

The NFIP and Building Codes: Development Standards for Floodplains

Ashokan Watershed Conference

July 28, 2023



Agenda

- NFIP and Building Code Standards for Floodplain Development
 - Types of Floods and Floodplains
 - FEMA's Regulatory Staircase
 - International Building Code and NYS Uniform Code
 - Key Terms and Definitions
 - Elevations
 - Design Standards
 - Variances
 - Summary of Recent Code Changes

Major Categories of Floods

- Riverine Flooding

- Overbank Flooding
- Flash Flooding
- Riverine Erosion
- Ice Jam Flooding

- Coastal Flooding

- Coastal Storms
- Coastal Erosion
- Tsunamis
- Lake Flooding

- Shallow Flooding

- Sheet Flow
- Ponding
- Urban Drainage



Overbank Flooding

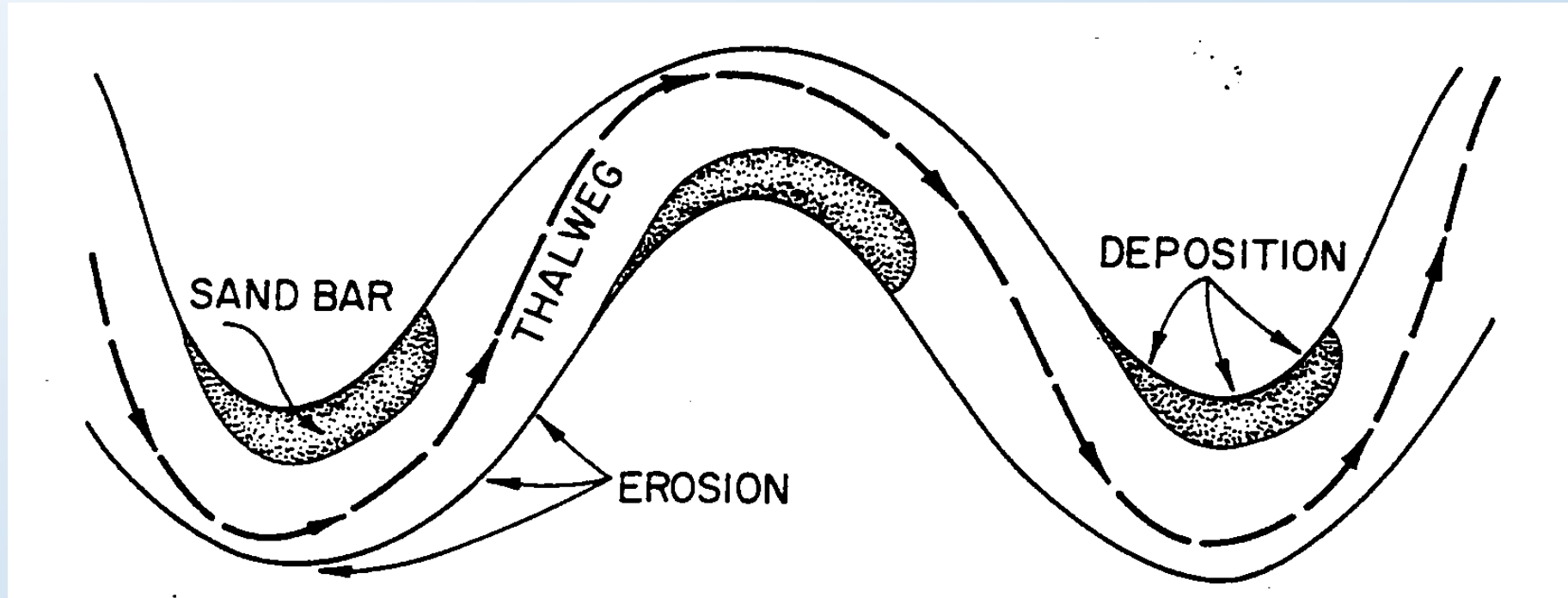




Flash Flooding



Riverine Erosion



Riverine Erosion



Ice Jam Flooding



Photograph taken in during an ice jam in 1999. This view is of the Rexford Bridge looking west. Jam is lodged in the Niskayauna pool just downstream from this point (see map below) (J.I. Garver).

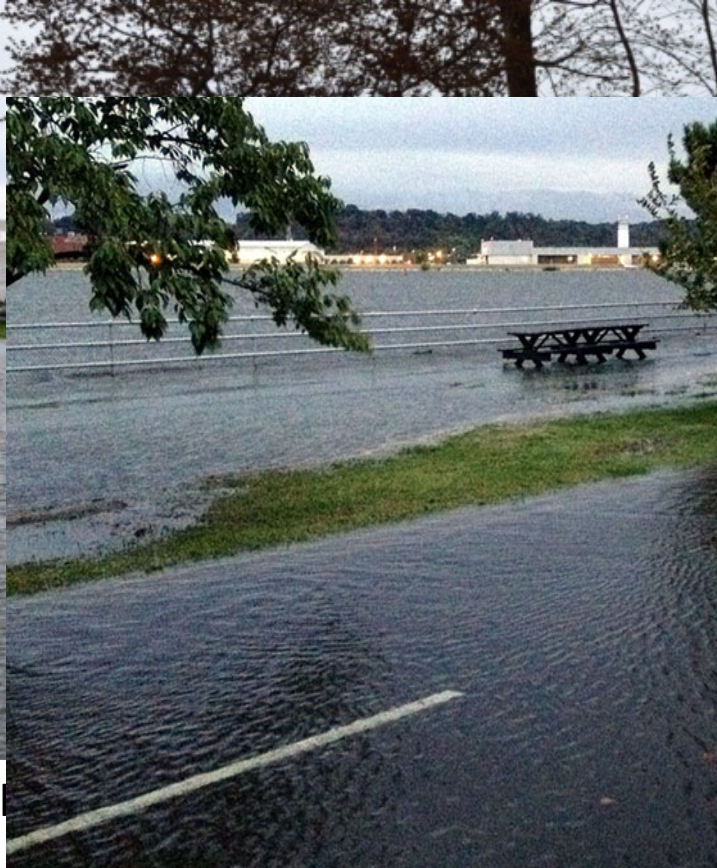


Pemigewasset River, NH, 11/30/2000, USGS Photo

Coastal Flooding



Lake Ontario Coastal
NYSDEC



Tidal flooding during perigean spring
Photo by NOAA



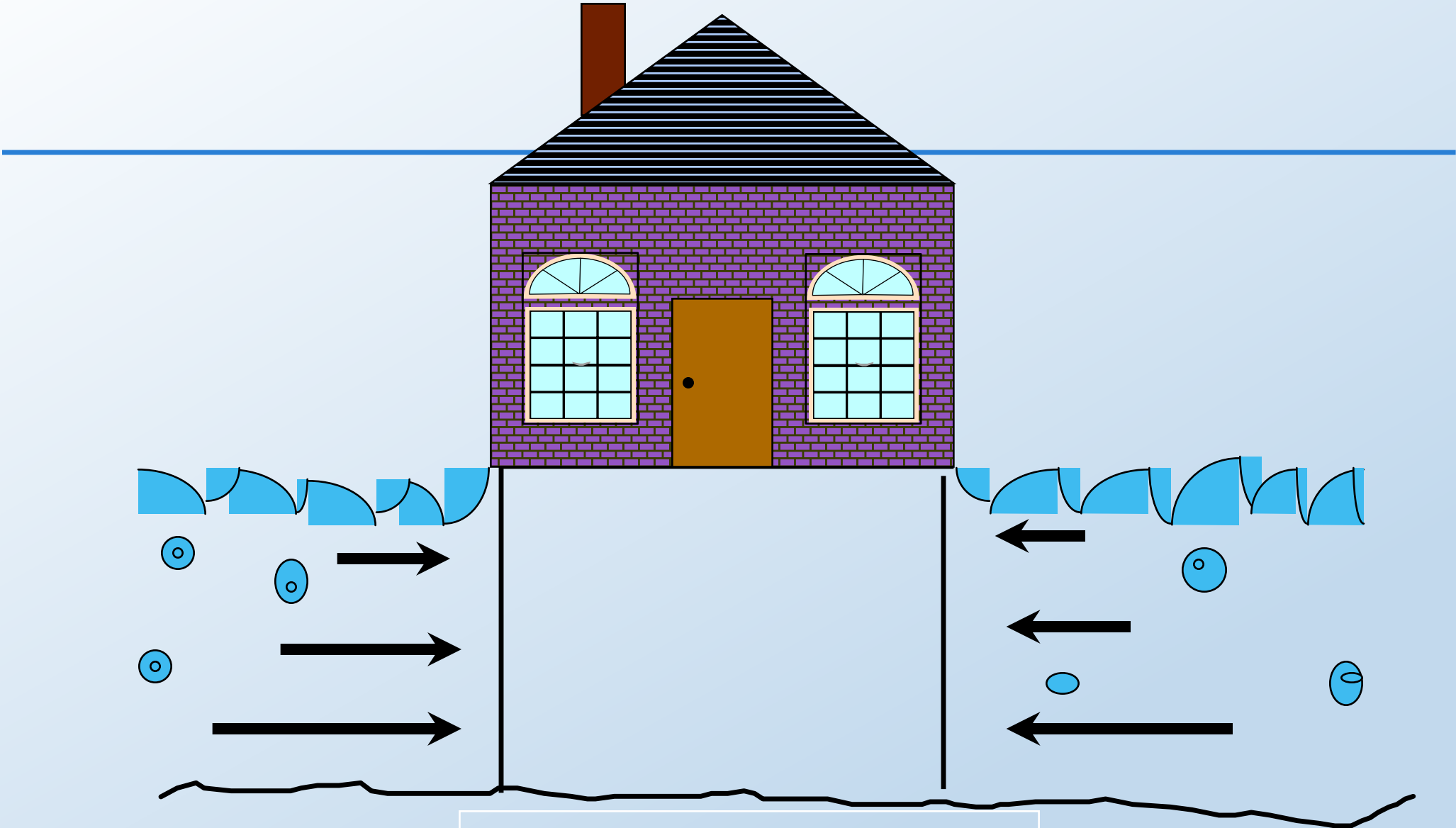
Breezy Point, Rockaway, NY after Sandy. Photo by NYC
OEM, Published by National Weather Service

Urban Flooding



Photo by USGS, Public Domain

- Inadequate Storm Sewers
- Precipitation surpassing drainage design
- Increased impermeable landscape
- Often not shown on flood maps



Hydrostatic Forces

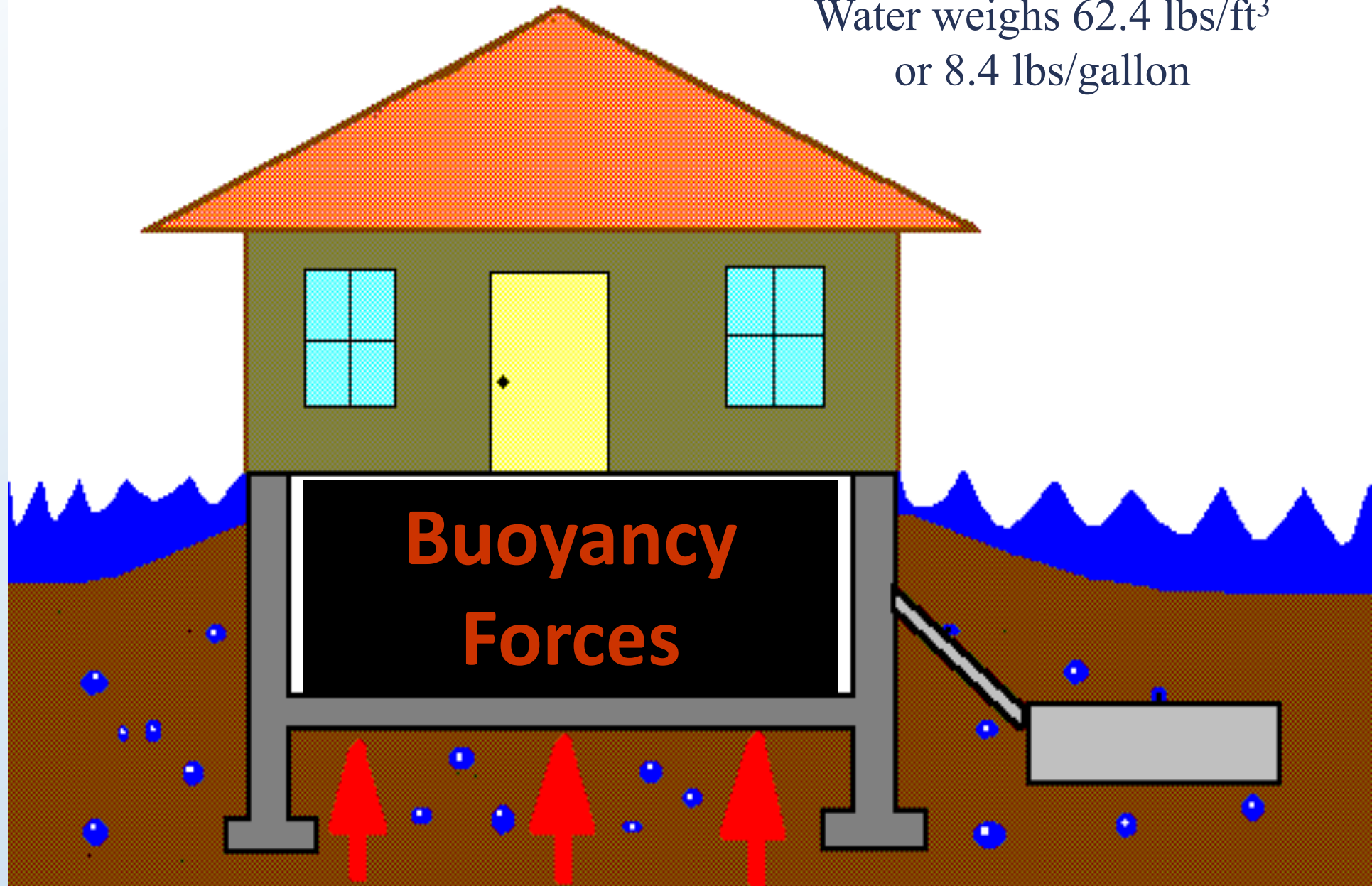


3 ft. of standing water can collapse walls



Basement Walls and Floors are Particularly Vulnerable

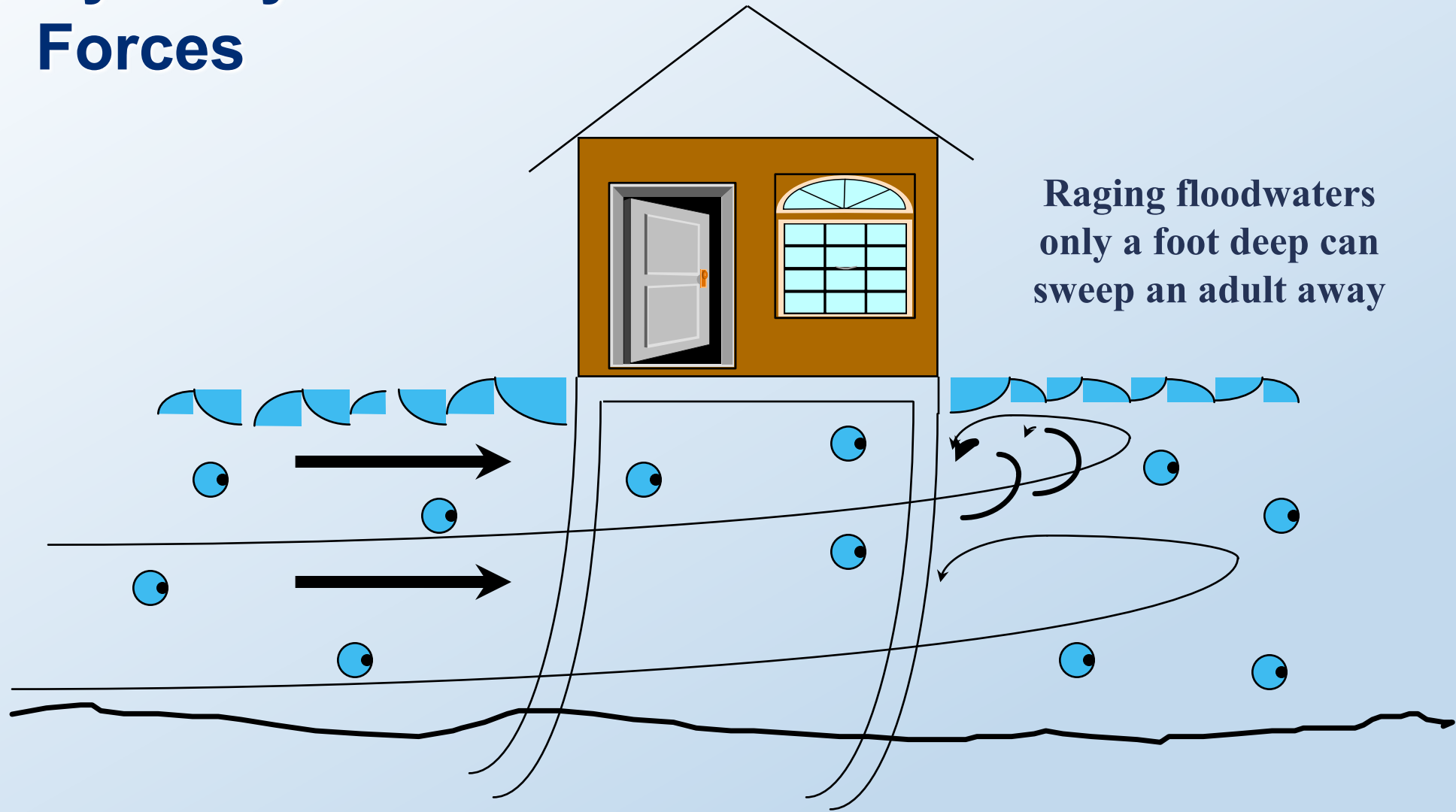
Water weighs 62.4 lbs/ft^3
or 8.4 lbs/gallon



Buoyancy Forces



Hydrodynamic Forces



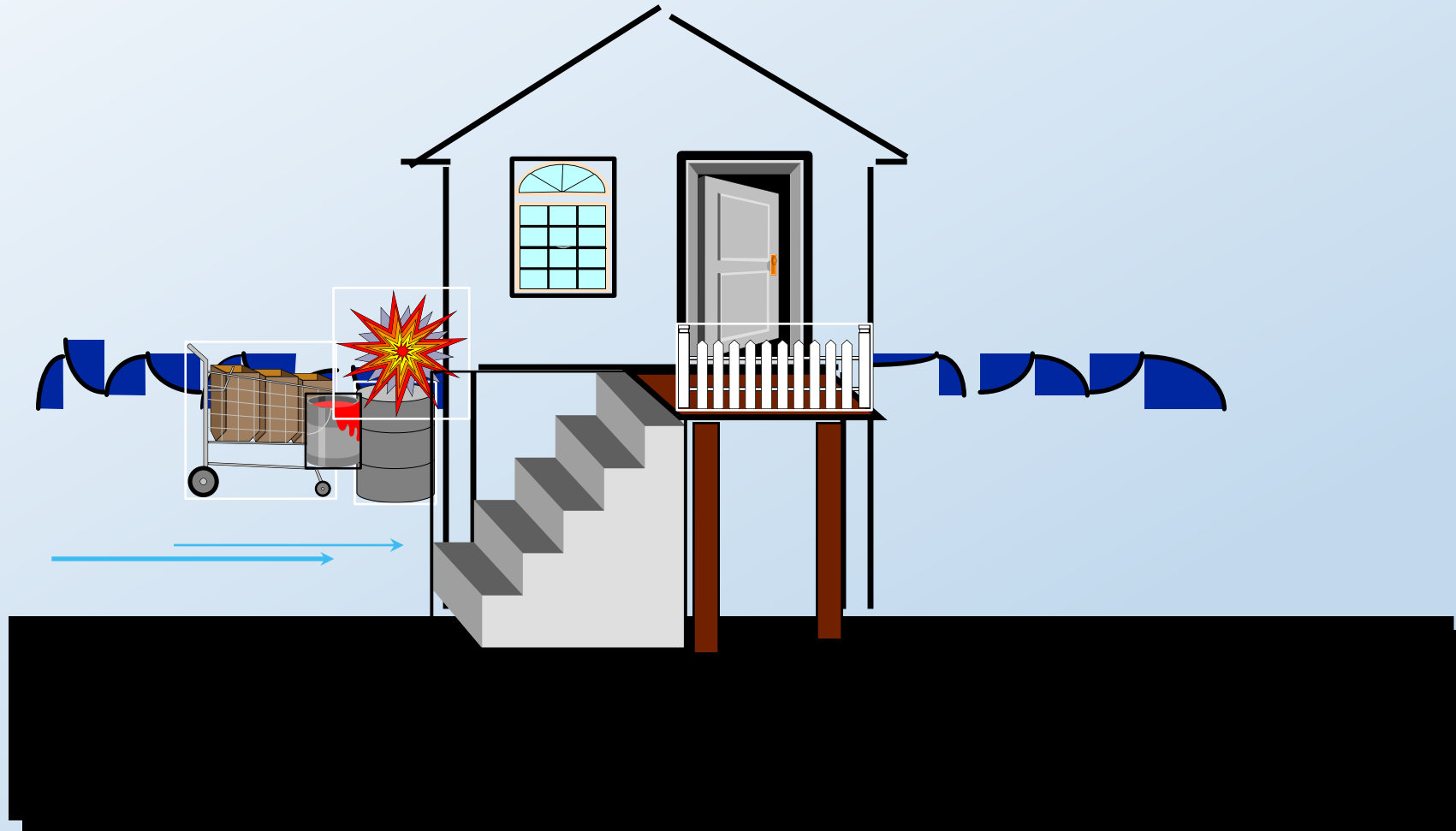


Hydrodynamic Forces

Water moving at 4 mph has same force as a 100 mph wind.



Debris Impact Forces



Debris Impact Forces



ON ALBANY ST. AFTER THE FLOOD, HERKIMER, N.Y. 1910 '53





Soaking



Sediment and Contaminants



The Regulatory Floodplain: A Review

- To Administer Floodplain Regulations, You Must Know About
 - The Special Flood Hazard Area
 - Floodways
 - Coastal Floodplains

Definition of Special Flood Hazard Area

- “Darkly shaded area on a Flood Hazard Boundary Map or a Flood Insurance Rate Map which identifies that area that has a 1 percent chance of being flooded in any given year. The FIRM identifies these shaded areas as flood zones A, AO, AH, A1-30, AE, A99, V, V1-30, and VE.”

Floodway

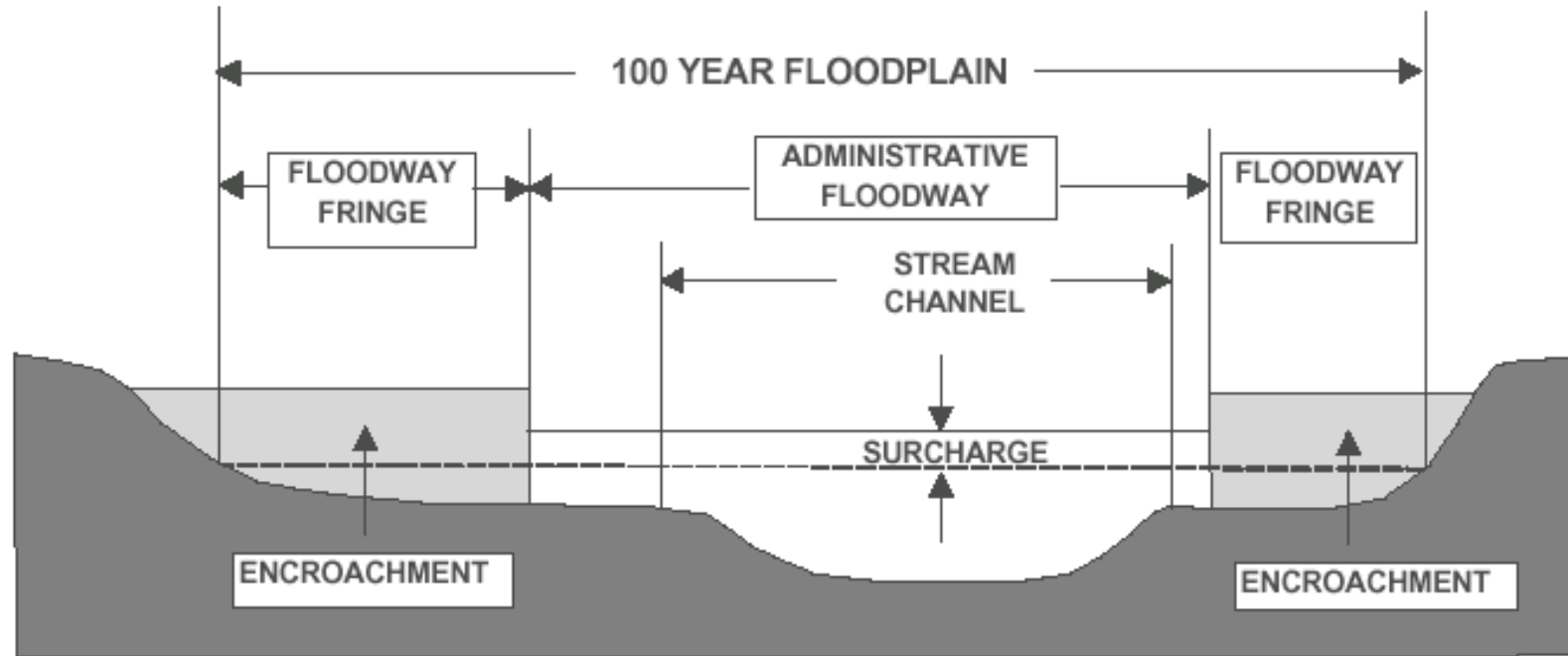


The water channel and adjacent areas that are reserved to discharge the base flood

Definition of Floodway

- “...means the channel of a river or other watercourse 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 foot.”
- Also referred to as the “Regulatory Floodway.”
- FEMA Uses One Foot Rise Criteria:
- A computer model "squeezes" the water until there is less than a one-foot rise anywhere along the watercourse.

FLOODWAY SCHEMATIC



(FLOODWAY) + (FLOODWAY FRINGE) = 100 YEAR FLOODPLAIN (SFHA)

SURCHARGE NOT TO EXCEED 1.0 FEET

ENCROACHMENT AREA IS THE AREA THAT COULD BE USED FOR DEVELOPMENT

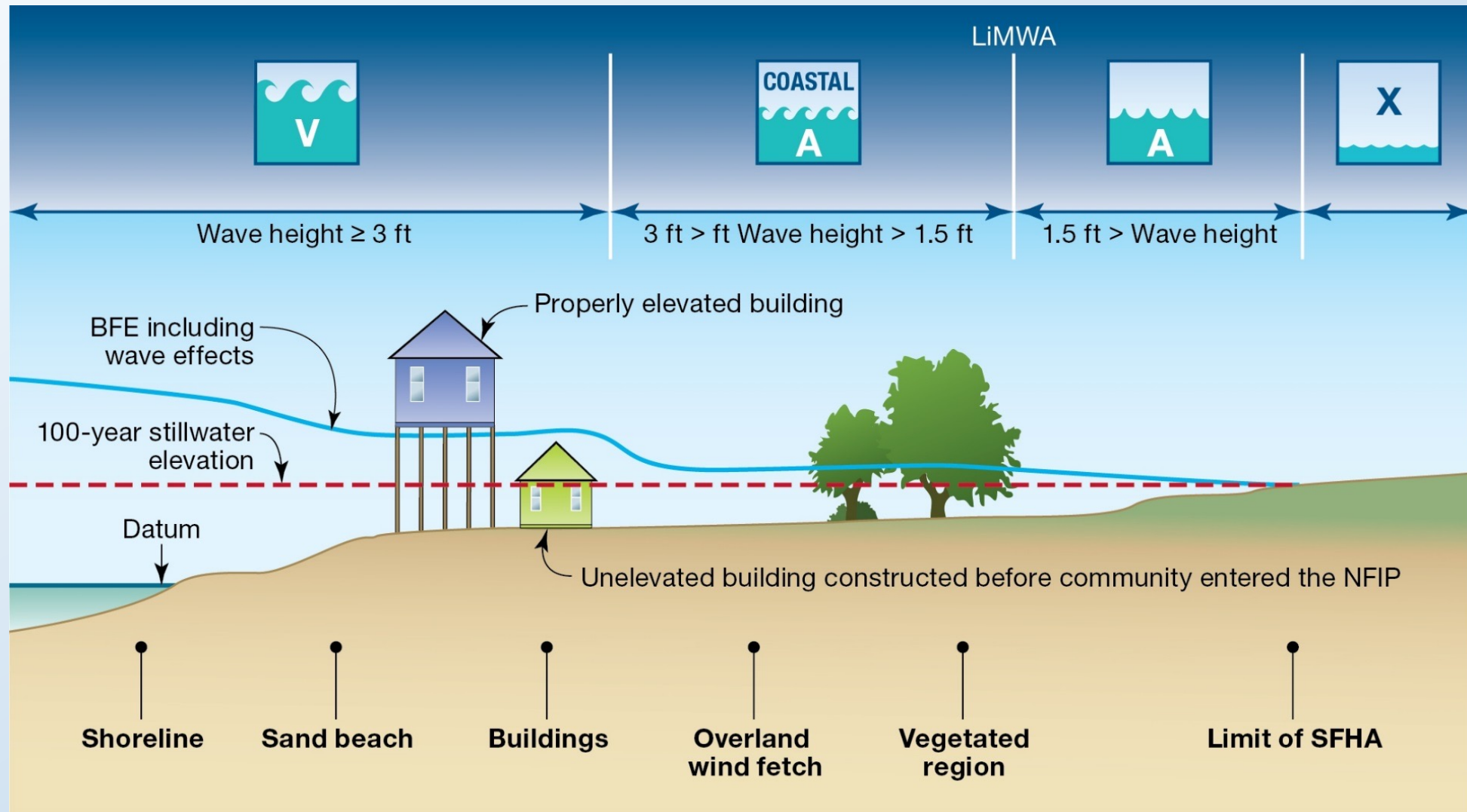
Coastal Areas:

Stillwater and Wave Elevations



- Wave heights during storm surges are analyzed along transects (cross-section lines) along a coast.

Coastal Area Floodplains



What Do Floodplains Do for Us?

- Naturally store and convey floodwaters.
- Maintain water quality.
- Recharge groundwater aquifers and naturally regulate flows into rivers and lakes.
- Support large and diverse populations of plants and animals.
- Provide historical, scientific, recreational, and economic benefits to communities.



Altering Natural Floodplains

- Damages or destroys fish and wildlife breeding, nursery, and feeding grounds.
- Robs downstream habitats of nutrients.
- Threatens a significant percentage of endangered species.
- Increases Peak Flow
- Decreases Groundwater Storage
- Decreases Base Flow

Only 20-30% of U.S. floodplains remain undisturbed.



Floodplain Management

- Regulations and Building Codes to avoid or minimize the impact of new development.
- Use zoning, land acquisitions and easements to preserve and restore natural functions.
- Growth and development policies.
- Use tax incentives, public education, and other means to build public support.
- Make sure that new development is Reasonably Safe from Flooding.

Evolution of Floodplain Management

- Pre-1940: Flood control structures (dams, dikes, levees)
 - 1942: “Human Adjustment to Floods”
“Floods are acts of God but flood losses are largely acts of man.”
– Dr. Gilbert F. White (1911 – 2006)
- 1965: Water Resources Planning Act created Federal – State River Basin Commissions and integrated Water Resource Planning
- 1966: House Document (HD) 465: Unified National Program for Managing Flood Losses
 - Recognized that structural measures not sufficient to reduce flood losses
- 1968: National Flood Insurance Act of 1968 (established the NFIP)

1973-1980: Environmental Era

- 1973—Flood Disaster Protection Act
 - Enhanced floodplain management.
 - Established requirements for mandatory purchase of flood insurance for federally backed mortgage loans.
 - Required NFIP participation to receive some types of disaster assistance.
- 1974—Disaster Relief Act
 - Created system of Presidential Disaster Declarations
- 1977—Executive Orders
 - 11988—Floodplain Management
 - 11990—Wetlands Protection



1982-Present: Economic Approach

- 1982 - Coastal Barrier Resources Act
 - No Federal Aid, Including Flood Insurance in designated CBRA zones
- 1986 - Cost sharing for Federal projects
 - Federal Flood Control Studies and Projects require Non-Federal Cost-Sharing
- 1988 - Stafford Act – including HMGP
 - 15% of FEMA disaster assistance calculated and for HMGP hazard mitigation fund
- 1993 - Midwest floods, \$12-16 billion
- 1994 - Flood Insurance Reform Act
 - Strengthened Mandatory Flood Insurance Purchase Requirements
- 2000 - Disaster Mitigation Act of 2000
 - Requirements for State and Local Hazard Mitigation Plans

1982-Present: Economic Approach

- 2004 - Flood Insurance Reform Act
 - Severe Repetitive Loss focus
- 2005 - Hurricane Katrina, \$140 billion
- 2012 - Flood Insurance Reform Act (Biggert – Waters)
 - Movement towards Actuarial Rates
- 2012 - Hurricane Sandy, \$60 billion
- 2014 – Homeowner Flood Insurance Affordability Act
 - Slowed Down Movement towards Actuarial Rates
- 2020 – NFIP reauthorization and reform under discussion
 - Possible Revolving Loan Flood Mitigation Fund
 - Expansion of Increased Cost of Compliance coverage

The National Flood Insurance Act of 1968

The National Flood Insurance Act created the Federal Insurance Administration and directed it to:

- Identify flood-prone areas within the U.S.
- Establish flood-risk zones within those areas.
- Require new and substantially improved buildings be constructed in ways that minimize flood damage.
- Transfer cost of private property flood losses from taxpayer to property owner.

Flood Disaster Protection Act of 1973

- Significant expansion of the NFIP and required:
 - Acceleration of flood insurance studies
 - Notification of flood-prone communities
 - Mandatory purchase requirement
 - Participation in the NFIP for Federal assistance

National Flood Insurance Reform Act of 1994

- Expanded flood insurance purchase requirements / Lender penalties for non-compliance
- Requires lenders to determine if structure is located in a flood hazard area
- Flood disaster assistance requires maintenance of flood insurance policy
- Increased Cost of Compliance -- allows insurance payment to elevate, demolish or relocate structure

NFIP Amendments, 2012, 2014 and Now(?)

- Biggert-Waters Flood Insurance Reform Act of 2012
 - Many Insurance Related Changes to Address Debt Program Debt
 - Heavy push-back
 - Also addresses some mapping issues, including future conditions
- Homeowners Flood Insurance Affordability Act of 2014
 - Rolled back pace of 2012 flood insurance increases
- Current law expires in September 2023
 - Several Efforts to Modify Law, None have Passed So Far

The National Flood Insurance Program

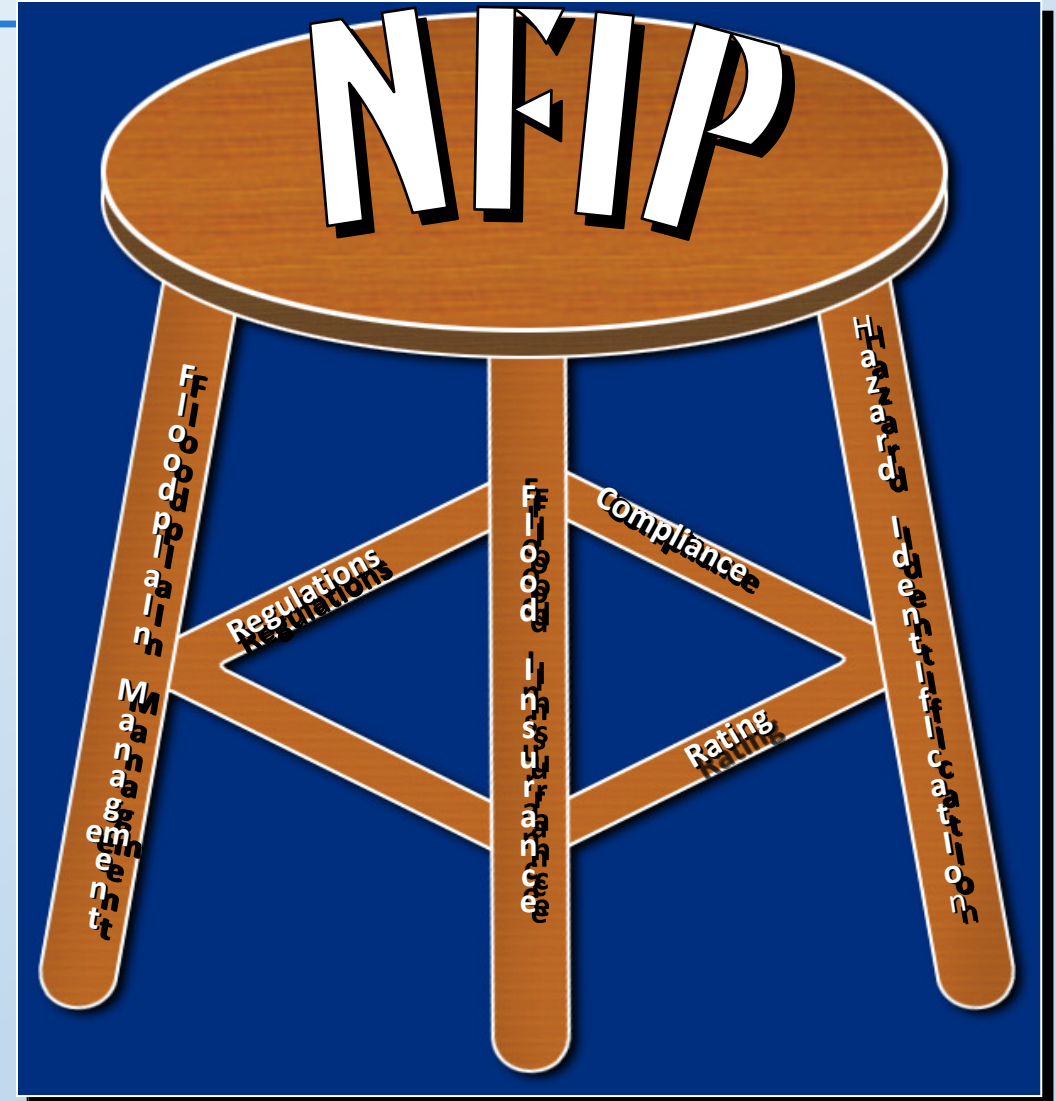
A voluntary program based on a mutual agreement between the Federal government and the local community:

In exchange for adopting and enforcing a FPM ordinance, Federally-backed flood insurance is made available to property owners throughout the community, and Federal Disaster Assistance is available for structures within the SFHA.

“The Three-Legged Stool”

- The NFIP balances three related program areas:
 - Flood Hazard Identification (mapping).
 - Floodplain Management (regulations such as building codes and zoning).
 - Flood Insurance (provision of federal flood insurance for property owners in participating communities).
- **Fourth Leg: Mitigation**

Community must Adopt and Enforce
Floodplain Regulations as Condition of
NFIP Participation



NFIP Goals

- Reduce loss of life and property caused by flooding
- Reduce rising disaster relief costs caused by flooding
- Allow federal flood insurance to be available to property owners and renters

Knowledge Check

What is NOT part of the NFIP?

- A. Flood Insurance
- B. Floodplain Management
- C. Flood Warnings
- D. Mitigation
- E. Flood Maps

Knowledge Check

What includes building codes, land use regulations and other tools

- A. Flood Insurance
- B. Floodplain Management
- C. Flood Warnings
- D. Mitigation
- E. Flood Maps

Knowledge Check

This is mandatory for property owners as condition of a mortgage in a Special Flood Hazard area

- A. Flood Insurance
- B. Floodplain Management
- C. Flood Warnings
- D. Mitigation
- E. Flood Maps

Knowledge Check

What do you use to determine if a property is in a regulated flood zone?

- A. Flood Insurance
- B. Floodplain Management
- C. Flood Warnings
- D. Mitigation
- E. Flood Maps

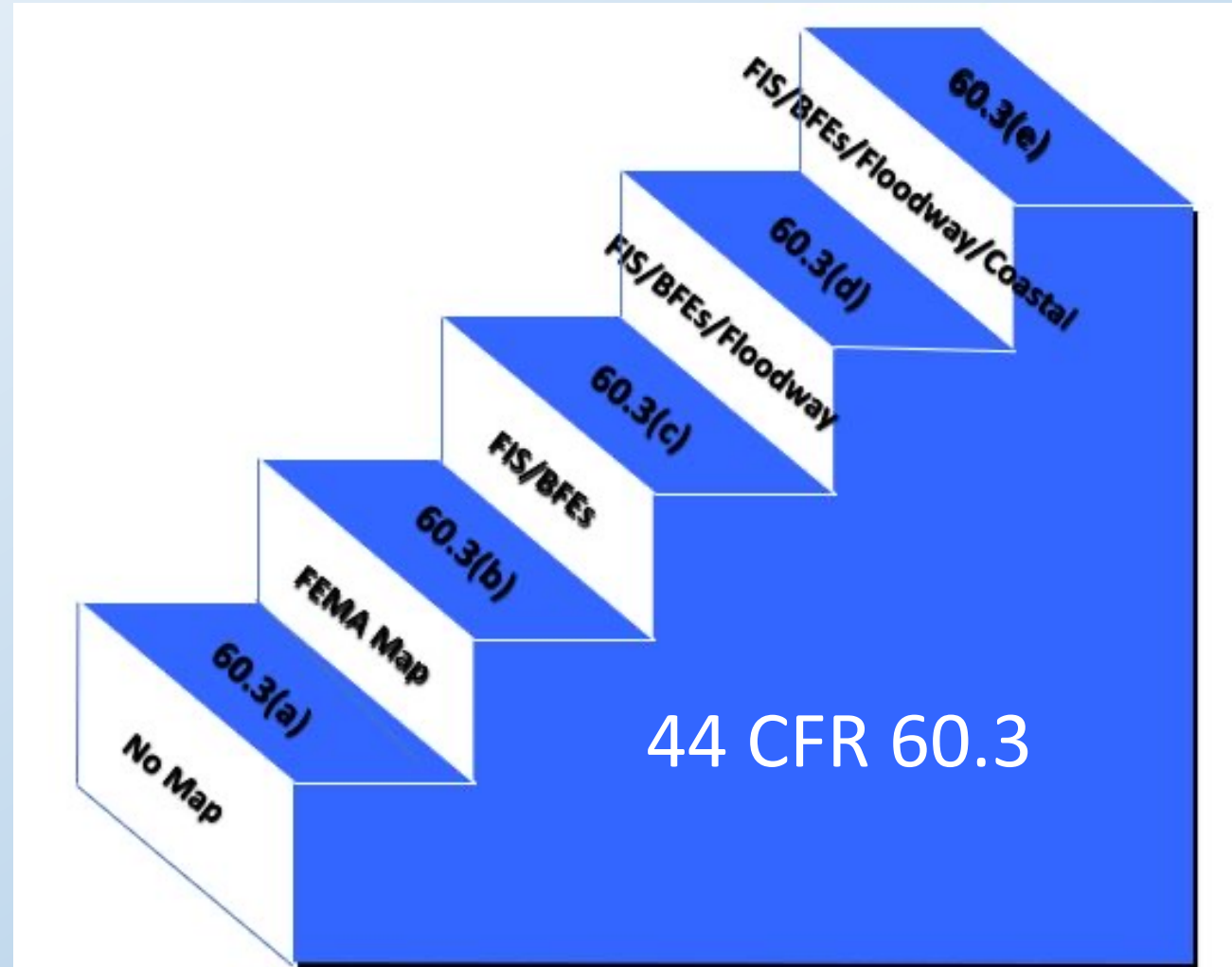
Floodplain Regulations

FEMA's NFIP Regulations

- Part 59 – General Provisions
 - Definitions
 - Program Description and Eligibility Requirements
 - Community Sanctions
- Part 60
 - Floodplain Management Regulations
 - State Requirements
 - Additional Considerations
 - Planning
 - Mudslide/Mudflow
 - Erosion Prone Areas
 - State Coordinating Agencies
- Parts 61-64 Primarily Relate to Flood Insurance
- Part 65 – Mapping, Including
 - Submitting new Technical Data
 - Map Revisions and Amendments
 - Levee Certification

FEMA Regulation “Staircase”

- Regulations build cumulatively in increments according to mapping and flood zone designations.
- Each step adds more stringent requirements as risk increases.
- FEMA regulations are minimum requirements.



FEMA Regulations Apply To...

- All Proposed Construction or Other Development
 - Including fill, paving, grading, etc.
- New Construction
- Substantial Improvements
- Substantial Damage Repairs

44 CFR 60.3 Regulatory Staircase

- Part (a): Community has no FIRM but participates in NFIP
 - Permits for all development
 - Ensure that all Necessary Permits (local, State, Federal) are received
 - Review Permit Applications for Building Sites to be Reasonably Safe from Flooding

44 CFR 60.3 Regulatory Staircase

- Part (a): Continued
 - If site may flood, buildings must be
 - Designed and Anchored to prevent Flotation, Collapse and Lateral Movement
 - Constructed using Flood Resistant Materials
 - Built using Methods and Practices that Minimize Flood Damage
 - Include Protected Utilities
 - Subdivision Design Review – Utility Protection, Need to Minimize Flood Damage, Drainage
 - Water Supply and Wastewater System Protection – Backflow Prevention

44 CFR 60.3 Regulatory Staircase

- Part (b): Community Has Flood Map but no BFE's
 - All of Part A requirements except that Permits only Within SFHA
 - Use any Available BFE or Floodway Data
 - Require BFEs for new subdivisions or other developments over 50 lots or 5 acres
 - Provide Notification of Water Course Alterations (Neighboring Communities, State and Feds)
 - Ensure Flood-Carrying Capacity with any altered Watercourse is Maintained
 - Elevate and Anchor Manufactured Homes

44 CFR 60.3 Regulatory Staircase

- Part (c): Community Has Flood Map AND BFE's
 - All of Part B Requirements Plus
 - Lowest Floor (including basement) must be at or above BFE
 - Fully Enclosed Areas below Lowest Floor may be used ONLY for
 - Parking of Vehicles
 - Building Access
 - Storage
 - Non-Residential Buildings may be floodproofed to BFE

44 CFR 60.3 Regulatory Staircase

- Part (c): Continued
 - Flood Vents for Fully Enclosed Areas below Lowest Floor
 - Equalizes Flood Forces on Exterior Walls
 - Elevation of Manufactured Homes
 - No New Construction including Fill unless it has been demonstrated that cumulative effect of development, when combined with existing and anticipated development, does not increase BFE by more than 1' at any location.
 - RV standards in zones with BFE
 - Licensed and Ready for Road use
 - On site fewer than 180 Days

44 CFR 60.3 Regulatory Staircase

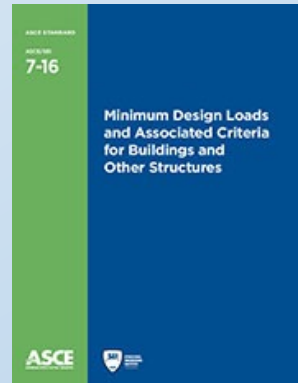
- Part (d): Community has BFEs and at least one Floodway
 - All of Part C requirements plus
 - Prohibit Encroachments within Regulatory Floodway unless Demonstrated through Hydrologic and Hydraulic Analyses that there would be no increase in the flood levels at any location during the base flood.
 - Floodway Encroachments may allow for an increase in BFE only if community applies for a Letter of Map Revision

44 CFR 60.3 Regulatory Staircase

- Part (e): Community Has Zone V1-V30, VE and/or V
 - Meet Requirements of Part C
 - If there are any Floodways, Also Meet Part D
 - New Construction in Zone V must be Landward of Mean High Tide
 - Elevate on Pilings or Columns so that Bottom of Lowest Horizontal Structural Member is above BFE
 - Anchoring to Resist Flotation, Collapse and Lateral Movement
 - Space Below Lowest Floor Free of Obstruction or Breakaway Walls
 - No Fill for Structural Support
 - No Man-Made Alteration of Sand Dunes or Mangrove Stands that would increase flood damage

Codes and Requirements

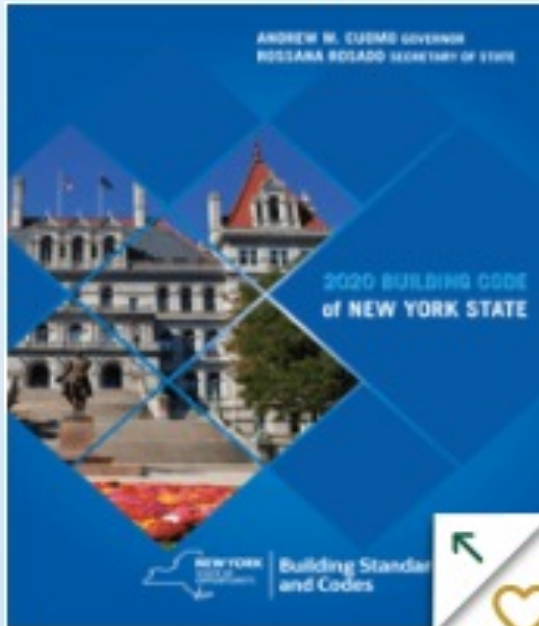
- FEMA's NFIP Requirements: 44CFR60.3 and 44CFR65.3
- International Building Code
- International Residential Code
- International Existing Building Code
- ASCE 24-05 and 24-14, ASCE 7-10 and 7-16
- Different states use different editions



New York State Codes

- 2020 Building Code of NYS
- 2020 Residential Code of NYS
- 2020 Existing Building Code of NYS

<https://dos.ny.gov/building-standards-and-codes>



Uniform Code of NYS

- Purchase or Read Online
- NYS Codes also reference ASCE 24-14 and 7-16
- New York City has own Building Code
 - Must be at least as stringent as Uniform Code of NYS

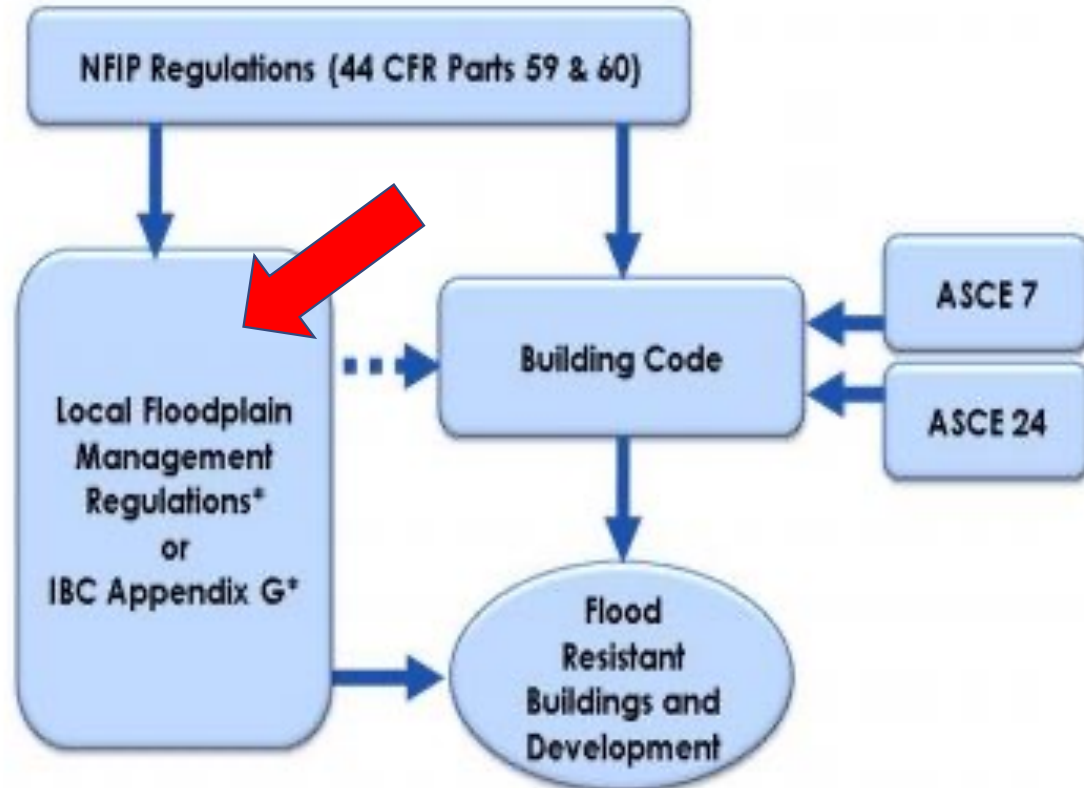
What Code to Use?

- All Jurisdictions in NYS except NYC Must use the Uniform Code
- NYS Uniform Code is from 2020; Most recent International Building Codes were updated in 2021
- In NYS, the Codes Division of the Department of State has Adopted the 2020 Uniform Code
 - Derived from I-Codes but with Amendments in the Text

What Code to Use?

- Not all states use a statewide code
- Some states allow local governments discretion in adopting a code
- Statewide code may not be the most recent
- In NYS, the Codes Division of the Department of State has Adopted the 2020 Uniform Code
 - Derived from I-Codes but with Amendments in the Text

How it Fits Together



* NFIP-consistent administrative provisions, community-specific adoption of FIS and maps, and technical requirements for development outside the scope of the building code (and higher standards, in some communities).

Most states have model local laws that are approved by FEMA for adoption by local communities. NYS DEC has model local laws for communities to use.

International Building Code

- Construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or appurtenances connected or attached;
- **Exception:** Detached one- and two-family dwellings and townhouses not more than three stories above grade. These are covered by the **International Residential Code**
- **NOTE:** Except where mentioned, International Code references and NYS Uniform Code references are interchangeable

International Existing Building Code

- Repair, Alteration, Change of Occupancy, Addition to or Relocation of existing buildings
- **Exception:** Detached one- and two-family dwellings and townhouses not more than three stories above grade. These are covered by this code or the **International Residential Code**

ASCE 7 and 24

- Consensus standards have been referenced by I-Codes since 2000
- IBC directly references detailed requirements contained in ASCE documents
- IRC references ASCE-24 for dwellings in floodways
 - IRC contains specific requirements, but design professionals may use ASCE-24 as an alternative to the IRC
- ASCE 7 contains detailed foundation load resistance requirements
- ASCE 24 contains detailed building elevation and structure requirements

Building Codes

- I-Codes incorporate most of the FEMA NFIP requirements
 - Directly through IRC
 - Indirectly via IBC to ASCE-24
 - IRC references ASCE-24 for floodway encroachments
- NFIP requires some land use considerations that are not in I-Codes
- There are differences in variance requirements
- I-Codes go beyond NFIP minimums in several areas, including freeboard

Uniform Code: NYS Differences from I-Codes

- Building Code
 - Where No DFE's, and one cannot be obtained: DFE is 3' above Highest Adjacent Grade prior to Construction
 - IBC is Moot on this
 - RCNYS does not designate but Building Officials should contact NYS DOS Codes Division Technical Support for guidance
 - DFE shall include Freeboard of 2'
 - Exception: Freeboard Not Required when using 3' above HAG standard
 - This is the standard rather than the tables in ASCE - 24
 - ASCE-24 contains varying Freeboard Requirements based on Building Classification

BFE and DFE

Base Flood Elevation

- FEMA Determined
- Elevation of 1% Annual Chance Flood
- Usually called 100-Year Flood
- AE, AH, A1-A30 zone on FIRMs
 - A1-A30 are on pre-1988 maps only

Design Flood Elevation

- May be Community Determined
- R322.1.4 – In NYS: the higher of BFE + 2' OR The elevation of the design flood associated with the area designated on a flood hazard map adopted by the community, or otherwise legally designated, plus 2'
- R322.1.4 (IRC): Higher of BFE or community determined
- R322.2.1 (NYS) – Elevation Requirement is BFE + 2' or DFE, “whichever is higher”
 - IRC is 1'
- ASCE 24-14 – Design Flood is greater of area subject to 1% or greater chance flood, or area designated by a community's flood hazard map, or otherwise legally designated

More on DFE

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

GROUND SNOW LOAD	WIND DESIGN				SEISMIC DESIGN CATEGORY ^f	SUBJECT TO DAMAGE FROM			WINTER DESIGN TEMP ^g	ICE BARRIER UNDERLAYMENT REQUIRED ^h	FLOOD HAZARDS ^g	AIR FREEZING INDEX ⁱ	MEAN ANNUAL TEMP ^j
	Speed ^d (mph)	Topographic effects ^k	Special wind region ^l	Wind-borne debris zone ^m		Weathering ^a	Frost line depth ^b	Termite ^c					

g. The *jurisdiction* shall fill in this part of the table with (a) the date of the *jurisdiction's* entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas), (b) the date(s) of the Flood Insurance Study and (c) the panel numbers and dates of the currently effective FIRMs and FBFMs or other flood hazard map adopted by the authority having *jurisdiction*, as amended.

R322.1.4 Establishing the design flood elevation. The elevation of the design flood associated with the area designated on a flood hazard map adopted by the community, *or otherwise legally designated* (plus 2 feet of freeboard (in NYS)). (emphasis added)

Adopting a Flood Hazard Map in NYS

- From Table R301.2(1)

g. [NY] To establish flood hazard areas, each community regulated under Title 19, Part 1203 of the Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR) shall adopt a flood hazard map and supporting data. The flood hazard map shall include, **at a minimum**, special flood hazard areas as identified by the Federal Emergency Management Agency in the Flood Insurance Study for the community, as amended or revised with:

- i. The accompanying Flood Insurance Rate Map (FIRM),
- ii. Flood Boundary and Floodway Map (FBFM), and
- iii. Related supporting data along with any revisions thereto.

The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

Uniform Code: NYS Differences from I-Codes

- Residential Code
 - DFE shall include Freeboard of 2'
 - International Residential Code has Freeboard of 1'

We Will Go Over the Following

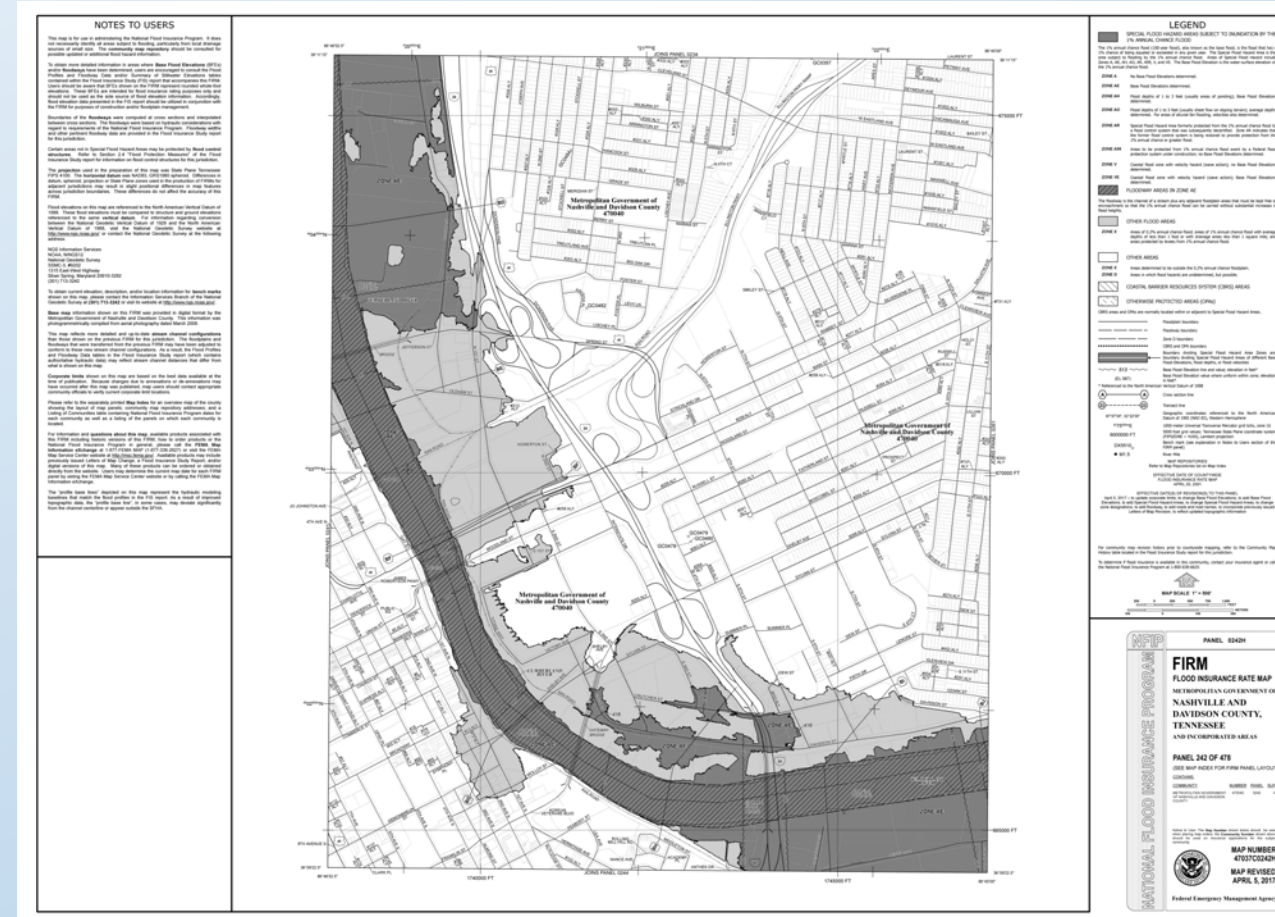
- Flood Insurance Rate Map
- Flood Zones
- Lowest Floor and Areas Below Lowest Floor
- Openings in Foundation Walls
- Ways to Elevate
- Anchoring
- Fuel Tanks
- Floodway
- Base Flood Elevation, Design Flood Elevation and Freeboard
- Substantial Damage / Substantial Improvement
- Coastal Areas
- Dry Floodproofing
- Manufactured Homes
- Variances

Deeper Dives

- Agricultural Buildings
- Accessory Structures
- Utilities
- Additions to Existing Structures
- Crawlspace
- Decks and Staircases
- Historic Buildings

Flood Insurance Rate Map

- Official FEMA produced map.
 - Shows Flood Zones
 - Shows Base Flood Elevations to Nearest Whole Foot
 - For River and Stream Flood Zones, use Flood Insurance Study to determine Base Flood Elevation to 0.1'
 - Find at msc.fema.gov



Flood Maps Defined

- FEMA Definition

- *Flood Insurance Rate Map* (FIRM) means an official map of a community, on which the Administrator has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

- Building Codes

- NY and IRC: Table R301.2(1)
- NY and IBC: Section 1612.3:
 - “To establish *flood hazard areas*, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard identified by FEMA and an engineering study entitled “The Flood Insurance Study for (jurisdiction).”

Flood Zones

- A Zones
 - AE, A1-A30, have BFE's. May be along stream or lake
 - AH and AO - Areas of Shallow Flooding. AH has BFE. AO has Depth.
 - A – Area of Flood Risk without BFE.
- V Zones
 - Coastal Flood Zones with Wave of at least 3'
 - Or Seaward of Primary Frontal Dune
 - May be in tidal areas or on Great Lakes
- Zone X – Everything Else. Shaded X is 500 – Year Flood Zone.

New York 28, Mount Tremper, NY X

Show search results for Emerson Res...

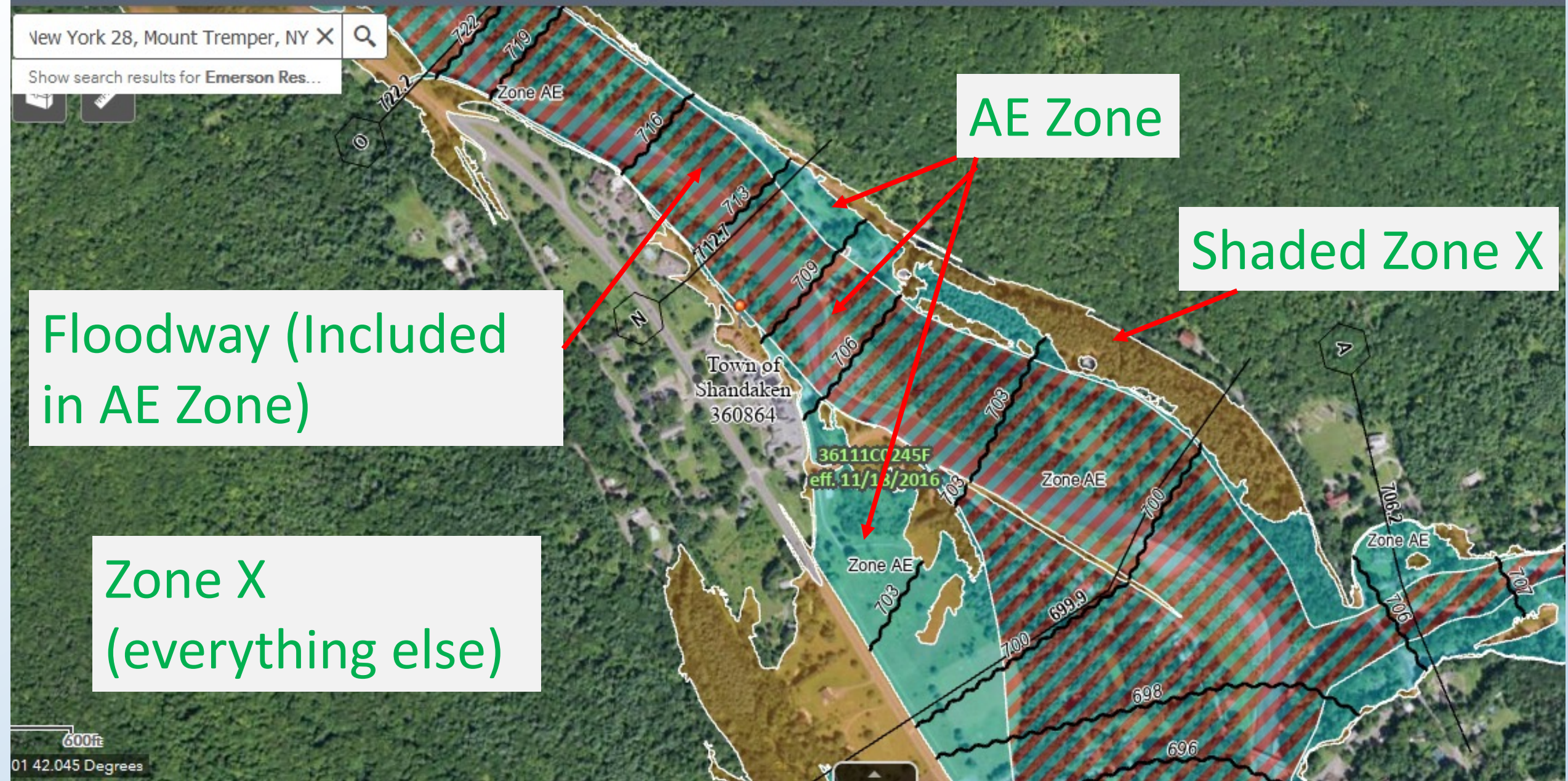


AE Zone

Shaded Zone X

Floodway (Included in AE Zone)

Zone X (everything else)

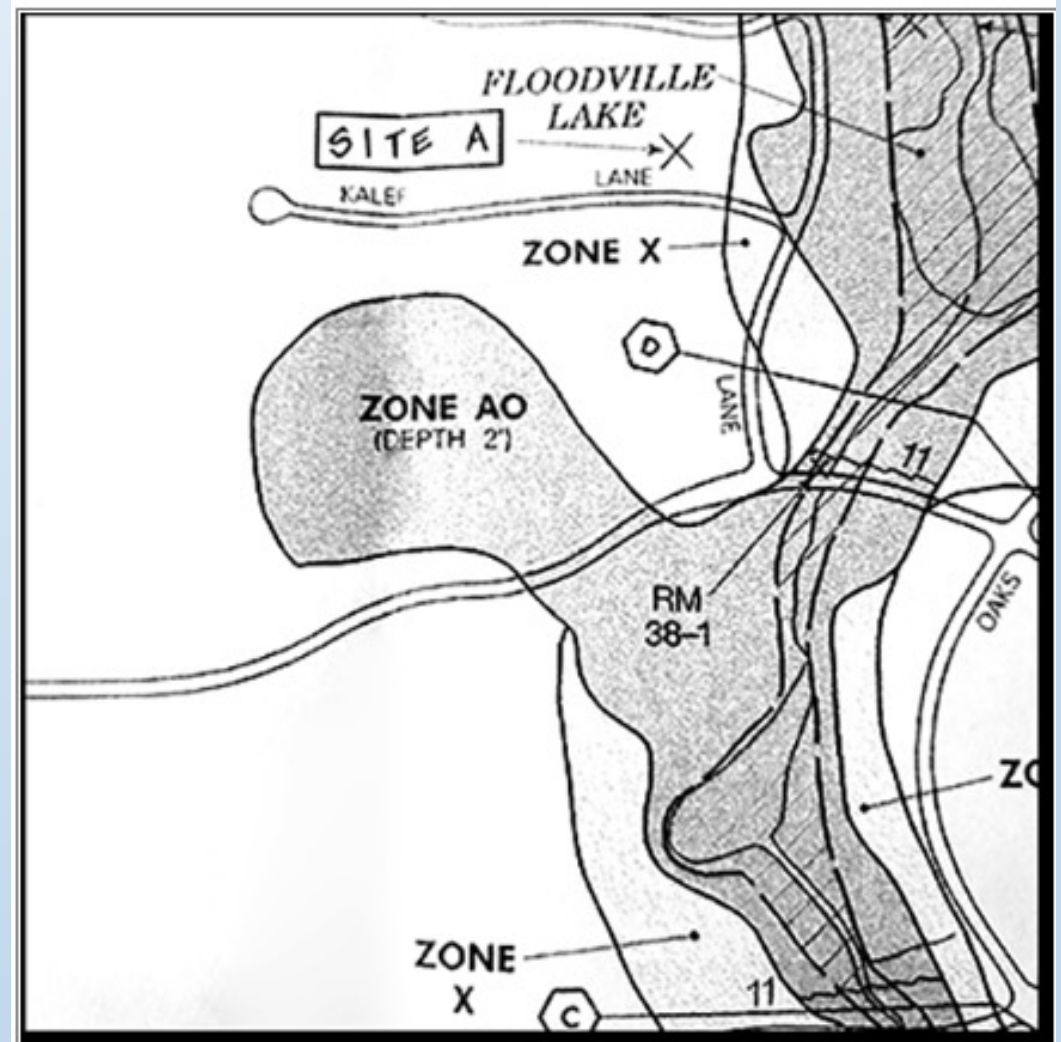


Deeper Dive – Shallow Flooding

- Defined as Flooding with Average Depth of 1-3 Feet
 - Ponding: Water Collects in Ponds or Depressions
 - Sheet Flow: In Steeper Areas with No Defined Channels
 - Urban Drainage: Runoff Collecting in Streets or Yards.
 - May be from Storm Sewer Backup
 - Coastal Flooding: Wave Runup Collecting in Shallow Ponds or Behind an Obstruction
- Shown as Zone AO or Zone AH

Shallow Flooding Zones

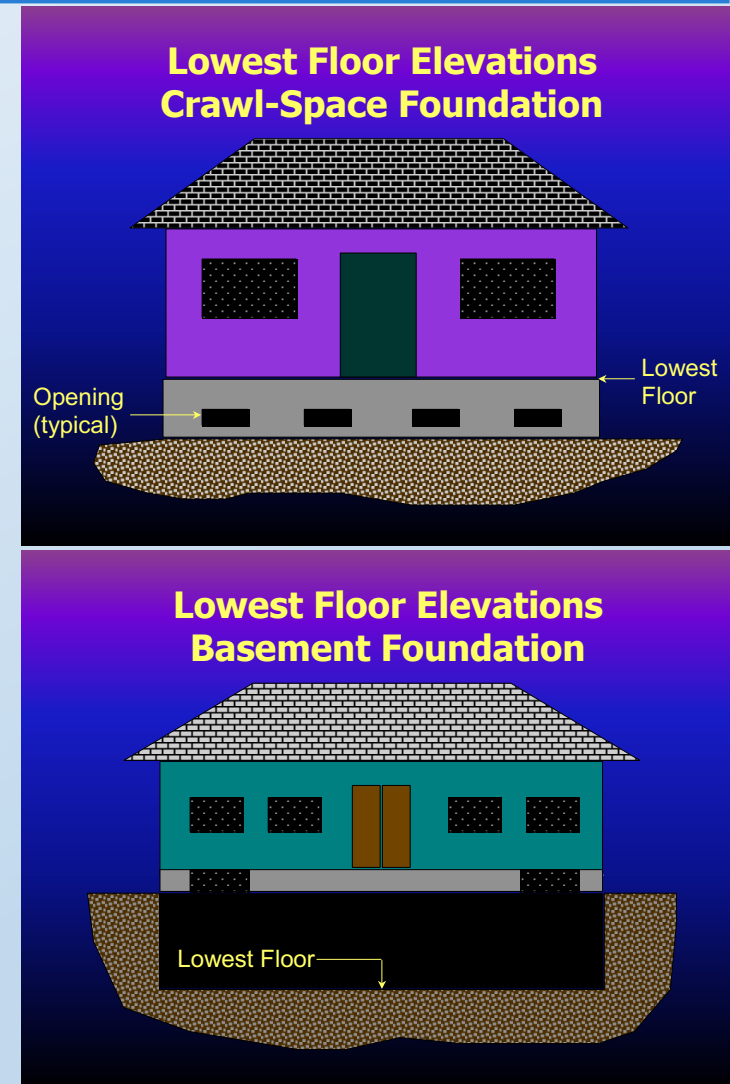
- AO: Sheet Flow, Ponding, or Shallow Flooding. Base Flood Depths (Feet above Ground) are Shown. Depths are shown as between one and three feet.
 - Usually Sheet Flow on Undulating Terrain without a Defined Channel
- AH: Shallow Flooding; BFE's are Provided
 - Usually Ponding Areas



Lowest Floor – FEMA Definition

“...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 storage in an area other than a basement area is not considered a building’s lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance.”

Building Code definitions are similar



Lowest Floor: I-Codes and NYS Codes

“The floor of the lowest enclosed area, including *basement*, but excluding any flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of...

- ...Section 1612” (definitions section)
- ...This Section” (IRC Section R322.1.5)

Basement

- Definition from Building Code:
 - BASEMENT (for flood loads). The portion of a building having its floor subgrade (below ground level) on all sides. The definition of “Basement” is limited in application to the provisions of Section 1612
- Residential Code does not define “basement” from a flooding perspective
 - R322.2.1(3) Basement floors that are below grade on all sides shall be elevated to or above bfe plus 2’...
 - Definitions section of Residential code refers to Building Code for terms not otherwise defined

Lowest Floor: What Does it Mean

- Do not confuse with Lowest Residential Floor
 - Basement (area subgrade on all sides) is always the lowest floor
 - Area not to render structure in violation...

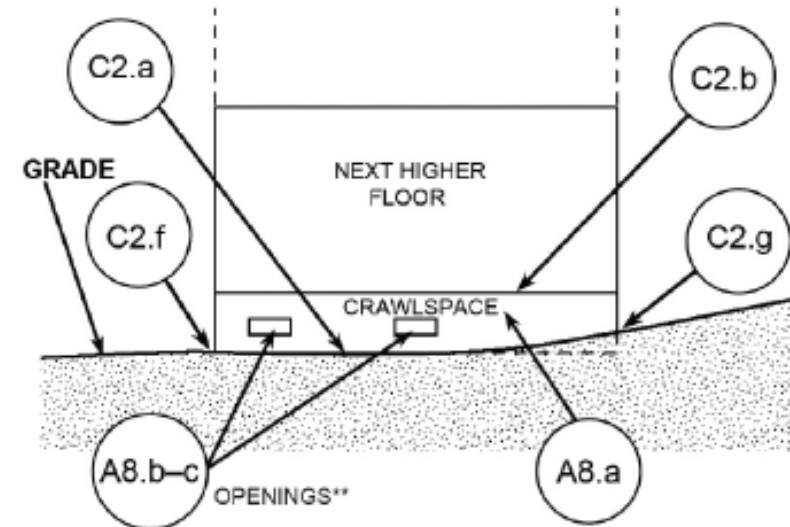
Lowest Floor vs Bottom Floor

- Lowest Floor is FEMA and Building Codes definition.
 - Compliant Structure?
- Bottom Floor from Elevation Certificate
 - Includes basement, crawlspace or enclosure floor
 - Does not necessarily mean non-compliance

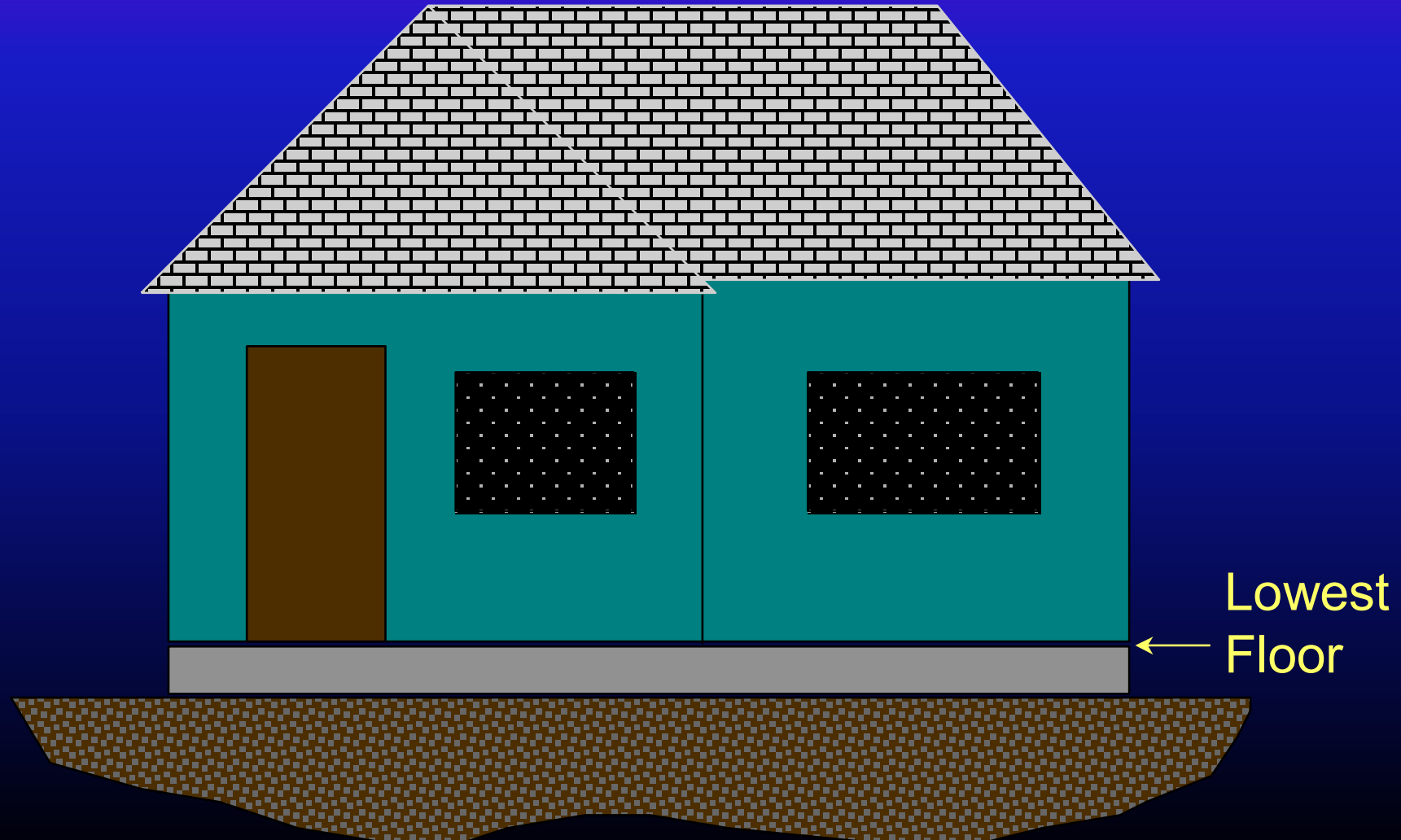
DIAGRAM 8:

All buildings elevated on a crawlspace with the floor of the crawlspace at or above grade on at least one side, with or without an attached garage.

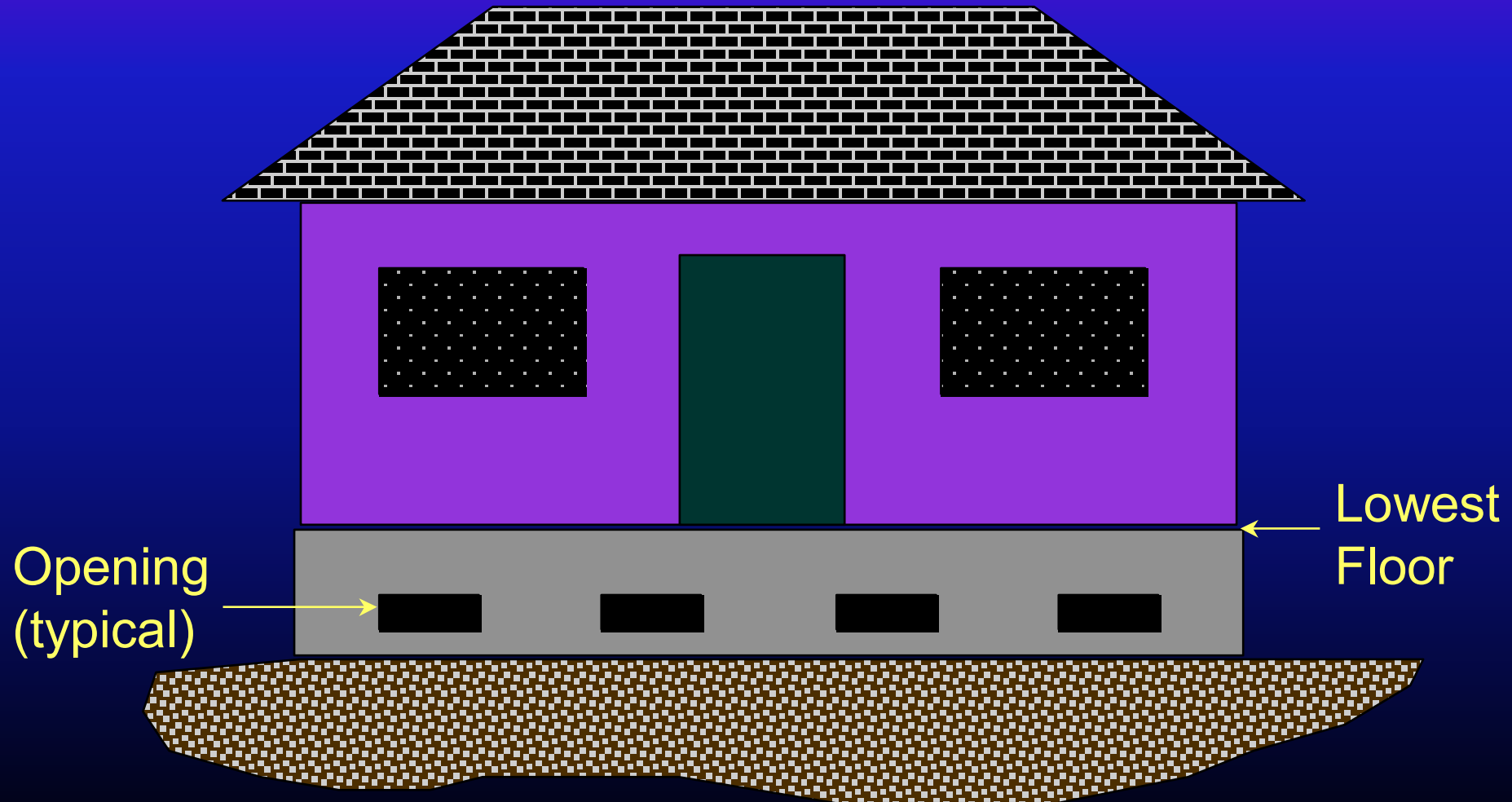
Distinguishing Feature – For all zones, the area below the first floor is enclosed by solid or partial perimeter walls. In all A zones, the crawlspace is with or without openings** present in the walls of the crawlspace. Indicate information about crawlspace size and openings in Section A - Property Information. (If the distance from the crawlspace floor to the top of the next higher floor is more than 5 feet, use Diagram 7.)



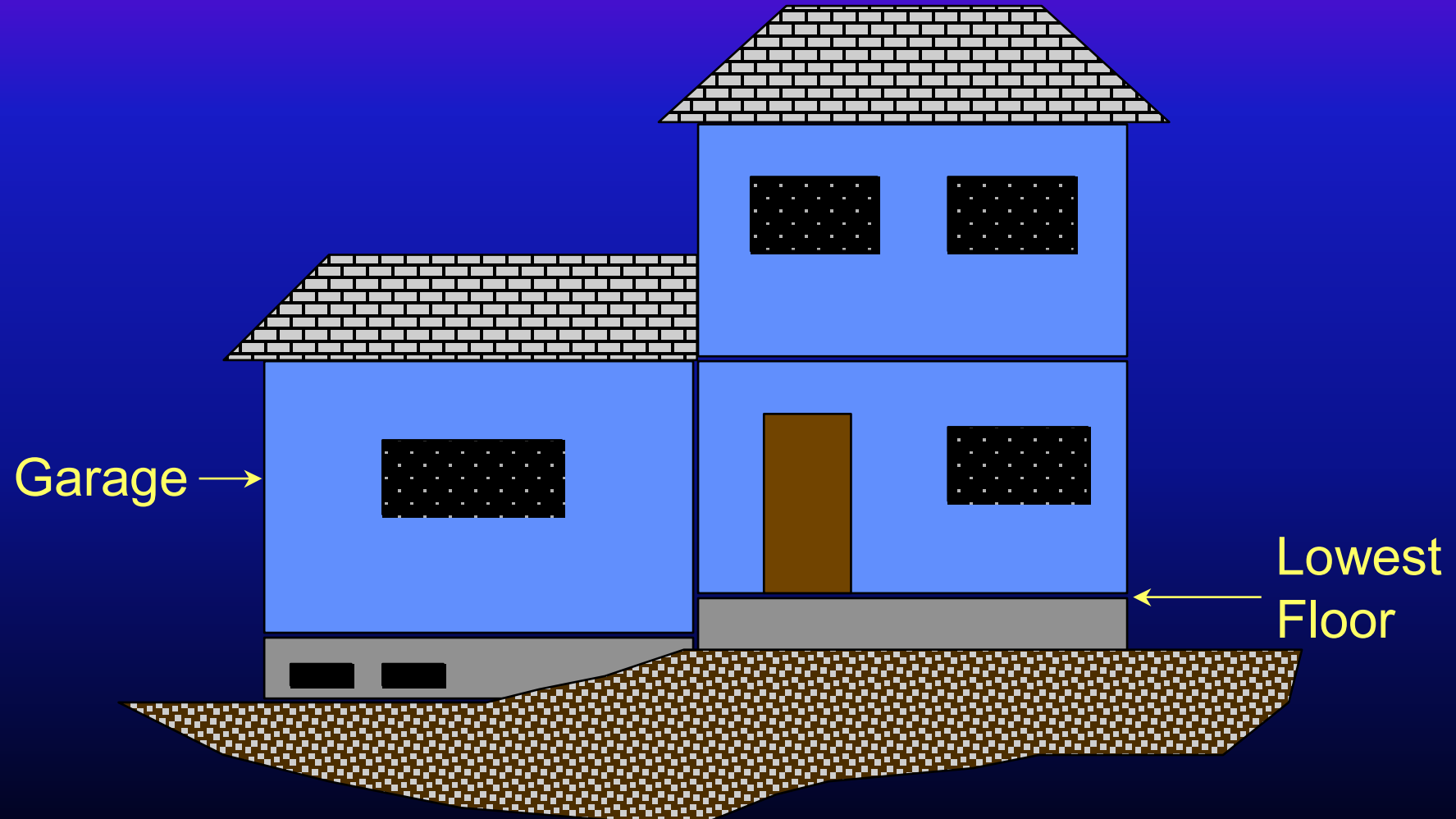
Lowest Floor Elevations Slab Foundation



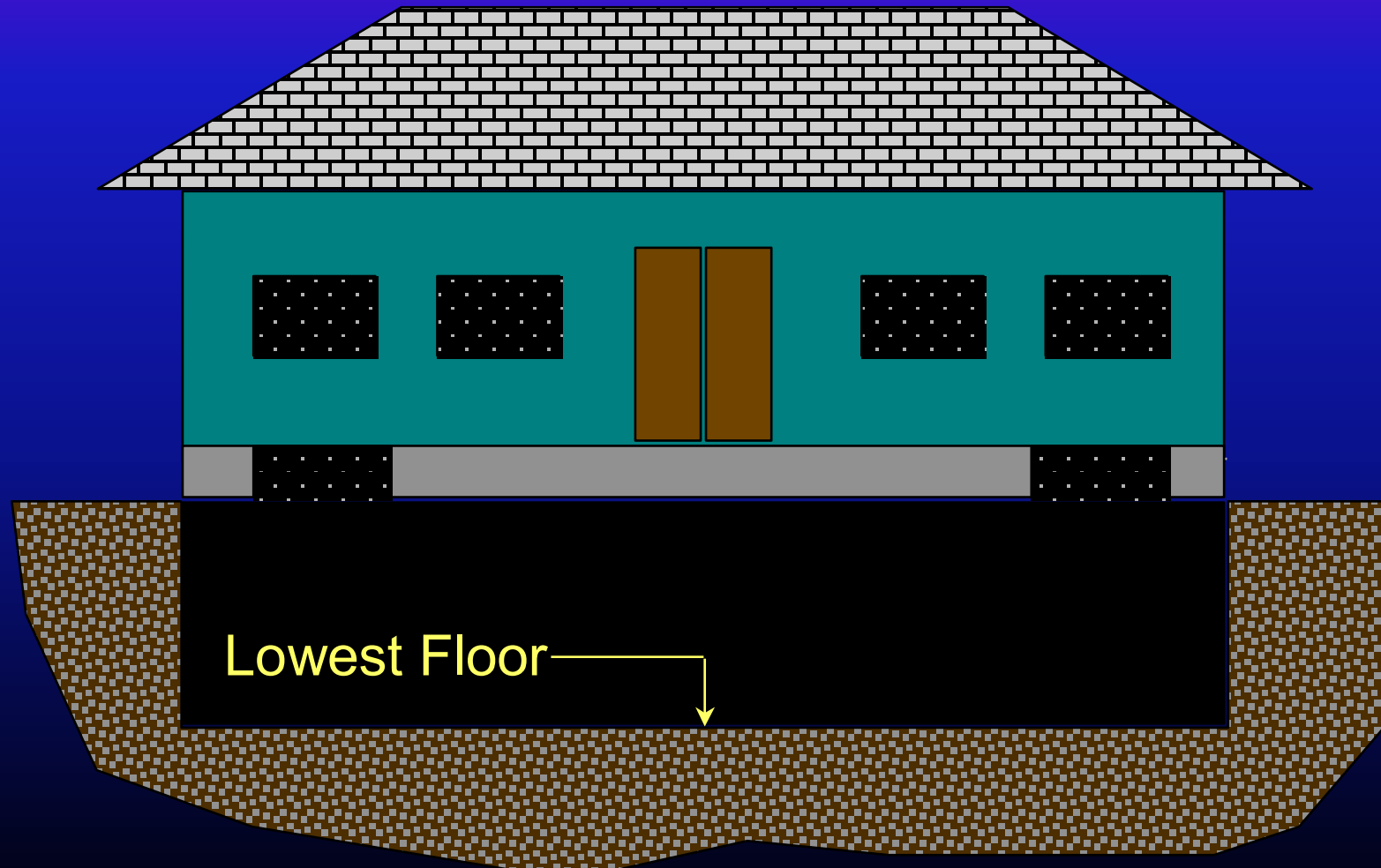
Lowest Floor Elevations Crawl-Space Foundation



Lowest Floor Elevations Split Level

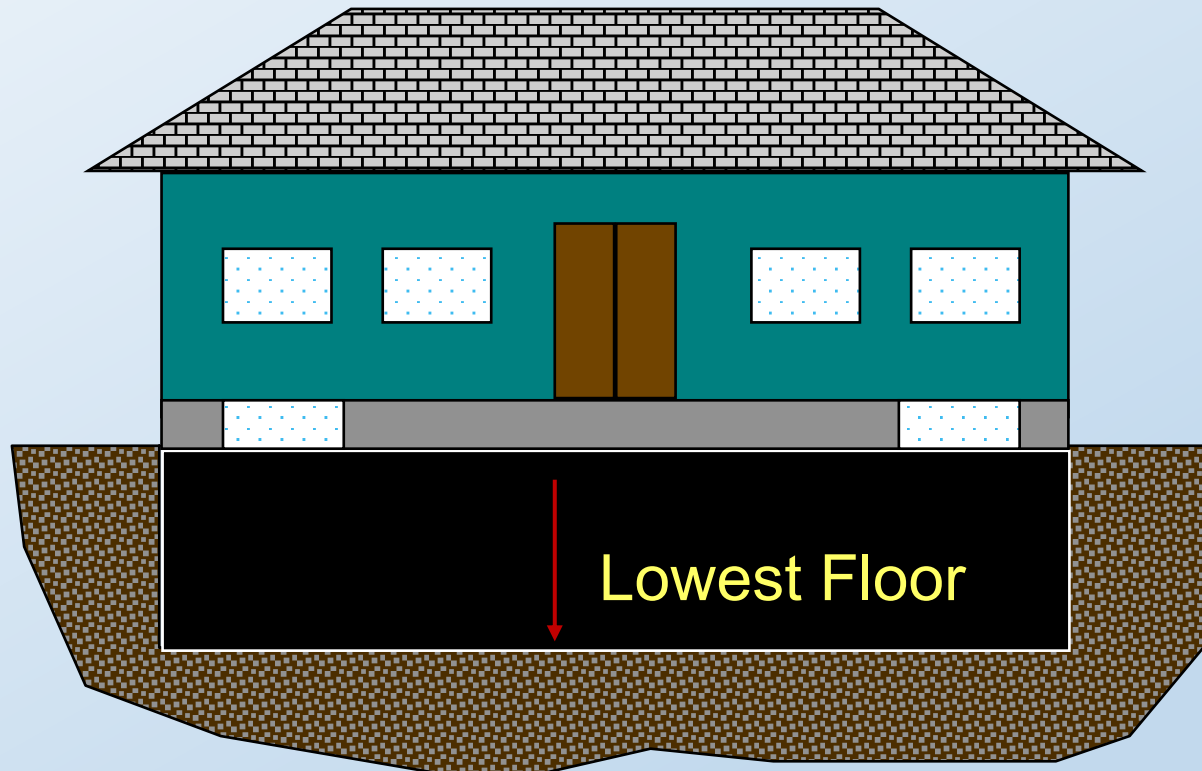


Lowest Floor Elevations Basement Foundation

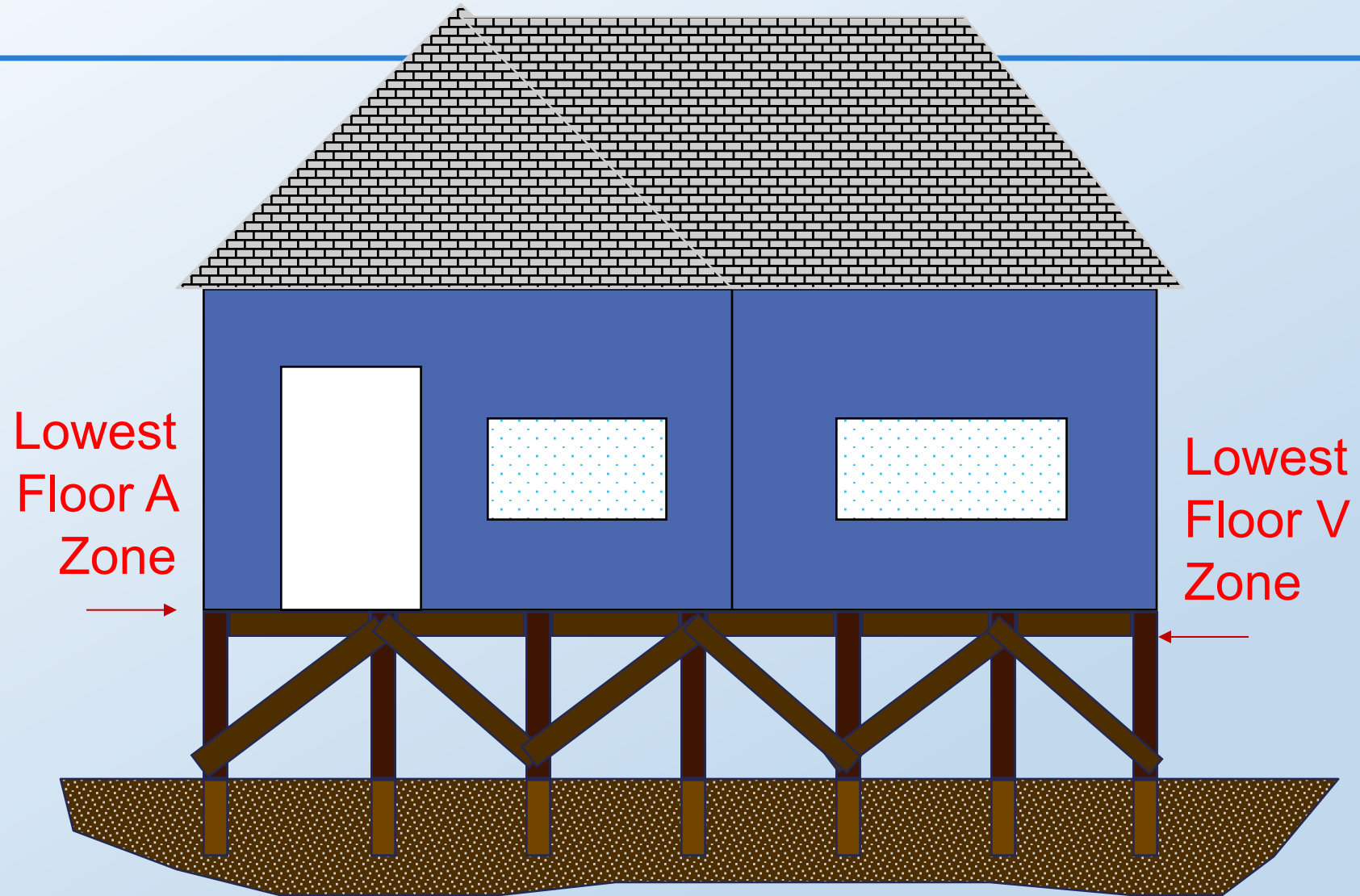


Definition of Basement

- Basement or Cellar is that portion of a building having its floor subgrade (below ground level) on all sides.



Pile Foundation



Areas Below the Lowest Floor

- Utilities
- Flood Resistant Materials
- Flood Vents

Utilities

44CFR60.3(a)(3)(iv)

Designed and/or Located to
Prevent Water from Entering or
Accumulating

IBC 2018 Refers to ASCE 24,
Section 7.1

Elevate to BFE plus 1' or 2'
(depending on type of structure)
or designed or located to prevent
water from entering or
accumulating
(DFE + 2' in NYS)

Resid. Code, Section R322.1.6
Electrical Systems, equipment,
components, heating, AC,
plumbing appliances, duct
systems, located at or above
required elevations or designed
or installed to prevent water
from entering or accumulating

Deeper Dive – Building Utilities

- Heating and Air Conditioning
- Oil or Propane Storage Tanks
- Duct Systems
- Water Heaters
- Generators
- Electrical Connection and Meters

Utilities – FEMA Regulations – 60.3(a)(3)(iv)

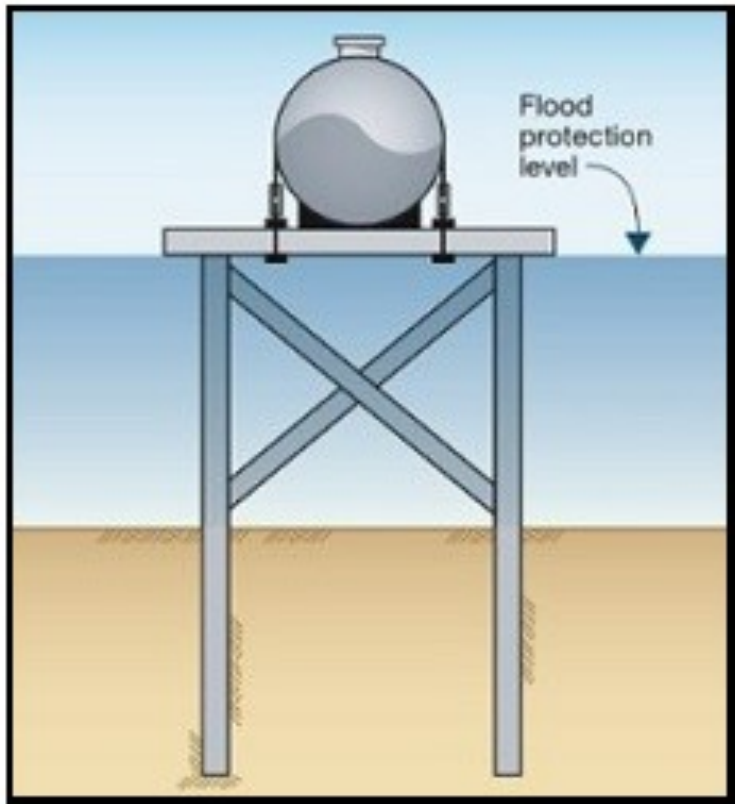
All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located to prevent water from entering or accumulating within the components during conditions of flooding.

AC Units



- Elevate on Pedestal or on Cantilevered Platform
- Protective Flood Barriers OK for Non-Residential Installations Only

Elevating and Anchoring Propane Tanks



Fuel Tanks

- Fuel Tanks are Considered “Structures”
- 44 CFR 59.1: Definitions - Structure means, for floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.
- Like Other Structures, They Must be Anchored
- Elevated Platforms are Recommended

Underground Tanks

- Subject to Buoyant Forces; At Risk of Displacement
- Subject to Crushing from Flood Forces
- Fuel Lines can be Damaged by Moving Floodwaters
- Vent Lines connected to Fuel Oil Tanks can allow Floodwaters to Enter Tanks – Should have Watertight Caps
- Mitigate Existing Tanks by Elevating and Protecting Fill and Vent Pipes and Anchoring
- New Construction: All Tanks should be Elevated and Anchored

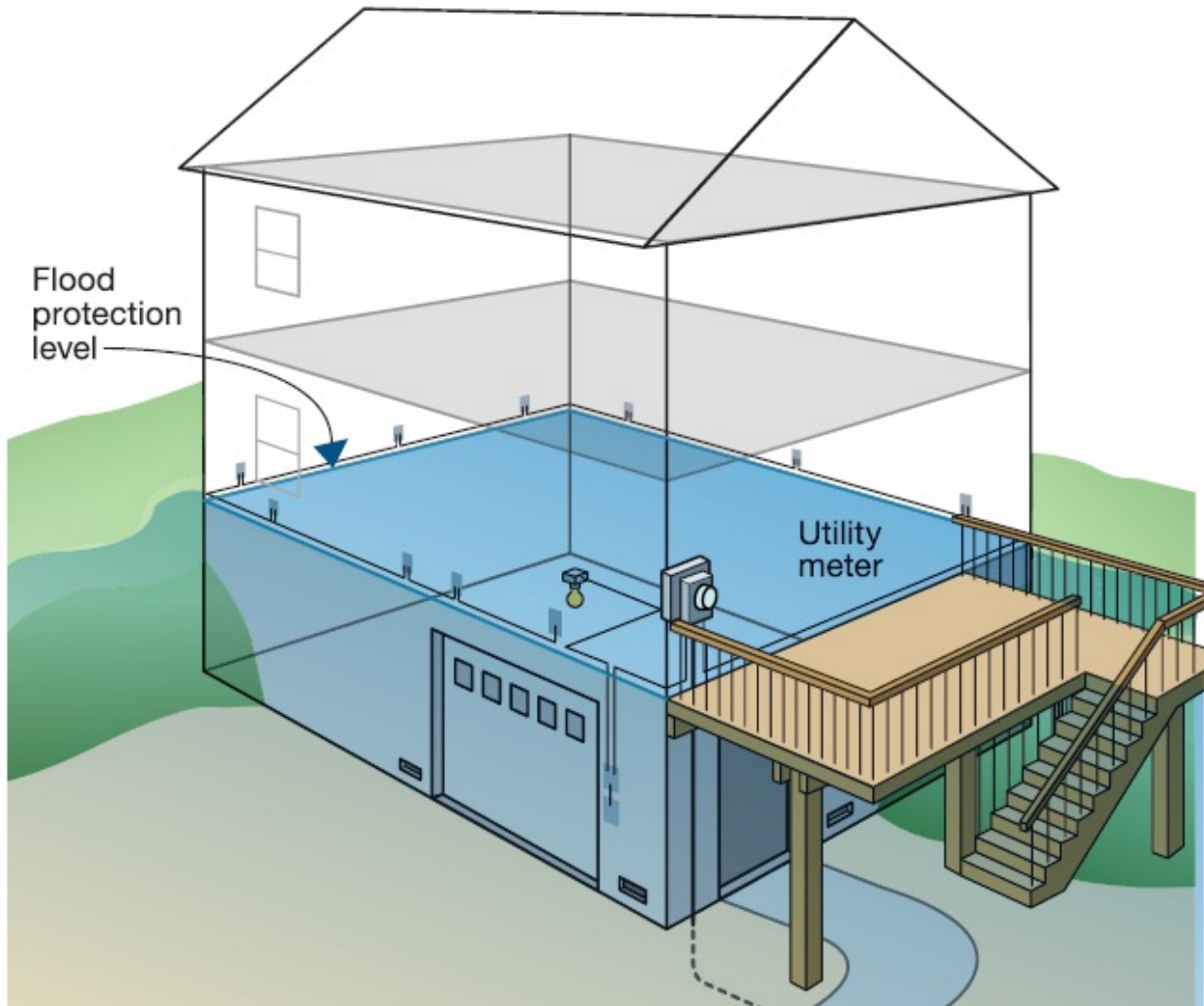
Duct Systems

- Not Intended to Prevent Flood Waters from Entering
- Will Not Resist Flood Loads when Submerged
- Residential Code of NYS requires The Following to be Elevated above BFE plus 2' (R322.1.6):
 - Electrical Systems, Equipment and Components;
 - Heating, Ventilating, Air Conditioning Equipment;
 - Plumbing Appliances and Fixtures;
 - Duct Systems

Generators

- Elevate Generator and Components to above BFE + 2';
May floodproof if non-residential
- This applies to New Construction of Substantial Improvement/Substantial Damage

Meters should be Elevated



Deck provides meter access and allows the meter and main service panel to be elevated and protected from flooding. Electrical components placed below the flood protection level remain vulnerable to flood damage. From FEMA P-348, Protecting Building Utility Systems from Flood Damage

Protecting Building Utility Systems



Protecting Building Utility Systems From Flood Damage

Principles and Practices for the Design and
Construction of Flood Resistant Building
Utility Systems

FEMA P-348, Edition 2 / February 2017



- HVAC
- Electrical Systems
- Plumbing Systems
- Fuel Systems and Tanks
- Elevators and Lifts

Take a Break



Area Beneath Lowest Floor

- May only be used for building access, storage or parking.
 - 44 CFR 60.3 (c)(5)
 - R322.2.2 (1)
 - ASCE 24-14: language contained in definition of lowest floor and in Section 1.5.2
- Must be constructed of flood resistant materials
 - 44 CFR 60.3 (a)(3)(ii)
 - R322.1.5
 - ASCE 24-14: Section 5.1

Flood Resistant Materials

44CFR60.3(a)(3)(ii)

Constructed with materials resistant to flood damage

IBC 2018 & NYS Code Refers to ASCE 24, Section 5.1

New construction and substantial improvements shall be constructed with flood-damage resistant materials below specified elevations. Sufficient strength, rigidity and durability to resist flood and other loads

IRC 2018, NYS Resid Code Section R322.1.8

Building materials and installation methods used for flooring and interior and exterior walls and wall coverings below required elevations shall be flood damage – resistant materials that conform to FEMA TB-2

Flood Resistant Materials



Flood Damage-Resistant Materials Requirements

for Buildings Located in Special Flood Hazard Areas in accordance with the National Flood Insurance Program

Technical Bulletin 2 / August 2008



Table 2. Types, Uses, and Classifications of Materials

Types of Building Materials	Uses of Building Materials		Classes of Building Materials				
	Floors	Walls/Ceilings	Acceptable		Unacceptable		
			5	4	3	2	1
Structural Materials (floor slabs, beams, subfloors, framing, and interior/exterior sheathing)							
Asbestos-cement board		■	■				
Brick							
Face or glazed		■	■				
Common (clay)		■		■			
Cast stone (in waterproof mortar)		■	■				
Cement board/fiber-cement board		■	■				
Cement/latex, formed-in-place	■			■			

Includes detailed tables of materials and uses. Is currently being updated.

Flood Vents: Engineered and Non-Engineered

44CFR60.3(c)(5)

Certified by engineer to meet or exceed venting requirements OR minimum of two openings, net area ≥ 1 sq. in. / sq. ft. of enclosed space. Bottom no more than 1' above grade.

IBC 2018 & NYS Code Refers to ASCE 24, Section 2.6.2

Non-Engineered: at least 2 openings, net area ≥ 1 sq. in. / sq. ft. of enclosed space. Bottom no more than 1' above grade.

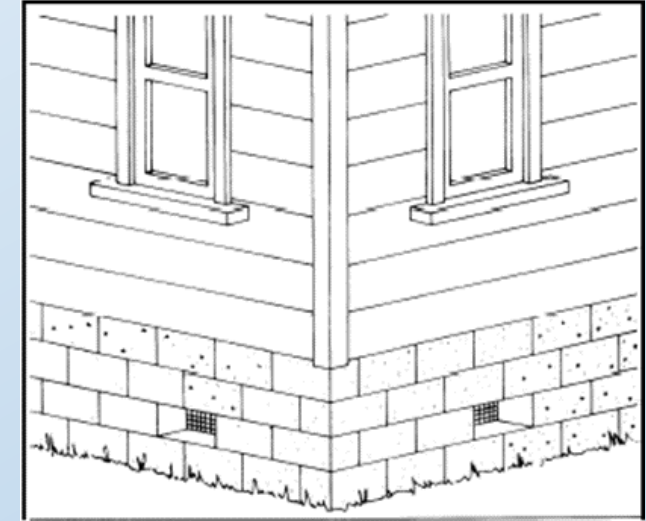
Engineered: Difference between interior and exterior flood levels shall not exceed 1'

IRC 2018, NYS Resid Code Section R322.2.2

Net area of non-engineered vents not less than 1 sq. in. for each sq. ft. of enclosed area measured on the exterior walls OR certified by registered design professional that design will provide for equalization of flood forces.

Standards for Non-Engineered Vents – Residential Code AND ASCE 24-14

- Total net area not less than 1 sq in / sq ft of enclosed area
- Openings not less than 3” in any direction along plane of wall
- May use louvers, blades, screens and faceplates or other covers and devices shall allow for automatic flow of floodwaters in and out of enclosed area
- No fewer than two openings in different sides of each enclosed area
- Bottom of each opening no more than 1’ above higher of interior grade or floor and finished exterior grade under each opening



Standards for Elevation on Perimeter Wall Foundations

- Fully enclosed areas below the lowest floor shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters
 - 44 CFR 60.3(c)(5) – Language then contains specifications
 - R322.2.2 includes language for engineered and nonengineered openings
 - ASCE 24-05 Section 2.6.1: Foundation walls that enclose an area below the DFE...shall contain openings to allow for automatic entry and exit of floodwaters during design flood conditions.

Engineered Flood Vents

- Include a Statement by Registered Design Professional
- Can have smaller vent area BUT the openings must be shown to provide for equalization of hydrostatic flood forces on exterior walls
- R322.2.2(2.1): meet specifications of ASCE24, Section 2.7.2.2
 - Automatic entry and exit of floodwaters
 - Performance must account for presences of louvers, blades, screens or other covers and devices
 - Difference between exterior and interior floodwater levels shall not exceed 1 ft.

Engineered Flood Vents: ASCE 24, 2.7.2.2

- Each individual opening must allow automatic entry and exit of floodwaters during design flood or lesser conditions
- Performance shall account for presence of louvers, blades, screens, faceplates or other coverings
- Openings shall not be less than 3" in any direction
- Performance shall ensure that difference between interior and exterior floodwater levels shall not exceed 1'
 - Assume minimum rate of rise and fall of 5'/hr unless higher rate warranted
- Engineering formula for minimum total net area

Flood Vents



Requirements for Flood Openings in Foundation Walls and Walls of Enclosures

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

NFIP Technical Bulletin 1 / March 2020



Flood Vents – Non Engineered

- May use screens, louvres, etc. but be careful!



Non-Engineered Flood Vent with Cover that can Trap Debris



Engineered Flood Vent from City of Key West web page

Deeper Dive – Crawlspace



Crawl Spaces

- Common Elevation Technique
- Equip with Vent Openings (Lattice is OK)
- Floor of Crawlspace must be At or Above Lowest Adjacent Grade
 - Floor of Crawlspace Below LAG Becomes a Basement
- FEMA Regulations do not mention Crawlspace
 - Instead, Lowest Floor and Vent Requirements Apply
 - Area may only be used for Building Access, Storage, or Parking

Crawlspaces – Building Code

- A crawlspace is an underfloor space that is NOT a basement
- Residential Code does not include Height Minimums or Maximums
- Air Venting is Required unless Class I Vapor Retarder Material is Used
- Flood Vents Required in Flood Zones
- Access Required through floor above or through wall

Deeper Dive – Agriculture

- Building Code Exempts Agricultural Buildings;
- Flood Codes DO NOT Exempt Agricultural Buildings
- Floodway Requirements Apply
 - Consider Fencing, Fill and other Non-Structural Development
- FEMA Guidance: Policy #104-008-03, February 2020
 - https://www.fema.gov/sites/default/files/2020-08/fema_floodplain-management_agriculture-accessory-structures_2020.pdf

FEMA Policy – Agriculture Structures Basics

- Excludes Buildings for Human Habitation, Place of Employment, or Place of Entertainment
- Structure used exclusively for agricultural purposes
 - “Walled and Roofed” if at least two outside rigid walls and a roof
- A Pole Barn, for example, may be roofed but not walled
- Generally no walled and roofed building is exempt from NFIP Requirements.... BUT....

FEMA Guidance – Agricultural Structures

- Substantial Damage from Flooding may be Repaired to Pre-Damage Condition; However Not Eligible for FEMA Disaster Assistance Under This Exclusion
- Flood Insurance May Be Denied unless Wet Floodproofed
- New Structures – May be Wet Floodproofed via Variance
 - Justification on a Case by Case Basis
- Floodway Requirements Apply

FEMA Guidance – Agricultural Structures

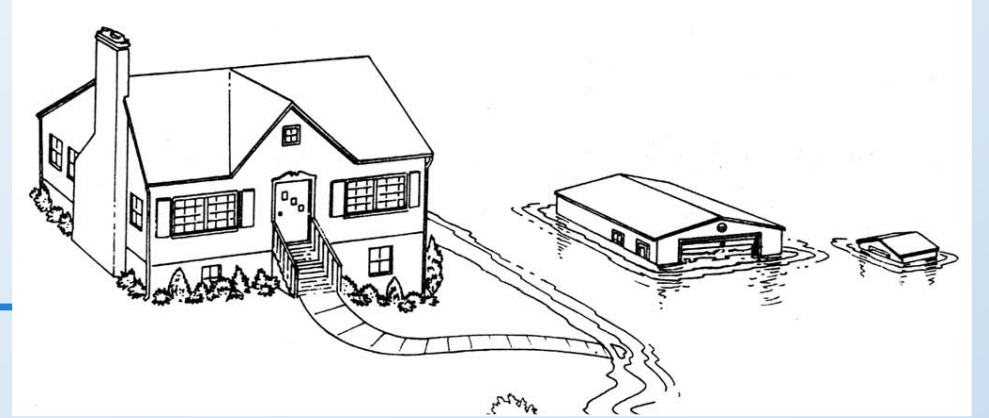
- Community may request Community – Wide Exemption for Certain Agricultural or Accessory Structures
- Requires Local Regulations to be Approved by FEMA
- NYS DEC Can Assist with Language
- Minimum Requirements include Anchoring, Flood Resistant Materials, and Wet Floodproofing

Garages

- May Be Below BFE
- Must Have Flood Vents
- Flood Resistant Materials
- Used for Building Access, Storage or Parking
- If in Residential Structure, Floor must be At or Above Grade



Accessory Structures



- FEMA Guidance
 - Referenced in ASCE 24, C1.2
- Used for Storage or Parking of Vehicles (detached garages)
- Community should Define Size or Maximum Cost
- Suggest: 2-Car Garage or Smaller;
- or Limited Storage representing not more than 10% of Value of Primary Structure
- No Human Habitation

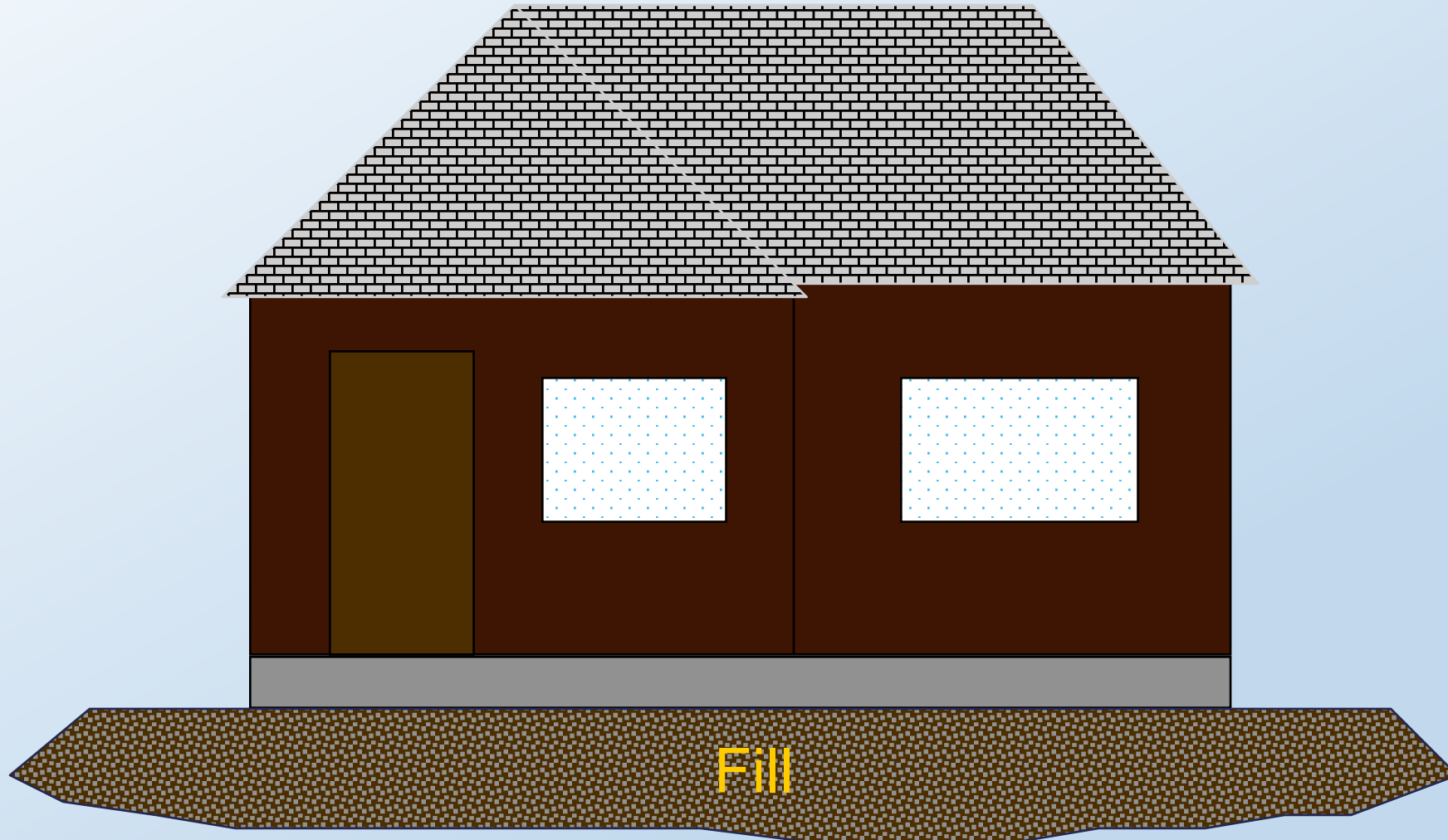
Accessory Structures

- Elevation of Structure Not Required IF done via variance or Language Added to Local Law
- DEC Has Guidance on Local Law Language
- Meet building anchoring standards
- Use Flood Resistant Materials for Areas Below BFE + 2'
- Flood Vents
- Utilities must meet Utility Standards for Elevation or Flood Protection

Ways to Elevate

- Fill
- Slab on Grade, Raised Slab on Grade or Slab on Stem Wall with Fill
- Perimeter Wall
- Pile (Mostly coastal but may be used in areas of deep or high velocity flooding)
- Less Common:
 - Shear Walls
 - Posts
 - Peers

Slab on Fill



Standards for Elevation on Fill

- Fill should be placed in maximum 12-inch lifts, and compacted to 95% of the maximum density obtainable with the Standard Proctor Test Method
- Fill slopes should be no steeper than 1.0-foot vertical to 1.5-foot horizontal

This is FEMA Guidance for Residential Construction but would be required for a Letter of Map Revision based on Fill;
See ASCE 24 2.4 for use of fill for structural support.

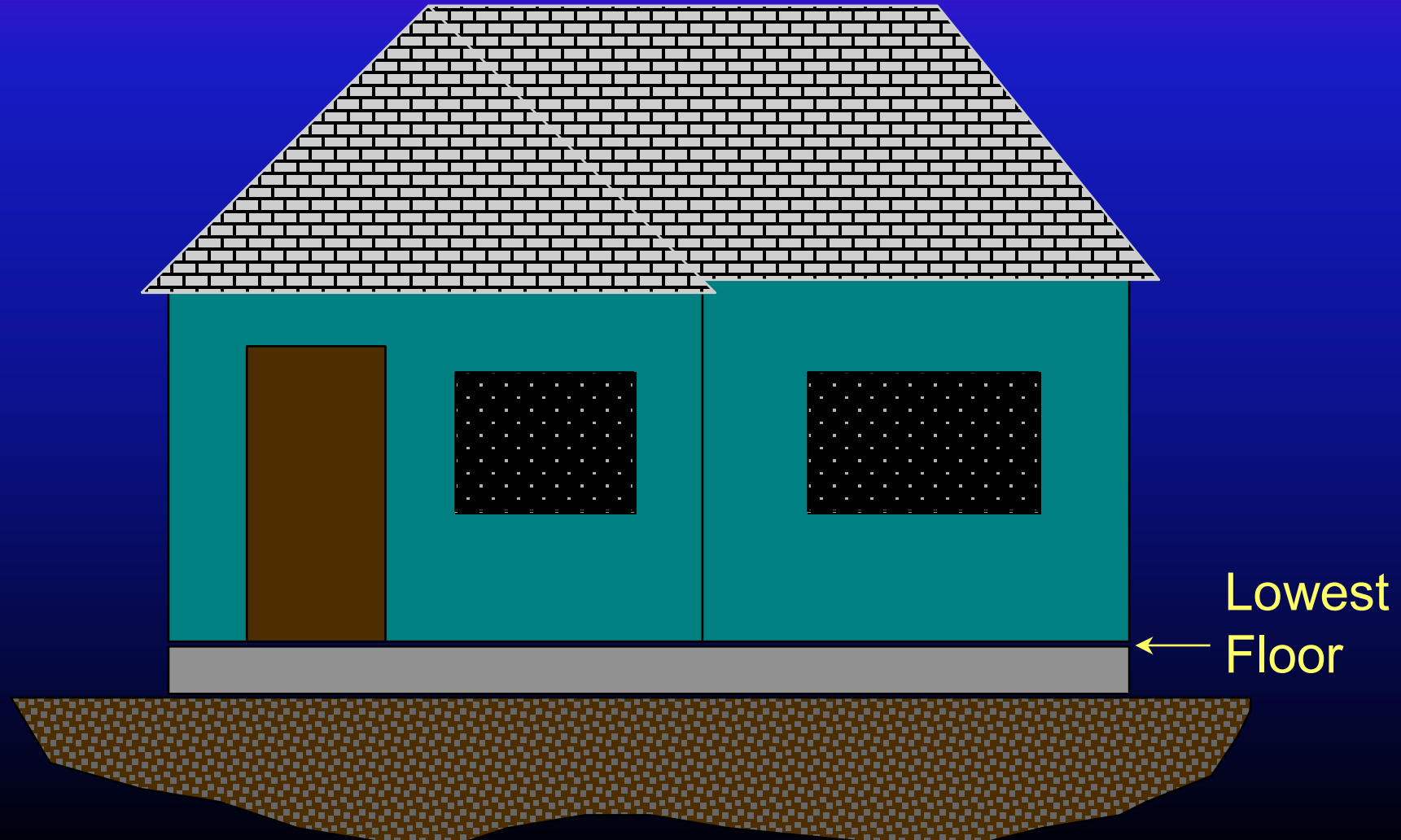
Standards for Elevation on Fill...

- Fill will NOT settle below BFE
- Protected from scour, differential settlement, and erosion
 - Flood flow less than 5 ft/sec – vegetation
 - Flood flow greater than 5 ft/sec - armoring

Placement of Fill

- No Fill in a Floodway
- No Fill for Structural Support in a V zone (R322.3.2, ASCE 24-14, 4.5.4)
- Zones A1-A30 and AE without a Floodway must demonstrate that the cumulative effect of the proposed development when combined with all other existing and anticipated development will not increase the base flood by more than 1 foot.
 - 44 CFR 60.3(c)(10)
 - R322.1.4.2
 - ASCE 24-14, Section 2.2
- **Construction on fill still subject to NFIP regs unless site first removed by LOMR-F**

Lowest Floor Elevations Slab Foundation

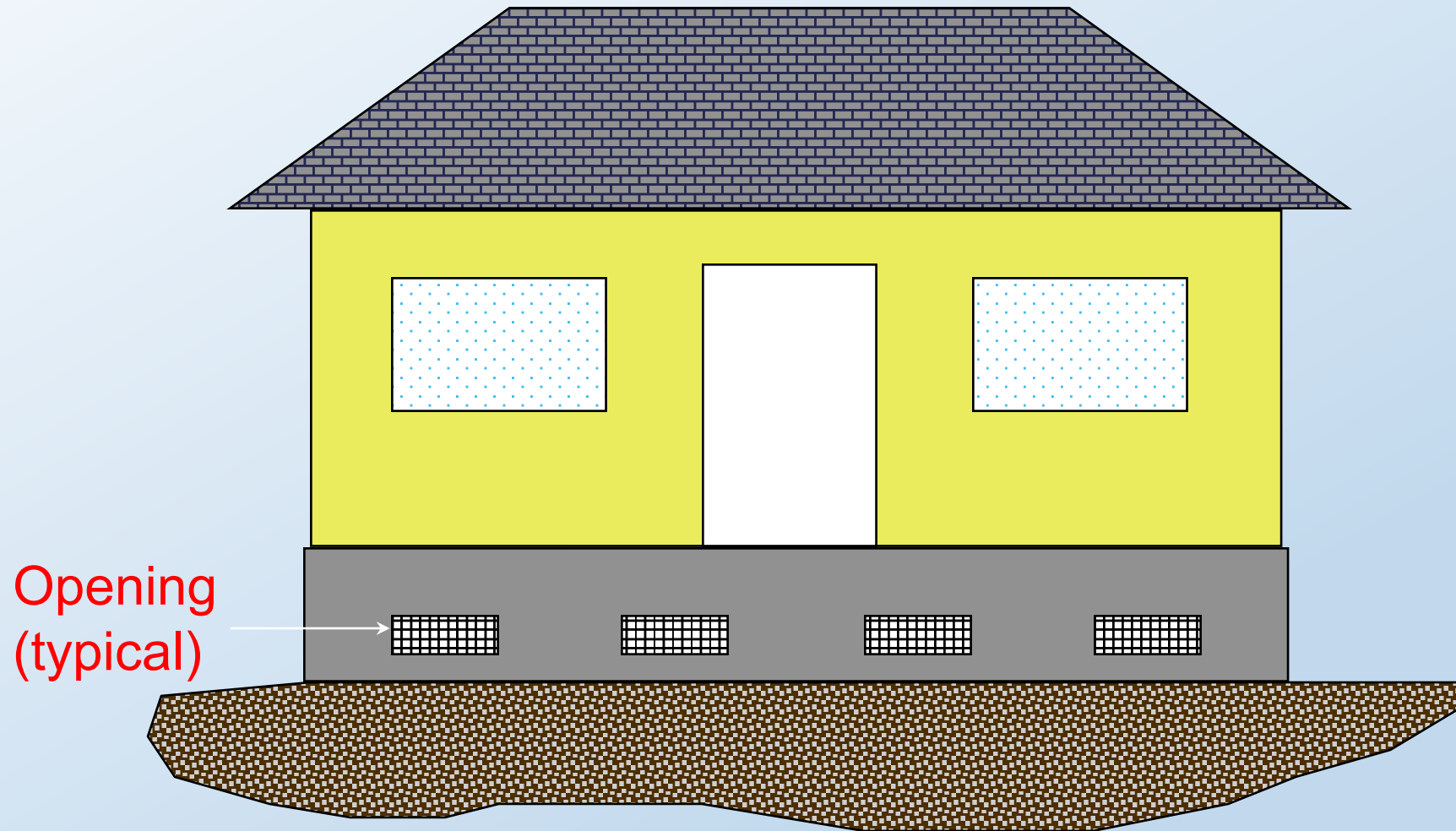


Filled Stem Wall Foundation

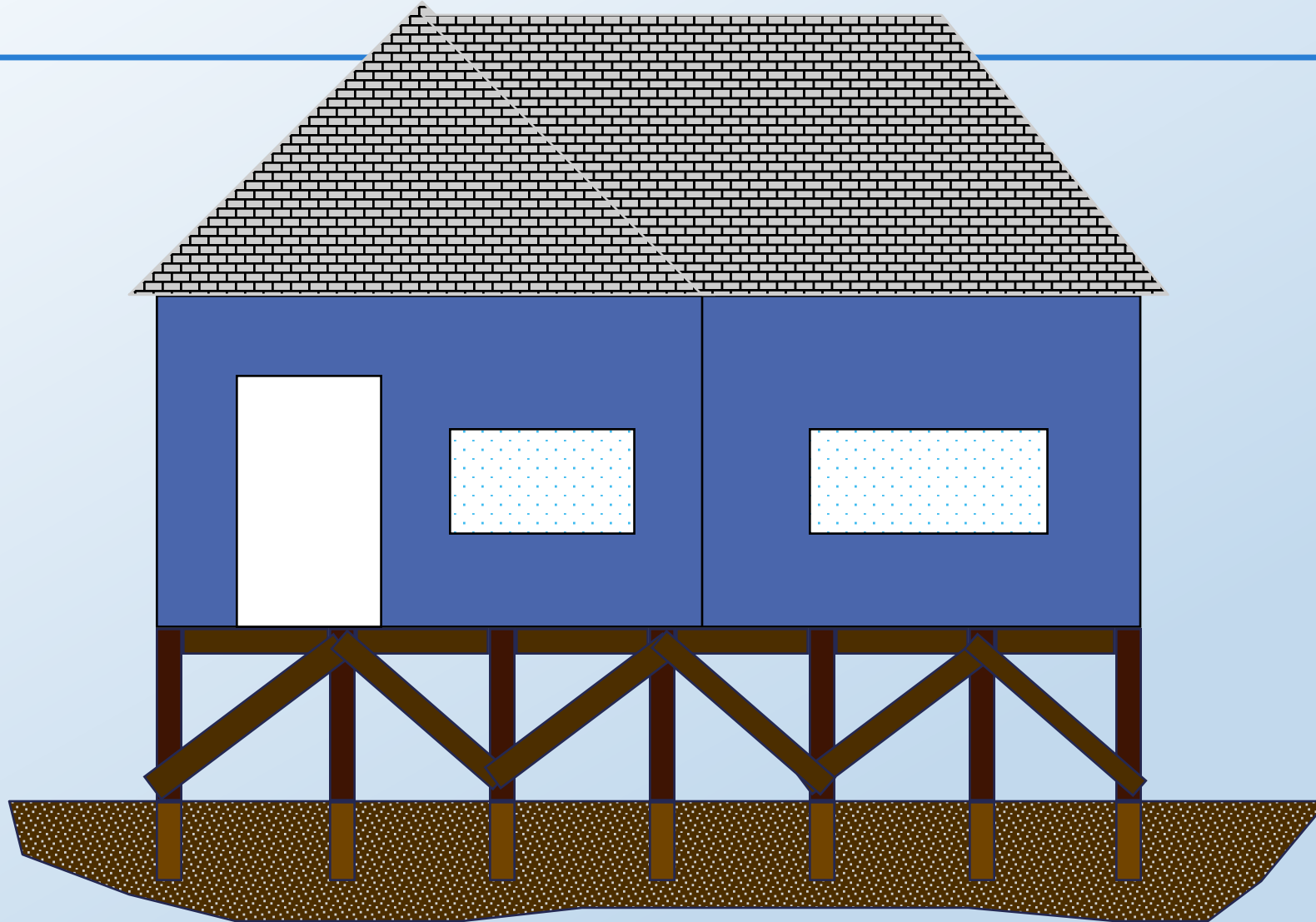
- Primarily in coastal areas
- Floor System is Above
- Backfilled with Soil or Gravel to Underside of Floor System
- Must account for flood velocity, Debris Impact, Erosion, Scour
- Where area is prone to Erosion or Scour, deep footings are recommended



Perimeter Wall Foundation



Pile Foundation



Post or Pile Foundations

- Have much greater resistance to lateral loads
- Should be used in areas of deep flooding and/or high velocities
- Over-the-top ties or frame ties must be used on manufactured homes to resist wind and water forces

Other Elevated Foundation Systems

- Shear Walls
- Posts
- Piers



Anchoring and Elevated Foundations

- All structures must be properly anchored to prevent flotation, collapse, or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy. (44 CFR 60.3(a)(3))
- Structural systems of buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation (R322.1.2)
- ASCE 24-14, Section 1.5.1: “New construction and substantial improvement shall be designed, constructed, connected, and anchored...”



Revisiting Fuel Tanks

- FEMA defines *structure* as a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.
 - Not insurable under NFIP
 - But must be anchored
- There are detailed requirements in ASCE 24-14



This is NOT how to anchor a propane tank!

Fuel Tanks – Residential Code

- R322.2.4 – Tanks
 - Underground Tanks shall be Anchored to Prevent Flotation, Collapse and Lateral Movement
 - Above-ground Tanks, at or above required elevations and anchored to prevent flotation, collapse and lateral movement during conditions of the base flood
- Recommend reviewing ASCE 24-14 Section 9.7 for detailed requirements
- Also see FEMA P-348: Protecting Building Utility Systems from Flood Damage



Pier Foundations

- Have limited resistance to lateral loads
- Should only be used in low velocity areas
- Must have vertical steel reinforcement to resist lateral forces
- Ground anchors must be used to resist wind and water forces

Anchoring to Foundation



(T) Charleston - End of Butler
Pit - adjacent to creek -
additional photo 4/24/96



01-04-24-96 (T) CHARLESTON
END OF BUTLER DR - ADJACENT

Floodways

44CFR60.3(d)(3)

Prohibit encroachments
...unless it has been
demonstrated through H&H
analyses performed in
accordance with standard
engineering practice that there
will be no increase in flood
levels during occurrence of the
base flood discharge

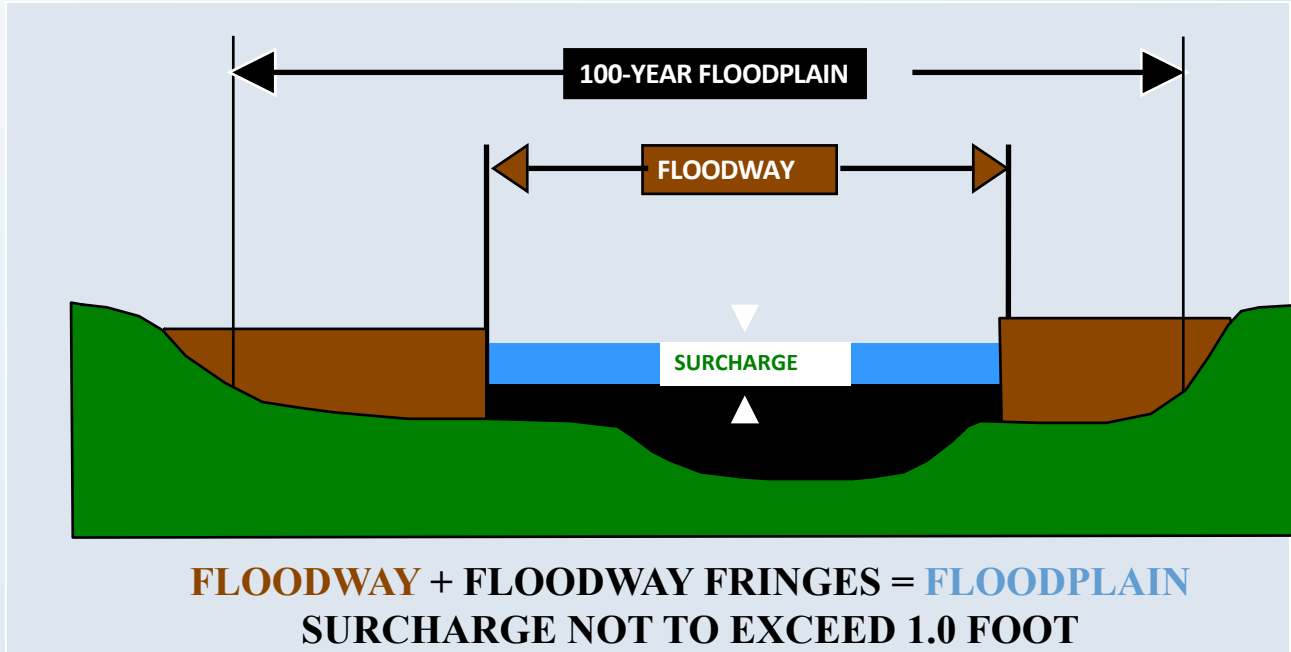
ASCE 24, Section 2.2

Structures and fill shall not
be constructed or placed ...
unless it is demonstrated
that there is no increase in
flood level and no
reduction in conveyance of
the floodway

R301.2.4

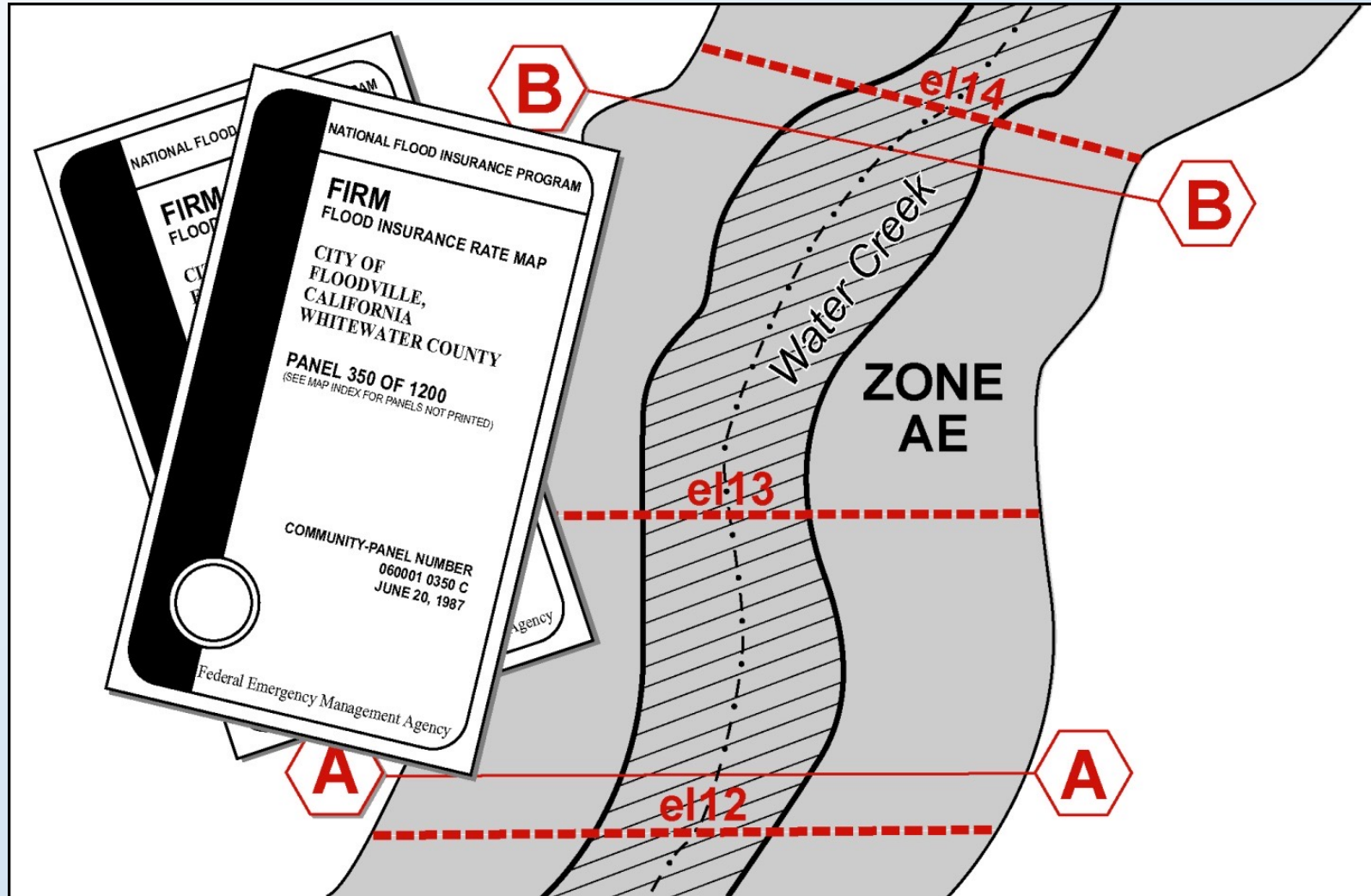
Buildings and structures
located in whole or in part
in identified floodways shall
be designed and
constructed in accordance
with ASCE 24

Floodway Schematic



- No New Development that would Increase Flood Heights
- Hydraulic Analysis Required
- No NFIP Variances Allowed
- Community shall notify FEMA of changes in BFE due to physical changes affecting flooding conditions (44cfr65.3)

FIRM With Floodway: 60.3(d)(3)



Knowledge Check

What must be above DFE OR protected from water entering or accumulating

- A. Flood Vents
- B. Floodways
- C. Anchoring
- D. Utilities
- E. Basements
- F. FEMA Regulatory Staircase

Knowledge Check

All structures, including fuel tanks must have this

- A. Flood Vents
- B. Floodways
- C. Anchoring
- D. Utilities
- E. Basements
- F. FEMA Regulatory Staircase

Knowledge Check

What is off limits to encroachment without a “no-rise” analysis?

- A. Flood Vents
- B. Floodways
- C. Anchoring
- D. Utilities
- E. Basements
- F. FEMA Regulatory Staircase

Knowledge Check

Their purpose is to equalize flood pressures on foundations

- A. Flood Vents
- B. Floodways
- C. Anchoring
- D. Utilities
- E. Basements
- F. FEMA Regulatory Staircase

Freeboard

- Elevation above BFE or DFE to provide reduced damage from floods
- Definition: Additional height used as a factor of safety in setting the minimum elevation of a structure (ASCE 24)
 - IRC 2018: Elevation Requirements = higher of BFE + 1' or DFE
 - NYS – Higher of BFE + 2' or DFE + 2'
 - ASCE 24-05 and 24-14 include 0' to 2' of freeboard above BFE, or DFE, or 500 year flood elevation depending on classification of building
 - Bldg Code of NYS specifies a freeboard of 2' in all cases where a DFE has been determined

Why Freeboard?

- Freeboard is a factor of safety, usually expressed in feet above a flood level
- May be adopted by community or state
 - New York State has had a 2' freeboard in its building code since 2006
- Requires higher lowest floor
- Results in MUCH lower risk and flood insurance rates may be half the rates of only building to the BFE.

How Elevation Affects Flood Insurance

Annual Flood Insurance Rates based on Elevation
Two Story Home, Owner Occupied
2020 Rates from FEMA Flood Insurance Manual
Includes all fees

Feet above BFE	\$100K Bldg, \$25K Contents	\$200K Bldg, \$25K Contents	\$250K Bldg, \$100K Contents
0'	\$1541	\$1707	\$1781
1'	\$771	\$938	\$1011
2'	\$524	\$690	\$764
3'	\$441	\$607	\$681
4'	\$413	\$580	\$653

Elevation Discounts: RR 2.0

First Floor Height* (In Feet)	Slab on Grade	Basement	Crawlspace (including Subgrade Crawlspace)	Elevated with Enclosure Not on Posts, Piles, or Piers	Elevated with Enclosure on Posts, Piles, or Piers	Elevated without Enclosure on Posts, Piles, or Piers
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	-8.0%	-8.0%	-8.0%	-8.0%	-9.0%	-10.0%
2	-15.4%	-15.4%	-15.4%	-15.4%	-17.2%	-19.0%
3	-22.1%	-22.1%	-22.1%	-22.1%	-24.6%	-27.1%
4	-28.4%	-28.4%	-28.4%	-28.4%	-31.4%	-34.4%
5	-34.1%	-34.1%	-34.1%	-34.1%	-37.6%	-41.0%
6	-36.7%	-36.7%	-36.7%	-36.7%	-43.2%	-46.9%
7	-39.3%	-39.3%	-39.3%	-39.3%	-48.3%	-52.2%
8	-41.7%	-41.7%	-41.7%	-41.7%	-53.0%	-57.0%
9	-44.0%	-44.0%	-44.0%	-44.0%	-57.2%	-61.3%
10 - 14	-46.3% to -54.4%	-46.3% to -54.4%	-46.3% to -54.4%	-46.3% to -54.4%	-61.1% to -73.3%	-65.1% to -77.1%
15 - 25	-56.2% to -70.9%	-56.2% to -70.9%	-56.2% to -70.9%	-56.2% to -70.9%	-75.7% to -86.6%	-79.4% to -88.9%

Larger Discount with an Open Foundation

So what Elevation to Use?

- The Uniform Code (NY) and the I-Codes allow a community to adopt a DFE that is higher than the BFE
 - 2' Freeboard Applies on top of DFE
 - Approval by the NYS Code Council is not Required in this case
- If a community adopts a higher DFE, it must do so by adopting its own map that is at least as restrictive as the FIRM
- ASCE 24-14 allows the “Design Flood” to be otherwise legally designated

ASCE 24 Building Classifications

(Does Not Apply in NYS)

Flood Design Classification	Description	Lowest Floor Elevation: AE Zone
1	Normally Unoccupied; Minimal Risk. Temporary Structures, Accessory Storage Buildings, Minor Storage Facilities, Small Parking Structures, Some Agricultural Buildings	DFE
2	Moderate Risk to Public. Most Residential, Commercial and Industrial Buildings. All structures not in Class 1, 3 or 4.	BFE + 1 or DFE
3	High Risk to Public or Significant Disruption to Community if Flooded. Includes places of assembly, museums, community centers, athletic facilities, schools and child care facilities, correctional facilities, health care facilities other than hospitals, power generating stations, water/wastewater treatment facilities, telecommunications facilities, facilities for handling of hazardous waste/materials.	BFE + 1 or DFE
4	Essential facilities and services necessary for emergency response and recovery. Includes hospitals, fire, rescue, ambulance and police stations, emergency shelters, emergency power generating facilities, critical aviation facilities, facilities necessary for above to remain functional.	BFE + 2 or DFE or 500 Yr Elevation

What if no BFE?



MAP SCALE 1" = 500'

250 0 500 1000 FEET
0 150 300 METERS

NFIP

PANEL 0179D

FIRM
FLOOD INSURANCE RATE MAP
ALBANY COUNTY,
NEW YORK
(ALL JURISDICTIONS)

PANEL 179 OF 434
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

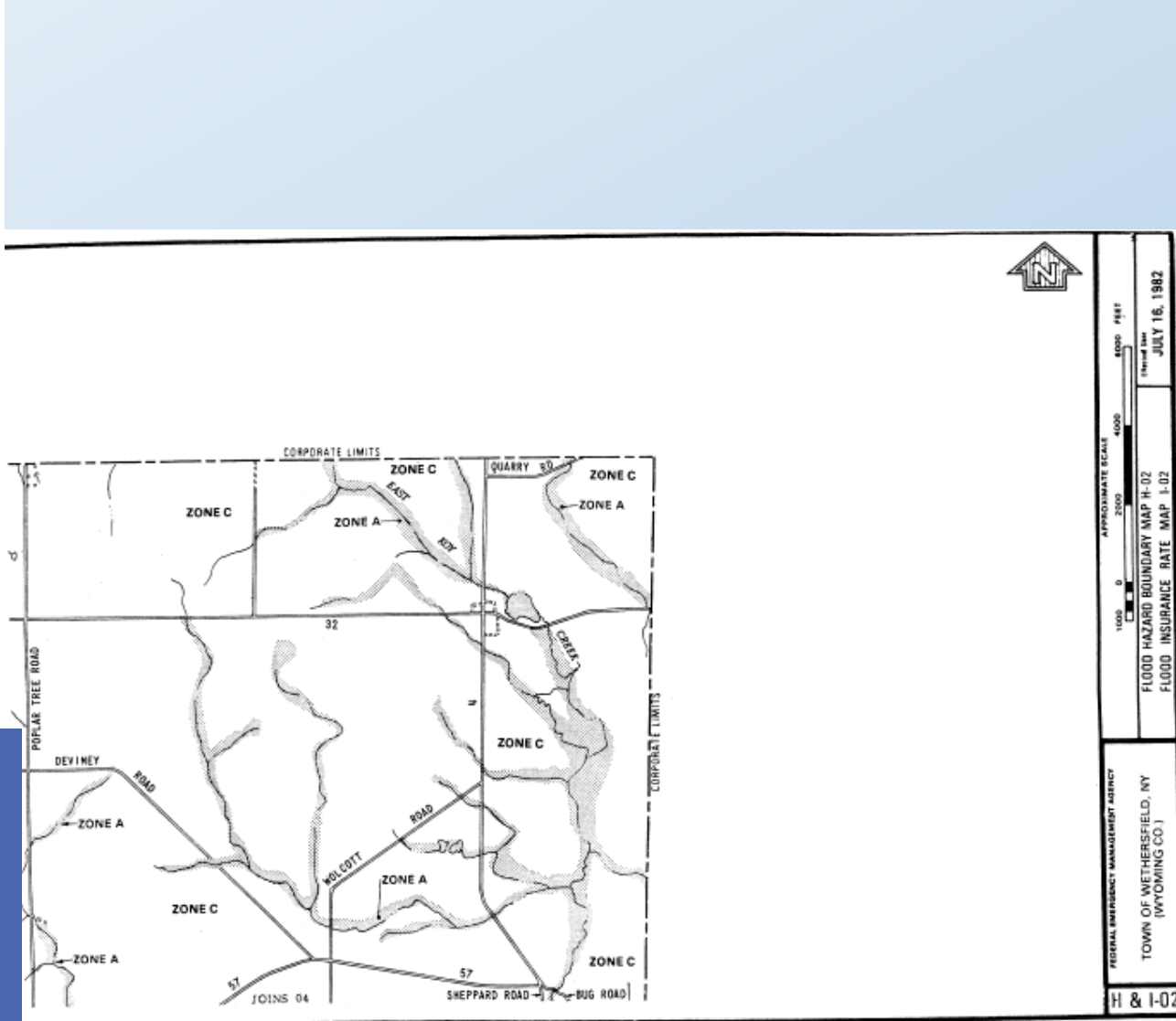
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBANY, CITY OF	360001	0179	D
COLONIE, TOWN OF	360007	0179	D
COLONIE, VILLAGE OF	360377	0179	D
GUILDERLAND, TOWN OF	360919	0179	D

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
36001C0179D
EFFECTIVE DATE
MARCH 16, 2015

FEDERAL EMERGENCY MANAGEMENT AGENCY



NYS:
1,506 Municipalities in NFIP
78 Have No SFHA
411 Only Have A zones without BFE's

What if no BFE?

- 44 CFR 60.3(b)
 - Designated A zones but no water surface elevations or floodways
 - (1) Require permits for all proposed construction and other developments
 - (2) Require application of Part (a)
 - Determine if Reasonably Safe from Flooding
 - Construct in manner that resists flood forces and minimizes flood damages
 - (3) Require flood elevation data for development over 50 lots or over 5 acres
 - (4) Obtain, review and reasonably utilize any BFE and floodway data from Federal, State or other source

What if no BFE?

- Determination of Design Flood Elevations: R322.1.4.1 and IBC 1612.3.1
 - If not specified, the building official is authorized to require the applicant to:
 - Obtain and reasonably use data from a federal, state or other source; or
 - Determine DFE in accordance with accepted hydrologic and hydraulic engineering practices
 - NOTES
 - Same language is in 2012, 2015 and 2018 I-Codes
 - ASCE-24 is moot on the topic

What if no BFE? NYS

- In addition to the Language in the Previous Slide:
 - Bldg Code of NYS: 1612.3.1 Exception:
 - Where it is not possible to obtain a design flood elevation in accordance with Section 1612.3.1, Items 1 and 2, the DFE shall be 3 feet above the highest adjacent grade, where the highest adjacent grade is the natural ground elevation within the perimeter of the proposed building side prior to construction
- The Residential Code of NYS had the same provision prior to the 2020 update. Consult with the Department of State Codes Division or the NYS DEC Floodplain Management Section for guidance.

No BFE: What to do?

- NFIP regs only require elevation determination based on 50 Lot or 5 Acre standard
- Building Code officials may require DFE's for all development in flood zones
- NYS Building Code has 3' Above HAG exception
- What is Reasonable and Prudent?
- Do your flood maps contain Advisory Flood Elevations as a GIS layer?
- Suggest go at least 3' higher than Highest Adjacent Grade
 - 5' is even better!

Changing Elevation Standards in I-Codes

IRC through 2012

Lowest Floor at or Above DFE

AO Zones: higher of depth number above HAG or 2' above HAG

IRC 2015

Lowest Floor at or above BFE + 1', or DFE, whichever is higher

AO Zones: Above HAG + Depth on FIRM + 1'

ASCE 24-05

Select Building Category

I: DFE
II: BFE + 1' or DFE
III: BFE + 1' or DFE
IV: BFE + 2' or DFE

ASCE 24-14

Select Building Category

I: DFE
II: BFE + 1' or DFE
III: BFE + 1' or DFE
IV: BFE + 2' or DFE or 500 yr flood elevation

NYS Codes have required 2' of Freeboard since 2007.

Substantial Damage – Substantial Improvement – 44 CFR 59.1: Definitions

- Substantial Damage: Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.
- Substantial Improvement: Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the ‘start of construction’ of the improvement.
 - Term includes structures which have incurred ‘substantial damage’ regardless of actual repair work performed.’

Substantial Damage – Substantial Improvement – Building Code Definitions

IBC 2018 and 2020 Building Code of NYS

Substantial Damage: Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Substantial Damage – Substantial Improvement – Building Code Definitions

IBC 2018 and 2020 Building Code of NYS

Substantial Improvement: Any repair, reconstruction, rehabilitation, alteration, addition or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained *substantial damage*, any repairs are considered a substantial improvement regardless of the actual repair work performed.

Substantial Damage / Substantial Improvement

44CFR60.3

All references to new construction include “substantial improvement”
Remember that definition of “substantial improvement” includes “substantial damage”

IBC 2018 and NYS 2020 Bldg Code, Section 1612.1

All new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage...

Then references ASCE 24

R322.1

Buildings and structures constructed in whole or in part in flood hazard areas...and substantial improvement and **repair** of substantial damage...shall be designed and constructed in accordance with provisions contained in this section

Substantial Improvement and ASCE-24

- ASCE 24-14, Section 1.1: The general provisions of this section shall apply to all new construction and substantial improvements in flood hazard areas
 - Similar language applies to other sections of ASCE 24
- Definitions are similar to those in FEMA regs. Substantial improvement includes substantial damage.

Substantial Damage / Improvement - FEMA

- Tie-ins to Permitting
 - 44 CFR 60.3(b)(1) – (the community shall) Require permits for all proposed construction and other developments including the placement of manufactured homes, within Zone A on a community's FIRM
 - 44 CFR 60.3(a)(3) – If a proposed building site is in a flood-prone area, all new construction and substantial improvements shall (meet flood resistant requirements)
 - Remember that definition of “substantial improvement” includes “substantial damage”

Substantial Damage / Improvement I-Codes

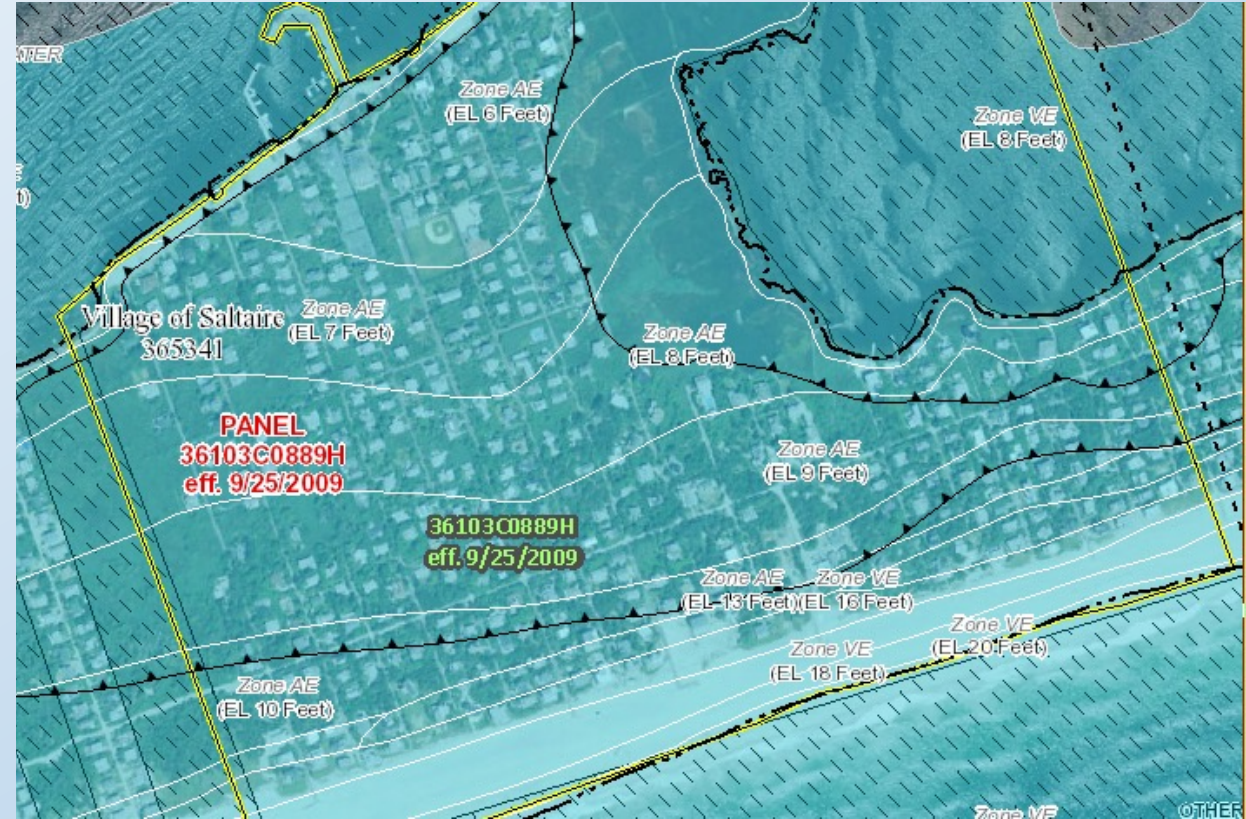
- Tie-ins to Permitting
 - IRC R104.2: The building official shall receive applications, review construction documents and issue permits for the erection and alteration of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.
 - IBC 104.2: Same language but also includes demolition and moving of structures
 - IBC 104.2.1 refers to determination of substantially improved or substantially damaged existing buildings and structures in flood hazard areas.

Substantial Damage / Improvement NYS Codes

- R105.2: No person or entity shall commence, perform, or continue any work that must conform with the Uniform Code without a valid permit
- R105.2.2.1: For any building permit, the building official shall review construction documents and determine substantial damage or substantial improvement
- Building Code of NYS: Section 1612.1: All new construction ... including substantial improvement and restoration of substantial damage ... shall be designed...

Some Coastal Standards

- Applications in V Zones and Coastal A Zones
- Elevation Standards
- Foundation Standards
- Areas Below Elevated Floor



Coastal Flood Zones

- V Zone: Area with waves of 3' or more during base flood
- Coastal A Zone: Area with waves of 1.5' to 3' during base flood
 - FEMA designates boundary as Limit of Moderate Wave Action (LiMWA)
- A Zone: Area with waves below 1.5'
 - Same standards as inland A zones

Coastal Design Standards

- Landward of Mean High Tide
- No alteration of sand dunes or mangrove stands without an engineering analysis showing no increase in potential flood damage

Coastal Elevation Standard

- Bottom of Lowest Horizontal Structural Members supporting Lowest Floor at or above Flood Elevation Standards (DFE + 2' in NYS)
- No Basement Floors below grade
- No Fill for Structural Support
 - Minor grading is allowed

Coastal Foundation Standards

- Supported on Pilings or Columns
- Pilings must have adequate soil penetration to resist combined wave and wind loads
 - Exception in Coastal A Zones: Stem wall foundations supporting a floor system and backfilled with soil or gravel under the floor system is permitted providing that it is designed to account for wave action, debris impact, erosion and scour.
- Concrete Slabs under buildings are allowed but must be structurally independent

Areas below Elevated Floor

- Open, Insect Screening, Lattice, or Break Away Walls
- Break Away Walls must fail without damaging structure under resistance of 10 – 20 lbs / square foot
- Break Away Walls must have Vent Openings (new in latest code)
- Area below the elevated floor may be used for building access, storage or parking

Dry Floodproofing – FEMA Regulation

44 CFR 60.3(c)(3): Require that all new construction and substantial improvements of *non-residential* structures have the lowest floor (including basement) elevated... or together with attendant utility and sanitary facilities, be designed so that below the base flood level the structure is 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

Dry Floodproofing

- Residential Codes: No language on dry floodproofing. Not allowed for residential structures.
- IBC and NYS Building Code: Section 1612.4: For dry floodproofed nonresidential buildings, construction documents shall include a statement that dry floodproofing is designed in accordance with ASCE 24
- ASCE 24 – Detailed standard in Section 6
- Also see FEMA Technical Bulletin 3: Non-Residential Floodproofing – Requirements and Certification

Comments on Dry Floodproofing

- Need Certification from Licensed Engineer
- May not be feasible if:
 - flood depths above 3'
 - High velocity flooding (over 5'/sec)
 - Long duration flooding
- Requires human intervention and routine maintenance
- NFIP insurance standards subtract 1' from effective floodproofed elevation

Manufactured Homes

44CFR60.3(b)(8)

Elevated and anchored

44CFR60.3(c)(6)

Above BFE except:

44CFR60.3(c)(12)

On sites in an existing
manuf. home park – above
BFE OR 36" above grade

R322.1.9

Bottom of the Frame:
Elevated in accordance
with standards for other
structures. Anchor and
tie-down requirements
included.

ASCE 24-14

Same standards as other
buildings

Recreational Vehicles

44CFR59.1 – Definitions:
Single Chassis,
= $\leq 400\text{ft}^2$,
Self Propelled or Towable,
Not as Permanent
Dwelling

44CFR: No mention in A
zones
AE zones:
On site < 180 Days and
Licensed, Ready for Road;
OR meet building
foundation and elevation
requirements

Building Codes are Moot
on Topic

Historic Buildings

44CFR59.1

Individually Listed on National Register or by Certified State Historic Preservation Program, or Certified or Preliminarily Determined by Dept of Interior as contributing to historical significance of a registered or preliminary determined historic district.

44CFR59.1

Exempt from Substantial Improvement Definition as long as work does not preclude continued historic designation

I-Codes and NYS Uniform Codes:

Exempt from Substantial Improvement Definition as long as work does not preclude continued historic designation

Historic Structure – FEMA Definition

Historic Structure means any structure that is:

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

Historic Structure, NYS Residential Code

Historic Building. A Building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places in the National Register of Historic Places.
2. Designated as historic under an applicable state or local law,
3. Certified as a contributing resources within a National Register-listed, or a state-designated or locally designated historic district.

Historic Building Exemption

- I-Codes and Bldg Code of NYS
 - Definitions Section defines Substantial Improvement & Substantial Damage and Excludes Alterations of a Historic Structure ... As long as alteration will not preclude the structure's continued designation
- IRC – R105.3.1.1 – Determination Substantially Improved Building
 - R105.3.1.1.2 – Excludes alteration of Historic Structures and Includes Detailed Definition of Historic Structure
- NYS R105.2.2.1
 - Excludes Alteration of Historic Structure but Excludes Detailed Definition
 - Instead Definition is included in Definitions Section

Additions to Existing Buildings

FEMA

Regulations refer
only to
Substantial
Improvement

Existing
Building
Code of
NYS

Residential
Code of
NYS:
Appendix J

Additions to Existing Buildings

- Definition: An Extension on Floor Area, Number of Stories, or Height of a Building or Structure
- Existing Building Code of NYS: “In Flood Hazard Areas, alterations that constitute substantial improvement shall require that the building comply with Section 1612 of the Building Code of NYS, or Section 322 of the Residential Code of NYS, as applicable
- Residential Code, Appendix J: “In flood hazard areas, alterations that constitute substantial improvement shall require that the building comply with Section R322 of this Code

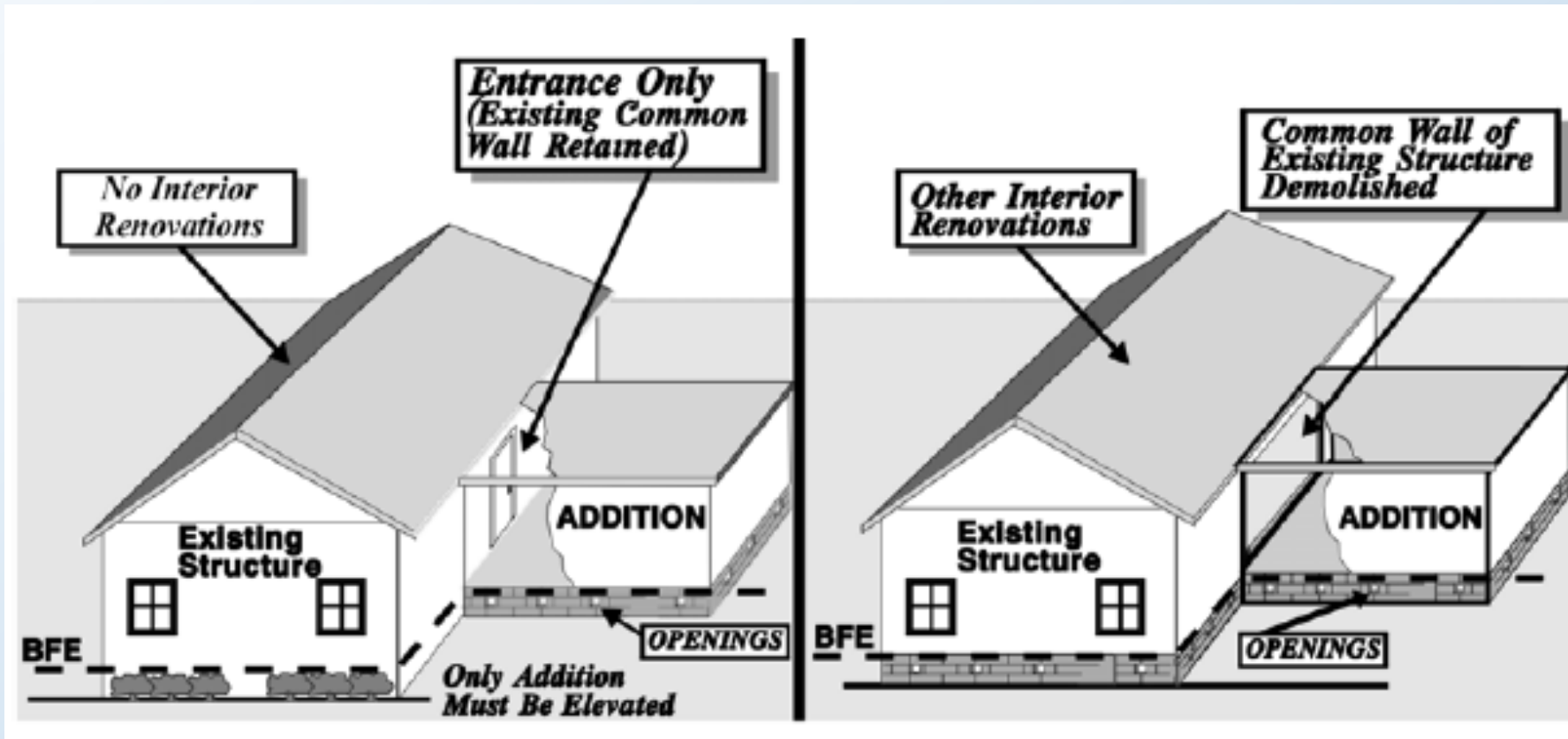
Sounds Simple, Right?

- What's an Addition, Really?
- Is it Structurally Interconnected to the Existing Building?
- Is it a Vertical Addition?
- Is it Combined with Other Work?

Must the Addition be Elevated?

- If Structurally Interconnected to the Existing Building AND if Addition plus All Other Proposed Work combined constitute Substantial Improvement
 - The existing building AND the Addition must be Elevated
- If Not Structurally Interconnected (separate roof, common wall with only a doorway cut in between)
 - The Addition must be Elevated; Existing Building must be Elevated if Addition plus Other Work is a Substantial Improvement
- Vertical Addition: Use Substantial Improvement Determination
- New, Replacement, Raised or Extended Foundation: Use Substantial Improvement Determination

Must the Addition be Elevated?



YES!

Graphic from FEMA 480, NFIP Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials

Exterior Decks and Steps

- Attached Decks or Steps can bring entire Structure into SFHA, even if main part of the structure is outside of SFHA.
- Elevation Certificate requires Elevation of Lowest Adjacent Grade at lowest elevation of attached deck or stairs, including structural support.
- Flood Damage to Decks and Steps may also Damage Structure

Variations and Appeals

- NFIP requires certain conditions for variations (44 CFR 60.6(a))
- NFIP does not allow variations for floodway encroachments that increase flood elevations
- NFIP considers the local NFIP participating community to be the regulating body
- Theoretical concerns if state issues variations for projects that violate local NFIP requirements in which community has not issued a variance
 - Building Codes do not Contain Prohibition of Variance due to Floodway Encroachment

Definition of Variance (FEMA Regulations)

- “Means a grant of relief from the requirements of this local law which permits construction in a manner that would otherwise be prohibited by this local law.”

FEMA may review a community’s findings justifying the granting of variances.

Appeals under I-Codes

- IBC Section 113 and IRC Section 112 Establish a Board of Appeals
- IBC Appendix B defines the makeup, membership and decision-making process
- Reasons for an Appeal:
 - Code or Rules Incorrectly Interpreted, or
 - Provisions of code do not fully apply, or
 - An equally good or better form of construction is proposed
- Board shall not have authority to waive requirements of the code

Variance under NYS Codes

- Bldg Code of NYS: Part 103.3, refers to Department of State Regulations, Part 1205
 - Establishes Regional Boards of Review
 - Allows Boards of Review to vary or modify any provision of the Uniform Code due to
 - Excessive and Unreasonable Economic Burden
 - Would Not Achieve Code's Intended Objective
 - Would inhibit some other important public policy
 - Would be physically or legally impracticable
 - Would be an alternative to ensure the code's intended objective
 - Would entail a negligible additional benefit

FEMA Conditions for Variances

- 1) Variances must pertain to a piece of property and are not personal in nature.
- 2) Variances shall not be issued within any designated regulatory floodway if any increase in flood levels during the base flood discharge would result.
- 3) The variance will not cause additional threats to public safety or create nuisances.
- 4) The variance will not result in extraordinary public expense.

More Conditions for Variances

- 5) A determination that the granting of the variance will not result in increased flood heights.
- 6) The variance will not cause fraud on or victimization of the public.
- 7) The variance will not result in conflict with existing local laws or ordinances.
- 8) A determination that the variance is the minimum necessary to afford relief.

Generally Permissible Variances

- Lots of 1/2 acre or less. For larger lots, technical justification increases.
- Good and sufficient cause
- A determination that failure to grant a variance would result in exceptional hardship to the applicant

Permissible Variances - Exceptional Hardship

- The hardship that would result from the failure to grant a requested variance must be exceptional, unusual, and **specific to the property involved**.
- Inconvenience, aesthetic considerations, physical handicaps, personal preferences, the disapproval of one's neighbors, or homeowners association restrictions cannot, as a rule, qualify as exceptional hardships.

Some Permissible Variances

- Repair or rehabilitation of historic structures if minimum relief necessary to preserve the historic character and design
- Functionally dependent uses: cannot carry out intended purposes unless it is in close proximity to water (e.g.: docking, port or ship building or repair facilities)

Insufficient Reasons

- Less than a drastic depreciation of property
- Convenience of property owner
- Circumstances of owner not the land
- To obtain better financial return
- Property similar to others in neighborhood
- Hardship created by owner's own actions

When Issuing a Variance:

Community must issue a letter to the applicant that:

1. The issuance of a variance to construct below base flood level will result in insurance premiums up to \$25 per \$100 of coverage;
2. Such construction below the base flood level increases risks to life and property.

Variance Key Feature

- Variance granted must be minimum necessary, considering the flood hazard, to afford relief.
- Where the variance conflicts with the Uniform Code of NYS, there must also be a state variance through the regional board of review.

Variance Record Keeping – FEMA Requirements

- Community shall maintain a record of all variance actions;
- Community shall report such variances as requested by FEMA or by state NFIP coordinating agency when doing a community contact for FEMA.

Some Conclusions

- Building Codes and by reference ASCE-24 contain most of FEMA's NFIP requirements.
- NFIP requires land use considerations that I-Codes do not, particularly if the Residential Code's Appendix G is not adopted
- Building Codes and especially ASCE-24 are often more specific and some requirements are stronger
- NFIP regulations are recognized as minimum standards

Some Resources

- NFIP Technical Bulletins
 - <https://www.fema.gov/emergency-managers/risk-management/building-science/national-flood-insurance-technical-bulletins>
- FEMA Building Sciences: Building Code References
 - <https://www.fema.gov/emergency-managers/risk-management/building-science/building-codes/flood>
- Map Service Center
 - <https://msc.fema.gov>
- National Flood Hazard Layer
 - <https://www.fema.gov/national-flood-hazard-layer-nfhl>

Where's the Lowest Floor?



Lowest Floor

Where's the Lowest Floor?



Lowest Floor

Knowledge Check

What is the correct response regarding basements in a flood zone?

- a) It's OK as long as there is no residential use
- b) It's OK as long as no finished floor or walls
- c) It's never OK if below grade on all sides
- d) It's OK if it is a shallow basement

Knowledge Check

Fill within a Special Flood Hazard Area:

- a) Must receive a permit from the community
- b) Is always OK if there is no building on site
- c) Is always OK if outside of floodway
- d) Is not covered by floodplain regulations

Knowledge Check

A local community's elevation standards:

- a) May not exceed the BFE
- b) May not exceed the DFE
- c) May include freeboard
- d) Is determined by the building inspector

Knowledge Check

If a structure has been damaged:

- a) It must be rebuilt to its previous condition
- b) It must be rebuilt to current flood standards
- c) It must meet current standards if damaged by flood
- d) It must meet current standards if substantially damaged

Thank You

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