of the floodplain or it may involve dismantling a structure and rebuilding it elsewhere. It may be possible to relocate a building to a higher part of the same parcel or lot, but often it will be necessary to move the building to another site. In either case, it is the most reliable of all mitigation measures. In addition to relieving the property owner from future anxiety about flooding, this method can offer the opportunity to significantly reduce or



Built by John Holm in 1847, the Magnolia Hotel, badly damaged from Hurricane Camille in 1969, was moved 100 yards north and restored by the City of Biloxi in 1972. As a result, the hotel experienced only minimal flooding during Hurricane Katrina.

even eliminate the need for flood insurance. Relocation may be the best option in cases where the building site is subject to repeat flooding or severe flooding, where flood depths and velocities can have significant impact on the building.

Obviously, moving a structure is a complex operation and will have to be done by a professional with experience in relocating structures. Relocation generally involves raising the building and placing it on a wheeled vehicle, usually a large flatbed trailer. The building is then transported to the new site and lowered onto a new foundation. In general, structures over a crawl space or basement are the easiest to relocate, while structures that are slab-on-grade or multi-story are more difficult. Masonry buildings, buildings with stone or brick veneer, and buildings with chimneys may require extensive bracing to prevent cracking or structural failure. As structures become larger, moving them may become more complicated and more expensive.

Relocation may, in some cases, be an appropriate option for historic structures by moving them out of harm's way. However, historic structures often share important features to the site, such as landscaping, outbuildings, alleyways, orientation, setback from the street, or other historical context. These contributing features often help to define a neighborhood's historic significance. If this option is being considered for a historic structure, consult with a historic preservation professional. The State Historic Preservation Officer or Tribal Historic Preservation Officer can also offer guidance. An example of a historic structure, which was relocated out of harm's way, follows.

Relocation in Fulton, New York. On January 19, 1996, floodwaters of the Schoharie Creek rose nearly 18 feet damaging many properties in the Town of Fulton, in Schoharie County, New York. The Town of Fulton submitted a Hazard Mitigation Grant Program application to FEMA for the acquisition and demolition of 12 properties. In reviewing the Town of Fulton’s application, FEMA initiated consultation under section 106 of the National Historic Preservation Act. As a result, FEMA determined and the New York State Historic Preservation Officer concurred that one of the buildings in the application – known as the “Bruchmann residence” – was eligible for inclusion on the National Register of Historic Places and that its demolition would result in an “adverse effect.” The residence is significant as a notable and substantially intact example of a mid-19th century vernacular design and construction.



Dismantling of Bruchmann residence, May 2000

Based on the “adverse effect” determination, a Memorandum of Agreement (MOA) was negotiated between the State Historic Preservation Officer, FEMA, and the Town of Fulton wherein the town would explore alternatives to demolition. The town implemented an advertising campaign in an attempt to identify a party willing and able to relocate the structure to another site. After more than 2 years, an interested party submitted a statement of interest to the applicant and a deal was struck.

The house was re-erected on its new site in Delaware County.

Hazard Mitigation Planning Can Benefit Historic Structures

Historic properties and cultural resources are valuable, economic assets in communities throughout the United States. For many communities, historic and cultural resources are a catalyst for economic development. Often not considered are the potentially devastating effects that flooding can have on historic properties. When disaster strikes and a community’s historic resources are damaged, the economic and social vitality of the community can be severely impacted. Communities can take steps to minimize the impacts of flooding on the community’s historic resources by integrating historic property and cultural resource protection into hazard mitigation planning.

FEMA has developed a series of mitigation planning “how-to” guides for the purpose of assisting communities, States, and Tribes in developing an effective hazard mitigation plan. These guides have been developed by FEMA to provide an overview of the core elements associated with hazard mitigation planning. The four core elements include – organizing resources, assessing risks, developing a mitigation plan, and implementing the plan and monitoring progress. These “how-to series” include:

- Getting started with the mitigation planning process, including important considerations for how one can organize efforts to develop an effective mitigation plan (FEMA 386-1);
- Identifying hazards and assessing losses to community, State, or Tribe (FEMA 386-2);
- Setting mitigation priorities and goals for community, State, or Tribe, and writing the plan (FEMA 386-3); and
- Implementing the mitigation plan, including project funding and maintaining a dynamic plan that changes to meet new developments (FEMA 386-4).

One particular guide developed specifically to address historic properties and cultural resources is the FEMA publication titled *Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning* (FEMA 386-6 / May 2005). This guide should be used in conjunction with the four guides described above. This guide will help communities accomplish the following with respect to historic structures and historic districts:

- Identify and pull together resources for incorporating historic property and cultural resource considerations into a hazard mitigation plan;
- Determine which historic properties and cultural resources are likely to be damaged in a disaster and prioritize them for protection;
- Evaluate potential hazard mitigation actions for historic properties and cultural resources through the use of benefit-cost analysis and other decision-making tools; and
- Develop and implement a hazard mitigation plan that addresses historic properties and cultural resources.

To obtain copies of these publications, refer to Further Information section and Order Information section.

Further Information

State and Local Mitigation Planning “How-To” Guides

Getting Started – building support for mitigation planning, FEMA 386-1, September 2002.

Understanding Your Flood Risk – identifying hazards and estimating losses, FEMA 386-2, August 2001.

Developing the Mitigation Plan – identifying mitigation actions and implementation strategies, FEMA 386-3, April 2003.

Bringing the Plan to Life – implementing the hazard mitigation plan, FEMA 386-4, August 2003.

Integrating Historic Property and Cultural Resource Considerations Into Hazard Mitigation Planning, FEMA 386-6, May 2005.

Other Mitigation Documents

Homeowner's Guide to Retrofitting, Six Ways to Protect Your House from Flooding, FEMA 312, June 1998.

Floodproofing Non-Residential Structures, FEMA 102, May 1986.

Flood-Resistant Materials Requirements for Buildings Located in Special Flood Hazard Areas in Accordance with the National Flood Insurance Program, FEMA Technical Bulletin 2-93, FIA-TB-2. 4/93.

Hurricane Katrina in the Gulf Coast, Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance, FEMA 549, July 2006. Chapter 6 and Appendix J.

Openings in Foundation Walls for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program, FEMA Technical Bulletin 1-93, FIA-TB-1 4/93.

Non-Residential Floodproofing-Requirements and Certification for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program, FEMA Technical Bulletin 3-93, FIA-TB-3. 4/93.

Protecting Building Utilities From Flood Damage, Principles and Practices for the Design and Construction of Flood Resistant Building Utility Systems, FEMA 348, November 1999.

Recommended Residential Construction for the Gulf Coast, Building on Strong and Safe Foundations, FEMA 550, July 2006.

Repairing Your Flood Home, Federal Emergency Management Agency and the American Red Cross, ARC 4477 or FEMA 234, 1992.

Wet Floodproofing Requirements for Structures Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program, Technical Bulletin 7-93, FIA-TB-7 12/93.

To obtain a copy of these publications, see the section on Ordering Information. They are also available to view and download from <http://www.fema.gov/library/index.jsp>.

Comments

Any comments on the Floodplain Management Bulletin should be directed to:

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