

**HYDE COUNTY**  
**FLOOD DAMAGE PREVENTION ORDINANCE**

Coastal Regular Phase

**ARTICLE 1. STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND OBJECTIVES.**

**SECTION A. STATUTORY AUTHORIZATION.**

The Legislature of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Article 6 of Chapter 153A; Article 8 of Chapter 160A; and Article 7, 9, and 11 of Chapter 160D (Effective January 1, 2021) of the North Carolina General Statutes, delegated to local governmental units the authority to adopt regulations designed to promote the public health, safety, and general welfare.

Therefore, the Board of Commissioners of Hyde County, North Carolina, does ordain as follows:

**SECTION B. FINDINGS OF FACT.**

- (1) The flood prone areas within the jurisdiction of Hyde County are subject to periodic inundation which results in loss of life, property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures of flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare.
- (2) These flood losses are caused by the cumulative effect of obstructions in floodplains causing increases in flood heights and velocities and by the occupancy in flood prone areas of uses vulnerable to floods or other hazards.

**SECTION C. STATEMENT OF PURPOSE.**

It is the purpose of this ordinance to promote public health, safety, and general welfare and to minimize public and private losses due to flood conditions within flood prone areas by provisions designed to:

- (1) Restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion, flood heights or velocities;
- (2) Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- (3) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- (4) Control filling, grading, dredging, and all other development that may increase erosion or flood damage; and
- (5) Prevent or regulate the construction of flood barriers that will unnaturally divert flood waters or which may increase flood hazards to other lands.

**SECTION D. OBJECTIVES.**

The objectives of this ordinance are to:

- (1) Protect human life, safety, and health;
- (2) Minimize expenditure of public money for costly flood control projects;

- (3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- (4) Minimize prolonged business losses and interruptions;
- (5) Minimize damage to public facilities and utilities (i.e. water and gas mains, electric, telephone, cable and sewer lines, streets, and bridges) that are located in flood prone areas;
- (6) Minimize damage to private and public property due to flooding;
- (7) Make flood insurance available to the community through the National Flood Insurance Program;
- (8) Maintain the natural and beneficial functions of floodplains;
- (9) Help maintain a stable tax base by providing for the sound use and development of flood prone areas; and
- (10) Ensure that potential buyers are aware that property is in a Special Flood Hazard Area.

## ARTICLE 2. DEFINITIONS.

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance it's most reasonable application.

"Accessory Structure (Appurtenant Structure)" means a structure located on the same parcel of property as the principal structure and the use of which is incidental to the use of the principal structure. Garages, carports and storage sheds are common urban accessory structures. Pole barns, hay sheds and the like qualify as accessory structures on farms, and may or may not be located on the same parcel as the farm dwelling or shop building.

"Addition (to an existing building)" means an extension or increase in the floor area or height of a building or structure.

"Alteration of a watercourse" means a dam, impoundment, channel relocation, change in channel alignment, channelization, or change in cross-sectional area of the channel or the channel capacity, or any other form of modification which may alter, impede, retard or change the direction and/or velocity of the riverine flow of water during conditions of the base flood.

"Appeal" means a request for a review of the Floodplain Administrator's interpretation of any provision of this ordinance.

"Area of Shallow Flooding" means a designated Zone AO or AH on a community's Flood Insurance Rate Map (FIRM) with base flood depths determined to be from one (1) to three (3) feet. These areas are located where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate, and where velocity flow may be evident.

"Area of Special Flood Hazard" see "Special Flood Hazard Area (SFHA)".

"Base Flood" means the flood having a one (1) percent chance of being equaled or exceeded in any given year.

"Base Flood Elevation (BFE)" means a determination of the water surface elevations of the base flood as published in the Flood Insurance Study. When the BFE has not been provided in a "Special Flood Hazard Area", it may be obtained from engineering studies available from a Federal, State, or other source using FEMA approved engineering methodologies. This elevation, when combined with the "Freeboard", establishes the "Regulatory Flood Protection Elevation".

"Basement" means any area of the building having its floor subgrade (below ground level) on all sides.

"Breakaway Wall" means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or the supporting foundation system.

"Building" see "Structure".

"Chemical Storage Facility" means a building, portion of a building, or exterior area adjacent to a building used for the storage of any chemical or chemically reactive products.

“Coastal Area Management Act (CAMA)” means North Carolina’s Coastal Area Management Act, this act, along with the Dredge and Fill Law and the Federal Coastal Zone Management Act, is managed through North Carolina Department of Environmental Quality (NCDEQ) Division of Coastal Management (DCM).

“Coastal A Zone (CAZ)” means an area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped V zones. In a Coastal A Zone, the principal source of flooding must be astronomical tides, storm surges, seiches, or tsunamis, not riverine flooding. During the base flood conditions, the potential for wave heights shall be greater than or equal to 1.5 feet. Coastal A Zones are not normally designated on FIRMs. (see Limit of Moderate Wave Action (LiMWA))

“Coastal Barrier Resources System (CBRS)” consists of undeveloped portions of coastal and adjoining areas established by the Coastal Barrier Resources Act (CoBRA) of 1982, the Coastal Barrier Improvement Act (CBIA) of 1990, and subsequent revisions, and includes areas owned by Federal or State governments or private conservation organizations identified as Otherwise Protected Areas (OPA).

“Coastal High Hazard Area” means a Special Flood Hazard Area extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. The area is designated on a FIRM, or other adopted flood map as determined in Article 3, Section B of this ordinance, as Zone VE.

“Design Flood”: See “Regulatory Flood Protection Elevation.”

“Development” means any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials.

“Development Activity” means any activity defined as Development which will necessitate a Floodplain Development Permit. This includes buildings, structures, and non-structural items, including (but not limited to) fill, bulkheads, piers, pools, docks, landings, ramps, and erosion control/stabilization measures.

“Digital Flood Insurance Rate Map (DFIRM)” means the digital official map of a community, issued by the Federal Emergency Management Agency (FEMA), on which both the Special Flood Hazard Areas and the risk premium zones applicable to the community are delineated.

“Disposal” means, as defined in NCGS 130A-290(a)(6), the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste into or on any land or water so that the solid waste or any constituent part of the solid waste may enter the environment or be emitted into the air or discharged into any waters, including groundwater.

“Elevated Building” means a non-basement building which has its lowest elevated floor raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns.

“Encroachment” means the advance or infringement of uses, fill, excavation, buildings, structures or development into a special flood hazard area, which may impede or alter the flow capacity of a floodplain.

“Existing building and existing structure” means any building and/or structure for which the “start of construction” commenced before February 4, 1987, the effective date of the initial Flood Insurance Rate Map.

“Existing Manufactured Home Park or Manufactured Home Subdivision” means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) was completed before the effective date of the initial floodplain management regulations adopted by the community, dated December 15, 1986.

“Flood” or “Flooding” means a general and temporary condition of partial or complete inundation of normally dry land areas from:

- (a) The overflow of inland or tidal waters; and/or
- (b) The unusual and rapid accumulation or runoff of surface waters from any source.

“Flood Boundary and Floodway Map (FBFM)” means an official map of a community, issued by the FEMA, on which the Special Flood Hazard Areas and the floodways are delineated. This official map is a supplement to and shall be used in conjunction with the Flood Insurance Rate Map (FIRM).

“Flood Hazard Boundary Map (FHBM)” means an official map of a community, issued by the FEMA, where the boundaries of the Special Flood Hazard Areas have been defined as Zone A.

“Flood Insurance” means the insurance coverage provided under the National Flood Insurance Program.

“Flood Insurance Rate Map (FIRM)” means an official map of a community, issued by the FEMA, on which both the Special Flood Hazard Areas and the risk premium zones applicable to the community are delineated. (see also DFIRM)

“Flood Insurance Study (FIS)” means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations (if appropriate), flood hazard risk zones, and other flood data in a community issued by the FEMA. The Flood Insurance Study report includes Flood Insurance Rate Maps (FIRMs) and Flood Boundary and Floodway Maps (FBFMs), if published.

“Flood Prone Area” see “Floodplain”

“Flood Zone” means a geographical area shown on a Flood Hazard Boundary Map or Flood Insurance Rate Map that reflects the severity or type of flooding in the area.

“Floodplain” means any land area susceptible to being inundated by water from any source.

“Floodplain Administrator” is the individual appointed to administer and enforce the floodplain management regulations.

“Floodplain Development Permit” means any type of permit that is required in conformance with the provisions of this ordinance, prior to the commencement of any development activity.

“Floodplain Management” means the operation of an overall program of corrective and preventive measures for reducing flood damage and preserving and enhancing, where possible, natural resources in the floodplain, including, but not limited to, emergency preparedness plans, flood control works, floodplain management regulations, and open space plans.

“Floodplain Management Regulations” means this ordinance and other zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances, and other applications of police power. This term describes federal, state or local regulations, in any combination thereof, which provide standards for preventing and reducing flood loss and damage.

“Floodproofing” means any combination of structural and nonstructural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitation facilities, structures, and their contents.

“Flood-resistant material” means any building product [material, component or system] capable of withstanding direct and prolonged contact (minimum 72 hours) with floodwaters without sustaining damage that requires more than low-cost cosmetic repair. Any material that is water-soluble or is not resistant to alkali or acid in water, including normal adhesives for above-grade use, is not flood-resistant. Pressure-treated lumber or naturally decay-resistant lumbers are acceptable flooring materials. Sheet-type flooring coverings that restrict evaporation from below and materials that are impervious, but dimensionally unstable are not acceptable. Materials that absorb or retain water excessively after submergence are not flood-resistant. Please refer to Technical Bulletin 2, *Flood Damage-Resistant Materials Requirements*, and available from the FEMA. Class 4 and 5 materials, referenced therein, are acceptable flood-resistant materials.

“Floodway” means the channel of a river or other watercourse, including the area above a bridge or culvert when applicable, and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot.

“Floodway encroachment analysis” means an engineering analysis of the impact that a proposed encroachment into a floodway or non-encroachment area is expected to have on the floodway boundaries and flood levels during the occurrence of the base flood discharge. The evaluation shall be prepared by a qualified North Carolina licensed engineer using standard engineering methods and hydraulic models meeting the minimum requirement of the National Flood Insurance Program.

“Freeboard” means the height added to the BFE to account for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, blockage of bridge or culvert openings, storm surge or precipitation exceeding the base flood, and the hydrological effect of urbanization of the watershed. The BFE plus the freeboard establishes the “Regulatory Flood Protection Elevation”.

“Functionally Dependent Facility” means a facility which cannot be used for its intended purpose unless it is located in close proximity to water, limited to a docking or port facility necessary for the loading and unloading of cargo or passengers, shipbuilding, or ship repair. The term does not include long-term storage, manufacture, sales, or service facilities.

“Hazardous Waste Management Facility” means, as defined in NCGS 130A, Article 9, a facility for the collection, storage, processing, treatment, recycling, recovery, or disposal of hazardous waste.

“Highest Adjacent Grade (HAG)” means the highest natural elevation of the ground surface, prior to construction, immediately next to the proposed walls of the structure.

“Historic Structure” means any structure that is:

- (a) Listed individually in the National Register of Historic Places (a listing maintained by the US Department of Interior) or preliminarily determined by the Secretary of Interior as meeting the requirements for individual listing on the National Register;
- (b) Certified or preliminarily determined by the Secretary of 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 local inventory of historic landmarks in communities with a “Certified Local Government (CLG) Program”; or
- (d) Certified as contributing to the historical significance of a historic district designated by a community with a “Certified Local Government (CLG) Program.”

Certified Local Government (CLG) Programs are approved by the US Department of the Interior in cooperation with the North Carolina Department of Cultural Resources through the State Historic Preservation Officer as having met the requirements of the National Historic Preservation Act of 1966 as amended in 1980.

“Letter of Map Change (LOMC)” means an official determination issued by FEMA that amends or revises an effective Flood Insurance Rate Map or Flood Insurance Study. Letters of Map Change include:

- (a) Letter of Map Amendment (LOMA): An official amendment, by letter, to an effective National Flood Insurance Program map. A LOMA is based on technical data showing that a property had been inadvertently mapped as being in the floodplain, but is actually on natural high ground above the base flood elevation. A LOMA amends the current effective Flood Insurance Rate Map and establishes that a specific property, portion of a property, or structure is not located in a special flood hazard area.
- (b) Letter of Map Revision (LOMR): A revision based on technical data that may show changes to flood zones, flood elevations, special flood hazard area boundaries and floodway delineations, and other plan metric features.
- (c) Letter of Map Revision Based on Fill (LOMR-F): A determination that a structure or parcel of land has been elevated by fill above the BFE and is, therefore, no longer located within the special flood hazard area. In order to qualify for this determination, the fill must have been permitted and placed in accordance with the community’s floodplain management regulations.
- (d) Conditional Letter of Map Revision (CLOMR): A formal review and comment as to whether a proposed project complies with the minimum NFIP requirements for such projects with respect to delineation of special flood hazard areas. A CLOMR does not revise the effective Flood Insurance Rate Map or Flood Insurance Study; upon submission and approval of certified as-built documentation, a Letter of Map Revision may be issued by FEMA to revise the effective FIRM.

“Light Duty Truck” means any motor vehicle rated at 8,500 pounds Gross Vehicular Weight Rating or less which has a vehicular curb weight of 6,000 pounds or less and which has a basic vehicle frontal area of 45 square feet or less as defined in 40 CFR 86.082-2 and is:

- (a) Designed primarily for purposes of transportation of property or is a derivation of such a vehicle, or
- (b) Designed primarily for transportation of persons and has a capacity of more than 12 persons; or
- (c) Available with special features enabling off-street or off-highway operation and use.

“Limit of Moderate Wave Action (LiMWA)” means the boundary line given by FEMA on coastal map studies marking the extents of Coastal A Zones (CAZ).

“Lowest Adjacent Grade (LAG)” means the lowest elevation of the ground, sidewalk or patio slab immediately next to the building, or deck support, after completion of the building.

“Lowest Floor” means 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 limited storage in an area other than a basement area is not considered a building’s lowest floor, provided that such an enclosure is not built so as to render the structure in violation of the applicable non-

elevation design requirements of this ordinance.

**"Manufactured Home"** means a structure, transportable in one or more sections, which is built on a permanent chassis and designed to be used with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle".

**"Manufactured Home Park or Subdivision"** means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

**"Map Repository"** means the location of the official flood hazard data to be applied for floodplain management. It is a central location in which flood data is stored and managed; in North Carolina, FEMA has recognized that the application of digital flood hazard data products carries the same authority as hard copy products. Therefore, the NCEM's Floodplain Mapping Program websites house current and historical flood hazard data. For effective flood hazard data, the NC FRIS website (<http://FRIS.NC.GOV/FRIS>) is the map repository, and for historical flood hazard data the Flood NC website (<http://FLOODNC.GOV/NCFLOOD>) is the map repository.

**"Market Value"** means the building value, not including the land value and that of any accessory structures or other improvements on the lot. Market value may be established by independent certified appraisal; replacement cost depreciated for age of building and quality of construction (Actual Cash Value); or adjusted tax assessed values.

**"New Construction"** means structures for which the "start of construction" commenced on or after December 15, 1986, the effective date of the initial floodplain management regulations and includes any subsequent improvements to such structures.

**"Non-Conversion Agreement"** means a document stating that the owner will not convert or alter what has been constructed and approved. Violation of the agreement is considered a violation of the ordinance and, therefore, subject to the same enforcement procedures and penalties. The agreement must be filed with the recorded deed for the property. The agreement must show the clerk's or recorder's stamps and/or notations that the filing has been completed. (If this is in the ordinance then the other red section must be in)

**"Non-Encroachment Area (NEA)"** means the channel of a river or other watercourse, including the area above a bridge or culvert when applicable, and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot as designated in the Flood Insurance Study report.

**"Otherwise Protected Area (OPA)"** see "Coastal Barrier Resources System (CBRS)".

**"Post-FIRM"** means construction or other development for which the "start of construction" occurred on or after February 4, 1987, the effective date of the initial Flood Insurance Rate Map.

**"Pre-FIRM"** means construction or other development for which the "start of construction" occurred before February 4, 1987, the effective date of the initial Flood Insurance Rate Map.

**"Primary Frontal Dune (PFD)"** means a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

**"Principally Above Ground"** means that at least 51% of the actual cash value of the structure is above ground.

**"Public Safety" and/or "Nuisance"** means anything which is injurious to the safety or health of an entire community or neighborhood, or any considerable number of persons, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, or river, bay, stream, canal, or basin.

**"Recreational Vehicle (RV)"** means a vehicle, which is:

- (a) Built on a single chassis;
- (b) 400 square feet or less when measured at the largest horizontal projection;
- (c) Designed to be self-propelled or permanently towable by a light duty truck;
- (d) Designed primarily not for use as a permanent dwelling, but as temporary living quarters for recreational, camping, travel, or seasonal use, and
- (e) Is fully licensed and ready for highway use.

( For the purpose of this ordinance, “Tiny Homes/Houses” and Park Models that do not meet the items listed above are not considered Recreational Vehicles and should meet the standards of and be permitted as Residential Structures.)

“Reference Level” is the top of the lowest floor for structures within Special Flood Hazard Areas designated as Zones A, AE, AH, AO, and A99. The reference level is the bottom of the lowest horizontal structural member of the lowest floor for structures within Special Flood Hazard Areas designated as Zone VE.

“Regulatory Flood Protection Elevation” In Special Flood Hazard Areas means the “Base Flood Elevation” plus the “Freeboard” for those areas where base flood elevations have been determined on the FIRM; the base flood depth above the highest adjacent grade or local elevation standards for those areas identified as AO zones of the FIRM, or the local elevation standard for those areas identified as Shaded X or X zones on the FIRM. (New Term used in the Ordinance)

In AE zones, the RFPE is the Base Flood Elevation as designated on the effective FIRM plus 3 feet of freeboard OR an elevation to above 7.5 feet NAVD 1988 , whichever is greater.

In AO zones, the RFPE is the designated base flood depth on the effective FIRM plus three (3) of freeboard above the highest natural adjacent grade OR and elevation to or above 7.5 feet NAVD 1988, whichever is greatest.

In Shaded X and X zones, the RFPE is 7.5 feet NAVD 1988 OR the natural grade elevation if the natural grade is greater than 7.5 feet NAVD 1988.

On the Island of Ocracoke, the RFPE is 9.0 feet NAVD 1988 for all zones.

“Remedy a Violation” means to bring the structure or other development into compliance with state and community floodplain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of the ordinance or otherwise deterring future similar violations, or reducing federal financial exposure with regard to the structure or other development.

“Riverine” means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

“Salvage Yard” means any non-residential property used for the storage, collection, and/or recycling of any type of equipment, and including but not limited to vehicles, appliances and related machinery.

“Sand Dunes” means naturally occurring accumulations of sand in ridges or mounds landward of the beach.

“Shear Wall” means walls used for structural support but not structurally joined or enclosed at the end (except by breakaway walls). Shear walls are parallel or nearly parallel to the flow of the water.

“Solid Waste Disposal Facility” means any facility involved in the disposal of solid waste, as defined in NCGS 130A-290(a) (35).

“Solid Waste Disposal Site” means, as defined in NCGS 130A-290(a) (36), any place at which solid wastes are disposed of by incineration, sanitary landfill, or any other method.

“Special Flood Hazard Area (SFHA)” means the land in the floodplain subject to a one percent (1%) or greater chance of being flooded in any given year, as determined in Article 3, Section B of this ordinance.

“Start of Construction” includes substantial improvement, and means the date the building permit was issued provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit

date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading, and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of the building, whether or not that alteration affects the external dimensions of the building.

**“Structure”** means a walled and roofed building, a manufactured home, or a gas, liquid, or liquefied gas storage tank that is principally above ground.

**“Substantial Damage”** means damage of any origin sustained by a structure during any one-year period 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. See definition of “substantial improvement”. *Substantial damage also means flood-related damage sustained by a structure on two separate occasions during a 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred.*

**“Substantial Improvement”** means any combination of repairs, reconstruction, rehabilitation, addition, or other improvement of a structure, taking place during any one-year period for which the cost equals or exceeds 50 percent of the market value of the structure before the “start of construction” of the improvement. This term includes structures which have incurred “substantial damage”, regardless of the actual repair work performed. The term does not, however, include either:

- (a) Any correction of existing violations of state or community health, sanitary, or safety code specifications which have been identified by the community code enforcement official and which are the minimum necessary to assure safe living conditions; or
- (b) Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure and the alteration is approved by variance issued pursuant to Article 4 Section E of this ordinance.

**“Technical Bulletin and Technical Fact Sheet”** means a FEMA publication that provides guidance concerning the building performance standards of the NFIP, which are contained in Title 44 of the U.S. Code of Federal Regulations at Section 60.3. The bulletins and fact sheets are intended for use primarily by State and local officials responsible for interpreting and enforcing NFIP regulations and by members of the development community, such as design professionals and builders. New bulletins, as well as updates of existing bulletins, are issued periodically as needed. The bulletins do not create regulations; rather they provide specific guidance for complying with the minimum requirements of existing NFIP regulations.

It should be noted that Technical Bulletins and Technical Fact Sheets provide guidance on the minimum requirements of the NFIP regulations. State or community requirements that exceed those of the NFIP take precedence. Design professionals should contact the community officials to determine whether more restrictive State or local regulations apply to the building or site in question. All applicable standards of the State or local building code must also be met for any building in a flood hazard area.

**“Temperature Controlled”** means having the temperature regulated by a heating and/or cooling system, built-in or appliance.

**“Variance”** is a grant of relief from the requirements of this ordinance.

**“Violation”** means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in Articles 4 and 5 is presumed to be in violation until such time as that documentation is provided.

**“Water Surface Elevation (WSE)”** means the height, in relation to NAVD 1988, of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas.

**“Watercourse”** means a lake, river, creek, stream, wash, channel or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial flood damage may occur.

### **ARTICLE 3. GENERAL PROVISIONS.**

#### **SECTION A. LANDS TO WHICH THIS ORDINANCE APPLIES.**

This ordinance shall apply to all Special Flood Hazard Areas within the jurisdiction, of Hyde County.

**SECTION B. BASIS FOR ESTABLISHING THE SPECIAL FLOOD HAZARD AREAS.**

The Special Flood Hazard Areas are those identified under the Cooperating Technical State (CTS) agreement between the State of North Carolina and FEMA in its FIS dated June 19, 2020 for Hyde County and associated DFIRM panels, including any digital data developed as part of the FIS, which are adopted by reference and declared a part of this ordinance, and all revisions thereto after January 1, 2021. Future revisions to the FIS and DFIRM panels that do not change flood hazard data within the jurisdictional authority of Hyde County are also adopted by reference and declared a part of this ordinance. Subsequent Letter of Map Revisions (LOMRs) and/or Physical Map Revisions (PMRs) shall be adopted within 3 months.

**SECTION C. ESTABLISHMENT OF FLOODPLAIN DEVELOPMENT PERMIT.**

A Floodplain Development Permit shall be required in conformance with the provisions of this ordinance prior to the commencement of any development activities within Special Flood Hazard Areas determined in accordance with the provisions of Article 3, Section B of this ordinance.

**SECTION D. COMPLIANCE.**

No structure or land shall hereafter be located, extended, converted, altered, or developed in any way without full compliance with the terms of this ordinance and other applicable regulations.

**SECTION E. ABROGATION AND GREATER RESTRICTIONS.**

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

**SECTION F. INTERPRETATION.**

In the interpretation and application of this ordinance, all provisions shall be:

- (a) Considered as minimum requirements;
- (b) Liberally construed in favor of the governing body; and
- (c) Deemed neither to limit nor repeal any other powers granted under State statutes.

**SECTION G. WARNING AND DISCLAIMER OF LIABILITY.**

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering consideration. Larger floods can and will occur. Actual flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the Special Flood Hazard Areas or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of Hyde County or by any officer or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made hereunder.

**SECTION H. PENALTIES FOR VIOLATION.**

Violation of the provisions of this ordinance or failure to comply with any of its requirements, including violation of conditions and safeguards established in connection with grants of variance or special exceptions, shall constitute a Class 1 misdemeanor pursuant to NC G.S. § 143-215.58. Any person who violates this ordinance or fails to comply with any of its requirements shall, upon conviction thereof, be fined not more than \$100.00 or imprisoned for not more than thirty (30) days, or both. Each day such violation continues shall be considered a separate offense. Nothing herein contained shall prevent Hyde County from taking such other lawful action as is necessary to prevent or remedy any violation.

**ARTICLE 4. ADMINISTRATION.**

**SECTION A. DESIGNATION OF FLOODPLAIN ADMINISTRATOR.**

The Building Inspector, hereinafter referred to as the "Floodplain Administrator", or their designee, is hereby appointed to administer and implement the provisions of this ordinance. In instances where the Floodplain Administrator receives assistance from others to complete tasks to administer and implement this ordinance, the Floodplain Administrator shall be responsible for the coordination and community's overall compliance with the National Flood Insurance Program and the provisions of this ordinance.

**SECTION B. FLOODPLAIN DEVELOPMENT APPLICATION, PERMIT AND CERTIFICATION REQUIREMENTS.**

- (1) **Application Requirements.** Application for a Floodplain Development Permit shall be made to the Floodplain Administrator prior to any development activities located within Special Flood Hazard Areas. The following items shall be presented to the Floodplain Administrator to apply for a floodplain development permit:
- (a) A plot plan drawn to scale which shall include, but shall not be limited to, the following specific details of the proposed floodplain development:
    - (i) The nature, location, dimensions, and elevations of the area of development/disturbance; existing and proposed structures, utility systems, grading/pavement areas, fill materials, storage areas, drainage facilities, and other development;
    - (ii) The boundary of the Special Flood Hazard Area as delineated on the FIRM or other flood map as determined in Article 3, Section B, or a statement that the entire lot is within the Special Flood Hazard Area;
    - (iii) Flood zone(s) designation of the proposed development area as determined on the FIRM or other flood map as determined in Article 3, Section B;
    - (iv) The boundary of the floodway(s) or non-encroachment area(s) as determined in Article 3, Section B;
    - (v) The Base Flood Elevation (BFE) where provided as set forth in Article 3, Section B; Article 4, Section C; or Article 5, Section D;
    - (vi) The old and new location of any watercourse that will be altered or relocated as a result of proposed development; and
    - (vii) The boundary and designation date of the Coastal Barrier Resource System (CBRS) area or Otherwise Protected Areas (OPA), if applicable.
  - (b) Proposed elevation, and method thereof, of all development within a Special Flood Hazard Area including but not limited to:
    - (i) Elevation in relation to NAVD 1988 of the proposed reference level (including basement) of all structures;
    - (ii) Elevation in relation to NAVD 1988 to which any non-residential structure in Zones A, AE, AH, AO, A99 will be floodproofed; and
    - (iii) Elevation in relation to NAVD 1988 to which any proposed utility systems will be elevated or floodproofed.
  - (c) If floodproofing, a Floodproofing Certificate (FEMA Form 086-0-34) with supporting data, an operational plan, and an inspection and maintenance plan that include, but are not limited to, installation, exercise, and maintenance of floodproofing measures.
  - (d) A Foundation Plan, drawn to scale, which shall include details of the proposed foundation system to ensure all provisions of this ordinance are met. These details include but are not limited to:
    - (i) The proposed method of elevation, if applicable (i.e., fill, solid foundation perimeter wall, solid backfilled

foundation, open foundation on columns/posts/piers/piles/shear walls); and

- (ii) Openings to facilitate automatic equalization of hydrostatic flood forces on walls in accordance with Article 5, Section B(4)(d) when solid foundation perimeter walls are used in Zones A, AE, AH, AO, A99.
  - (iii) The following, in Coastal High Hazard Areas, in accordance with the provisions of Article 5, Section B (4) (e) and Article 5, Section G and (Article 5, Section H if applicable):
    - (1) V-Zone Certification with accompanying plans and specifications verifying the engineered structure and any breakaway wall designs; In addition, prior to the Certificate of Compliance/Occupancy issuance, a registered professional engineer or architect shall certify the finished construction is compliant with the design, specifications and plans for VE Zone construction.
    - (2) Plans for open wood latticework or insect screening, if applicable; and
    - (3) Plans for non-structural fill, if applicable. If non-structural fill is proposed, it must be demonstrated through coastal engineering analysis that the proposed fill would not result in any increase in the BFE or otherwise cause adverse impacts by wave ramping and deflection on to the subject structure or adjacent properties.
  - (e) Usage details of any enclosed areas below the lowest floor.
  - (f) Plans and/or details for the protection of public utilities and facilities such as sewer, gas, electrical, and water systems to be located and constructed to minimize flood damage.
  - (g) Certification that all other Local, State and Federal permits required prior to floodplain development permit issuance have been received.
  - (h) Documentation for placement of Recreational Vehicles and/or Temporary Structures, when applicable, to ensure that the provisions of Article 5, Section B, subsections (6) and (7) of this ordinance are met.
  - (i) A description of proposed watercourse alteration or relocation, when applicable, including an engineering report on the effects of the proposed project on the flood-carrying capacity of the watercourse and the effects to properties located both upstream and downstream; and a map (if not shown on plot plan) showing the location of the proposed watercourse alteration or relocation.
- (2) **Permit Requirements.** The Floodplain Development Permit shall include, but not be limited to:
- (a) A complete description of all the development to be permitted under the floodplain development permit (e.g. house, garage, pool, septic, bulkhead, cabana, pier, bridge, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials, etc.).
  - (b) The Special Flood Hazard Area determination for the proposed development in accordance with available data specified in Article 3, Section B.
  - (c) The Regulatory Flood Protection Elevation required for the reference level and all attendant utilities.
  - (d) The Regulatory Flood Protection Elevation required for the protection of all public utilities.
  - (e) All certification submittal requirements with timelines.
  - (f) A statement that no fill material or other development shall encroach into the floodway or non-encroachment area of any watercourse unless the requirements of Article 5, Section F have been met.
  - (g) The flood openings requirements, if in Zones A, AE, AH, AO, A99.
  - (h) Limitations of below BFE enclosure uses. (i.e., parking, building access and limited storage only).
  - (i) A statement, if in Zone VE, that there shall be no alteration of sand dunes which would increase potential flood damage.
  - (j) A statement, if in Zone VE, that there shall be no fill used for structural support.

(k) A statement, that all materials below BFE/RFPE must be flood resistant materials.

(3) **Certification Requirements.**

(a) Elevation Certificates

(i) An Elevation Certificate (FEMA Form 086-0-33) is required after the reference level is established. Within seven (7) calendar days of establishment of the reference level elevation, it shall be the duty of the permit holder to submit to the Floodplain Administrator a certification of the elevation of the reference level, in relation to NAVD 1988. Any work done within the seven (7) day calendar period and prior to submission of the certification shall be at the permit holder's risk. The Floodplain Administrator shall review the certificate data submitted. Deficiencies detected by such review shall be corrected by the permit holder immediately and prior to further work being permitted to proceed. Failure to submit the certification or failure to make required corrections shall be cause to issue a stop-work order for the project.

(ii) A final Finished Construction Elevation Certificate (FEMA Form 086-0-33) is required after construction is completed and prior to Certificate of Compliance/Occupancy issuance. It shall be the duty of the permit holder to submit to the Floodplain Administrator a certification of final as-built construction of the elevation of the reference level and all attendant utilities. The Floodplain Administrator shall review the certificate data submitted. Deficiencies detected by such review shall be corrected by the permit holder immediately and prior to Certificate of Compliance/Occupancy issuance. In some instances, another certification may be required to certify corrected as-built construction. Failure to submit the certification or failure to make required corrections shall be cause to withhold the issuance of a Certificate of Compliance/Occupancy. The Finished Construction Elevation Certificate certifier shall provide at least 2 photographs showing the front and rear of the building taken within 90 days from the date of certification. The photographs must be taken with views confirming the building description and diagram number provided in Section A. To the extent possible, these photographs should show the entire building including foundation. If the building has split-level or multi-level areas, provide at least 2 additional photographs showing side views of the building. In addition, when applicable, provide a photograph of the foundation showing a representative example of the flood openings or vents. All photographs must be in color and measure at least 3" x 3". Digital photographs are acceptable.

(b) Floodproofing Certificate

(i) If non-residential floodproofing is used to meet the Regulatory Flood Protection Elevation requirements, a Floodproofing Certificate (FEMA Form 086-0-34), with supporting data, an operational plan, and an inspection and maintenance plan are required prior to the actual start of any new construction. It shall be the duty of the permit holder to submit to the Floodplain Administrator a certification of the floodproofed design elevation of the reference level and all attendant utilities, in relation to NAVD 1988. Floodproofing certification shall be prepared by or under the direct supervision of a professional engineer or architect and certified by same. The Floodplain Administrator shall review the certificate data, the operational plan, and the inspection and maintenance plan. Deficiencies detected by such review shall be corrected by the applicant prior to permit approval. Failure to submit the certification or failure to make required corrections shall be cause to deny a Floodplain Development Permit. Failure to construct in accordance with the certified design shall be cause to withhold the issuance of a Certificate of Compliance/Occupancy.

(ii) A final Finished Construction Floodproofing Certificate (FEMA Form 086-0-34), with supporting data, an operational plan, and an inspection and maintenance plan are required prior to the issuance of a Certificate of Compliance/Occupancy. It shall be the duty of the permit holder to submit to the Floodplain Administrator a certification of the floodproofed design elevation of the reference level and all attendant utilities, in relation to NAVD 1988. Floodproofing certificate shall be prepared by or under the direct supervision of a professional engineer or architect and certified by same. The Floodplain Administrator shall review the certificate data, the operational plan, and the inspection and maintenance plan. Deficiencies detected by such review shall be corrected by the applicant prior to Certificate of Occupancy. Failure to submit the certification or failure to make required corrections shall be cause to deny a Floodplain Development Permit. Failure to construct in accordance with the certified design shall be cause to deny a Certificate of Compliance/Occupancy.

- (c) If a manufactured home is placed within Zones A, AE, AH, AO, A99 and the elevation of the chassis is more than 36 inches in height above grade, an engineered foundation certification is required in accordance with the provisions of Article 5, Section B(3)(b).
- (d) If a watercourse is to be altered or relocated, a description of the extent of watercourse alteration or relocation; a professional engineer's certified report on the effects of the proposed project on the flood-carrying capacity of the watercourse and the effects to properties located both upstream and downstream; and a map showing the location of the proposed watercourse alteration or relocation shall all be submitted by the permit applicant prior to issuance of a floodplain development permit.
- (e) Certification Exemptions. The following structures, if located within Zones A, AE, AH, AO, A99, are exempt from the elevation/floodproofing certification requirements specified in items (a) and (b) of this subsection:
  - (i) Recreational Vehicles meeting requirements of Article 5, Section B (6) (a);
  - (ii) Temporary Structures meeting requirements of Article 5, Section B (7); and
  - (iii) Accessory Structures that are 150 square feet or less or \$5000 or less and meeting requirements of Article 5, Section B (8).
- (f) A V-Zone Certification with accompanying design plans and specifications is required prior to issuance of a Floodplain Development permit within coastal high hazard areas. It shall be the duty of the permit applicant to submit to the Floodplain Administrator said certification to ensure the design standards of this ordinance are met. A registered professional engineer or architect shall develop or review the structural design, plans, and specifications for construction and certify that the design and methods of construction to be used are in accordance with accepted standards of practice for meeting the provisions of this ordinance. This certification is not a substitute for an Elevation Certificate. In addition, prior to the Certificate of Compliance/Occupancy issuance, a registered professional engineer or architect shall certify the finished construction is compliant with the design, specifications and plans for VE Zone construction.

(4) **Determinations for existing buildings and structures.**

For applications for building permits to improve buildings and structures, including alterations, movement, enlargement, replacement, repair, change of occupancy, additions, rehabilitations, renovations, substantial improvements, repairs of substantial damage, and any other improvement of or work on such buildings and structures, the Floodplain Administrator, in coordination with the Building Official, shall:

- (a) Estimate the market value, or require the applicant to obtain an appraisal of the market value prepared by a qualified independent appraiser, of the building or structure before the start of construction of the proposed work; in the case of repair, the market value of the building or structure shall be the market value before the damage occurred and before any repairs are made;
- (b) Compare the cost to perform the improvement, the cost to repair a damaged building to its pre-damaged condition, or the combined costs of improvements and repairs, if applicable, to the market value of the building or structure;
- (c) Determine and document whether the proposed work constitutes substantial improvement or repair of substantial damage; and
- (d) Notify the applicant if it is determined that the work constitutes substantial improvement or repair of substantial damage and that compliance with the flood resistant construction requirements of the NC Building Code and this ordinance is required.

**SECTION C. DUTIES AND RESPONSIBILITIES OF THE FLOODPLAIN ADMINISTRATOR.**

The Floodplain Administrator shall perform, but not be limited to, the following duties:

- (1) Review all floodplain development applications and issue permits for all proposed development within Special Flood Hazard Areas to assure that the requirements of this ordinance have been satisfied.
- (2) Review all proposed development within Special Flood Hazard Areas to assure that all necessary local, state and federal

permits have been received, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334.

- (3) Notify adjacent communities and the North Carolina Department of Public Safety, Division of Emergency Management, State Coordinator for the National Flood Insurance Program prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Emergency Management Agency (FEMA).
- (4) Assure that maintenance is provided within the altered or relocated portion of said watercourse so that the flood-carrying capacity is maintained.
- (5) Prevent encroachments into floodways and non-encroachment areas unless the certification and flood hazard reduction provisions of Article 5, Section F are met.
- (6) Obtain actual elevation (in relation to NAVD 1988) of the reference level (including basement) and all attendant utilities of all new and substantially improved structures, in accordance with the provisions of Article 4, Section B (3).
- (7) Obtain actual elevation (in relation to NAVD 1988) to which all new and substantially improved structures and utilities have been floodproofed, in accordance with the provisions of Article 4, Section B (3).
- (8) Obtain actual elevation (in relation to NAVD 1988) of all public utilities in accordance with the provisions of Article 4, Section B (3).
- (9) When floodproofing is utilized for a particular structure, obtain certifications from a registered professional engineer or architect in accordance with the provisions of Article 4, Section B (3) and Article 5, Section B (2).
- (10) Where interpretation is needed as to the exact location of boundaries of the Special Flood Hazard Areas, floodways, or non-encroachment areas (for example, where there appears to be a conflict between a mapped boundary and actual field conditions), make the necessary interpretation. The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in this article.
- (11) When BFE data has not been provided in accordance with the provisions of Article 3, Section B, obtain, review, and reasonably utilize any BFE data, along with floodway data or non-encroachment area data available from a federal, state, or other source, including data developed pursuant to Article 5, Section D (2) (c), in order to administer the provisions of this ordinance.
- (12) When BFE data is provided but no floodway or non-encroachment area data has been provided in accordance with the provisions of Article 3, Section B, obtain, review, and reasonably utilize any floodway data or non-encroachment area data available from a federal, state, or other source in order to administer the provisions of this ordinance.
- (13) When the lowest floor and the lowest adjacent grade of a structure or the lowest ground elevation of a parcel in a Special Flood Hazard Area is above the BFE, advise the property owner of the option to apply for a Letter of Map Amendment (LOMA) from FEMA. However, if the property is to be removed from the V Zone it must not be located seaward of the landward toe of the primary frontal dune. Maintain a copy of the LOMA issued by FEMA in the floodplain development permit file.
- (14) Permanently maintain all records that pertain to the administration of this ordinance and make these records available for public inspection, recognizing that such information may be subject to the Privacy Act of 1974, as amended.
- (15) Make on-site inspections of work in progress. As the work pursuant to a floodplain development permit progresses, the Floodplain Administrator shall make as many inspections of the work as may be necessary to ensure that the work is being done according to the provisions of the local ordinance and the terms of the permit. In exercising this power, the Floodplain Administrator has a right, upon presentation of proper credentials, to enter on any premises within the jurisdiction of the community at any reasonable hour for the purposes of inspection or other enforcement action.
- (16) Issue stop-work orders as required. Whenever a building or part thereof is being constructed, reconstructed, altered, or repaired in violation of this ordinance, the Floodplain Administrator may order the work to be immediately stopped. The stop-work order shall be in writing and directed to the person doing or in charge of the work. The stop-work order shall state the specific work to be stopped, the specific reason(s) for the stoppage, and the condition(s) under which the work may be resumed. Violation of a stop-work order constitutes a misdemeanor.
- (17) Revoke floodplain development permits as required. The Floodplain Administrator may revoke and require the return of the floodplain development permit by notifying the permit holder in writing stating the reason(s) for the revocation. Permits shall

be revoked for any substantial departure from the approved application, plans, and specifications; for refusal or failure to comply with the requirements of State or local laws; or for false statements or misrepresentations made in securing the permit. Any floodplain development permit mistakenly issued in violation of an applicable State or local law may also be revoked.

- (18) Make periodic inspections throughout the Special Flood Hazard Areas within the jurisdiction of the community. The Floodplain Administrator and each member of his or her inspections department shall have a right, upon presentation of proper credentials, to enter on any premises within the territorial jurisdiction of the department at any reasonable hour for the purposes of inspection or other enforcement action.
- (19) Follow through with corrective procedures of Article 4, Section D.
- (20) Review, provide input, and make recommendations for variance requests.
- (21) Maintain a current map repository to include, but not limited to, historical and effective FIS Report, historical and effective FIRM and other official flood maps and studies adopted in accordance with the provisions of Article 3, Section B of this ordinance, including any revisions thereto including Letters of Map Change, issued by FEMA. Notify State and FEMA of mapping needs.
- (22) Coordinate revisions to FIS reports and FIRMs, including Letters of Map Revision Based on Fill (LOMR-Fs) and Letters of Map Revision (LOMRs).

#### **SECTION D. CORRECTIVE PROCEDURES.**

- (1) Violations to be corrected: When the Floodplain Administrator finds violations of applicable state and local laws; it shall be his or her duty to notify the owner or occupant of the building of the violation. The owner or occupant shall immediately remedy each of the violations of law cited in such notification.
- (2) Actions in Event of Failure to Take Corrective Action: If the owner of a building or property shall fail to take prompt corrective action, the Floodplain Administrator shall give the owner written notice, by certified or registered mail to the owner's last known address or by personal service, stating:
  - (a) That the building or property is in violation of the floodplain management regulations;
  - (b) That a hearing will be held before the Floodplain Administrator at a designated place and time, not later than ten (10) days after the date of the notice, at which time the owner shall be entitled to be heard in person or by counsel and to present arguments and evidence pertaining to the matter; and
  - (c) That following the hearing, the Floodplain Administrator may issue an order to alter, vacate, or demolish the building; or to remove fill as applicable.
- (3) Order to Take Corrective Action: If, upon a hearing held pursuant to the notice prescribed above, the Floodplain Administrator shall find that the building or development is in violation of the Flood Damage Prevention Ordinance, he or she shall issue an order in writing to the owner, requiring the owner to remedy the violation within a specified time period, not less than sixty (60) calendar days, nor more than one-hundred-eighty (180) calendar days. Where the Floodplain Administrator finds that there is imminent danger to life or other property, he or she may order that corrective action be taken in such lesser period as may be feasible.
- (4) Appeal: Any owner who has received an order to take corrective action may appeal the order to the local elected governing body by giving notice of appeal in writing to the Floodplain Administrator and the clerk within ten (10) days following issuance of the final order. In the absence of an appeal, the order of the Floodplain Administrator shall be final. The local governing body shall hear an appeal within a reasonable time and may affirm, modify and affirm, or revoke the order.
- (5) Failure to Comply with Order: If the owner of a building or property fails to comply with an order to take corrective action for which no appeal has been made or fails to comply with an order of the governing body following an appeal, the owner shall be guilty of a Class 1 misdemeanor pursuant to NC G.S. § 143-215.58 and shall be punished at the discretion of the court.

#### **SECTION E. VARIANCE PROCEDURES.**

- (1) The Hyde County Board of Commissioners as established by Hyde County, hereinafter referred to as the "appeal board", shall

hear and decide requests for variances from the requirements of this ordinance.

- (2) Any person aggrieved by the decision of the appeal board may appeal such decision to the Court, as provided in Chapter 7A of the North Carolina General Statutes.
- (3) Variances may be issued for:
  - (a) The repair or rehabilitation of historic structures upon the determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and that the variance is the minimum necessary to preserve the historic character and design of the structure;
  - (b) Functionally dependent facilities if determined to meet the definition as stated in Article 2 of this ordinance, provided provisions of Article 4, Section E(9)(b), (c), and (e) have been satisfied, and such facilities are protected by methods that minimize flood damages during the base flood and create no additional threats to public safety; or
  - (c) Any other type of development provided it meets the requirements of this Section.
- (4) In passing upon variances, the appeal board shall consider all technical evaluations, all relevant factors, all standards specified in other sections of this ordinance, and:
  - (a) The danger that materials may be swept onto other lands to the injury of others;
  - (b) The danger to life and property due to flooding or erosion damage;
  - (c) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;
  - (d) The importance of the services provided by the proposed facility to the community;
  - (e) The necessity to the facility of a waterfront location as defined under Article 2 of this ordinance as a functionally dependent facility, where applicable;
  - (f) The availability of alternative locations, not subject to flooding or erosion damage, for the proposed use;
  - (g) The compatibility of the proposed use with existing and anticipated development;
  - (h) The relationship of the proposed use to the comprehensive plan and floodplain management program for that area;
  - (i) The safety of access to the property in times of flood for ordinary and emergency vehicles;
  - (j) The expected heights, velocity, duration, rate of rise, and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site; and
  - (k) The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, and streets and bridges.
- (5) A written report addressing each of the above factors shall be submitted with the application for a variance.
- (6) Upon consideration of the factors listed above and the purposes of this ordinance, the appeal board may attach such conditions to the granting of variances as it deems necessary to further the purposes and objectives of this ordinance.
- (7) Any applicant to whom a variance is granted shall be given written notice specifying the difference between the BFE and the elevation to which the structure is to be built and that such construction below the BFE increases risks to life and property, and that the issuance of a variance to construct a structure below the BFE may result in increased premium rates for flood insurance up to \$25 per \$100 of insurance coverage. Such notification shall be maintained with a record of all variance actions, including justification for their issuance.
- (8) The Floodplain Administrator shall maintain the records of all appeal actions and report any variances to the FEMA and the State of North Carolina upon request.

(9) Conditions for Variances:

- (a) Variances shall not be issued when the variance will make the structure in violation of other federal, state, or local laws, regulations, or ordinances.
- (b) Variances shall not be issued within any designated floodway or non-encroachment area if the variance would result in any increase in flood levels during the base flood discharge.
- (c) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
- (d) Variances shall only be issued prior to development permit approval.
- (e) Variances shall only be issued upon:
  - (i) A showing of good and sufficient cause;
  - (ii) A determination that failure to grant the variance would result in exceptional hardship; and
  - (iii) A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, or extraordinary public expense, create nuisance, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

(10) A variance may be issued for solid waste disposal facilities or sites, hazardous waste management facilities, salvage yards, and chemical storage facilities that are located in Special Flood Hazard Areas provided that all of the following conditions are met.

- (a) The use serves a critical need in the community.
- (b) No feasible location exists for the use outside the Special Flood Hazard Area.
- (c) The reference level of any structure is elevated or floodproofed to at least the Regulatory Flood Protection Elevation.
- (d) The use complies with all other applicable federal, state and local laws.
- (e) Hyde County has notified the Secretary of the North Carolina Department of Public Safety of its intention to grant a variance at least thirty (30) calendar days prior to granting the variance.

**ARTICLE 5. PROVISIONS FOR FLOOD HAZARD REDUCTION.**

**SECTION A. GENERAL STANDARDS.**

In all Special Flood Hazard Areas, the following provisions are required:

- (1) All new construction and substantial improvements shall be designed (or modified) and adequately anchored to prevent flotation, collapse, and lateral movement of the structure.
- (2) All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage in accordance with the FEMA Technical Bulletin 2, *Flood Damage-Resistant Materials Requirements*.
- (3) All new construction and substantial improvements shall be constructed by methods and practices that minimize flood damages.
- (4) All new electrical, heating, ventilation, plumbing, air conditioning equipment, and other service equipment shall be located at or above the RFPE or designed and installed to prevent water from entering or accumulating within the components during the occurrence of the base flood. These include, but are not limited to, HVAC equipment, water softener units, bath/kitchen fixtures, ductwork, electric/gas meter panels/boxes, utility/cable boxes, water heaters, and electric outlets/switches.

- (a) Replacements part of a substantial improvement, electrical, heating, ventilation, plumbing, air conditioning equipment, and other service equipment shall also meet the above provisions.
  - (b) Replacements that are for maintenance and not part of a substantial improvement may be installed at the original location provided the addition and/or improvements only comply with the standards for new construction consistent with the code and requirements for the original structure.
- (5) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system.
  - (6) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into the systems and discharges from the systems into flood waters.
  - (7) On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding.
  - (8) Nothing in this ordinance shall prevent the repair, reconstruction, or replacement of a building or structure existing on the effective date of this ordinance and located totally or partially within the floodway, non-encroachment area, or stream setback, provided there is no additional encroachment below the Regulatory Flood Protection Elevation in the floodway, non-encroachment area, or stream setback, and provided that such repair, reconstruction, or replacement meets all of the other requirements of this ordinance.
  - (9) New solid waste disposal facilities and sites, hazardous waste management facilities, salvage yards, and chemical storage facilities shall not be permitted, except by variance as specified in Article 4, Section E (10). A structure or tank for chemical or fuel storage incidental to an allowed use or to the operation of a water treatment plant or wastewater treatment facility may be located in a Special Flood Hazard Area only if the structure or tank is either elevated or floodproofed to at least the Regulatory Flood Protection Elevation and certified in accordance with the provisions of Article 4, Section B (3).
  - (10) All subdivision proposals and other development proposals shall be consistent with the need to minimize flood damage.
  - (11) All subdivision proposals and other development proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.
  - (12) All subdivision proposals and other development proposals shall have adequate drainage provided to reduce exposure to flood hazards.
  - (13) All subdivision proposals and other development proposals shall have received all necessary permits from those governmental agencies for which approval is required by federal or state law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334.
  - (14) When a structure is partially located in a Special Flood Hazard Area, the entire structure shall meet the requirements for new construction and substantial improvements.
  - (15) When a structure is located in multiple flood hazard zones or in a flood hazard risk zone with multiple base flood elevations, the provisions for the more restrictive flood hazard risk zone and the highest BFE shall apply.

**SECTION B. SPECIFIC STANDARDS.**

In all Special Flood Hazard Areas where BFE data has been provided, as set forth in Article 3, Section B, or Article 5, Section D, the following provisions, in addition to the provisions of Article 5, Section A, are required:

- (1) Residential Construction. New construction and substantial improvement of any residential structure (including manufactured homes) shall have the reference level, including basement, elevated no lower than the Regulatory Flood Protection Elevation, as defined in Article 2 of this ordinance.
- (2) Non-Residential Construction. New construction and substantial improvement of any commercial, industrial, or other non-residential structure shall have the reference level, including basement, elevated no lower than the Regulatory Flood Protection Elevation, as defined in Article 2 of this ordinance. Structures located in Zones A, AE, AH, AO, A99 may be floodproofed to

the Regulatory Flood Protection Elevation in lieu of elevation provided that all areas of the structure, together with attendant utility and sanitary facilities, below the Regulatory Flood Protection Elevation are watertight with walls substantially impermeable to the passage of water, using structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. For AO Zones, the floodproofing elevation shall be in accordance with Article 5, Section I (2). A registered professional engineer or architect shall certify that the floodproofing standards of this subsection are satisfied. Such certification shall be provided to the Floodplain Administrator as set forth in Article 4, Section B (3), along with the operational plan and the inspection and maintenance plan.

(3) Manufactured Homes.

- (a) New and replacement manufactured homes shall be elevated so that the reference level of the manufactured home is no lower than the Regulatory Flood Protection Elevation, as defined in Article 2 of this ordinance.
- (b) Manufactured homes shall be securely anchored to an adequately anchored foundation to resist flotation, collapse, and lateral movement, either by certified engineered foundation system, or in accordance with the most current edition of the State of North Carolina Regulations for Manufactured Homes adopted by the Commissioner of Insurance pursuant to NCGS 143-143.15. Additionally, when the elevation would be met by an elevation of the chassis thirty-six (36) inches or less above the grade at the site, the chassis shall be supported by reinforced piers or engineered foundation. When the elevation of the chassis is above thirty-six (36) inches in height, an engineering certification is required.
- (c) All enclosures or skirting below the lowest floor shall meet the requirements of Article 5, Section B(4).
- (d) An evacuation plan must be developed for evacuation of all residents of all new, substantially improved or substantially damaged manufactured home parks or subdivisions located within flood prone areas. This plan shall be filed with and approved by the Floodplain Administrator and the local Emergency Management Coordinator.

(4) Elevated Buildings. Fully enclosed area, of new construction and substantially improved structures, which is below the lowest floor or below the lowest horizontal structural member in VE zones:

- (a) Shall not be designed or used for human habitation, but shall only be used for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises. Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage door) or limited storage of maintenance equipment (standard exterior door), or entry to the living area (stairway or elevator). The interior portion of such enclosed area shall not be finished or partitioned into separate rooms, except to enclose storage areas;
- (b) Shall not be temperature-controlled or conditioned;
- (c) Shall be constructed entirely of flood resistant materials at least to the Regulatory Flood Protection Elevation; and
- (d) Shall include, in Zones A, AE, AH, AO, A99 flood openings to automatically equalize hydrostatic flood forces on walls by allowing for the entry and exit of floodwaters. To meet this requirement, the openings must either be certified by a professional engineer or architect or meet or exceed the following minimum design criteria:
  - (i) A minimum of two flood openings on different sides of each enclosed area subject to flooding;
  - (ii) The total net area of all flood openings must be at least one (1) square inch for each square foot of enclosed area subject to flooding;
  - (iii) If a building has more than one enclosed area, each enclosed area must have flood openings to allow floodwaters to automatically enter and exit;
  - (iv) The bottom of all required flood openings shall be no higher than one (1) foot above the higher of the interior or exterior adjacent grade;
  - (v) Flood openings may be equipped with screens, louvers, or other coverings or devices, provided they permit the automatic flow of floodwaters in both directions; and
  - (vi) Enclosures made of flexible skirting are not considered enclosures for regulatory purposes, and, therefore, do not require flood openings. Masonry or wood underpinning, regardless of structural status, is considered an enclosure and requires flood openings as outlined above.

(e) Shall, in Coastal High Hazard Areas (Zone VE), meet the requirements of Article 5, Section G.

(5) Additions/Improvements.

(a) Additions and/or improvements to pre-FIRM structures when the addition and/or improvements in combination with any interior modifications to the existing structure are:

(i) Not a substantial improvement, the addition and/or improvements must be designed to minimize flood damages and must not be any more non-conforming than the existing structure.

(ii) A substantial improvement, with modifications/rehabilitations/improvements to the existing structure or the common wall is structurally modified more than installing a doorway; both the existing structure and the addition must comply with the standards for new construction.

(b) Additions to pre-FIRM or post-FIRM structures that are a substantial improvement with no modifications/rehabilitations/improvements to the existing structure other than a standard door in the common wall shall require only the addition to comply with the standards for new construction.

(c) Additions and/or improvements to post-FIRM structures when the addition and/or improvements in combination with any interior modifications to the existing structure are:

(i) Not a substantial improvement, the addition and/or improvements only must comply with the standards for new construction consistent with the code and requirements for the original structure.

(ii) A substantial improvement, both the existing structure and the addition and/or improvements must comply with the standards for new construction.

(d) Any combination of repair, reconstruction, rehabilitation, addition or improvement of a building or structure taking place during a one (1) year period, the cumulative cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started must comply with the standards for new construction. For each building or structure, the one (1) year period begins on the date of the first improvement or repair of that building or structure subsequent to the effective date of this ordinance. Substantial damage also means flood-related damage sustained by a structure on two separate occasions during a 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The requirement does not, however, include either:

(i) Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to assume safe living conditions.

(ii) Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a historic structure.

(6) Recreational Vehicles. Recreational vehicles shall either:

(a) Temporary Placement

(i) Be on site for fewer than 180 consecutive days; or

(ii) Be fully licensed and ready for highway use. (A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities, and has no permanently attached additions.)

(b) Permanent Placement. Recreational vehicles that do not meet the limitations of Temporary Placement shall meet all the requirements for new construction.

(7) Temporary Non-Residential Structures. Prior to the issuance of a floodplain development permit for a temporary structure, the applicant must submit to the Floodplain Administrator a plan for the removal of such structure(s) in the event of a hurricane, flash flood or other type of flood warning notification. The following information shall be submitted in writing to the

Floodplain Administrator for review and written approval:

- (a) A specified time period for which the temporary use will be permitted. Time specified may not exceed three (3) months, renewable up to one (1) year;
  - (b) The name, address, and phone number of the individual responsible for the removal of the temporary structure;
  - (c) The time frame prior to the event at which a structure will be removed (i.e., minimum of 72 hours before landfall of a hurricane or immediately upon flood warning notification);
  - (d) A copy of the contract or other suitable instrument with the entity responsible for physical removal of the structure; and
  - (e) Designation, accompanied by documentation, of a location outside the Special Flood Hazard Area, to which the temporary structure will be moved.
- (8) Accessory Structures. When accessory structures (sheds, detached garages, etc.) are to be placed within a Special Flood Hazard Area, the following criteria shall be met:
- (a) Accessory structures shall not be used for human habitation (including working, sleeping, living, cooking or restroom areas);
  - (b) Accessory structures shall not be temperature-controlled;
  - (c) Accessory structures shall be designed to have low flood damage potential;
  - (d) Accessory structures shall be constructed and placed on the building site so as to offer the minimum resistance to the flow of floodwaters;
  - (e) Accessory structures shall be firmly anchored in accordance with the provisions of Article 5, Section A (1);
  - (f) Accessory structures, regardless of the size or cost, shall not be placed below elevated buildings in V and VE Zones;
  - (g) All service facilities such as electrical shall be installed in accordance with the provisions of Article 5, Section A (4); and
  - (g) Flood openings to facilitate automatic equalization of hydrostatic flood forces shall be provided below Regulatory Flood Protection Elevation in conformance with the provisions of Article 5, Section B(4)(d).

An accessory structure with a footprint less than 150 square foot or that is a minimal investment of \$5000 or less and satisfies the criteria outlined above is not required to meet the elevation or floodproofing standards of Article 5, Section B (2). Elevation or floodproofing certifications are required for all other accessory structures in accordance with Article 4, Section B (3).

- (9) Tanks. When gas and liquid storage tanks are to be placed within a Special Flood Hazard Area, the following criteria shall be met:
- (a) Underground tanks. Underground tanks in flood hazard areas shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads during conditions of the design flood, including the effects of buoyancy assuming the tank is empty;
  - (b) Above-ground tanks, elevated. Above-ground tanks in flood hazard areas shall be elevated to or above the Regulatory Flood Protection Elevation on a supporting structure that is designed to prevent flotation, collapse or lateral movement during conditions of the design flood. Tank-supporting structures shall meet the foundation requirements of the applicable flood hazard area;
  - (c) Above-ground tanks not elevated. Above-ground tanks that do not meet the elevation requirements of Article 5, Section B (2) of this ordinance shall not be permitted in V or VE Zones. Tanks may be permitted in other flood hazard areas provided the tanks are designed, constructed, installed, and anchored to resist all flood-related and other loads, including the effects of buoyancy, during conditions of the design flood and without release of contents in the floodwaters or infiltration by floodwaters into the tanks. Tanks shall be designed, constructed, installed, and anchored to resist the

potential buoyant and other flood forces acting on an empty tank during design flood conditions.

- (d) Tank inlets and vents. Tank inlets, fill openings, outlets and vents shall be:
    - (i) At or above the Regulatory Flood Protection Elevation or fitted with covers designed to prevent the inflow of floodwater or outflow of the contents of the tanks during conditions of the design flood; and
    - (ii) Anchored to prevent lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy, during conditions of the design flood.
- (10) Other Development.
- (a) Fences in regulated floodways and NEAs that have the potential to block the passage of floodwaters, such as stockade fences and wire mesh fences, shall meet the limitations of Article 5, Section F of this ordinance.
  - (b) Retaining walls, sidewalks and driveways in regulated floodways and NEAs. Retaining walls and sidewalks and driveways that involve the placement of fill in regulated floodways shall meet the limitations of Article 5, Section F of this ordinance.
  - (c) Roads and watercourse crossings in regulated floodways and NEAs. Roads and watercourse crossings, including roads, bridges, culverts, low-water crossings and similar means for vehicles or pedestrians to travel from one side of a watercourse to the other side, that encroach into regulated floodways shall meet the limitations of Article 5, Section F of this ordinance.
  - (d) Commercial storage facilities are not considered "limited storage" as noted in this ordinance, and shall be protected to the Regulatory Flood Protection Elevation as required for commercial structures.

**SECTION C. RESERVED.**

**SECTION D. STANDARDS FOR FLOODPLAINS WITHOUT ESTABLISHED BASE FLOOD ELEVATIONS.**

Within the Special Flood Hazard Areas designated as Approximate Zone A and established in Article 3, Section B, where no BFE data has been provided by FEMA, the following provisions, in addition to the provisions of Article 5, Section A, shall apply:

- (1) No encroachments, including fill, new construction, substantial improvements or new development shall be permitted within a distance of twenty (20) feet each side from top of bank or five times the width of the stream, whichever is greater, unless certification with supporting technical data by a registered professional engineer is provided demonstrating that such encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.
- (2) The BFE used in determining the Regulatory Flood Protection Elevation shall be determined based on the following criteria:
  - (a) When BFE data is available from other sources, all new construction and substantial improvements within such areas shall also comply with all applicable provisions of this ordinance and shall be elevated or floodproofed in accordance with standards in Article 5, Sections A and B.
  - (b) When floodway or non-encroachment data is available from a Federal, State, or other source, all new construction and substantial improvements within floodway and non-encroachment areas shall also comply with the requirements of Article 5, Sections B and F.
  - (c) All subdivision, manufactured home park and other development proposals shall provide BFE data if development is greater than five (5) acres or has more than fifty (50) lots/manufactured home sites. Such BFE data shall be adopted by reference in accordance with Article 3, Section B and utilized in implementing this ordinance.
  - (d) When BFE data is not available from a Federal, State, or other source as outlined above, the reference level shall be elevated or floodproofed (nonresidential) to or above the Regulatory Flood Protection Elevation, as defined in Article 2. All other applicable provisions of Article 5, Section B shall also apply.

**SECTION E. STANDARDS FOR RIVERINE FLOODPLAINS WITH BASE FLOOD ELEVATIONS BUT WITHOUT ESTABLISHED FLOODWAYS OR NON-ENCROACHMENT AREAS.**

Along rivers and streams where BFE data is provided by FEMA or is available from another source but neither floodway nor non-encroachment areas are identified for a Special Flood Hazard Area on the FIRM or in the FIS report, the following requirements shall apply to all development within such areas:

- (1) Standards of Article 5, Sections A and B; and
- (2) Until a regulatory floodway or non-encroachment area is designated, no encroachments, including fill, new construction, substantial improvements, or other development, shall be permitted unless certification with supporting technical data by a registered professional engineer is provided demonstrating 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 (1) foot at any point.

**SECTION F. FLOODWAYS AND NON-ENCROACHMENT AREAS.**

Areas designated as floodways or non-encroachment areas are located within the Special Flood Hazard Areas established in Article 3, Section B. The floodways and non-encroachment areas are extremely hazardous areas due to the velocity of floodwaters that have erosion potential and carry debris and potential projectiles. The following provisions, in addition to standards outlined in Article 5, Sections A and B, shall apply to all development within such areas:

- (1) No encroachments, including fill, new construction, substantial improvements and other developments shall be permitted unless:
  - (a) It is demonstrated that the proposed encroachment would not result in any increase in the flood levels during the occurrence of the base flood discharge, based on hydrologic and hydraulic analyses performed in accordance with standard engineering practice and presented to the Floodplain Administrator prior to issuance of floodplain development permit; or
  - (b) A Conditional Letter of Map Revision (CLOMR) has been approved by FEMA. A Letter of Map Revision (LOMR) must also be obtained within six months of completion of the proposed encroachment.
- (2) If Article 5, Section F (1) is satisfied, all development shall comply with all applicable flood hazard reduction provisions of this ordinance.
- (3) Manufactured homes may be permitted provided the following provisions are met:
  - (a) The anchoring and the elevation standards of Article 5, Section B (3); and
  - (b) The encroachment standards of Article 5, Section F (1).

**SECTION G. COASTAL HIGH HAZARD AREA (ZONE VE).**

Coastal High Hazard Areas are Special Flood Hazard Areas established in Article 3, Section B, and designated as Zones VE. These areas have special flood hazards associated with high velocity waters from storm surges or seismic activity and, therefore, all new construction and substantial improvements shall meet the following provisions in addition to the provisions of Article 5, Sections A and B:

- (1) All new construction and substantial improvements shall:
  - (a) Be located landward of the reach of mean high tide;
  - (b) Comply with all applicable CAMA setback requirements.
- (2) All new construction and substantial improvements shall be elevated so that the bottom of the lowest horizontal structural member of the lowest floor (excluding pilings or columns) is no lower than the regulatory flood protection elevation. Floodproofing shall not be utilized on any structures in Coastal High Hazard Areas to satisfy the regulatory flood protection elevation requirements.

(3) All new construction and substantial improvements shall have the space below the bottom of the lowest horizontal structural member of the lowest floor either be free of obstruction or constructed with breakaway walls, open wood latticework or insect screening, provided they are not part of the structural support of the building and are designed so as to breakaway, under abnormally high tides or wave action without causing damage to the elevated portion of the building or supporting foundation system or otherwise jeopardizing the structural integrity of the building. The following design specifications shall be met:

(a) Material shall consist of open wood or plastic lattice having at least 40 percent of its area open, or

(b) Insect screening; or

(c) Breakaway walls shall meet the following design specifications:

(1) Breakaway walls shall have flood openings that allow for the automatic entry and exit of floodwaters to minimize damage caused by hydrostatic loads, per Article 5, Section B(4)(d) (i-vi); and

(2) Design safe loading resistance shall be not less than 10 nor more than 20 pounds per square foot; or

(3) Breakaway walls that exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by State or local codes) shall be certified by a registered professional engineer or architect that the breakaway wall will collapse from a water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). The water loading values used shall be those associated with the base flood. The wind loading values used shall be those required by the North Carolina State Building Code.

(4) All new construction and substantial improvements shall be securely anchored to pile or column foundations. All pilings and columns and the structure attached thereto shall be anchored to resist flotation, collapse, and lateral movement due to the effect of wind and water loads acting simultaneously on all building components.

(a) Water loading values used shall be those associated with the base flood.

(b) Wind loading values used shall be those required by the current edition of the North Carolina State Building Code.

(5) For concrete pads, including patios, decks, parking pads, walkways, driveways, pool decks, etc. the following is required:

(a) Shall be structurally independent of the primary structural foundation system of the structure and shall not adversely affect structures through redirection of floodwaters or debris;

(b) Shall be constructed to breakaway cleanly during design flood conditions, shall be frangible, and shall not produce debris capable of causing damage to any structure. (The installation of concrete in small segments (approximately 4 feet x 4 feet) that will easily break up during the base flood event, or score concrete in 4 feet x 4 feet maximum segments is acceptable to meet this standard);

(c) Reinforcing, including welded wire fabric, shall not be used in order to minimize the potential for concreted pads being a source of debris;

(d) Pad thickness shall not exceed 4 inches; or

(e) Provide a Design Professional's certification stating the design and method of construction to be used meet the applicable criteria of this section.

(6) For swimming pools and spas, the following is required:

(a) Be designed to withstand all flood-related loads and load combinations.

(b) Be elevated so that the lowest horizontal structural member is elevated above the RFPE; or

(c) Be designed and constructed to break away during design flood conditions without producing debris capable of causing damage to any structure; or

Commented [BD1]: A ratio of 40 percent means that only 29% of the area would be open. The new verbiage matches the Technical Bulletin 5 wording.

- (d) Be sited to remain in the ground during design flood conditions without obstructing flow that results in damage to any structure.
  - (e) Registered design professionals must certify to local officials that a pool or spa beneath or near a VE Zone building will not be subject to flotation or displacement that will damage building foundations or elevated portions of the building or any nearby buildings during a coastal flood.
  - (f) Pool equipment shall be located above the RFPE whenever practicable. Pool equipment shall not be located beneath an elevated structure.
- (7) All elevators, vertical platform lifts, chair lifts, etc., the following is required:
- (a) Elevator enclosures must be designed to resist hydrodynamic and hydrostatic forces as well as erosion, scour, and waves.
  - (b) Utility equipment in Coastal High Hazard Areas (VE Zones) must not be mounted on, pass through, or be located along breakaway walls.
  - (c) The cab, machine/equipment room, hydraulic pump, hydraulic reservoir, counter weight and roller guides, hoist cable, limit switches, electric hoist motor, electrical junction box, circuit panel, and electrical control panel are all required to be above RFPE. When this equipment cannot be located above the RFPE, it must be constructed using flood damage-resistant components.
  - (d) Elevator shafts/enclosures that extend below the RFPE shall be constructed of reinforced masonry block or reinforced concrete walls and located on the landward side of the building to provide increased protection from flood damage. Drainage must be provided for the elevator pit.
  - (e) Flood damage-resistant materials can also be used inside and outside the elevator cab to reduce flood damage. Use only stainless steel doors and door frames below the BFE. Grouting in of door frames and sills is recommended.
  - (f) If an elevator is designed to provide access to areas below the BFE, it shall be equipped with a float switch system that will activate during a flood and send the elevator cab to a floor above the RFPE.
- (8) Accessory structures, regardless of size or cost, shall not be permitted below elevated structures.
- (9) Property owners shall be required to execute and record a non-conversion agreement prior to issuance of a building permit declaring that the area below the lowest floor, or the detached accessory building shall not be improved, or otherwise converted; \_\_\_\_\_ (community name) will have the right to inspect the enclosed area. This agreement shall be recorded with the \_\_\_\_\_ (county name) County Register of Deeds and shall transfer with the property in perpetuity. *(OPTIONAL) (this goes with the definition section)*
- (10) Release of restrictive covenant. If a property which is bound by a non-conversion agreement is modified to remove enclosed areas below BFE, then the owner may request release of restrictive covenant after staff inspection and submittal of confirming documentation. *(OPTIONAL) (If you have 9 you need 10)*
- (11) A registered professional engineer or architect shall certify that the design, specifications and plans for construction are in compliance with the provisions of Article 4, Section B and Article 5, Section G (3) and (4), on the current version of the North Carolina V-Zone Certification form or equivalent local version. In addition, prior to the Certificate of Compliance/Occupancy issuance, a registered professional engineer or architect shall certify the finished construction is compliant with the design, specifications and plans for VE Zone construction.
- (12) Fill/Grading
- (a) Minor grading and the placement of minor quantities of nonstructural fill may be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
  - (b) The fill material must be similar and consistent with the natural soils in the area.
  - (c) The placement of site-compatible, non-structural fill under or around an elevated building is limited to two (2) feet. Fill greater than two (2) feet must include an analysis prepared by a qualified registered design professional demonstrating

no harmful diversion of floodwaters or wave run up and wave reflection that would increase damage to adjacent elevated buildings and structures.

- (d) Nonstructural fill with finished slopes that are steeper than five (5) units horizontal to one (1) unit vertical shall be permitted only if an analysis prepared by a qualified registered design professional demonstrates no harmful diversion of floodwaters or wave run up and wave reflection that would increase damage to adjacent elevated buildings and structures.
- (13) There shall be no alteration of sand dunes or mangrove stands which would increase potential flood damage.
- (14) No manufactured homes shall be permitted except in an existing manufactured home park or subdivision. A replacement manufactured home may be placed on a lot in an existing manufactured home park or subdivision provided the anchoring and elevation standards of this Section have been satisfied.
- (15) Recreational vehicles may be permitted in Coastal High Hazard Areas provided that they meet the Recreational Vehicle criteria of Article 5, Section B(6)(a).
- (16) A deck that is structurally attached to a building or structure shall have the bottom of the lowest horizontal structural member at or above the Regulatory Flood Protection Elevation and any supporting members that extend below the Regulatory Flood Protection Elevation shall comply with the foundation requirements that apply to the building or structure, which shall be designed to accommodate any increased loads resulting from the attached deck. The increased loads must be considered in the design of the primary structure and included in the V-Zone Certification required under Article 4, Section B, (3)(f).
- (17) A deck or patio that is located below the Regulatory Flood Protection Elevation shall be structurally independent from buildings or structures and their foundation systems, and shall be designed and constructed either to remain intact and in place during design flood conditions or to break apart into small pieces to minimize debris during flooding that is capable of causing structural damage to the building or structure or to adjacent buildings and structures.
- (18) In coastal high hazard areas, development activities other than buildings and structures shall be permitted only if also authorized by the appropriate state or local authority; if located outside the footprint of, and not structurally attached to, buildings and structures; and if analyses prepared by qualified registered design professionals demonstrate no harmful diversion of floodwaters or wave run up and wave reflection that would increase damage to adjacent buildings and structures. Such other development activities include but are not limited to:
  - (a) Bulkheads, seawalls, retaining walls, revetments, and similar erosion control structures;
  - (b) Solid fences and privacy walls, and fences prone to trapping debris, unless designed and constructed to fail under flood conditions less than the design flood or otherwise function to avoid obstruction of floodwaters.
  - (c) Docks, piers, and similar structures.
- (19) No more than four (4) electrical outlets and no more than four (4) electrical switches may be permitted below RFPE unless required by building code.

#### **SECTION H. STANDARDS FOR COASTAL A ZONES (ZONE CAZ) LHMWA (maximum 630 CRS points)**

Structures in CAZs shall be designed and constructed to meet V Zone requirements, including requirements for breakaway walls. However, the NFIP regulations also require flood openings in walls surrounding enclosures below elevated buildings in CAZs (see Technical Bulletin 1, *Openings in Foundation Walls and Walls of Enclosures*). Breakaway walls used in CAZs must have flood openings that allow for the automatic entry and exit of floodwaters to minimize damage caused by hydrostatic loads. Openings also function during smaller storms or if anticipated wave loading does not occur with the base flood.

- (1) All new construction and substantial improvements shall be elevated so that the bottom of the lowest horizontal structural member of the lowest floor (excluding pilings or columns) is no lower than the regulatory flood protection elevation. Floodproofing shall not be utilized on any structures in Coastal A Zones to satisfy the regulatory flood protection elevation requirements.

- (2) All new construction and substantial improvements shall have the space below the bottom of the lowest horizontal structural member of the lowest floor either be free of obstruction or constructed with breakaway walls, open wood latticework or insect screening, provided they are not part of the structural support of the building and are designed so as to breakaway, under abnormally high tides or wave action without causing damage to the elevated portion of the building or supporting foundation system or otherwise jeopardizing the structural integrity of the building. The following design specifications shall be met:
  - (a) Material shall consist of open wood or plastic lattice having at least 40 percent of its area open, or
  - (b) Insect screening; or
  - (c) Breakaway walls shall meet the following design specifications:
    - (1) Breakaway walls shall have flood openings to automatically equalize hydrostatic flood forces on walls by allowing for the entry and exit of floodwaters. To meet this requirement, the openings must either be certified by a professional engineer or architect or meet or exceed the design criteria in Article 5, Section B(4)(d); and
    - (2) Design safe loading resistance shall be not less than 10 nor more than 20 pounds per square foot; or
    - (3) Breakaway walls that exceed a design safe loading resistance of 20 pounds per square foot (either by design or when so required by State or local codes) shall be certified by a registered professional engineer or architect that the breakaway wall will collapse from a water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (structural and non-structural). The water loading values used shall be those associated with the base flood. The wind loading values used shall be those required by the North Carolina State Building Code.
- (3) Concrete pads, including patios, decks, parking pads, walkways, driveways, etc. must meet the provisions of Article 5, Section G (5).
- (4) All new construction and substantial improvements shall meet the provisions of Article 5, Section G (3).
- (5) A registered professional engineer or architect shall certify that the design, specifications and plans for construction are in compliance with the provisions of Article 4, Section B and Article 5, Section G (3) and (4), on the current version of the North Carolina V-Zone Certification form or a locally developed V-Zone Certification form.
- (6) Recreational vehicles may be permitted in Coastal A Zones provided that they meet the Recreational Vehicle criteria of Article 5, Section B(6)(a).
- (7) Fill/Grading must meet the provisions of Article 5, Section G (11)
- (8) Decks and patios must meet the provisions of Article 5 Section G (15) and (16).
- (9) In coastal high hazard areas, development activities other than buildings and structures must meet the provisions of Article 5, Section G (17)

**SECTION I. STANDARDS FOR AREAS OF SHALLOW FLOODING (ZONE AO).**

Located within the Special Flood Hazard Areas established in Article 3, Section B, are areas designated as shallow flooding areas. These areas have special flood hazards associated with base flood depths of one (1) to three (3) feet where a clearly defined channel does not exist and where the path of flooding is unpredictable and indeterminate. In addition to Article 5, Sections A and B, all new construction and substantial improvements shall meet the following requirements:

- (1) The reference level shall be elevated at least as high as the depth number specified on the Flood Insurance Rate Map (FIRM), in feet, plus a freeboard of three (3) feet, above the highest adjacent grade; or at least 7.5 feet NAVD 1988 whichever is greater above the highest adjacent grade if no depth number is specified.
- (2) Non-residential structures may, in lieu of elevation, be floodproofed to the same level as required in Article 5, Section I (1) so that the structure, together with attendant utility and sanitary facilities, below that level shall be watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. Certification is required in accordance with Article 4, Section B (3) and

Article 5, Section B (2).

- (3) Adequate drainage paths shall be provided around structures on slopes, to guide floodwaters around and away from proposed structures.

**SECTION J. STANDARDS FOR AREAS OF SHALLOW FLOODING (ZONE AH).**

Located within the Special Flood Hazard Areas established in Article 3, Section B, are areas designated as shallow flooding areas. These areas are subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are one (1) to three (3) feet. Base Flood Elevations are derived from detailed hydraulic analyses are shown in this zone. In addition to Article 5, Sections A and B, all new construction and substantial improvements shall meet the following requirements:

- (1) Adequate drainage paths shall be provided around structures on slopes, to guide floodwaters around and away from proposed structures.

**ARTICLE 6. LEGAL STATUS PROVISIONS.**

**SECTION A. EFFECT ON RIGHTS AND LIABILITIES UNDER THE EXISTING FLOOD DAMAGE PREVENTION ORDINANCE.**

This ordinance in part comes forward by re-enactment of some of the provisions of the Flood Damage Prevention Ordinance enacted December 15, 1986 as amended, and it is not the intention to repeal but rather to re-enact and continue to enforce without interruption of such existing provisions, so that all rights and liabilities that have accrued thereunder are reserved and may be enforced. The enactment of this ordinance shall not affect any action, suit or proceeding instituted or pending. All provisions of the Flood Damage Prevention Ordinance of Hyde County enacted on December 15, 1986, as amended, which are not reenacted herein are repealed.

**SECTION B. EFFECT UPON OUTSTANDING FLOODPLAIN DEVELOPMENT PERMITS.**

Nothing herein contained shall require any change in the plans, construction, size, or designated use of any development or any part thereof for which a floodplain development permit has been granted by the Floodplain Administrator or his or her authorized agents before the time of passage of this ordinance; provided, however, that when construction is not begun under such outstanding permit within a period of six (6) months subsequent to the date of issuance of the outstanding permit, construction or use shall be in conformity with the provisions of this ordinance.

**SECTION C. SEVERABILITY.**

If any section, clause, sentence, or phrase of the Ordinance is held to be invalid or unconstitutional by any court of competent jurisdiction, then said holding shall in no way effect the validity of the remaining portions of this Ordinance.

**SECTION D. EFFECTIVE DATE.**

This ordinance shall become effective \_\_\_\_\_ day of \_\_\_\_\_ 2020.

**SECTION E. ADOPTION CERTIFICATION.**

I hereby certify that this is a true and correct copy of the Flood Damage Prevention Ordinance as adopted by the Board of Commissioners of Hyde County, North Carolina, on the \_\_\_\_ day of \_\_\_\_\_, 2020.

WITNESS my hand and the official seal of Hyde County, this the \_\_\_\_ day of \_\_\_\_\_, 2020.

\_\_\_\_\_  
Earl Pugh Jr  
Chairman  
Hyde County Board of Commissioners

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Lois Stotesberry  
Clerk  
Hyde County Board of Commissioners

(SEAL)



## Building Higher in Flood Zones: Freeboard – Reduce Your Risk, Reduce Your Premium

One way flood risk is communicated is through maps that show base flood elevations (BFEs), or the height floodwaters would reach during a 1-percent-annual-chance flood in any given year.

*Freeboard* is a term used by FEMA’s National Flood Insurance Program (NFIP) to describe a factor of safety usually expressed in feet above the 1-percent-annual-chance flood level. The NFIP requires the lowest floor of structures built in Special Flood Hazard Areas (SFHAs) to be at or above the BFE, so a structure built with freeboard would have its lowest floor 1 foot or more above the BFE. Adding freeboard will reduce NFIP insurance premiums.

### Benefits of Freeboard

There are many benefits to incorporating freeboard into new construction plans, the most important being safety (Figure 1). Freeboard provides a margin of safety against extraordinary or unknown flood risk. BFEs reflect estimates of flood risk, but there are many unknown factors that can cause flood heights to rise above the BFE, such as wave action, bridge and culvert openings being blocked by debris, and development in the floodplain. It is important to remember that floods more severe than the 1-percent-annual-chance event can and do occur.

Other benefits of freeboard include incurring less damage, easier and faster cleanup after a flood event, and lower flood insurance rates. Incorporating freeboard into building plans can result in substantial savings in flood insurance premiums each year, especially for buildings located in Zone V (a coastal flood zone at risk from wave action). Figure 2 shows potential flood insurance rates based on the amount of freeboard in both riverine (Zone AE) and coastal (Zone VE) environments.

Communities that incorporate freeboard into their local floodplain ordinances can earn discounts on flood insurance by participating in the NFIP’s Community Rating System (CRS) program. CRS rewards communities that engage in floodplain management activities that exceed NFIP standards by offering discounts of up to 45 percent on flood insurance policies written for SFHAs in NFIP-participating communities.



Figure 1: House elevated above the BFE with 1 foot of freeboard

### What is Floodplain Management?

Floodplain management is the operation of a program of preventive and corrective measures for reducing flood damage. FEMA helps communities develop floodplain management regulations that comply with NFIP regulations. Communities may adopt more restrictive regulations. Community officials may have knowledge of local conditions that require higher standards than the NFIP regulations, particularly for human safety.

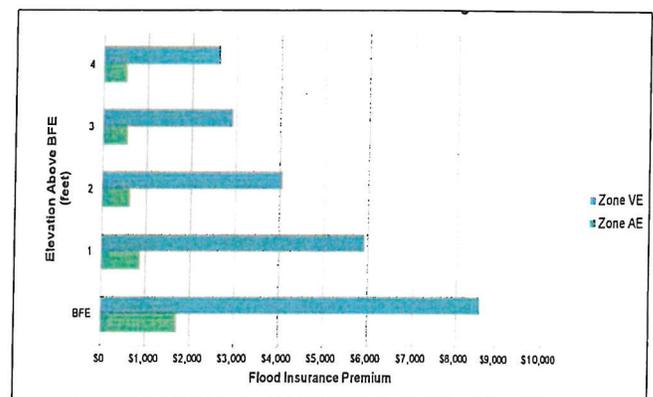


Figure 2: Maximum coverage for a \$250,000 residential building and \$100,000 contents

## Benefit-Cost Comparison

Incorporating freeboard into new construction is extremely cost effective. The up-front costs are generally only about 0.25 to 1.5 percent of the total construction costs for each foot of freeboard. However, the long-term savings on flood insurance will more than offset these costs.

For example, adding 2 feet of freeboard to a new home might add \$20 a month to the mortgage payment, or \$240 per year. The resulting flood insurance savings could be more than \$1,000 a year for a building in Zone AE (for instance, in a riverine flood zone not affected by wave action) and \$2,000 a year in Zone VE.

Many States and communities have incorporated freeboard requirements into the elevation and floodproofing requirements stipulated by the NFIP. Freeboard requirements can range from 6 inches to 4 feet, and it would be up to the community to decide what is most appropriate given their location and other community conditions.

### *Historically Speaking...*

Freeboard was (and still is) a nautical term. It refers to the height of a ship's deck above the waterline. If you think of the lowest floor of your house as the deck of your ship, and the BFE as the height of the sea, freeboard is the extra height that keeps the larger waves off your deck.

### FOR MORE INFORMATION...

**FEMA's Floodplain Management Branch**  
About floodplain management's role in the NFIP:  
<http://www.fema.gov/floodplain-management>

**FEMA 347 – Above the Flood: Elevating Your Floodprone House:**  
<http://www.fema.gov/media-library/assets/documents/725?id=1424>

**FEMA 312 – Homeowner's Guide to Retrofitting:**  
<http://www.fema.gov/media-library/assets/documents/480?id=1420>

**Homebuilder's Guide to Coastal Construction:**  
A series of fact sheets providing information about responsible building practices including freeboard.  
<http://www.fema.gov/library/viewRecord.do?id=2138>

**FloodSmart**  
Information for consumers and insurance agents about flood insurance and the NFIP  
[www.FloodSmart.gov](http://www.FloodSmart.gov)



## Costs of Building Higher

Under the rules of the National Flood Insurance Program, buildings must be protected to the Base Flood Elevation (BFE). Therefore, the cost of freeboard is just the additional cost of building higher than the minimum NFIP standard.

A study conducted by ASFPM in February 2017 estimated the approximate cost of building higher for a 2,000-square foot house. The study assumed the house was constructed to NFIP standards and then estimated the additional cost of building higher than the BFE (see table below).

Foundation Type*	Cost per add'l foot
Concrete block piers	\$890
Crawlspace with concrete block walls	\$1,850
Crawlspace with poured concrete walls	\$2,155
Stem wall with fill	\$2,345
Fill only	\$4,470

Using a house on fill with a stem wall (as illustrated on the cover), here are the average construction costs for building higher:

- 1 foot: \$2,345
- 2 feet: \$2,345 x 2 = \$4,690
- 3 feet: \$2,345 x 3 = \$7,035

*\*Costs are lower for other foundations.*

## Return on Investment

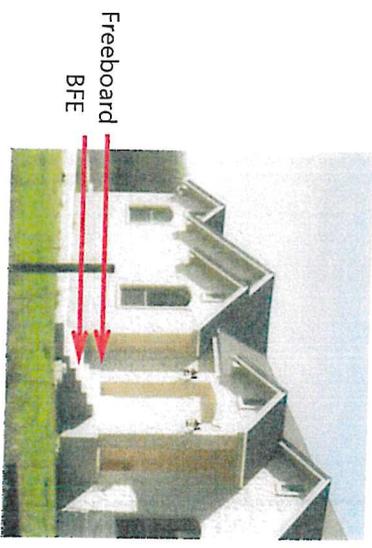
The owner of a building built higher will realize savings in two ways. The most important is when the area floods again and the building is not damaged. Also, the owner doesn't have to relocate, repair and rebuild.

Another form of savings is a reduced cost in flood insurance, which is required by most lenders. For example, using a 2,000-square foot home with a stem wall foundation with the floor 2 feet above the BFE (with fill underneath).

- Additional cost of construction: \$4,690
  - Annual flood insurance premium built to the BFE: \$2,147
  - Annual flood insurance premium built 2 feet above the BFE: \$734
  - Annual flood premium savings: \$1,413
  - Number of years to pay off \$4,690 via premium savings: 3.3 years
  - Added savings realized during a 30-year mortgage: \$37,300\*
- Another benefit of building is higher is potentially increase in value at the time of sale due to lower risk and lower insurance costs.

*\*Savings are greater for other foundations.*

## The Costs & Benefits of Building Higher



Assn. of State Floodplain Managers

[www.floods.org](http://www.floods.org)

## Building in the Floodplain

Communities that participate in the National Flood Insurance Program must ensure all new residential buildings constructed in the floodplain are elevated to or above the base flood elevation (BFE). The base flood is the flood that has a 1% chance of occurring or being exceeded in any given year.

Many communities concluded the BFE is not a sufficient level of protection, saying:

- Floods higher than the base flood can and do occur.
- Most flood studies do not account for debris or obstructions during the base flood, thereby underestimating the BFE.
- NFIP flood studies do not account for the impacts of future development or sea level rise. Over time, the regulatory standard does not keep up with increases in flood elevations.

→ In non-coastal areas, the protection level is measured at the top of the lowest floor, leaving the flooring, subfloor and floor joists exposed to the base flood.

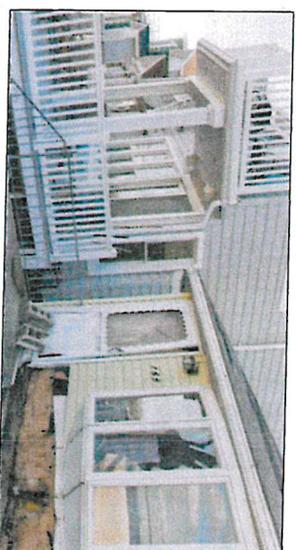
To offset these shortcomings of building only to the BFE, over half of the communities in the country require new buildings to be protected to one or more feet *higher* than the BFE. Floodplain managers call this “freeboard.”

## Flood Damage Protection

A building built higher than the minimum level required by the NFIP is better protected from:

- Waves that are higher than the BFE,
- Unpredictable flooding conditions, such as debris at a bridge or culvert that creates a dam to stream flow,
- Increases in flood heights due to development and climate change, and
- Damage to the floor joists and other parts of the building lower than the top of the lowest floor.

Through a national consensus process, building higher has been part of the International Building and Residential Codes and the American Society of Civil Engineers’ flood design and construction standard (ASCE 24).



Thousands of dollars in flood damage can be prevented by building higher.

## Flood Insurance Premiums

While the BFE is the minimum standard for communities in the NFIP, the program encourages regulations that set a higher protection level (44 CFR 60.1(d)).

As seen in the table below, flood insurance premiums are significantly lower for buildings with 1, 2 or 3 feet of freeboard.

More than 40 years of insurance claims experience has proven these buildings suffer much less flood damage. Less potential for damage means lower premiums.

Flood Insurance Premium Comparison		
Zone	Freeboard	Premium
AE	At BFE (no freeboard)	\$2,147
AE	BFE + 1 foot	\$1,106
AE	BFE + 2 feet	\$734
AE	BFE + 3 feet	\$614

Premiums are for a single-family house, one floor, slab on grade, stem wall foundation, or crawlspace with proper flood openings, \$200,000 in building coverage, \$80,000 in contents coverage, \$1,000 deductible, no CRS discount, April 2017 *Flood Insurance Manual*

Lower insurance premiums are an immediate benefit to the property owner. Other benefits include less flood damage in the community, less suffering, less business interruption, quicker recovery, and higher property values.



# Openings in Foundation Walls and Walls of Enclosures

Below Elevated Buildings in Special Flood Hazard Areas  
in accordance with the National Flood Insurance Program

*Technical Bulletin 1 / August 2008*



**FEMA**

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Comments on the Technical Bulletins should be directed to:

Department of Homeland Security  
FEMA Mitigation Directorate  
500 C Street, SW.  
Washington, D.C. 20472

Technical Bulletin 1-08 replaces Technical Bulletin 1-93, *Openings in Foundation Walls*.

Photograph Credits:

Figure 3. Bill Bryant, Anne Arundel County, Maryland  
Figure 4. Smart Vent, Inc.  
Figure 17. North Carolina Emergency Management/T. Riddle

## Introduction

Protecting buildings that are constructed in special flood hazard areas (SFHAs) from damage caused by flood forces is an important objective of the National Flood Insurance Program (NFIP). In support of this objective, the NFIP regulations include minimum building design criteria that apply to new construction, repair of substantially damaged buildings, and substantial improvement of existing buildings in SFHAs. The base flood is used to delineate SFHAs on Flood Insurance Rate Maps (FIRMs) prepared by the NFIP. The base flood is the flood that has a 1-percent chance of being equaled or exceeded in any given year (commonly called the “100-year” flood). Certain terms used in this Technical Bulletin are defined in the Glossary.

The NFIP regulations require that residential buildings constructed in A zones have the lowest floor (including basement) elevated to or above the base flood elevation (BFE). In this Technical Bulletin, the term “A zones” includes all zones shown on FIRMs as Zones A, AE, A1-A30, AR, AO, and AH.

Enclosed areas (enclosures) are permitted under elevated buildings provided the enclosed areas meet certain use restrictions and construction requirements related to flood resistance, including use of flood damage-resistant materials and installation of openings to allow for automatic entry and exit of floodwaters. Enclosures under buildings in V zones (includes all Zones V, VE, and V1-V30) must meet the same enclosure requirements except that openings are not required and walls must be non-supporting breakaway walls, open lattice-work, or insect screening (see Technical Bulletin 9, *Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings*).

The NFIP regulations for new construction and substantial improvements of existing buildings require that enclosed areas under elevated non-residential buildings meet the same requirements as those for enclosures under elevated residential buildings. New non-residential buildings constructed in A zones, and substantial improvements of existing non-residential buildings, must either have their lowest floors elevated to or above the BFE or be floodproofed (made watertight) to or above the BFE.

Many types of foundations are used to elevate buildings. While the main portions of elevated buildings are above the BFE, the foundation and any enclosed areas below the BFE will be exposed to flood forces. Enclosed areas below the BFE

Under the NFIP, the “lowest floor” is the floor of the lowest enclosed area of a building. An unfinished or flood-resistant enclosure that is used solely for parking of vehicles, building access, or storage is not the lowest floor, provided the enclosure is built in compliance with applicable requirements.

As used by the NFIP, an “enclosure” is an area that is enclosed on all sides by walls.

The NFIP defines a “basement” as any area that is below-grade on all sides. The regulations do not allow basements to extend below the BFE.

Owners of existing elevated buildings with enclosures below the BFE may wish to retrofit the enclosures. Lower NFIP flood insurance rates may apply if the retrofit enclosures have openings that meet the requirements in this Technical Bulletin and also meet other requirements for enclosures (limited use, flood damage-resistant materials, and elevated utilities).

(including crawlspaces) are permitted if used only for parking of vehicles, building access, and storage. Figure 1 illustrates a typical crawlspace foundation wall and a typical framed wall surrounding an enclosed area.

If enclosure walls are not designed with openings to relieve the pressure of standing or slow-moving water against them (called hydrostatic loads), the walls can be damaged or fail during a flood. If the walls are “load-bearing” walls that support the elevated building, failure of the walls may result in damage to, or collapse of, the building. To address this concern, the NFIP regulations require that enclosure walls contain openings that will allow for the automatic entry and exit of floodwaters. These openings allow floodwaters to reach equal levels on both sides of the walls, thereby lessening the potential for damage caused by a difference in hydrostatic loads on opposite sides of the walls. In A zones, the requirement for flood openings applies to all enclosed areas below new elevated buildings and below substantially improved buildings.

Areas of shallow flooding may be shown as AO zones on FIRMs. Rather than BFEs, AO zones have “flood depths” that range from 1 to 3 feet. In these zones, all NFIP requirements related to BFEs apply, including elevation of the lowest floor to or above the designated flood depth and requirements for enclosures with flood openings that are located so that floodwaters will flow in and out.

This Technical Bulletin explains the NFIP requirements for flood openings and provides guidance for prescriptive (non-engineered) openings and engineered openings. Non-engineered openings are used to meet the NFIP’s prescriptive requirement of 1 square inch of net open area for every square foot of enclosed area. As an alternative, engineered openings that have characteristics that differ from non-engineered openings may be used provided they are designed and certified by a registered design professional as meeting certain performance characteristics described in this Technical Bulletin.

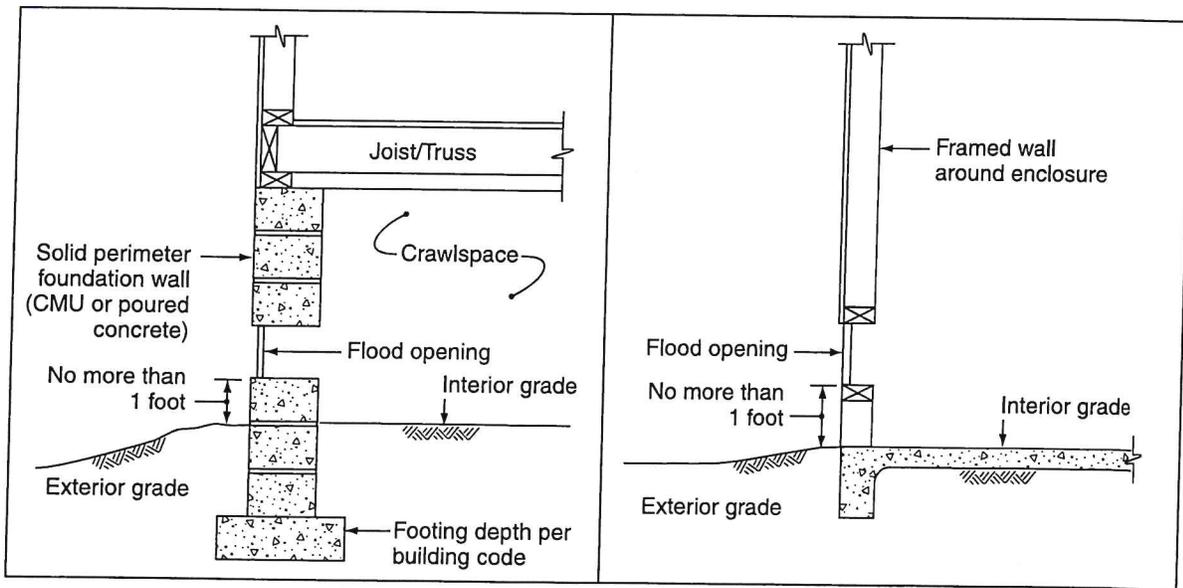


Figure 1. Typical enclosures with flood openings

This Technical Bulletin also discusses how openings could affect flood insurance premiums, provides examples of enclosures that require openings and situations where openings are not required, and outlines the requirements for, and provides guidance on, the following:

- Installation of openings, including the minimum number of openings and height of openings above grade,
- Non-engineered openings, and
- Engineered openings.

Examples are provided to illustrate types of buildings and enclosures that require openings, and to address several commonly encountered situations. Other situations may require the advice of a registered design professional. Questions should be directed to the appropriate local official, NFIP State Coordinating Office, or FEMA Regional Office.

Solid perimeter foundation walls and walls surrounding enclosed areas below the BFE may be damaged by forces related to moving floodwaters and wave impacts (called hydrodynamic loads), and debris impacts. The requirement for openings is intended to reduce only flood damage associated with hydrostatic – not hydrodynamic – loads.

Hydrodynamic loads and debris impacts may be significant in some flood hazard areas shown as A zones on FIRMs, including riverine areas where high flow velocities are likely (e.g., faster than 5 feet per second) and areas where wave heights of 1.5 feet or more are possible. In these areas, it is recommended that a registered design professional evaluate foundation designs. Open foundations without enclosed areas are less vulnerable to the type of damage that can be caused by high flow velocities and wave action.

This Technical Bulletin discusses openings in walls below the BFE. Readers should check with the community to determine whether a higher elevation standard is enforced. For example, communities may add freeboard or may regulate to the design flood elevation (DFE). In those cases, references to the BFE in this Technical Bulletin should be construed as references to the community's elevation requirement.

Buildings in V zones (Zones V, VE, and V1-V30) must meet certain design and construction requirements that are specified in the NFIP regulations at Section 60.3(e). The area below the lowest floors of buildings in V zones must be free of obstruction or, if enclosed, the walls of enclosures must be constructed with non-supporting breakaway walls, open wood lattice-work, or insect screening. Openings may be provided, but are not required, in breakaway walls under buildings in V zones. For information on V-zone design and construction requirements, refer to the NFIP regulations, the Technical Bulletin series (especially Technical Bulletin 5, *Free-of-Obstruction Requirements* and Technical Bulletin 9, *Design and Construction Guidance for Breakaway Walls Below Elevated Coastal Buildings*), the *Coastal Construction Manual* (FEMA 55CD), *Flood Resistant Design and Construction* (ASCE 24), and *Home Builder's Guide to Coastal Construction* (FEMA 499).

## NFIP Regulations

The NFIP regulations for enclosures are codified in Title 44 of the Code of Federal Regulations, in Section 60.3(c)(5), which states that a community shall:

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

Proposals for substantial improvement of existing buildings in SFHAs, and proposals to repair those that have sustained substantial damage, must comply with the requirements for new construction. In A zones, the applicable requirements include openings in the walls surrounding enclosed areas below the BFE. As part of issuing permits, community officials must review such proposals to determine whether they comply with the requirements. Further information on substantial improvement and substantial damage is found in *Answers to Questions About Substantially Damaged Buildings* (FEMA 213).

The NFIP Technical Bulletins provide guidance on the minimum requirements of the NFIP regulations. Community or State requirements that exceed those of the NFIP take precedence. Design professionals should contact the community to determine whether more restrictive provisions apply to the building or site in question. All other applicable requirements of the State or local building codes must also be met for buildings in flood hazard areas.

## How Openings Affect Flood Insurance Rates

Careful attention to compliance with the NFIP regulations for flood openings is important during design, plan review, construction, and inspection. Compliance influences both the vulnerability to flood damage and the cost of NFIP flood insurance. If openings are not compliant, the floor of the crawlspace or the floor of the enclosure becomes the “lowest floor.” In those cases, the result may be significantly higher flood insurance premiums, especially if the floor of the crawlspace or enclosure is more than a foot or two below the BFE.

## Documenting Elevations and Information About Openings

Communities are required to collect data from permittees to document the surveyed elevation of the lowest floors of new buildings and existing buildings that are substantially improved. Although the data may be provided in other formats, the NFIP's Elevation Certificate (FEMA Form 81-31) is designed specifically for this purpose. The current version of the Elevation Certificate is online at <http://www.fema.gov/business/nfip/elvinst.shtm>.

The Elevation Certificate is designed to collect information that facilitates determining compliance of new construction and to provide data necessary for the proper rating of NFIP flood insurance. For guidance, see the instructions that accompany the Elevation Certificate and the *Floodplain Management Bulletin: Elevation Certificate* (FEMA 467-1).

The Elevation Certificate has blanks that are to be completed if there are enclosures under elevated buildings, including:

- The square footage of the enclosed area,
- The number of flood openings within 1.0 foot above adjacent grade, and
- The total net area of flood openings.

The Elevation Certificate provides space for comments. As noted above and explained in more detail below, the regulations provide two ways to satisfy the requirements for openings. Comments should be provided when engineered openings are used, and when there are other aspects of enclosures and openings that comply with the requirements but that, without close inspection, may appear to be non-compliant. The documentation required for engineered openings should be attached to the Elevation Certificate (described on page 25, Documentation of engineered openings for flood insurance).

## Enclosed Areas Below Elevated Buildings

The NFIP regulations specify that enclosed areas under elevated buildings may be allowed provided the enclosed areas are used solely for:

- Parking of vehicles (attached garages or parking areas below elevated buildings)
- Building access (stairwells, foyers, elevators)
- Storage (low-value items)

Although crawlspaces are not listed explicitly as an allowable use, buildings may be elevated using perimeter foundation walls that create enclosed areas, typically called crawlspaces or under-floor spaces. Crawlspaces provide access to under-floor utilities such as pipes, ductwork, and electric conduits.

Some communities require permittees to execute a "non-conversion" agreement to document their understanding that the use of enclosures is limited, that conversion to other uses is not allowed, and that modification of enclosures may result in higher NFIP flood insurance rates.

It is important to understand how an otherwise compliant enclosed area below the BFE can be rendered non-compliant by installing features that are not consistent with the limitations on uses. The following are not allowed below the BFE because of potential damage and their presence is inconsistent with the allowed uses: appliances, heating and cooling equipment, plumbing fixtures, more than the minimum electric service required to address life safety and electric code requirements for building access and storage areas, and materials that are not flood damage-resistant.

The only exception to the openings requirement is for non-residential buildings that are engineered to be floodproofed by meeting stringent requirements to be watertight. For information on floodproofing, refer to Technical Bulletin 3, *Non-Residential Floodproofing – Requirements and Certification*.

The NFIP regulations require that enclosed areas surrounded by solid walls that extend below the BFE have flood openings. The requirement applies whether the walls are load-bearing walls or non-load-bearing walls. Therefore, openings are required in solid perimeter foundation walls that surround crawlspaces and openings are required in the walls of fully enclosed areas that meet the use limitations (parking of vehicles, building access, or storage). The requirement applies to new construction and to buildings that are undergoing substantial improvement, including repair of substantial damage.

## Enclosures That Require Openings

Several examples of enclosures that require openings are described below:

- Solid perimeter foundation walls (crawlspaces or under-floor spaces)
- Solid perimeter foundation walls (below-grade crawlspaces)
- Solid perimeter foundation walls (with full-height under-floor spaces)
- Garages attached to elevated buildings
- Enclosed areas under buildings elevated on open foundations in A zones
- Enclosed areas with breakaway walls under buildings elevated on open foundations in A zones
- Solid perimeter foundation walls on which manufactured homes are installed
- Accessory structures (detached garages and storage sheds)

### Solid perimeter foundation walls (crawlspaces or under-floor spaces)

The crawlspace or under-floor space that is created when a building is elevated on a solid perimeter foundation wall is an enclosed area below the BFE that must meet all of the requirements for enclosed areas (refer to Figure 1). If a brick veneer, siding, or other material covers the wall, then the openings must completely penetrate into the enclosed area. A crawlspace access with a door does not qualify as a flood opening unless

In many parts of the country, a common practice is to build "conditioned crawlspaces" that are sealed and have mechanical ventilation. In SFHAs, all crawlspaces must have flood openings that meet the requirements of the NFIP and the building codes.

the door has an opening installed in it or otherwise meets the performance requirement that it will allow automatic entry and exit of floodwaters.

As explained on page 14 (Height of Openings Above Grade), the bottom of each opening is to be located no higher than 1 foot above the higher of the final interior or exterior grades under the opening. Therefore, placement of the openings in the foundation wall requires knowledge of the expected finished exterior grade and the final interior grade of the crawl-space.

Building code requirements may call for ventilation of certain under-floor spaces. Ventilation openings typically are positioned near the top of the foundation wall to facilitate air flow. In most cases, ventilation openings will be too high above grade to satisfy the requirements for flood openings.

### Solid perimeter foundation walls (below-grade crawlspaces)

The NFIP regulations do not allow buildings to be constructed with areas that are below grade on all sides (basements), except for certain engineered non-residential buildings that are designed and certified to be floodproofed. Therefore, crawlspaces that are below-grade on all sides are not allowed because they are basements. An exception is available only in shallow floodplains, and then only if certain other requirements and limitations are met. Those requirements and limitations are detailed in Technical Bulletin 11, *Crawlspace Construction for Buildings Located in Special Flood Hazard Areas: National Flood Insurance Program Interim Guidance*. According to this guidance, below-grade crawlspaces may be allowed provided the wall height is less than 4 feet when measured from bottom of the floor joist/truss to the top of footing, which must be no more than 2 feet below-grade (see Figure 2). Flood openings are required in the foundation walls surrounding these crawlspaces and, as noted above, air ventilation may be required.

Although crawlspaces that satisfy the limitations in TB 11 are not considered basements for floodplain management purposes, it is important to note that they are basements for NFIP flood

Communities are required to adopt specific provisions in their ordinances to be consistent with the limitations in TB 11 in order to permit below-grade crawlspaces.

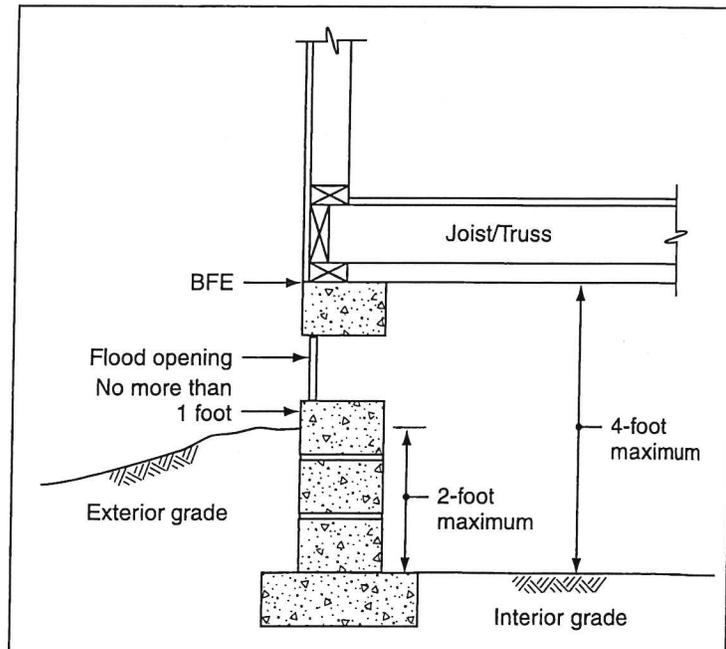


Figure 2. Limitations on below-grade crawlspaces in shallow flood hazard areas (TB 11)

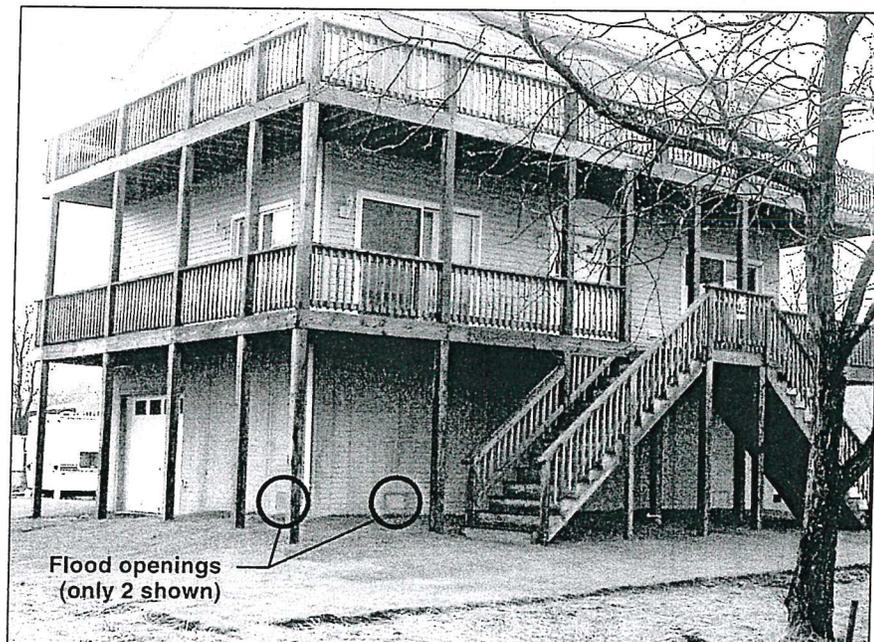
insurance purposes. Therefore, NFIP flood insurance will be more expensive if the grade inside the crawlspace is below the exterior grade on all sides. In addition, below-grade crawlspaces may contribute to increased humidity and mold growth. TB 11 requires that an adequate drainage system be provided in order to minimize floodwater contact with crawlspace materials and related moisture damage.

### **Solid perimeter foundation walls (with full-height under-floor spaces)**

In SFHAs where the BFE is more than 4 or 5 feet above grade, or where owners want enough head room to allow for parking of vehicles and storage, solid perimeter foundation walls may be used to create full-height under-floor spaces (see Figure 3). The walls surrounding the under-floor space must meet all of the opening requirements.

It is important that full-height under-floor spaces also meet all other NFIP requirements to minimize the likelihood of future conversion to uses other than the allowed uses (parking of vehicles, building access, or storage). As noted in the discussion of limitations on uses of enclosures, the following are not allowed below the BFE in full-height enclosures because of potential damage and their presence is inconsistent with the allowed uses: appliances, heating and cooling equipment, plumbing fixtures, more than the minimum electric service required to address life safety and electric code requirements for building access and storage areas, and materials that are not flood damage-resistant.

Figure 3. Full-height solid perimeter walls surrounding garage and storage area (only two openings visible)



### **Garages attached to elevated buildings**

Many buildings, especially homes, are designed with attached garages. An attached garage may have its floor below the BFE provided the garage meets all of the requirements for an enclosed area below the BFE. The use of the garage space must be limited to parking of vehicles, building access, and storage.

Openings are required in the exterior walls of the garage, and openings may be installed in exit doors and garage doors (see Figure 4). It is important to note that garage doors themselves do not meet the requirements for openings. Human intervention would be necessary to open garage doors when flooding is expected, which is inconsistent with the requirement that openings allow for the automatic entry and exit of floodwaters. Similarly, gaps that may be present between the garage door and the door jamb or walls do not guarantee automatic entry and exit of floodwaters and do not count towards the net open area requirement.

If an attached garage is built with its floor below the BFE and it does not have compliant openings, the garage floor becomes the lowest floor. Flood insurance premiums may be significantly higher than if the garage complies with the requirements for openings and other requirements, such as flood damage-resistant materials and elevated utilities.

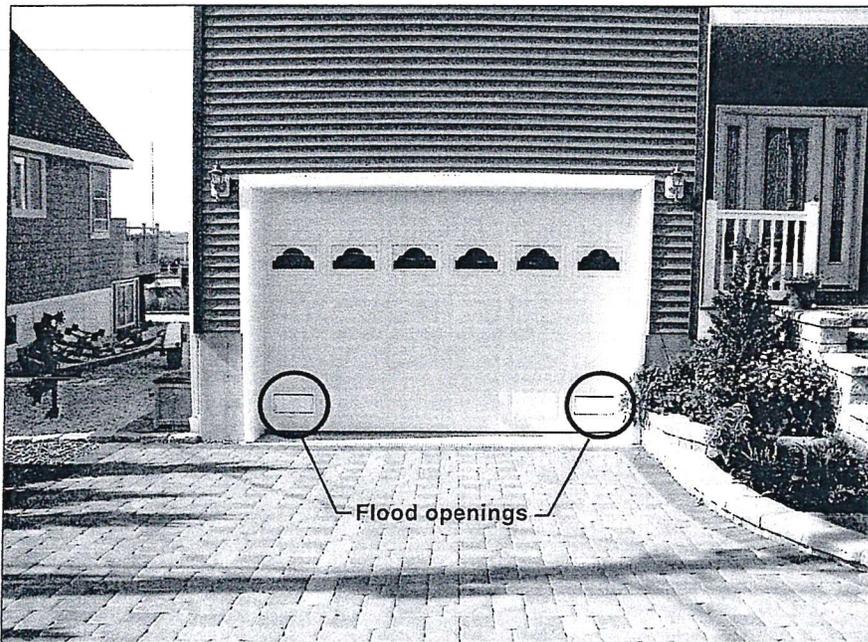


Figure 4. Attached garage, with engineered openings installed in the garage door

#### Enclosed areas under buildings elevated on open foundations in A zones

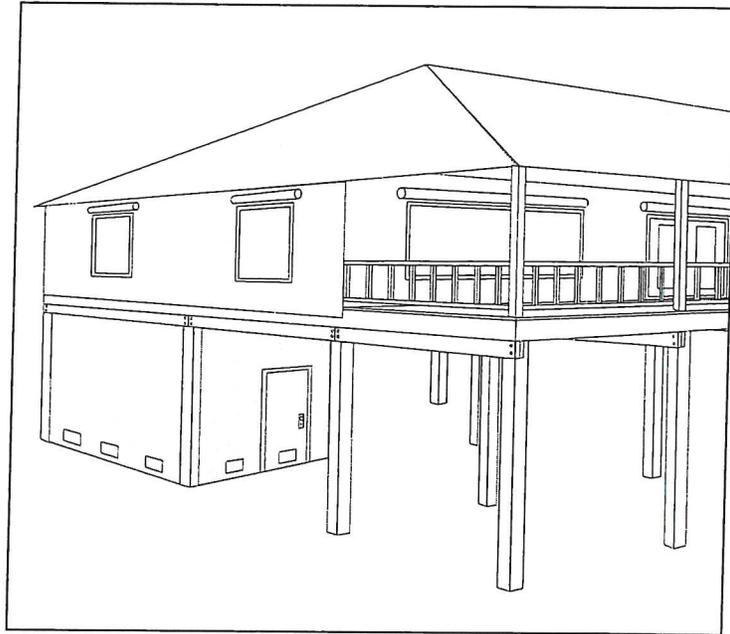
A building that is elevated on an open foundation (e.g., piers, posts, columns, or pilings) in an A zone may have enclosed areas below the elevated floor (see Figure 5). Sometimes only part of the footprint is enclosed, such as for a stairwell or storage room. All of the requirements for enclosed areas apply, including openings, elevated utilities, flood damage-resistant materials, and limitations on use (parking of vehicles, building access, and storage).

Open foundations are recommended in riverine flood hazard areas where flow velocities are expected to exceed 5 feet per second because of the anticipated hydrodynamic loads and potential for debris impact and scour. These loads may be sufficient to damage typical solid perimeter foundation walls, even though flood openings are provided.

ASCE 24 and several of the fact sheets included in the *Home Builder's Guide to Coastal Construction* (FEMA 499) are excellent resources for flood-resistant building methods in coastal A hazard areas.

If a waterway was studied using detailed methods and a floodway is shown on a FIRM, then the Floodway Data Table in the Flood Insurance Study should be reviewed for data that can be used to estimate velocities. For each cross section, the table provides the mean velocity that can be used to approximate velocities in the floodplain outside of the floodway. For other waterways in areas known to have fast-moving water, standard methods can be used to compute an approximate velocity. Examples of other sources of information that should be reviewed include local observations and studies prepared by State and local agencies.

Figure 5. Enclosure with flood openings, under house elevated on pilings



#### Enclosed areas with breakaway walls under buildings elevated on open foundations in A zones

Open foundations are also recommended in A zones in coastal areas where breaking wave heights can be between 1.5 and 3.0 feet (called Coastal A Zones). In these areas, it is recommended that walls surrounding enclosed areas be designed as breakaway walls. Flood openings are required in breakaway walls in A zones in order to comply with the NFIP requirements. ASCE 24 includes specific provisions for openings in breakaway walls.

#### Solid perimeter foundation walls on which manufactured homes are installed

Manufactured homes may be installed on solid perimeter foundation walls that enclose space below the homes (see Figure 6). Even if it is not part of the load-bearing foundation, a solid perimeter wall is required to have openings, otherwise hydrostatic loads may damage the perimeter wall, which could, in turn, damage the home's supporting foundation and anchor system.

Openings are required in rigid skirting that is attached to frames or foundations of manufactured homes to relieve hydrostatic loads and minimize transferring loads that can damage homes and their supporting foundation systems.

Figure 7 shows an example of a framed enclosure below an elevated manufactured home. In this case, the full-height enclosed

area is used for parking and storage. Openings are required because the walls surrounding the enclosed area are solid walls. As indicated by the driveway on the left, the interior slab is higher than the exterior grade along the side of the building. The openings shall be located within 1 foot of the interior grade.

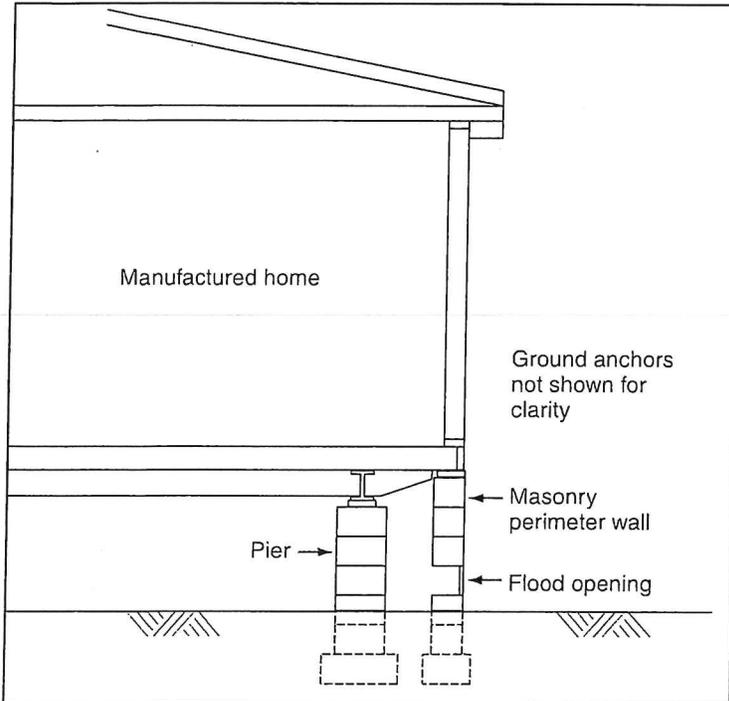


Figure 6. Manufactured home supported on piers; masonry perimeter wall with flood openings (ground anchors not shown)

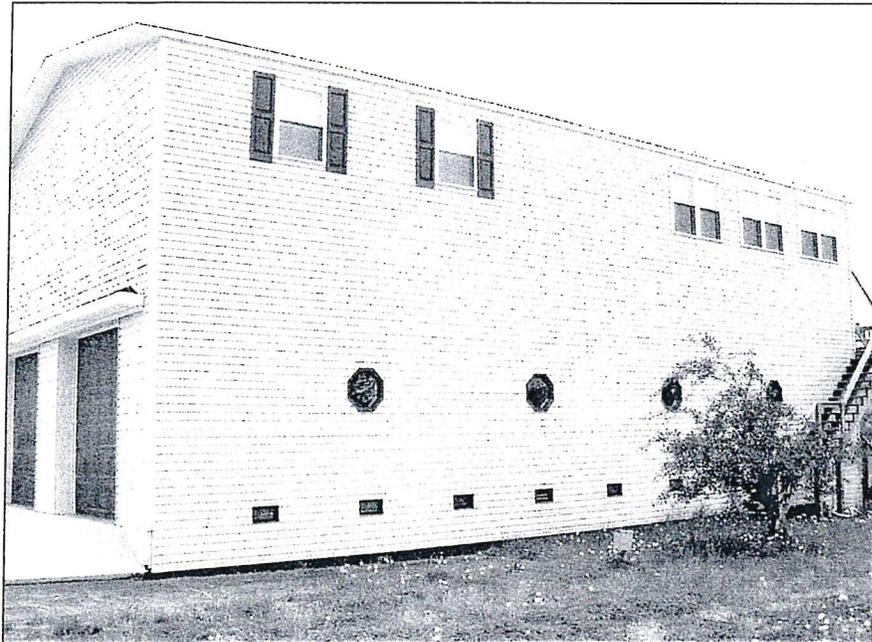


Figure 7. Manufactured home installed above a full-height framed garage (note elevation of driveway slab on left; the openings are within 1 foot of interior grade of the slab)

### Accessory structures: detached garages and storage sheds

Detached garages and detached storage buildings in A zones may be permitted without requiring them to be elevated if they comply with all of the requirements for enclosures. Garages and other accessory buildings must be used only for parking of vehicles and storage, utilities must be elevated, flood damage-resistant materials must be used below the BFE, the requirements for flood openings must be satisfied, and they must be anchored to resist flotation, collapse, or lateral movement under flood conditions.

Communities are required to regulate all development in SFHAs, including the placement of small storage sheds. Storage sheds in A zones are not required to be elevated if they comply with all of the requirements for enclosures. They must be used only for storage, utilities must be elevated, flood damage-resistant materials must be used below the BFE, and the requirements for flood openings must be satisfied. In addition, sheds are to be anchored to prevent flotation, collapse, or lateral movement under flood conditions.

### Situations That Do Not Require Openings

Two situations that do not require openings are described below:

- Manufactured home with skirting
- Back-filled stem wall foundation

#### Manufactured home with flexible skirting

Skirting used to enclose the area under manufactured homes typically is made of weather-resistant material and extends from the bottom of the home down to grade. Flexible skirting and rigid skirting that are not attached to the frame or foundation of a manufactured home are not required to have openings. However, where floodwaters are expected to rise rapidly, there may be concerns about the skirting being pushed against foundation systems. In these areas, open lattice may be more appropriate to minimize the potential for flood damage.

The National Fire Protection Association's standard, *Model Manufactured Home Installation Standard* (NFPA 225), specifies that installation of skirting does not trigger the requirement for flood openings provided the skirting does not provide structural support and will collapse under wind and water loads that are less than those expected during the base flood event without causing structural damage to the elevated home or the foundation.

#### Filled stem wall foundation

A filled stem wall foundation (also called a chain wall) can look like a solid perimeter foundation wall from the outside, but this type of foundation is backfilled with compacted structural fill that supports the floor slab (see Figure 8). Because of the fill, unbalanced lateral loads against the walls will be minimized as floodwaters, and thus openings are not required.

It is important that the final Elevation Certificate, or other documentation of elevations, include an explanation when stem wall foundations are used to avoid the assumption that it is a crawlspace that lacks the required openings. The Elevation Certificate diagrams do not illustrate filled stem wall foundations. A note in the comment section should describe the foundation so that insurance agents are alerted as to why there are no openings.

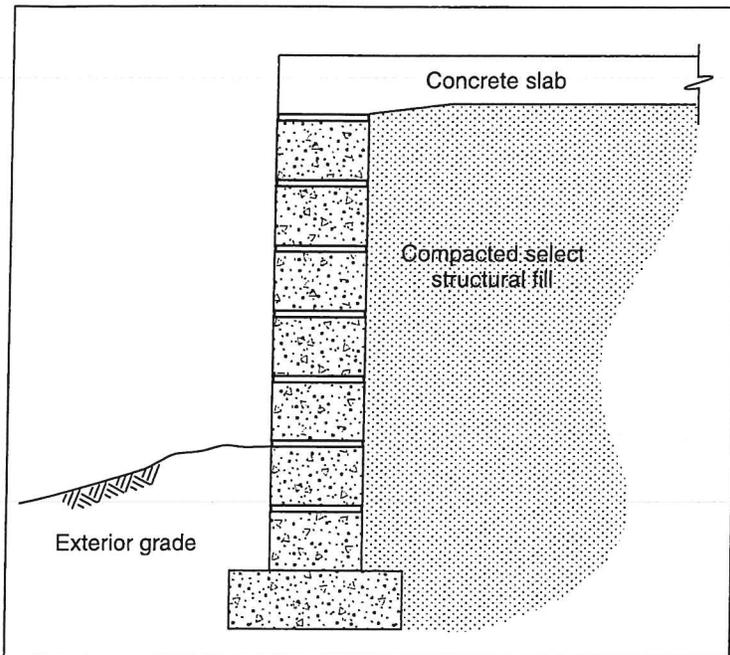


Figure 8. Back-filled stem wall foundation (openings not required)

## Requirements and Guidance for Installation of Openings

The NFIP regulations specify certain installation requirements that must be met by all flood openings, whether non-engineered openings or engineered openings, which are described starting on page 18. The installation requirements address the minimum number of openings and the maximum height of openings above grade. Additional guidance and explanations for various situations are described below.

### Minimum Number of Openings

Each enclosed area is required to have a minimum of two openings on exterior walls to allow floodwaters to enter directly. In order to meet the requirement, the openings must be located so that the portion of the opening intended to allow for inflow and outflow is below the BFE. Openings that are entirely above the BFE (or any portion of an opening that is above the BFE) will not serve the intended purpose during base flood conditions and thus are not counted towards the compliance with the flood opening requirements.

The openings should be installed on at least two sides of each enclosed area to decrease the chances that all openings could be blocked with floating debris and to allow for more even filling by floodwater and draining of the enclosed area. It is recommended that openings be reasonably distributed around the perimeter of the enclosed area unless there is clear justification for putting all openings on just one or two sides (such as in townhouses or buildings set into sloping sites).

*The International Residential Code® and the International Building Code® (by reference to ASCE 24) both require a "minimum of two openings on different sides of each enclosed area."*

Figure 9 shows a sketch illustrating where openings could be located when an elevated building has multiple enclosed areas. [Note: the number of openings shown in Figure 9 is for illustration only; the total number of openings and the adequacy of the net open area of those openings depend on the type of opening, covering, and whether vent devices or engineered openings are installed.]

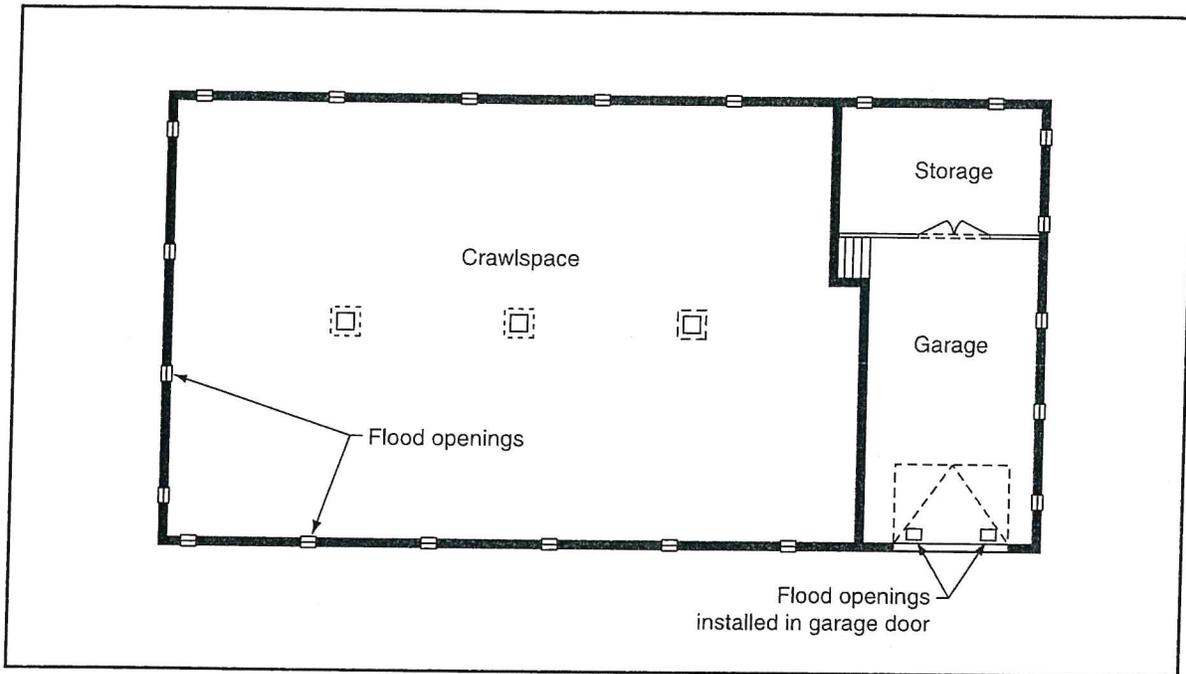


Figure 9. Sketch of foundation plan of home with multiple enclosed areas, each with flood openings (number of openings for illustration purposes only)

### Height of Openings Above Grade

The bottom of each opening is to be located no higher than 1 foot above the grade that is immediately under each opening. The purpose of this requirement is to satisfy the performance expectation that the difference in water levels between the interior and exterior will not exceed 1 foot as water begins to rise and as floodwaters recede from the site. Note that the openings (or those portions that count towards the required net open area) must be located below the BFE. In areas with shallow flood depths, this may require positioning the openings closer to grade than the maximum 1 foot allowed.

Given the requirement that the bottom of openings shall not be higher than 1 foot above grade, a question arises if the interior and exterior grades are different: which grade should be used to determine placement of flood openings? The higher of the final interior grade and the finished exterior grade that is immediately under each opening is used to make this determination:

- **Finished exterior grade.** Care should be taken when placing backfill, topsoil, and landscaping materials around the outside of enclosures, especially solid perimeter foundation

walls. If the finished exterior grade is higher than the interior grade on all sides of the building, then the enclosed area becomes a basement as defined by the NFIP.

- **Final interior grade.** The trench that is excavated to construct footings and foundation walls must be backfilled completely, otherwise a basement is created. If the interior grade is higher than the exterior grade, the openings are to be no higher than 1-foot above the interior grade.

## Installation Examples

### Interior grade higher than exterior grade

Consider a crawlspace enclosure that has its interior grade higher than the exterior grade. As water rises against the outside of the foundation, the ground or fill on the interior balances the hydrostatic load (see Figure 10). It is only when the water rises above the interior grade that the lateral load becomes unbalanced and therefore must be equalized by openings.

When viewed from the outside, a solid perimeter foundation wall or wall surrounding an enclosed area with the interior grade higher than the exterior grade will appear to not meet the installation requirements for openings. The openings will appear to be too high above the exterior grade (illustrated in Figure 7). Therefore, it is important that the final documentation of as-built elevations note the difference in interior and exterior grades. For example, if the NFIP Elevation Certificate is used, comments should explain that the interior grade is higher than the exterior grade and it should be noted whether the openings are (or are not) within 1 foot of the higher of the two grades.

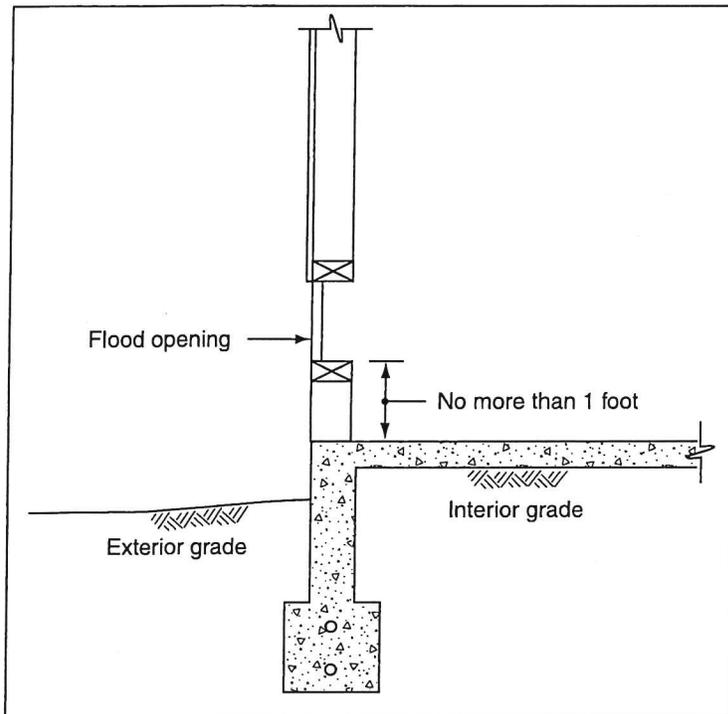


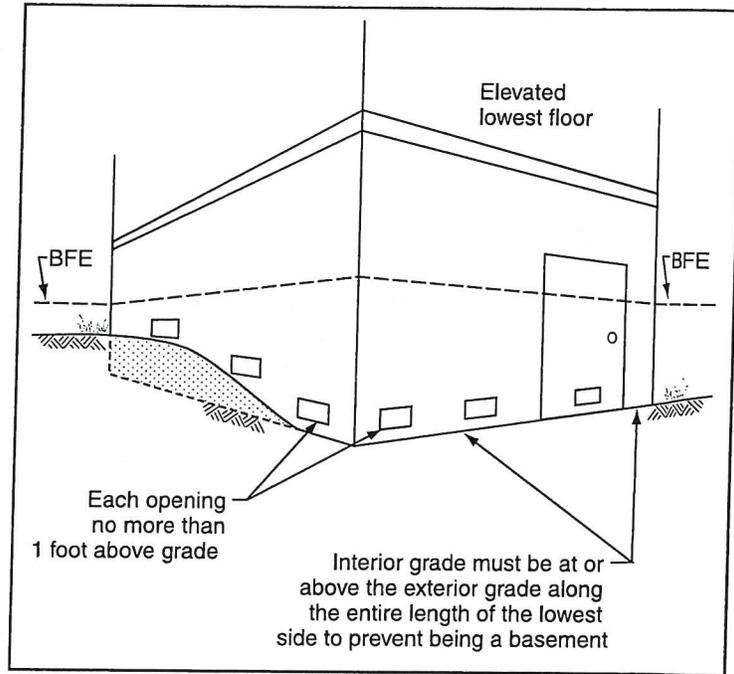
Figure 10. Illustration of flood openings installed within 1 foot of the higher of interior or exterior grade

## Sloping sites

Buildings on solid perimeter foundation walls that are set into a sloping site present another special situation with respect to installation of openings. Careful attention must be paid to the following:

- The interior floor along the lower side of a building that is set into a sloping site must be at or above the exterior grade across the entire length of that side of the building, otherwise the enclosure becomes a basement.
- The bottom of each opening shall be located no higher than 1 foot above the exterior or interior grade immediately below the opening, whichever is higher (see Figure 11).
- For openings to perform their intended function, sufficient open area must be below the BFE.

Figure 11. Openings in enclosure walls, sloping site



## Townhouses with limited exterior walls

Townhouses are single-family dwelling units constructed in a group of three or more attached units in which each unit extends from foundation to roof and with exterior walls on at least two sides. Openings are required if townhouses in SFHAs are constructed with solid perimeter foundation walls or with solid walls surrounding enclosed areas under the elevated portion of the building.

Because the interior townhouse units have less linear exterior wall length than the end units, it can be a challenge to meet all of the requirements, especially the requirement for adequate net open area and the requirement that each enclosed area have openings. If openings cannot be provided in at least two walls, the NFIP allows all openings to be installed in one wall.

Design of interior townhouse units can satisfy the guidance that openings should be on different sides if the walls inside the enclosed area have openings to connect enclosed spaces from front to back. Figure 12 shows suggested locations for openings. [Note: the number of openings shown in Figure 12 is for illustration only; the total number of openings and the adequacy of the net open area depend on the type of opening, covering, and whether a vent device is installed in the openings.]

It may be even more challenging to provide adequate openings in enclosures under interior townhouse units if the multi-unit building is set into a sloping site, in which case it may be appropriate to consider using a filled stem wall foundation or an open foundation. Use of fill across one side of elevated townhouses may create a similar complication.

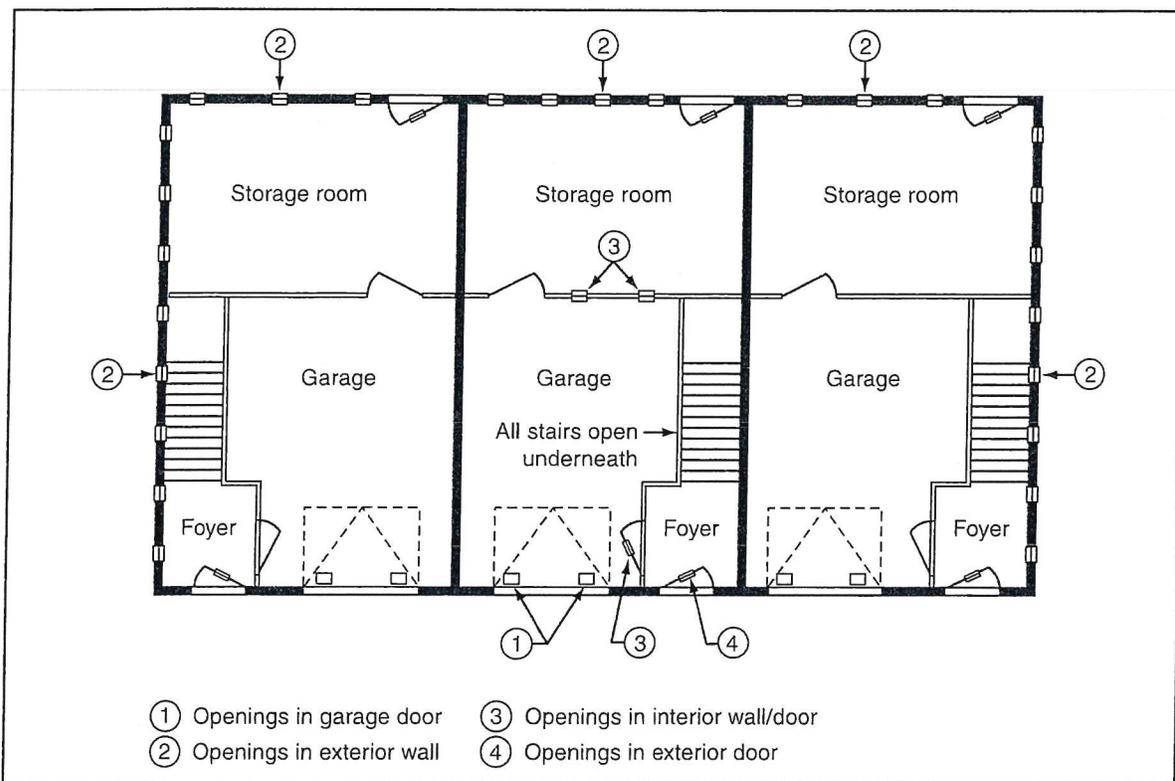
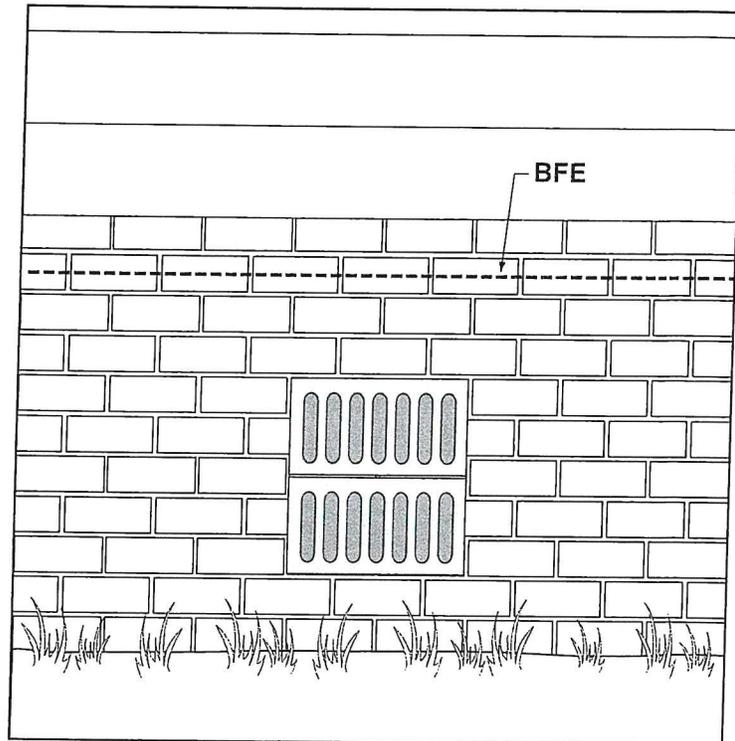


Figure 12. Illustration of suggested flood openings in enclosures under elevated townhouses (number of openings for illustration purposes only)

### Openings that extend above the BFE

Only those portions of openings that are below the BFE can be counted towards the required net open area. Stacked vent devices may be installed or large-dimension openings may be provided (Figure 13). In both cases, if the BFE does not reach the top of the opening, only the portion that is below the BFE will count as contributing to the required net open area. Similarly, if the floor of a mechanical room is below the BFE (with elevated equipment inside) and a louvered door provides ventilation, only the open portion of the louvered door that is below the BFE will count towards the required net area of flood openings.

Figure 13. Stacked vents inserted in large openings must be below the BFE



#### Depth of water 1 foot or less

Some FIRMs show mapped SFHAs where the depth of water will be 1-foot deep or shallower. Although the difference in water depth between the outside and inside of the enclosure under a building in these areas will not exceed 1 foot during the base flood, the NFIP regulations require openings.

There are at least two solutions to this situation. The first is to elevate the floor of the enclosure the necessary height so that it is at or above the BFE and there is no need for openings. The second solution is to install openings, taking care to ensure that all of the necessary open area is below the BFE (otherwise the openings will not function as intended). This can be accomplished by positioning the bottom of the openings at or very close to grade, rather than the maximum of 1 foot above grade. In addition to complying with the regulations, the walls will not experience excessive differential hydrostatic pressure when floodwaters rise higher than the BFE.

## Non-Engineered Openings and Engineered Openings

The NFIP regulations identify alternatives to provide sufficient size and number of openings to allow for the automatic entry and exit of floodwaters. This section describes how this level of performance can be satisfied by use of:

- Non-engineered openings (or covers and devices) that meet the prescriptive requirement to provide 1 square inch of net open area for each square foot of enclosed area (as

described below, a variety of options and devices can serve as non-engineered openings).

- Engineered openings (or covers and devices) that are specifically designed and certified by a registered design professional as meeting the required performance and design requirements outlined below (and, if applicable, the community's building code).
- Engineered openings (or covers and devices) for which an Evaluation Report has been issued by the International Code Council (ICC) Evaluation Service, Inc. (ICC-ES), a subsidiary of the International Code Council, Inc. (<http://www.iccsafe.org>).

*The International Residential Code®* includes both the prescriptive (non-engineered) alternative and the engineered openings alternative.

*The International Building Code®* also includes both alternatives by reference to ASCE 24.

The following requirements for installation apply regardless of whether engineered openings or non-engineered openings are used to satisfy the NFIP requirements (also see page 13, Requirements and Guidance for Installation of Openings):

- Each enclosed area must have a minimum of two openings; if there are multiple enclosed areas, each area must have openings in its exterior walls,
- The bottom of each opening must be no more than 1 foot above the higher of the interior or exterior grade immediately under the opening, and
- Any screens, grates, grilles, fixed louvers, or other covers or devices must not block or impede the automatic flow of floodwaters into and out of the enclosed area.

## Unacceptable Measures

It is important to note that FEMA has determined that certain measures are not acceptable as flood openings, including:

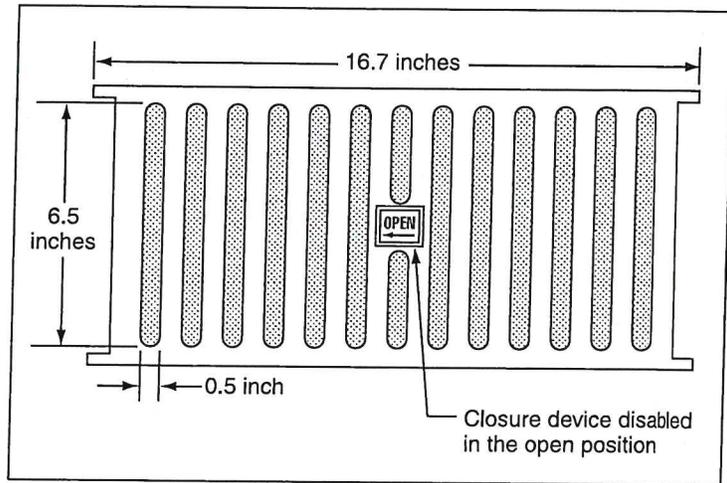
- Standard foundation air ventilation devices that can be closed manually, because they do not allow for the automatic entry and exit of floodwaters unless they are permanently disabled in the open position.
- Standard foundation air ventilation devices that have detachable solid covers that are intended to be manually installed over the opening in cold weather, because they do not allow for the automatic entry and exit of floodwaters when the cover is in place.
- Standard foundation air ventilation devices that are designed to open and close based on temperature (unless they also are designed to allow for the automatic entry and exit of floodwaters).
- Windows below the BFE, because the automatic entry and exit of floodwaters cannot be satisfied by the expectation that windows will break under rising floodwaters.
- Garage doors without openings installed in them, because human intervention is required to open the doors when flooding is expected. Gaps between the garage door and the door jamb or walls do not count towards the net open area requirement.
- Standard exterior doors without openings installed in them.

## Non-Engineered Openings

Non-engineered openings are openings that are used to satisfy the prescriptive requirement that calls for 1 square inch of net open area for each square foot of enclosed area. A wide variety of options is available to satisfy the prescriptive requirements.

The term “net open area” refers to the permanently open area of a non-engineered opening. The NFIP regulations indicate that flood openings may be equipped with coverings or devices provided that they permit the automatic entry and exit of floodwaters. The measurement of the net open area must take into consideration any coverings that have solid obstructions, such as grilles, fixed louvers, or faceplates. Figure 14 shows a typical standard air vent faceplate and measurements of the net open area.

Figure 14. Typical standard air vent faceplate (this example provides 42 square inches of net open area)



Manufacturers of devices intended for use as standard air vents typically indicate the number of square inches that each device provides for air flow (either stamped into the metal frame or noted on the packaging). The same number should be used for the net open area calculation when these devices are installed as non-engineered openings. However, in order to qualify as flood openings that permit automatic entry and exit of floodwaters, openings must not have solid covers that are installed during cold weather. Similarly, typical air vent devices that are designed to be opened and closed manually must be disabled permanently in the open position.

Insect screens that do not impede the entry and exit of floodwaters are allowed and do not affect the determination of the net open area. Communities that administer the *International Building Code*<sup>®</sup> (IBC<sup>®</sup>) or the *International Residential Code*<sup>®</sup> (IRC<sup>®</sup>) should note the requirement to cover ventilation openings to keep animals and insects from entering. These codes provide a list of acceptable covering materials. The commentaries that accompany those codes note that some covering materials may reduce the gross open area of the vent by as much as 50 percent. In areas where floodwaters are expected to carry debris such as grass clippings and leaves, it is notable that screens tend to clog (Figure 15). Local officials may determine that additional openings are required to increase the likelihood that openings will perform as expected, even if some become clogged with debris.



Figure 15. Typical air vent clogged by flood debris

Examples of several commonly used non-engineered openings are described below and shown in Figures 16 through 21:

- Figures 16 and 17 show typical standard air ventilation devices that are intended for installation in crawlspace foundation walls. If installed as flood openings, they must be disabled permanently in the open position to satisfy the requirement for automatic entry and exit of floodwaters (note that the device shown in Figure 17 is not compliant because it is not disabled in the open position).
- Figure 18 shows two examples where the builder provided decorative treatment for open holes; in each case, only the net open area is counted, and the area covered by the decorative treatment is not counted.
- Figure 19 shows a common practice for solid perimeter foundation walls constructed of standard 16" x 8" concrete masonry blocks. If a block is omitted as shown, the resulting void provides 128 square inches of net open area.
- Figure 20 shows where standard blocks are turned sideways. The voids in the blocks are measured to determine the net open area.
- Figure 21 shows a foundation in which a hole was created when the concrete was poured; a wood frame covered with screening is inserted in the hole. The framed void is measured to determine the net open area.

The IRC and IBC (through reference to ASCE 24) require that flood openings are to be not less than 3 inches in any direction in the plane of the wall. This requirement applies to the hole in the wall, excluding any device that may be inserted such as typical foundation air vent device.

Communities usually require screens over voids (open holes) that are created in walls to serve as flood openings, to limit the entry of insects and rodents provided the screens do not impede the inflow and outflow of floodwaters.

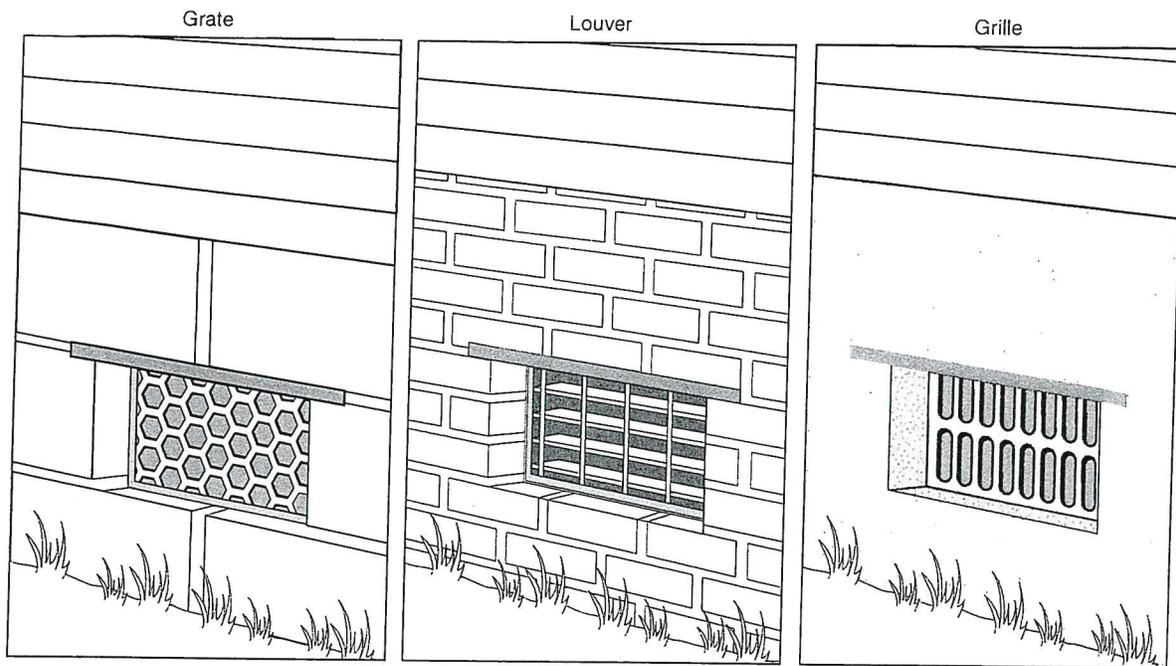


Figure 16. Examples of typical air vents used as flood openings (net open area varies)

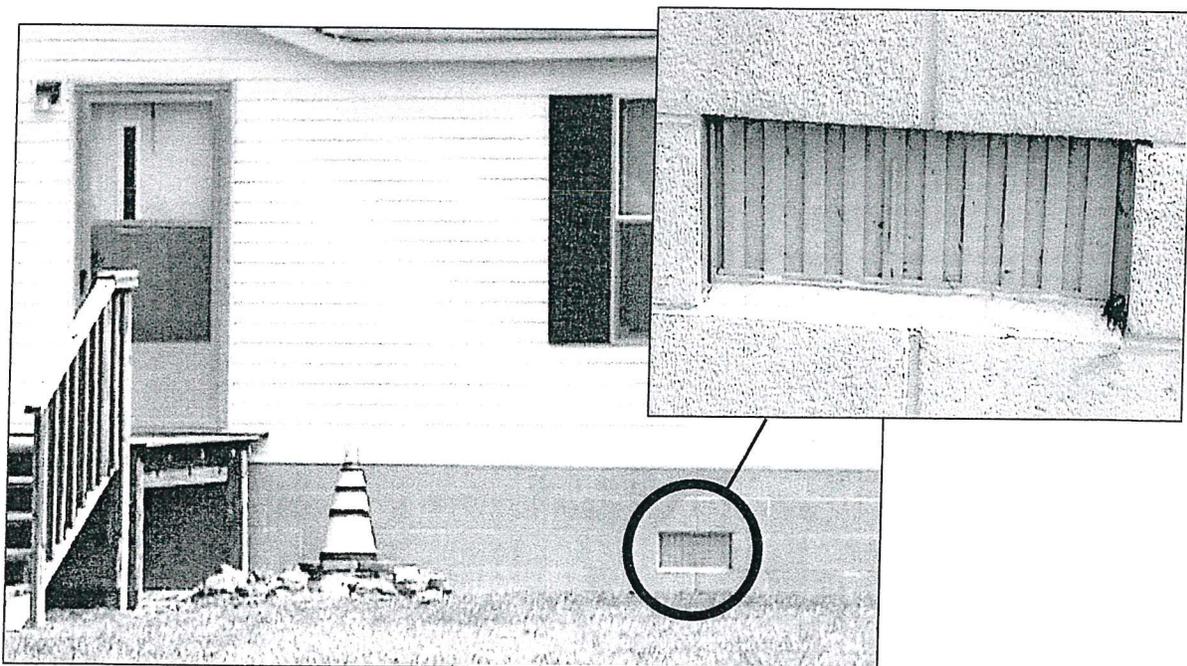


Figure 17. Although this standard air vent was intended as flood openings, it is not acceptable because it is not disabled in the open position and does not allow automatic inflow and outflow of floodwaters.

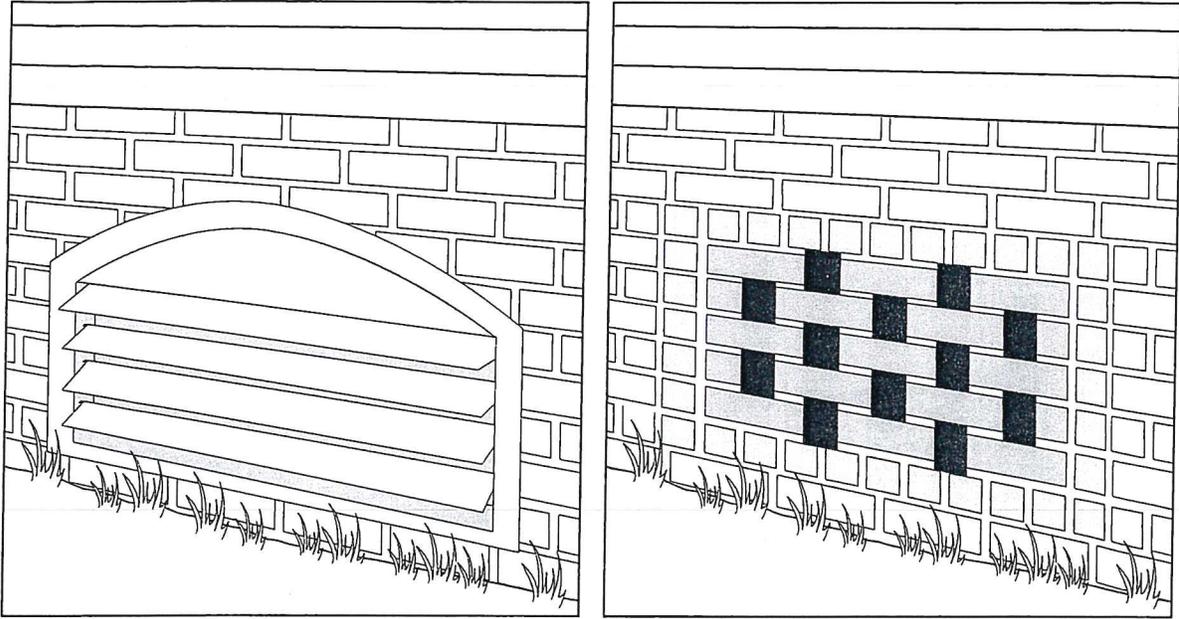


Figure 18. Decorative treatments using fixed louvers and brickwork (count the "net open area" or have certified as engineered openings)

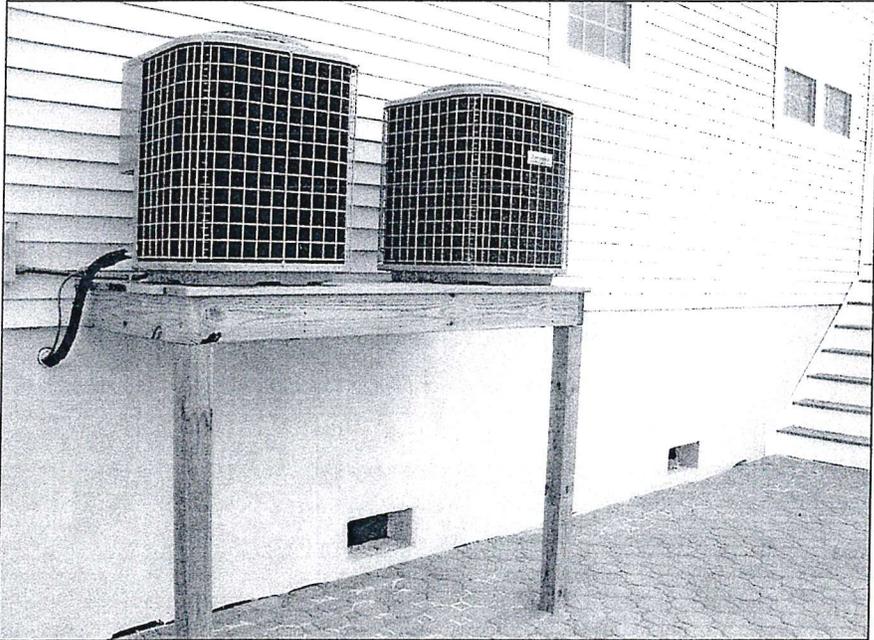


Figure 19. Foundation wall with omitted blocks as flood openings (insect screen not visible)

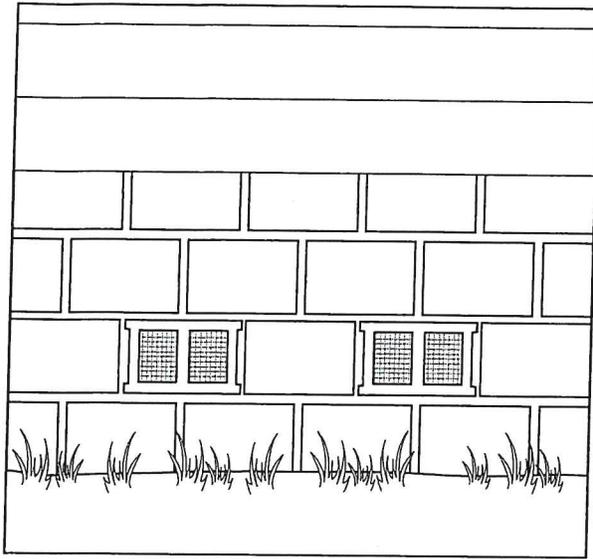


Figure 20. Concrete block turned sideways (insect screening shown)

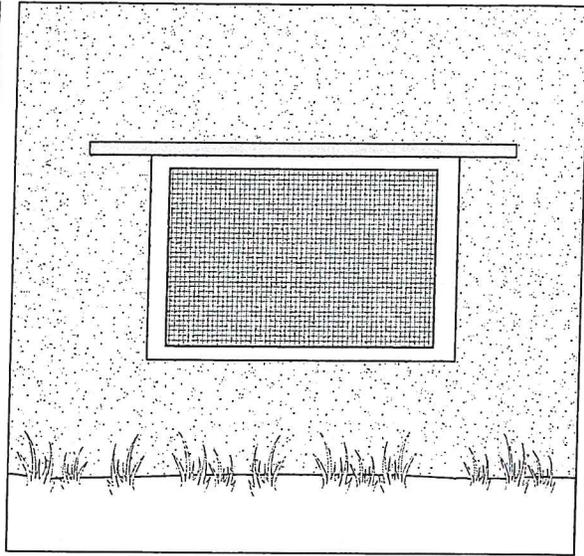


Figure 21. Wood frame with insect screen inserted in opening in poured concrete foundation wall

## Engineered Openings

Openings that are designed and certified by a registered design professional as meeting the performance required by the regulations are called “engineered openings.” This section describes certification and documentation requirements for engineered openings and the specific design requirements.

### Engineered openings with individual certification

For architectural or other reasons, building designers or owners may prefer to use unique or individually designed openings or devices. In these cases, a registered design professional must submit a certification. As a general rule, States require a designer to be licensed to practice in the State in which building is located.

The original certification of the engineered openings must include the design professional’s name, title, address, signature, type of license, license number, the State in which the license was issued, and the signature and applied seal of the certifying registered design professional. The certification shall identify the building in which the engineered openings will be installed. The language of the certification shall address the following:

- A statement certifying that the openings are designed to automatically equalize hydrostatic flood loads on exterior walls by allowing the automatic entry and exit of floodwaters in accordance with the Engineered openings, design requirements on page 26,
- Description of the range of flood characteristics tested or computed for which the certification is valid, such as rates of rise and fall of floodwaters, and
- Description of the installation requirements or limitations that, if not followed, will void the certification.

## Engineered openings with ICC-ES Evaluation Reports

Engineered openings or devices may be accepted by local officials as an alternative to non-engineered openings (prescriptive) provided the designs are certified. The certification may take the form of the individual certification described above, or it can be an Evaluation Report issued by the ICC-ES. The ICC-ES issues such reports for a variety of building products, methods, and materials. Evaluation Reports are issued only after the ICC-ES performs technical evaluations of documentation submitted by a manufacturer, including technical design reports, certifications, and testing that demonstrate code compliance and performance.

ICC-ES has issued *Acceptance Criteria for Automatic Foundation Flood Vents (AC364)* for one type of engineered opening. The ICC-ES will develop acceptance criteria for other types, upon request.

Evaluation Reports are supported by certifications that include appropriate language describing performance of the openings and the name, title, address, type of license, license number, the State in which the license was issued, and the signature and seal of the certifying registered design professional. The specific provisions that are addressed in the certification must include:

Local officials in communities that do not administer the International Code Series determine whether to accept building products that have received Evaluation Reports issued by the ICC-ES.

- A statement certifying that the openings are designed to automatically equalize hydrostatic flood loads on exterior walls by allowing the automatic entry and exit of floodwaters in accordance with the Engineered openings, design requirements below,
- Description of the range of flood characteristics tested or computed for which the certification is valid, such as rates of rise and fall of floodwaters, and
- Description of the installation requirements or limitations that, if not followed, will void the certification.

## Documentation of engineered openings for compliance

An important part of the evidence necessary to document compliance is the certification of engineered openings or the Evaluation Report. A copy of the individual certification or the Evaluation Report is required to be kept in the community's permanent permit files, along with inspection reports. The documentation can be submitted as part of the permit application and design drawings, or submitted separately. Owners should retain the certification or a copy of the Evaluation Report to submit along with applications for NFIP flood insurance.

## Documentation of engineered openings for flood insurance

Insurance agents will request that property owners provide documentation as part of applications for NFIP flood insurance. The documentation should be attached to the Elevation Certificate. The following are acceptable forms of documentation:

- For engineered openings with individual certification, the certification described above that is signed and sealed by a registered design professional who is licensed in the State where the building in which the engineered openings are used is located; or

- For engineered openings with ICC-ES Evaluation Reports, a copy of the Evaluation Report that documents that the engineered openings meet the performance requirements of the NFIP and the building code, and that specifies the number of such openings that are required for a specified square footage of enclosed area below the BFE; or
- For engineered openings with ICC-ES Evaluation Reports, a letter or other written evidence from the local official that use of engineered openings in a specific building is acceptable.

### Engineered openings, design requirements

The American Society of Civil Engineers (ASCE) developed the standard *Flood Resistant Design and Construction* (ASCE 24). This standard applies to buildings and site developments proposed in flood hazard areas; it is referenced by the *International Building Code*. ASCE 24 Section 2.6.2.2 contains installation and design criteria for engineered openings. ASCE 24 provides the equation below to determine the total net area of engineered openings that are installed in foundation walls or enclosure walls. The equation includes a coefficient that corresponds to a factor of safety of 5, which is consistent with design practices related to protection of life and property. This factor of safety also helps to account for the likelihood that insect screens may clog with flood-borne debris. The ASCE 24 commentary provides additional background on the derivation of the equation.

As with non-engineered openings, engineered openings must be designed to allow automatic entry and exit of floodwaters.

Three design and performance criteria for engineered openings are specified in ASCE 24 but are not explicitly identified in the NFIP regulations:

- Engineered openings are to perform such that difference between the exterior and interior water levels shall not exceed 1 foot during base flood conditions.
- Engineered openings are to be not less than 3 inches in any direction in the plane of the wall. This requirement applies to the hole in the wall, excluding any screen, grate, grille, louvers, or devices that may be placed in or over the opening.
- In the absence of reliable data on the rates of rise and fall, engineered openings are to be designed based on the assumption that the minimum rate of rise and fall will be 5 feet per hour. Where data or analyses indicate more rapid rates of rise and fall, the required number of openings is to be increased to account for those different conditions. The number or size of the openings may be decreased if data or analyses indicate rates of rise and fall are less than 5 feet per hour.

From ASCE 24, the equation to determine area of engineered openings:

$$A_o = 0.033 [1/c] R A_e$$

Where:  $A_o$  = total net area of openings required (in<sup>2</sup>)

0.033 = coefficient corresponding to a factor of safety of 5.0 (in<sup>2</sup> • hr/ft<sup>3</sup>)

$c$  = opening coefficient (non-dimensional; see ASCE 24, Table 2-2)

$R$  = worst case rate of rise and fall (ft/hr)

$A_e$  = total enclosed area (ft<sup>2</sup>)

[ASCE 24] Table 2-2

Flood Opening Coefficient of Discharge

Opening Shape and Condition	$c$
circular, unobstructed during design flood	0.60
rectangular, long axis horizontal, short axis vertical, unobstructed during design flood	0.40 <sup>a</sup>
square, unobstructed during design flood	0.35
rectangular, short axis horizontal, long axis vertical, unobstructed during design flood	0.25 <sup>b</sup>
other shapes, unobstructed during design flood	0.30

Notes:

- a. When the horizontal dimension is twice or more the vertical dimension, use 0.4; as the dimensions approach a square, interpolate from 0.4 to 0.35.
- b. When the horizontal dimension is half or less the vertical dimension, use 0.25; as the dimensions approach a square, interpolate from 0.25 to 0.35.

Used with permission from ASCE.

## The NFIP

The U.S. Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as protection against flood losses, in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government. If a community adopts and enforces adequate floodplain management regulations, FEMA will make flood insurance available within the community.

Title 44 of the U.S Code of Federal Regulations contains the NFIP criteria for floodplain management, including design and construction standards for new and substantially improved buildings located in SFHAs identified on the NFIP's Flood Insurance Rate Maps. FEMA encourages communities to adopt floodplain management regulations that exceed the NFIP criteria. As an insurance alternative to disaster assistance, the NFIP reduces the escalating costs of repairing damage to buildings and their contents caused by floods.

## NFIP Technical Bulletins

This is one of a series of Technical Bulletins that FEMA has produced to provide guidance concerning the building performance requirements of the NFIP. These requirements are contained in Title 44 of the U.S. Code of Federal Regulations at Section 60.3. The bulletins are intended for use by State and local officials responsible for interpreting and enforcing the requirements in their floodplain management regulations and building codes, and by members of the development community, such as design professionals and builders. New bulletins, as well as updates of existing bulletins, are issued periodically, as necessary. The bulletins do not create regulations; rather, they provide specific guidance for complying with the requirements of existing NFIP regulations. Users of the Technical Bulletins who need additional guidance should contact their NFIP State Coordinator or the appropriate FEMA regional office. The *User's Guide to Technical Bulletins* (<http://www.fema.gov/pdf/final/guide01.pdf>) lists the bulletins issued to date.

## Ordering Technical Bulletins

The quickest and easiest way to acquire copies of FEMA's Technical Bulletins is to download them from the FEMA website (<http://www.fema.gov/plan/prevent/floodplain/techbul.shtm>).

Technical Bulletins also may be ordered free of charge from the FEMA Publications Warehouse by calling 1-800-480-2520, or by faxing a request to 301-362-5355, Monday through Friday between 8 a.m. and 5 p.m. EST. Please provide the FEMA publication number, title, and quantity of each publication requested, along with your name, address, zip code, and daytime telephone number. Written requests may be also be submitted by mail to the following address:

FEMA Publications  
P.O. Box 2012  
Jessup, MD 20794

## Further Information

The following sources provide further information concerning openings in foundation walls and walls of enclosures.

American Society of Civil Engineers, Structural Engineering Institute. 2005. *Flood Resistant Design and Construction*, ASCE/SEI 24-05.

American Society of Civil Engineers, Structural Engineering Institute. 2005. *Minimum Design Loads for Buildings and Other Structures*, ASCE/SEI 7-05.

FEMA. 1991. *Answers to Questions About Substantially Damaged Buildings*, FEMA 213.

FEMA. 2000. *Coastal Construction Manual*, FEMA 55CD (3rd edition).

FEMA. 2004. *Floodplain Management Bulletin: Elevation Certificate*, FEMA 467-1 (<http://www.fema.gov/pdf/fima/fema467-6-10-04.pdf>).

FEMA. 2005. *Home Builder's Guide to Coastal Construction: Technical Fact Sheet Series*, FEMA 499.

FEMA. 2006. *Elevation Certificate* (FEMA Form 81-31, <http://www.fema.gov/pdf/nfip/elvcert.shtm>).

ICC Evaluation Service, Inc. 2007. *Acceptance Criteria for Automatic Foundation Flood Vents* (AC364, [http://www.icc-es.org/criteria/pdf\\_files/ac364.pdf](http://www.icc-es.org/criteria/pdf_files/ac364.pdf)).

International Code Council, Inc. 2006. *International Building Code*<sup>®</sup>, IBC<sup>®</sup> 2006.

International Code Council, Inc. 2006. *International Residential Code*<sup>®</sup>, IRC<sup>®</sup> 2006.

National Fire Protection Association. 2005. *Model Manufactured Home Installation Standard*<sup>®</sup>, NFPA 225.

National Fire Protection Association. 2006. *Building Construction and Safety Code*<sup>®</sup>, NFPA 5000.

## Glossary

**Accessory structure** – A structure that is on the same parcel of property as a principal structure, the use of which is incidental to the use of the principal structure.

**Base flood** – The flood having a 1-percent chance of being equaled or exceeded in any given year, commonly referred to as the “100-year flood.” The base flood is the national standard used by the NFIP and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development.

**Base flood elevation (BFE)** – The height of the base (1-percent annual chance or 100-year) flood in relation to a specified datum, usually the National Geodetic Vertical Datum of 1929 (NGVD), or the North American Vertical Datum of 1988 (NAVD).

**Basement** – Any area of a building having its floor subgrade (below ground level) on all sides.

**Elevation certificate** – A form developed by FEMA to collect surveyed elevations and other information about a building that is necessary to obtain flood insurance.

**Enclosure or enclosed area** – Areas created by a crawlspace or solid walls that fully enclose areas below the BFE.

**Federal Emergency Management Agency (FEMA)** – The Federal agency that, in addition to carrying out other activities, administers the National Flood Insurance Program.

**Flood Insurance Rate Map (FIRM)** – The official map of a community on which FEMA has delineated both the special flood hazard areas (SFHAs) and the risk premium zones applicable to the community.

**Hydrodynamic load** – The load imposed on an immersed object, such as a foundation element or enclosure wall, by water flowing against and around it. The magnitude of the hydrodynamic load varies as a function of velocity and other factors.

**Hydrostatic load** – The load imposed on an immersed object such as an enclosure wall, by standing or slowly moving water. The magnitude of the hydrostatic load increases linearly with water depth.

**Lowest floor** – The lowest floor of the lowest enclosed area of a building, including a basement. Any NFIP-compliant unfinished or flood-resistant enclosure usable solely for parking of vehicles, building access, or storage (in an area other than a basement) is not considered a building’s lowest floor, provided the enclosure does not render the structure in violation of the applicable design requirements of the NFIP.

**Mitigation Directorate** – The component of FEMA directly responsible for administering the flood hazard identification and floodplain management aspects of the NFIP.