Water Resource Center

Southwestern Pennsylvania Commission

Floodplain Management 101

Josh Lippert, CFM
City of Philadelphia Floodplain Manager
PAFPM – Vice Chair

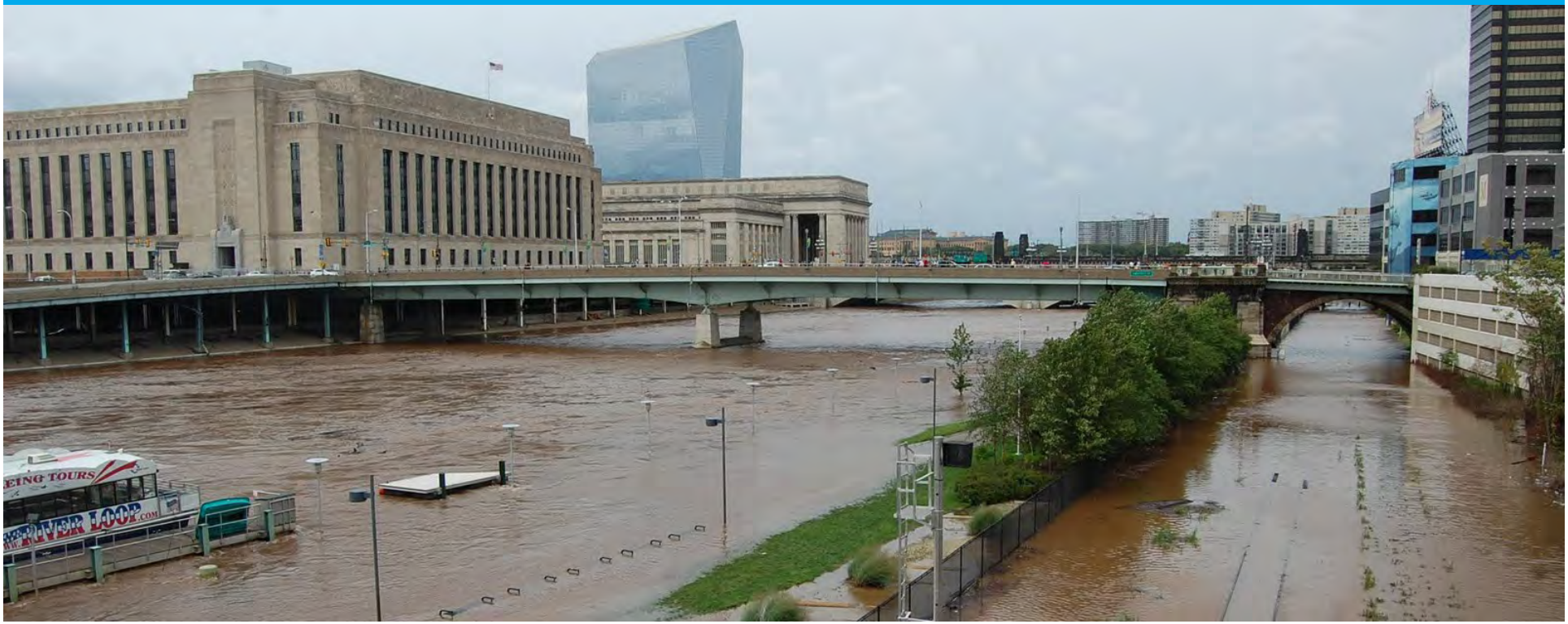
WEBINAR

Overview:

Flooding is the #1 natural hazard to affect all Pennsylvanians. Gain a holistic understanding of the regulatory requirements for development in floodplains. The presenter of this course will provide an overview on NFIP (National Flood Insurance Program) and current Pennsylvania floodplain regulations in the context of the State's model ordinance as well as International Construction Codes (ICC). Best practices and resources will be highlighted. Participants will learn the responsibilities for design professionals and local floodplain administrators/managers for managing flood risks and loss through proper planning, permitting, and design.

MAY 14, 2020

FLOODPLAIN MANAGEMENT 101



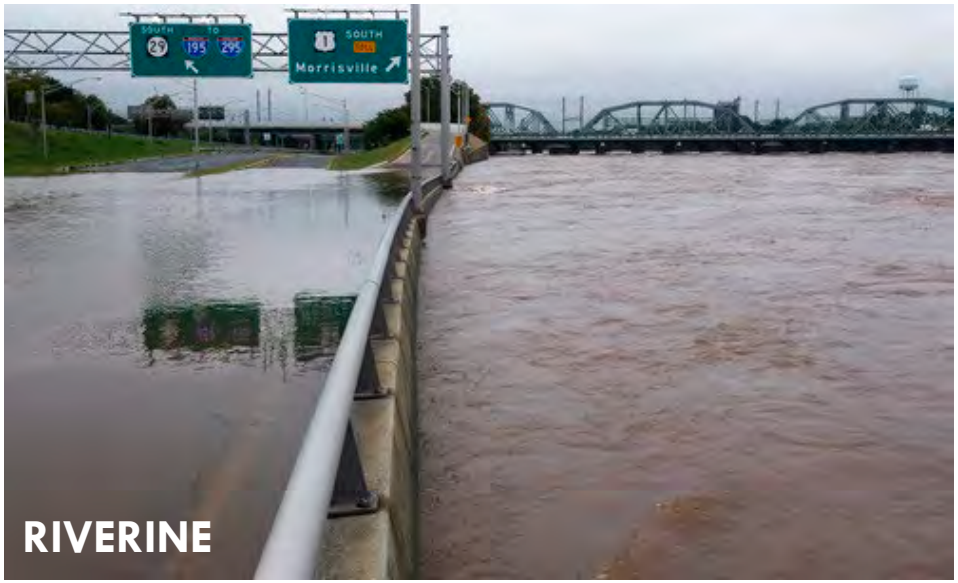
PAFPM

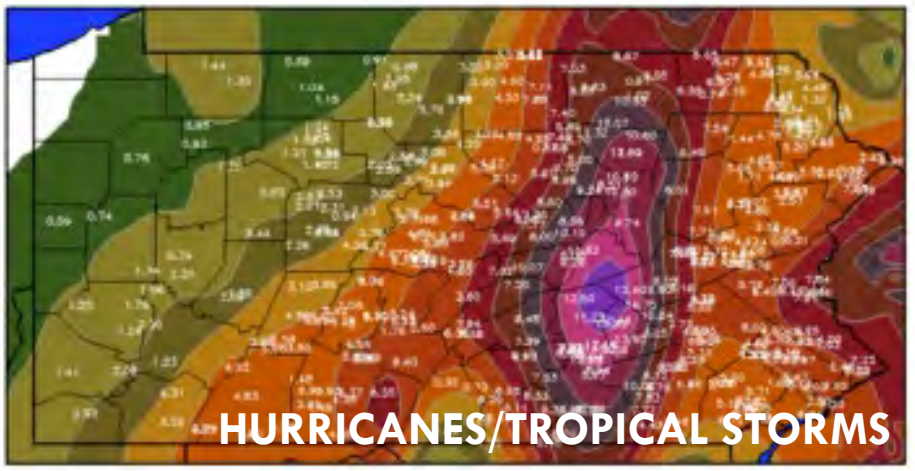
JOSH LIPPERT, *CFM*
FLOODPLAIN MANAGER
JOSHUA.LIPPERT@PHILA.GOV

DISCLAIMER
About this Training

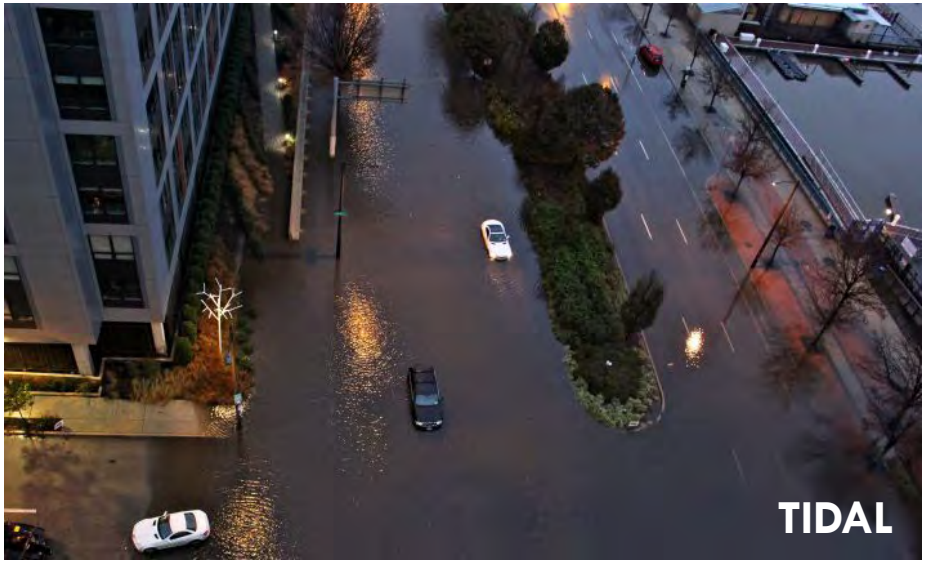
- **Advisory** [always review local codes/regulations]
- **Guidance** [best practices and resources – not necessarily adopted codes/regulations]
- **Codes/regulations** are generally based upon the PA Model Floodplain Ordinance (April 2016), with the incorporation of Building Codes (IRC, IBC, IBC Appendix G, & ASCE 24)

TYPES OF FLOODING
In Pennsylvania





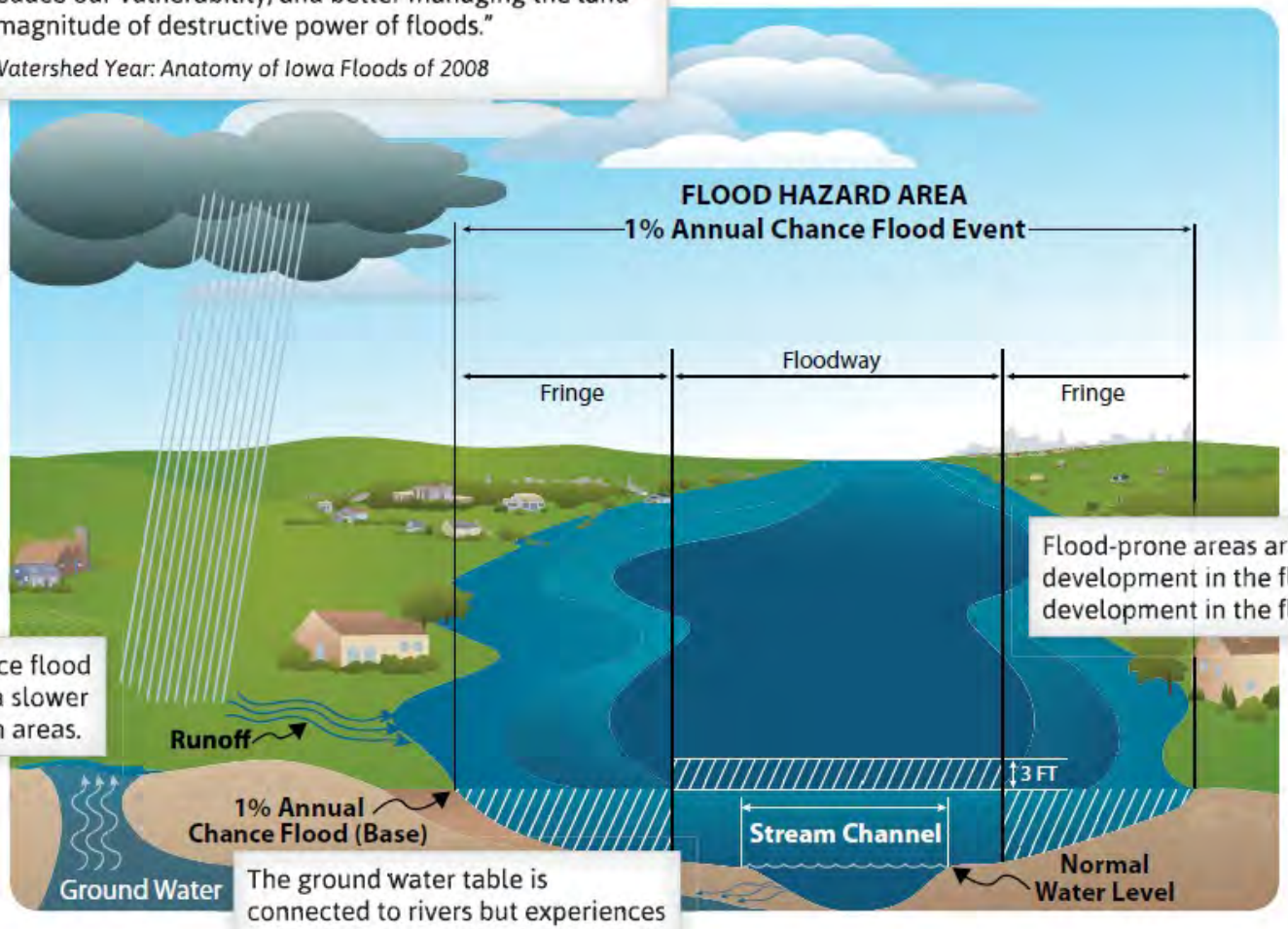
TYPES OF FLOODING
In Pennsylvania



WHAT IS A FLOODPLAIN?
Typical Section

"Living with floods involves two broad activities: better managing the risks and taking steps to reduce our vulnerability, and better managing the landscape to reduce the magnitude of destructive power of floods."

--Connie Mutel, *A Watershed Year: Anatomy of Iowa Floods of 2008*



Rural areas produce flood causing runoff at a slower rate than do urban areas.

Flood-prone areas are managed by restricting development in the floodway, but allowing development in the floodway fringe.

The ground water table is connected to rivers but experiences a delayed response to flood waters. Ground water rises in a flood event.

ROLES

Zoning Administrator/Building Code Official/ Floodplain Administrator/Manager

- Administer codes
  - Code interpretations, if escalated from supervisor
  - Code bulletins
  - Forms/guides/checklists
  - New/revised codes
- Training/education of codes
- Auditing of code effectiveness + compliance
- Permit audits (FEMA CAV's and Yearly Permit Report to State NFIP Coordinator)
- Letter of Map Change - Community Acknowledgment
- State and Federal agency coordination

ROLES
Plans Examiners

- Review plans to ensure they meet building codes, local ordinances, and zoning regulations
- Approve building plans
- Maintain permit records
  - Permit plans/details
  - Elevation Certificate
  - Floodproofing Certificate
- Pre-application meetings
- Coordinate with inspectors for approved plan questions
- Render decisions (issue permits, amend permits, revoke permits, etc.)

ROLES
Inspectors- Building Construction

- Review plans, including FEMA Elevation Certificate or Dry floodproofing Certificate
- Conduct inspections
  - Pre-construction meeting
  - Foundation/lowest floor installation
  - Final Construction (prior to Certificate of Occupancy)
  - Floodproofing Certificate
- Coordinate with plan review for approved plan questions
- Questions escalated to supervisors
- Render decisions (issue violations, stop work orders, etc.)

ROLES
Design Professionals

Types of design professionals (permitting)

- Land Surveyors
- Architects
- Landscape Architects
- Engineers
  - Structural
  - Civil
  - Water Resources/Hydraulic

Other design professionals (non-permitting)

- Urban Planners

NATIONAL FLOOD INSURANCE PROGRAM [NFIP]

FLOOD HAZARD INFORMATION

REGULATIONS

ELEVATION CERTIFICATE

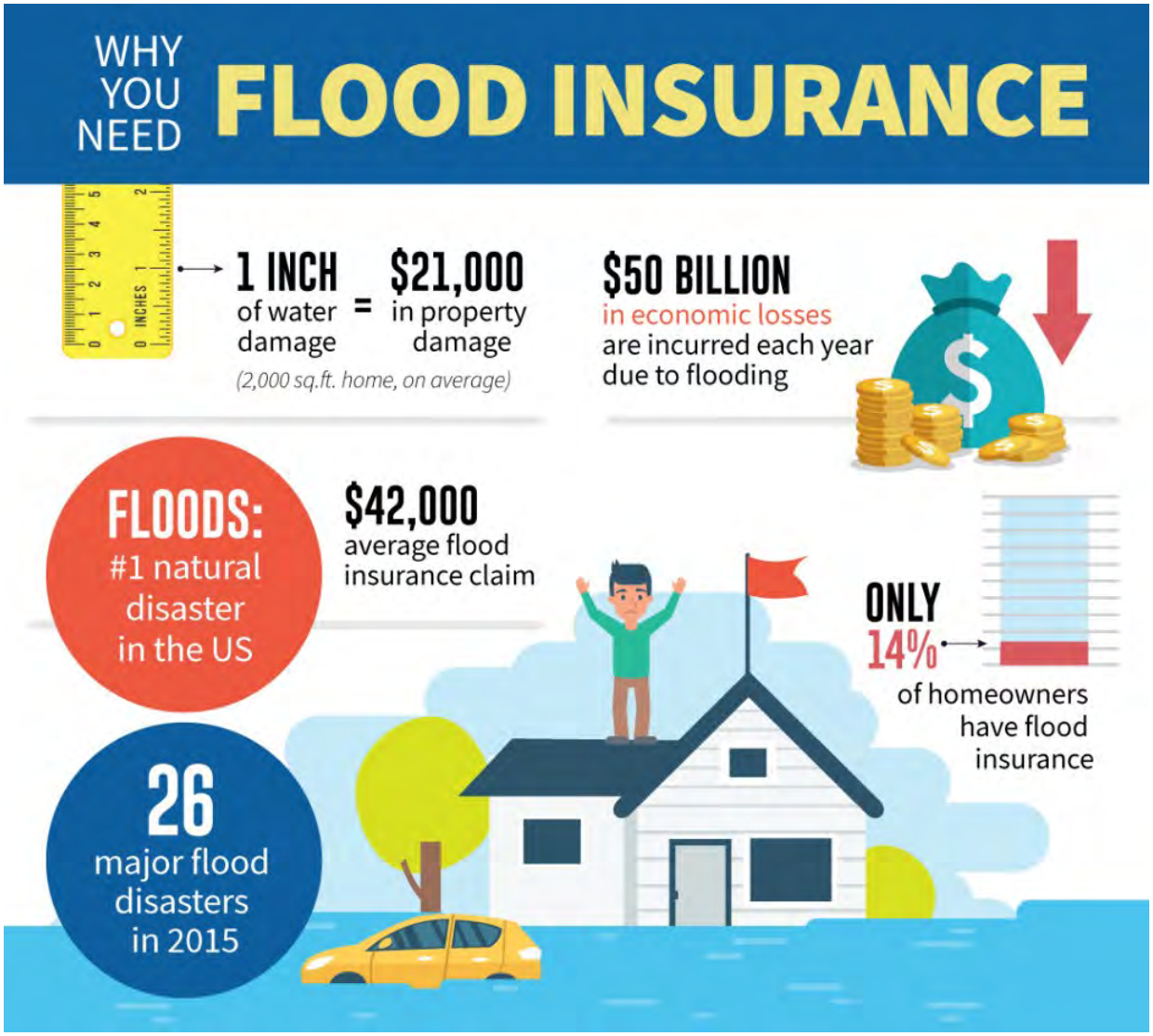
LETTER OF MAP REVISION [LOMC]

RESOURCES

BACKGROUND

National Flood Insurance Program [NFIP]

- Risk Identification (mapping)
- Management (regulations)
- Insurance



BACKGROUND
National Flood Insurance Program [NFIP]

Created by the National Flood Insurance Act of 1968

- Participation is **mandatory** in Pennsylvania
  (Pennsylvania Act 166 of 1978, the Pennsylvania Floodplain Management Act)
    - Adopt and enforce regulations

- Benefits of participation:
    - Flood insurance
    - Grants and loans
    - Disaster assistance
    - Federally-backed mortgages

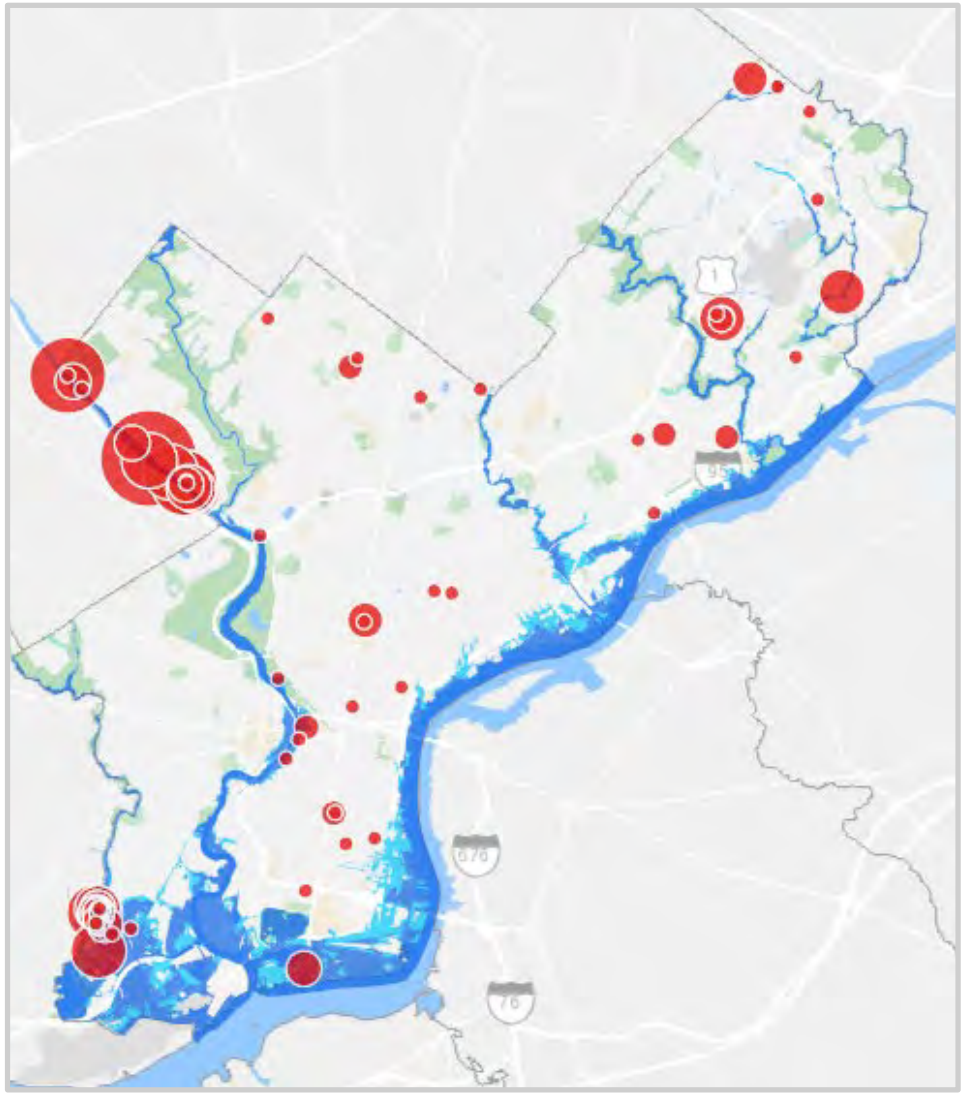
COST OF FLOOD INSURANCE
EXAMPLE

*$250,000 building coverage only (does not include contents), AE (high to moderate risk) zone, single-family, one-story structure without a basement at: 4 feet below Base Flood Elevation (BFE); at BFE; and at 3 feet above BFE. (Rating per FEMA flood insurance manual, October 1, 2012). The illustration above is based on a standard National Flood Insurance Program (NFIP) deductible.

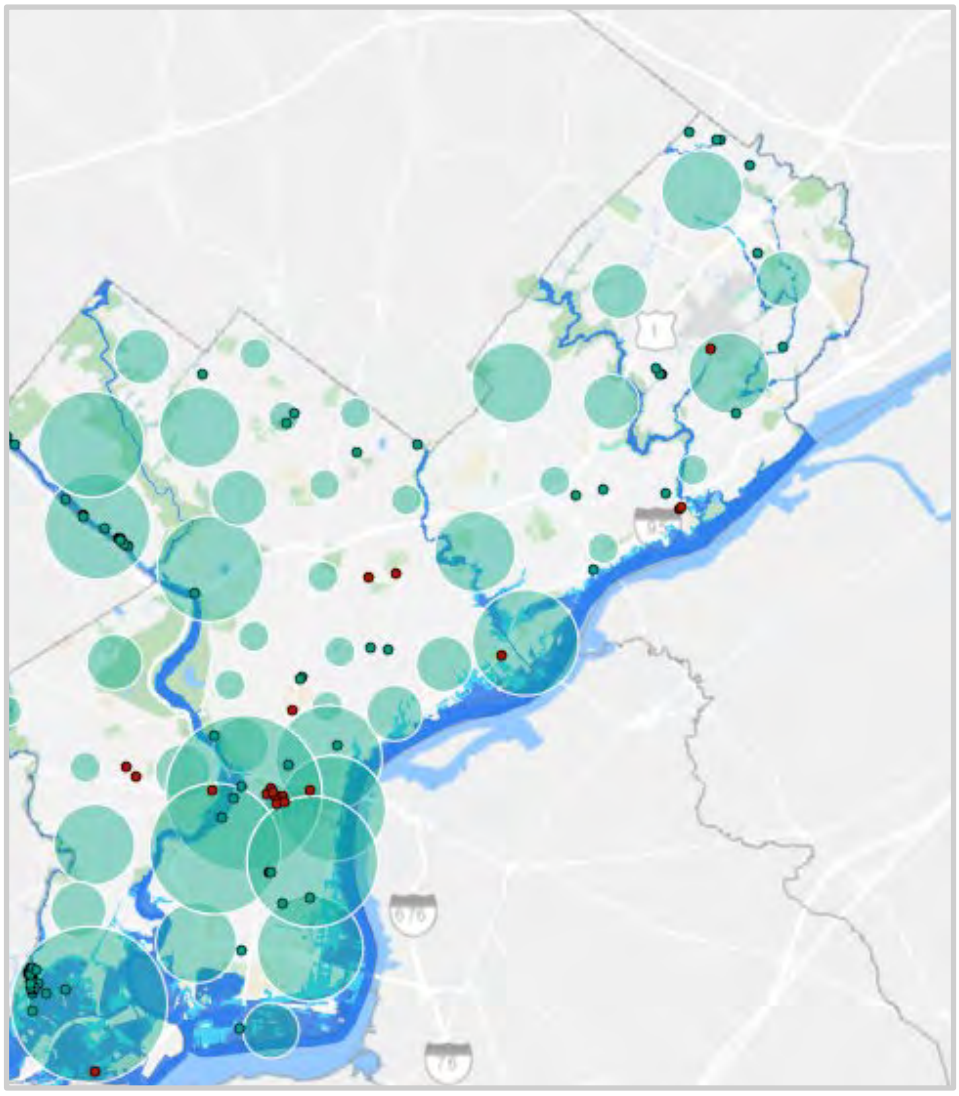
COST OF FLOOD INSURANCE

Losses and Insurance

Repetitive Loss Properties



NFIP Policies (+/- 4,200)



NFIP ROLE:
Federal and State

FEDERAL

- National program oversight
- Risk Identification (mapping)
- Establish development/building standards
- Provide insurance coverage

STATE

- State program oversight
- Establish development/building standards
- Provide technical assistance to local communities/agencies
- Evaluate and document floodplain

NFIP ROLE
Local Jurisdiction

Local Officials and Floodplain Administrators
[Licenses & Inspections, Planning Commission, Floodplain Manager]

- Adopt and enforce floodplain management ordinance compliant with Federal/State laws
- Issue or deny development
- Inspect development and maintain records
- Make substantial damage determinations
- Regulations apply to Special Flood Hazard Area (SFHA) on the Flood Insurance Rate Map (FIRM)
- Development oversight is a local responsibility our local regulations are located in the Zoning and Building Codes

FEMA COMMUNITY ASSISTANCE VISIT [CAV]

- Audit of the last 5 years of floodplain permits issued
- Tour throughout the community for non-permitted development
- Review of the community's "floodplain program"
- Review of community's compliant floodplain regulations

RESULTS:

- Potential violations of individual properties/development
- NFIP program compliance (codes, practice, etc.)
- Violations may lead to the locality being placed on **Probation**
- **NFIP Probation**
    - $50 surcharge to all NFIP policy holders, yearly until probation is lifted

ORDINANCE NON-COMPLIANCE

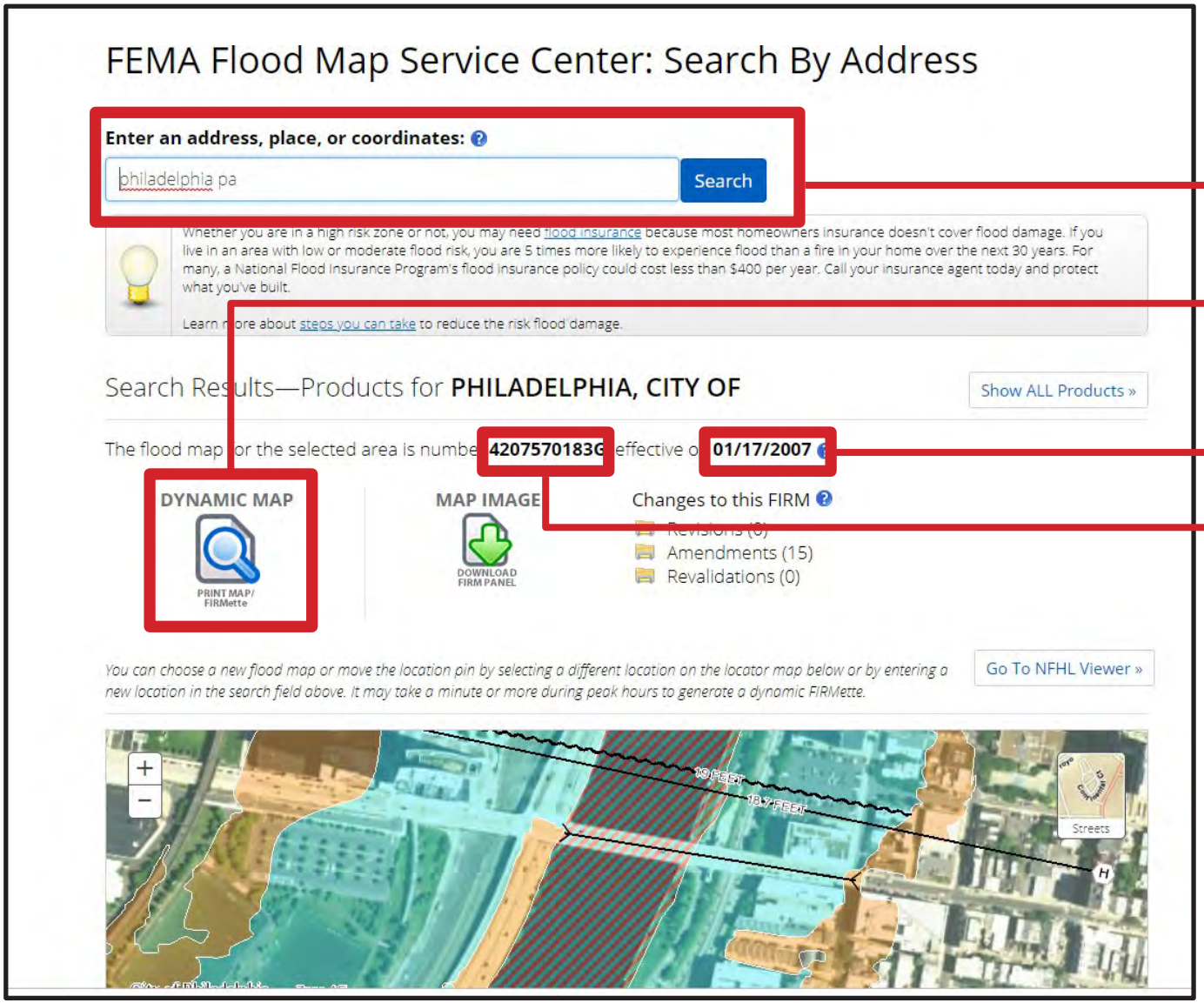
Failure to adopt a compliant ordinance by map effective date or having non-compliant ordinance = **easiest way to get suspended**

Unanswered CAV can also result in suspension

- Serious ramifications:
  - No federally backed mortgages or home equity loans in floodplain areas
  - No renewals of existing flood insurance policies
  - Loss of most forms of Disaster Assistance
  - No federal grants or loans
  - Loss of subsidized insurance for Pre-FIRM structures

FLOOD HAZARD INFORMATION
FEMA FLOOD MAP SERVICE CENTER

msc.fema.gov



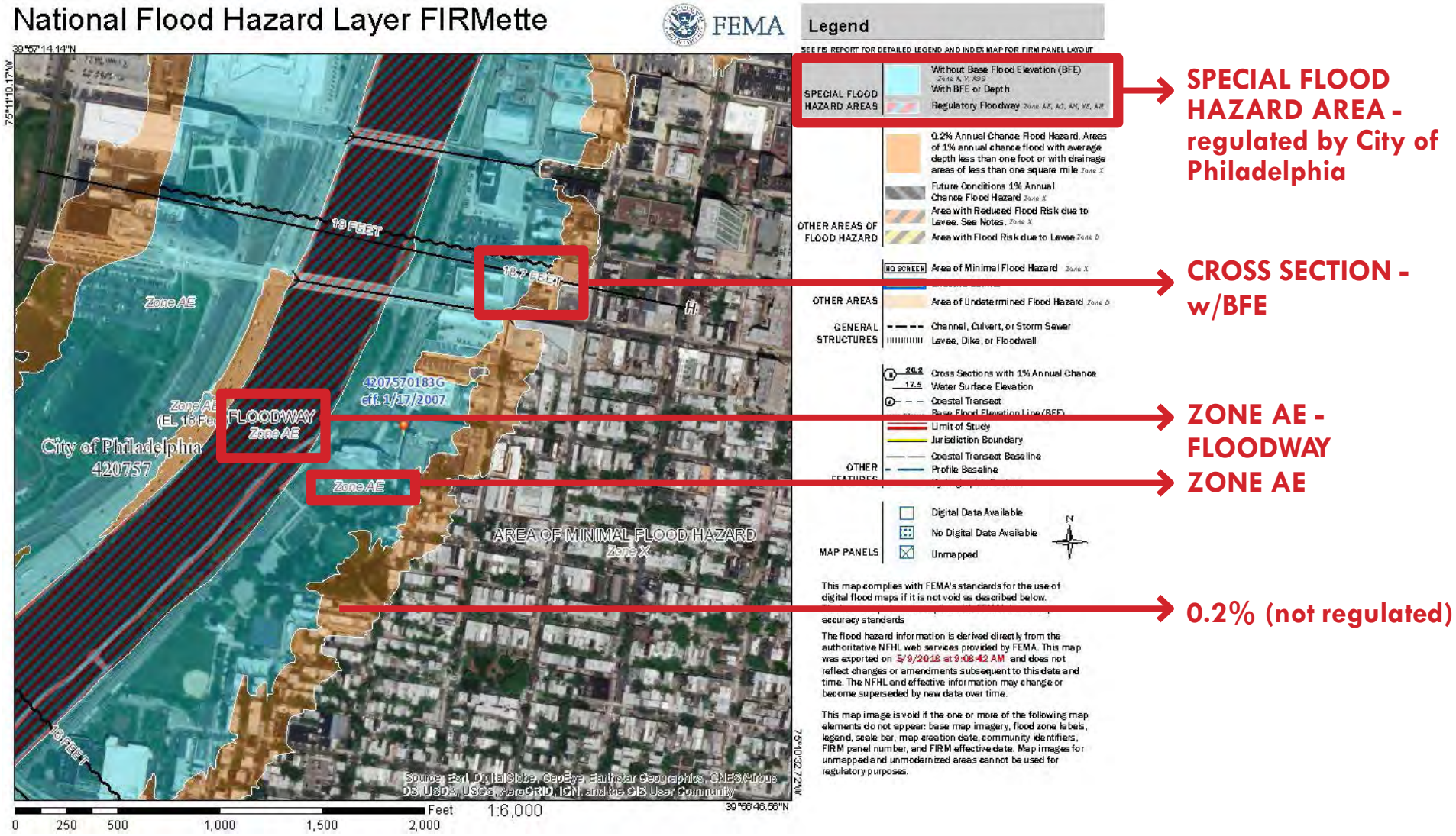
ADDRESS

CREATE FIRMette- 8.5x11" Print of property on FIRM Map

FIRM DATE

FIRM PANEL #

FIRMette
with mapped floodway



FLOOD INSURANCE STUDY [FIS]

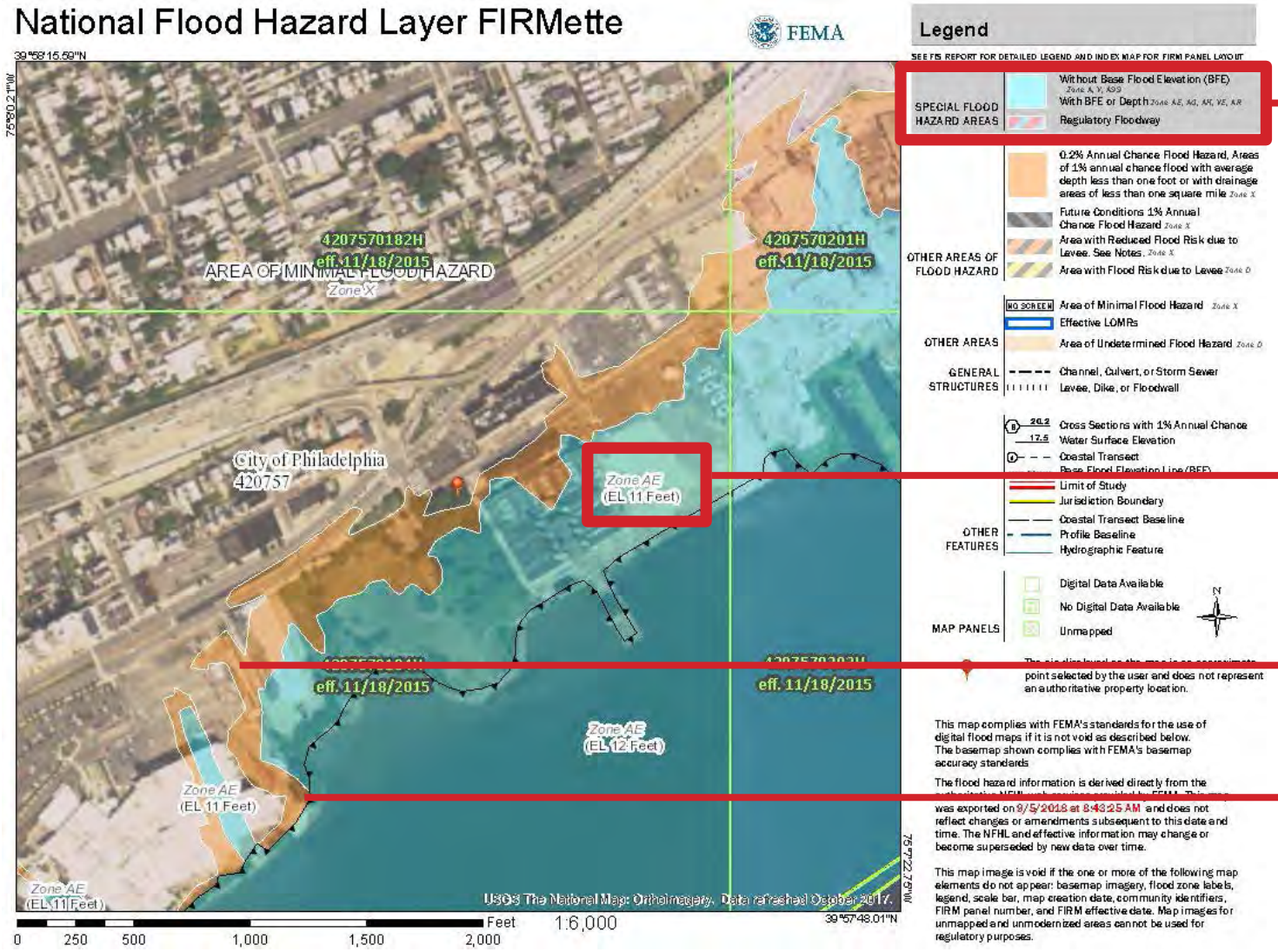
Riverine flood profile to determine BFE

Flood Profiles from Flood Insurance Study reports can be used to determine the BFE at a specific site. Profiles also show estimated water surface elevations for floods other than the 1% annual chance flood (100-year).

1. On the effective flood map, locate your site by measuring the distance, along the profile baseline of the stream channel, from a known point such as a road or cross section, for example, (JM) or (JN).
2. Scale that distance on the Flood Profile and read up to the profile of interest, then across to determine the BFE, to the nearest 1/10 of a foot. (Answer: 123 feet).

FIRMette
w/o mapped floodway [Coastal Flood Hazard]

- **areas mapped with a LiMWA, must comply with Coastal A Zone codes/regulations**



SPECIAL FLOOD HAZARD AREA - regulated by City of Philadelphia

COASTAL FLOOD HAZARD ZONE AE

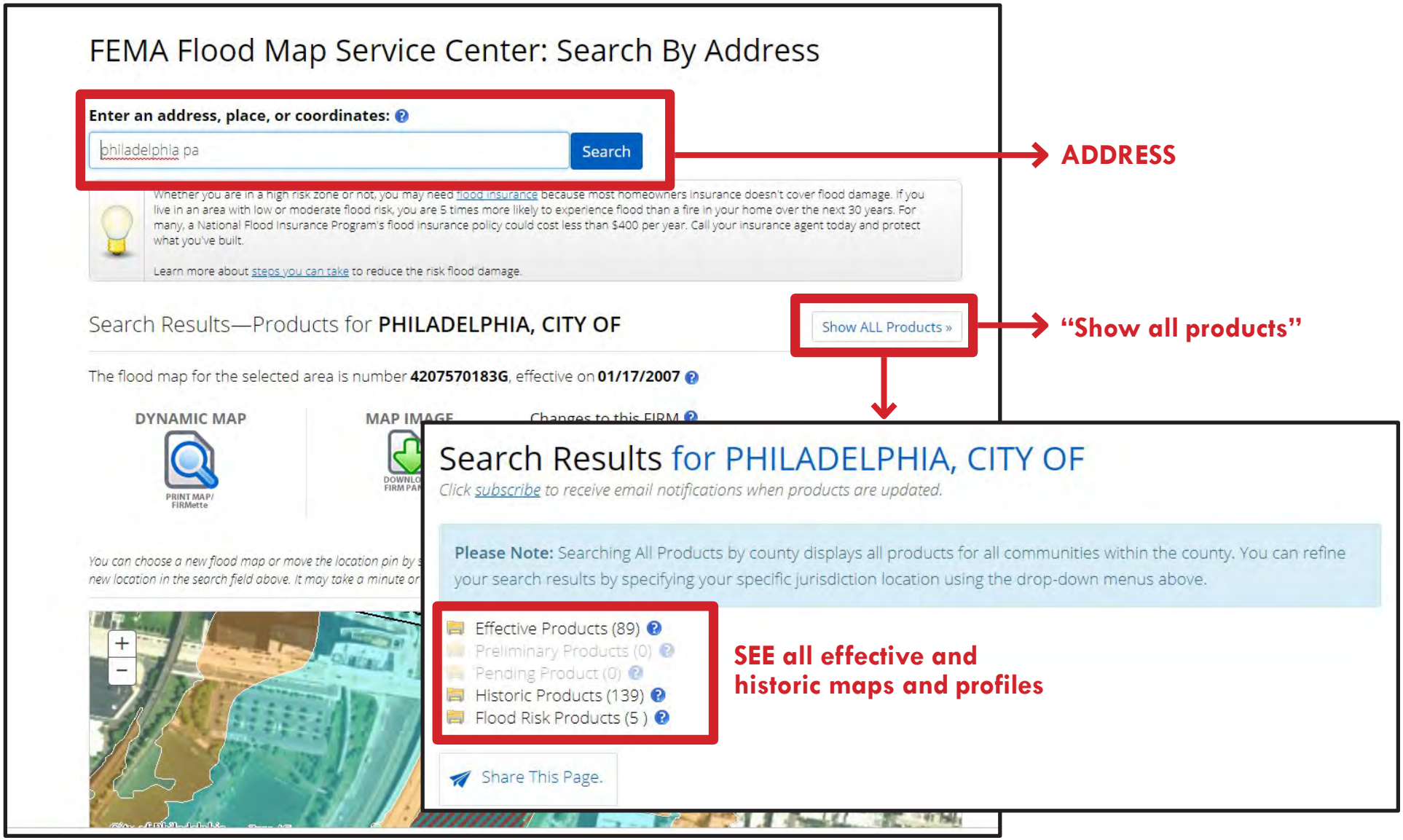
0.2% (not regulated)

LiMWA - limit of moderate wave action

FEMA FLOOD MAP SERVICE CENTER

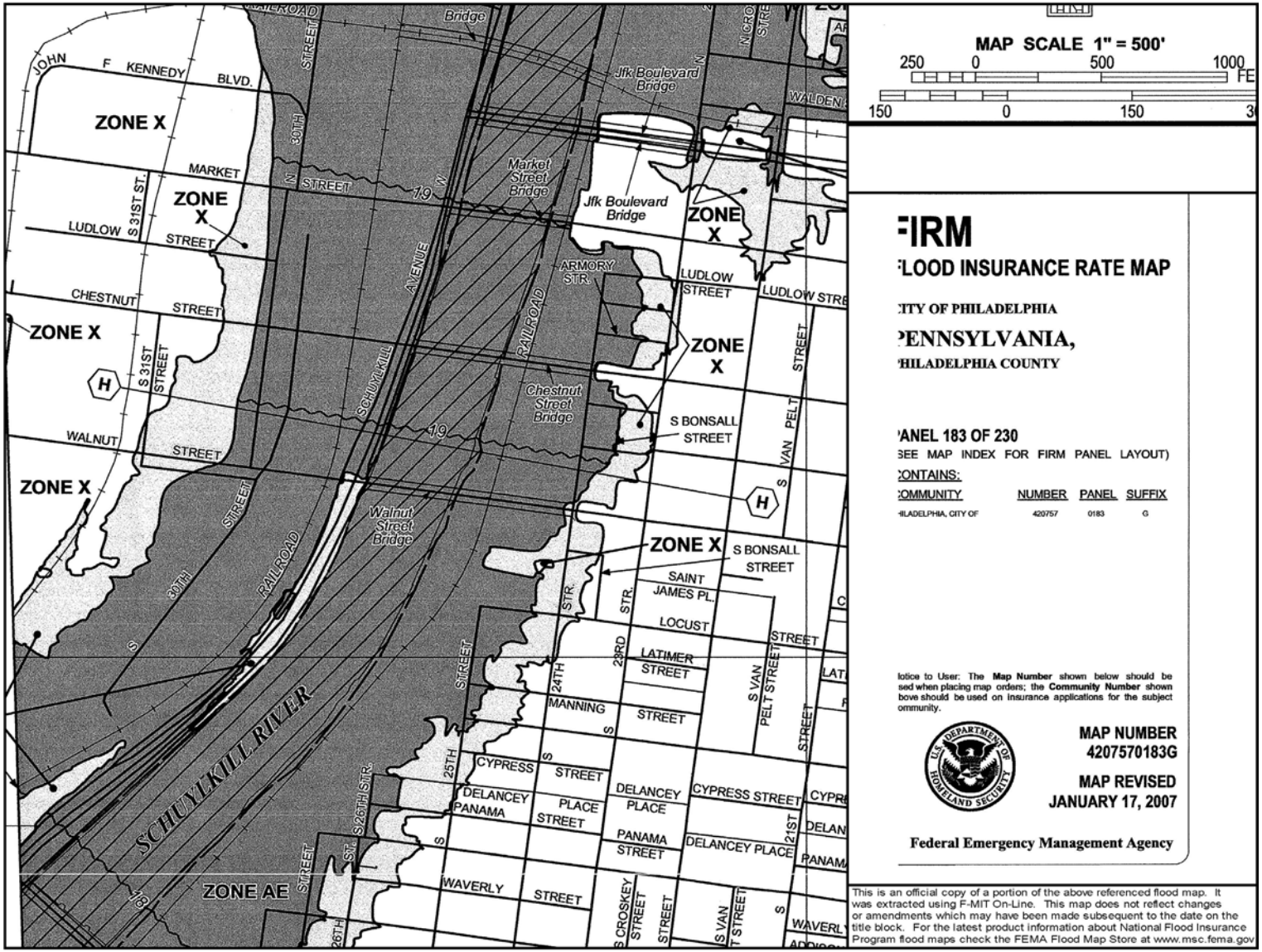
Previous FIRM maps and Flood Insurance Profiles [FIS]

msc.fema.gov



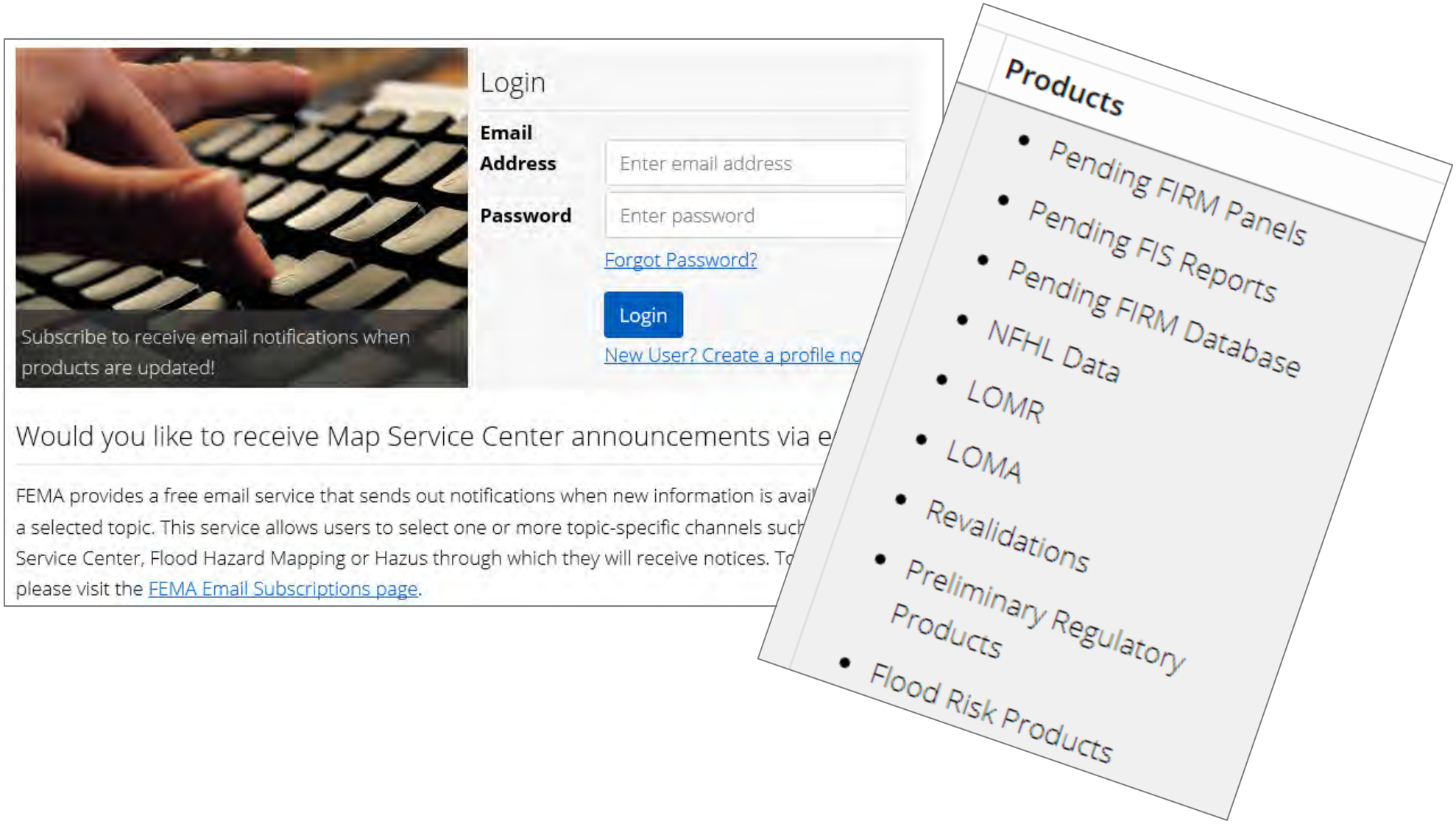
FIRMette

Print version (previous)



FIRMette

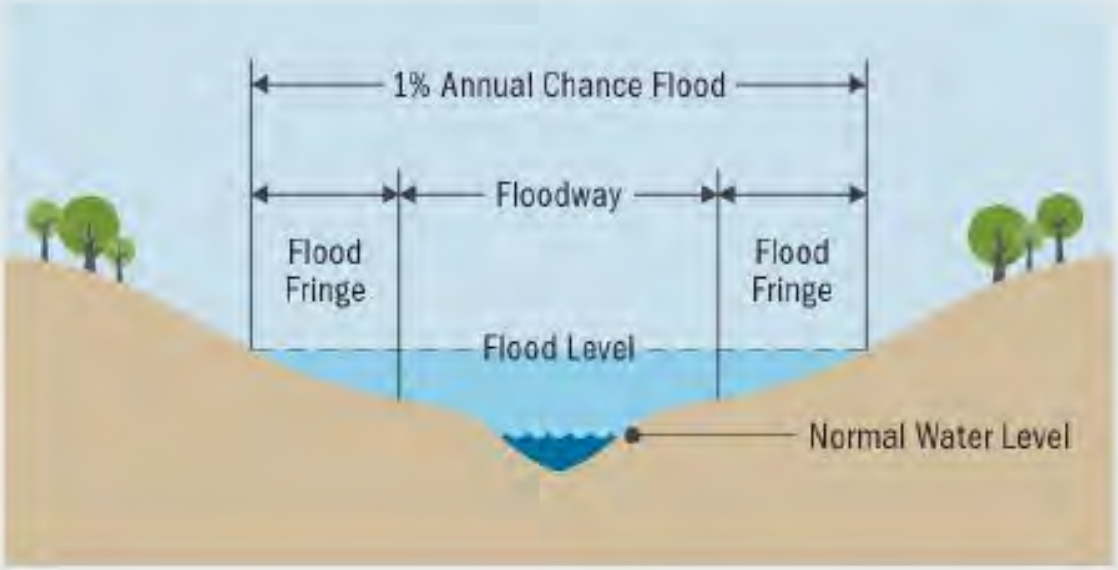
FEMA Map Change Notifications



REGULATIONS
Overview

Floodplain Management Regulations

Floodplain management regulations include zoning ordinances, subdivision regulations, building codes, health regulations, and special purpose ordinances (such as a floodplain ordinance, grading ordinance or erosion control ordinance). The term describes any combination of these State or local regulations that provides standards for preventing and reducing flood damage.



REGULATIONS
Various Sources

Suggested Provisions

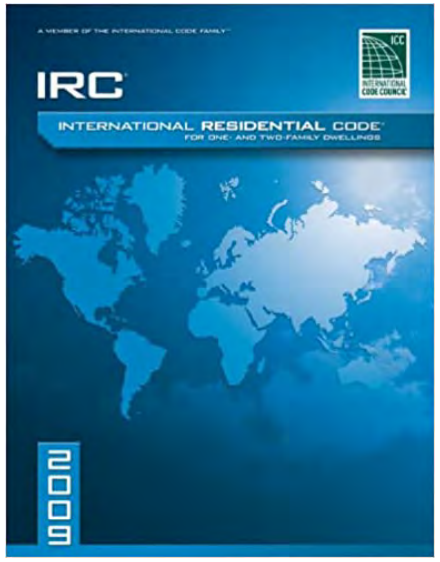
Meeting the Minimum Requirements of
the
THE NATIONAL FLOOD
INSURANCE PROGRAM
and the
PENNSYLVANIA FLOOD PLAIN
MANAGEMENT ACT (1978-166)
SECTION 60.3 (d)

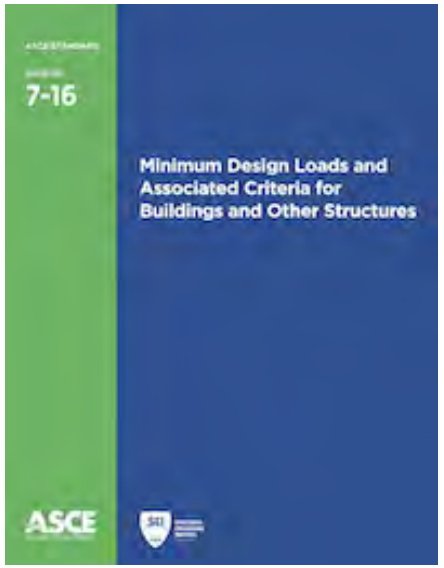
IBC Appendix G -
Flood-Resistant Construction

- Addresses flood-related administrative requirements
- The only place in the I-Code that addresses development **other than buildings**

G101 Administration	G501 Manufactured Homes
G102 Applicability	G601 Recreational Vehicles
G103 Powers and Duties	G701 Tanks
G104 Permits	G801 Other Building Work
G105 Variances	G901 Temp Structures & Temp Storage
G201 Definitions	G1001 Utility & Miscellaneous Group U
G301 Subdivisions	
G401 Site Improvement	

FEMA





REGULATIONS
NFIP + Building Codes

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

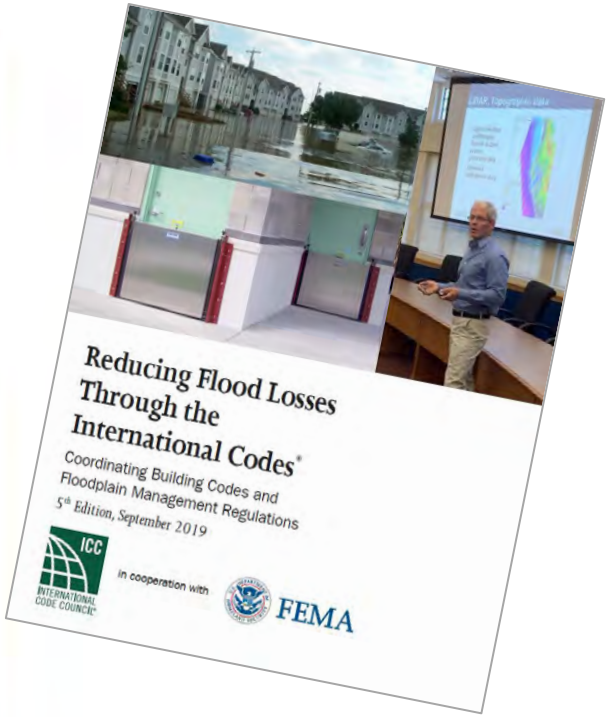
Figure 1-1: Relationship of NFIP regulations to building code flood provisions

REGULATIONS
Conflicts

- **Wording differences.** If regulations use different, although similar, words to describe similar requirements, the differences may be interpreted to be meaningful, which can complicate resolution of the differences on a case-by-case basis.
- **Differences in requirements.** Although the concept that the more restrictive of conflicting provisions prevails is common, allowing known conflicts to remain can cause confusion. Having such differences places an undue burden on property owners, design professionals, builders, and local officials who have to determine which regulation or code contains the more restrictive provisions. This step adds to the cost of preparing, reviewing, and revising designs and construction documents. Importantly, local officials may be liable for failing to enforce the more restrictive provisions, especially if that failure is shown to have contributed to damage after a flood event.

REGULATIONS
Approaches

Building Codes	Comprehensive Approach (plans, zoning, subdivisions, other regulations, and building codes)	Stand-Alone Floodplain Management Regulations Plus Building Codes
THEN	**THEN**	**THEN**
Adopt the IBC with IBC Appendix G, IRC, IEBC, and other I-Codes, AND Adopt the applicable code-coordinated floodplain management ordinance (Chapter 6 of this guide).	Ensure any NFIP requirements not retained when adopting the I-Codes are incorporated into other regulations, OR Adopt the applicable code-coordinated floodplain management ordinance (Chapter 6 of this guide).	Continue to maintain and enforce floodplain management regulations, resolving differences with flood provisions of the I-Codes.
AND	**AND**	**AND**
Prior to adoption of any amendments to the flood provisions of the I-Codes, review proposed amendments with the NFIP State Coordinator or FEMA Regional Office.	Prior to adoption of any amendments to the flood provisions of the I-Codes, review proposed amendments with the NFIP State Coordinator or FEMA Regional Office.	Review regulations and codes with other State and community authorities involved in regulation of flood hazard areas to avoid overlap, conflicting provisions, and duplication.



REGULATIONS
Benefits of the I-Codes

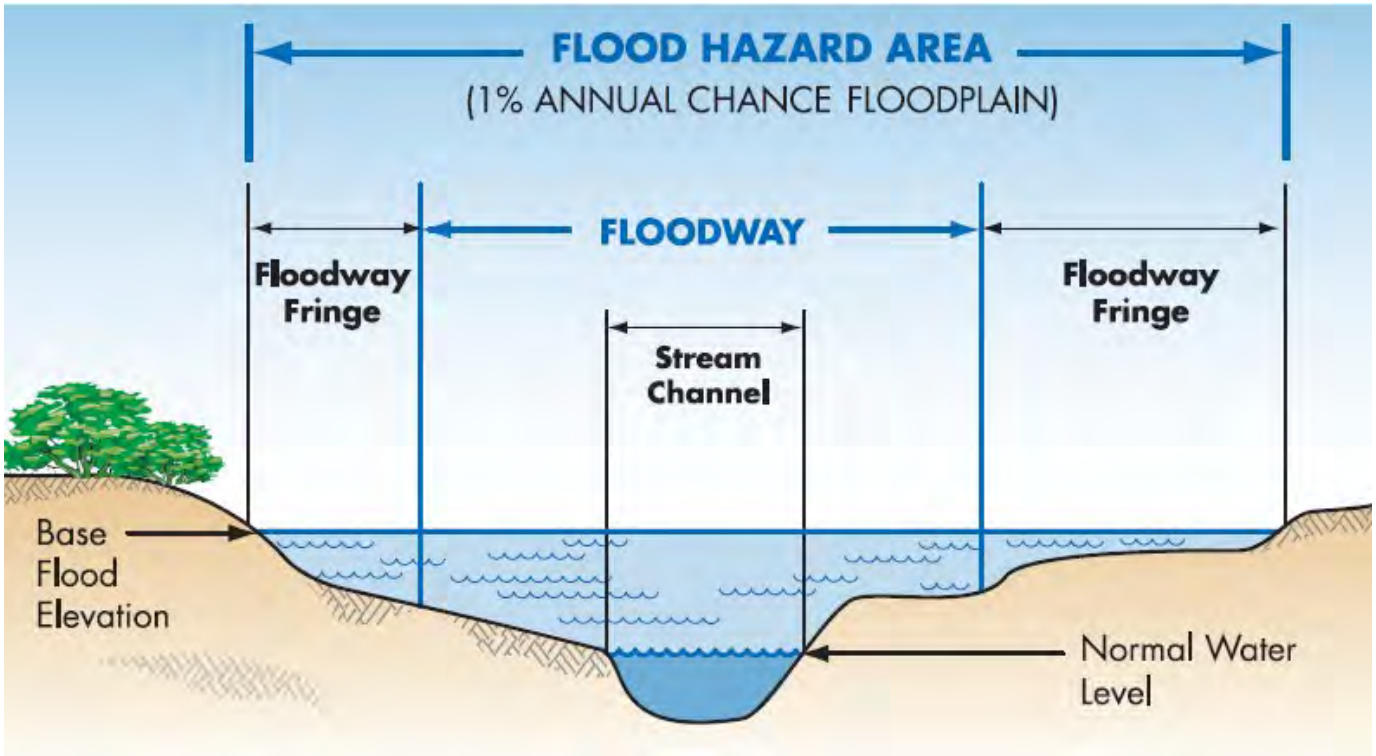
- Fewer conflicts
- All hazard related building construction requirements in one place
- Improved construction quality
- Exceed or are more specific than NFIP requirements
- Aligned with FEMA's goals and emerging policies
- Consistent permit conditions and requirements
- Permits issued for all buildings and structures
- Strengthened enforcement
- Effective, routine inspections
- Improved compliance with requirements for existing buildings
- Saves money

REGULATIONS
Concerns of the I-Codes

- Building codes apply only to buildings and structures
- States many limit local adoption of higher standards
- Certain structures may be exempt or not required to obtain permits
- Potential for codes to be inconsistent with the NFIP

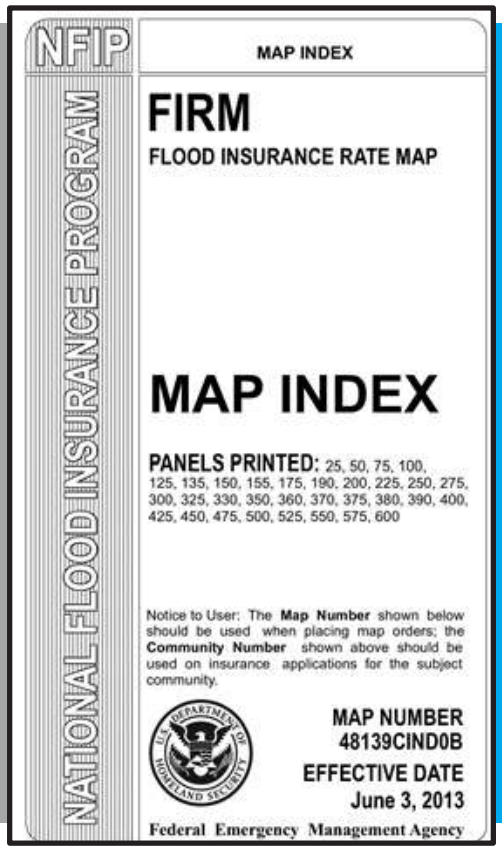
REGULATIONS
Development Definition

- development located in flood hazard areas, including the subdivision of land; installation of utilities; placement and replacement of manufactured homes; new construction and repair, reconstruction, rehabilitation or additions to new construction; substantial improvement of existing buildings and structures, including restoration after damage; **temporary structures and temporary or permanent storage**; utility and miscellaneous buildings and structures



REGULATIONS
Key Dates

PRE-FIRM
BUILT BEFORE
or structures mapped into SFHA's post construction, see historical FIRM maps



POST-FIRM
BUILT AFTER

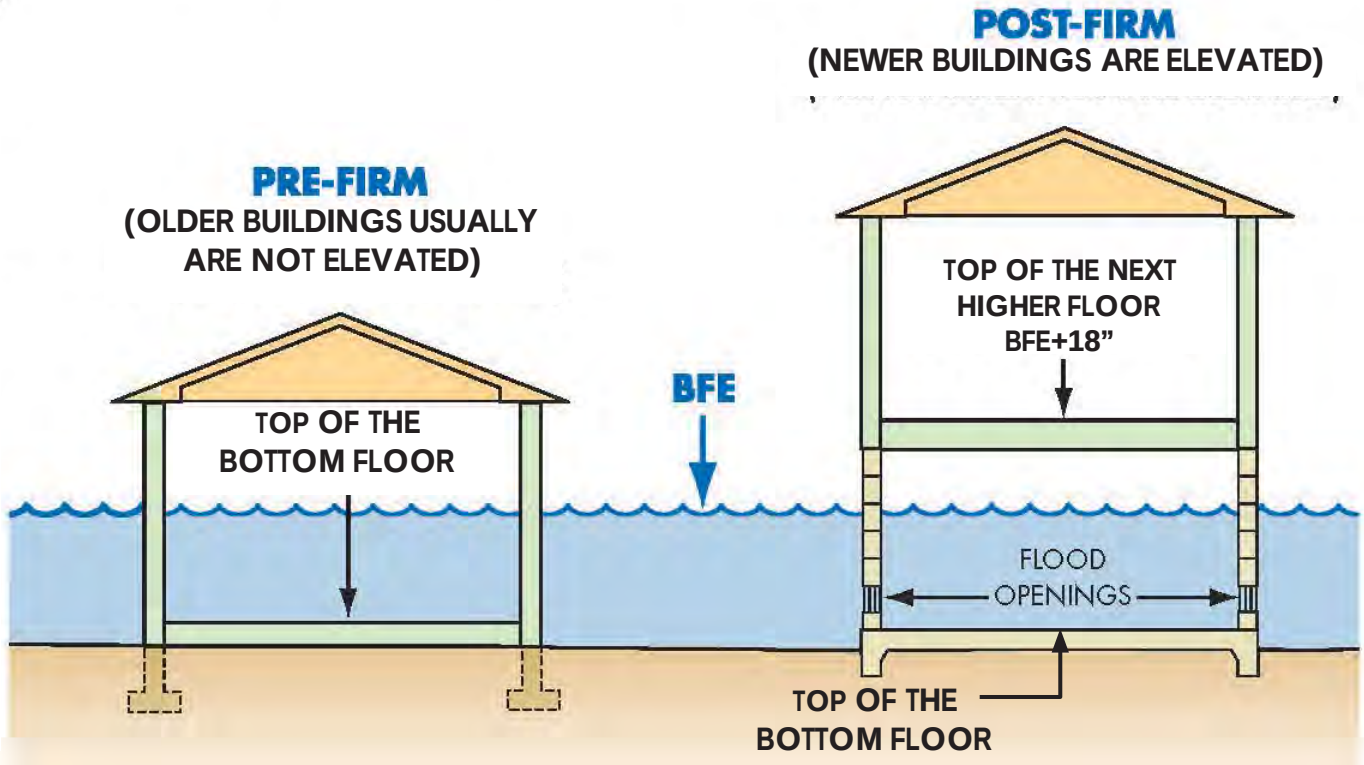
Regulations **do not** apply unless substantially improved, but mitigation is always highly suggested

MUST maintain compliance from date of initial construction and/ or substantial improvement

REGULATIONS
Lowest Floor

- Lowest Floor - lowest enclosed floor including: crawl space, basement, garage.

Pre-FIRM and **Post-FIRM** are insurance terms tied to a community's initial FIRM. The terms are used to determine flood insurance rates. Although common, the terms should not be used to distinguish between new construction built before a community joined the NFIP and those built after, especially in communities where the FIRMs have been revised.



REGULATIONS
Prohibited/restricted uses

Prohibited Uses:

- Hospitals
- Group living uses housing the elderly or disabled persons with limited mobility
- Detention or correctional facilities
- New manufactured home park
- Manufactured home subdivision
- Substantial improvement to an existing manufactured home park or manufactured home subdivision.

REGULATIONS
Prohibited/restricted uses

Development Which May Endanger Human Life

- production or storage or will be used for any activity requiring the maintenance of a supply of more than 550 gallons, or other comparable volume, of any of the following dangerous materials or substances on the premises; or, 3. will involve the production, storage, or use of any amount of radioactive substances; shall be subject to the provisions of this section, in addition to all other applicable provisions. The following list of materials and substances are considered dangerous to human life:

- Acetone
- Ammonia
- Benzene Calcium carbide
- Carbon disulfide
- Celluloid
- Chlorine
- Hydrochloric acid
- Hydrocyanic acid
- Magnesium
- Nitric acid and oxides of nitrogen
- Petroleum products (gasoline, fuel oil, etc.)
- Phosphorus
- Potassium
- Sodium
- Sulphur and sulphur products
- Pesticides (including insecticides, fungicides, and rodenticides)
- Radioactive substances, insofar as such substances are not otherwise regulated.

REGULATIONS
Subdivisions

50 lots or at least 5 acres, whichever is the lesser, in Identified Floodplain Areas where base flood elevation data are not available

- hydrologic and hydraulic (H&H) engineering analyses that determine base flood elevations and floodway information
- prepared by a licensed professional engineer in a format required by FEMA for a Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR). Submittal requirements and processing fees shall be the responsibility of the applicant

REGULATIONS
Definitions ASCE 24-14

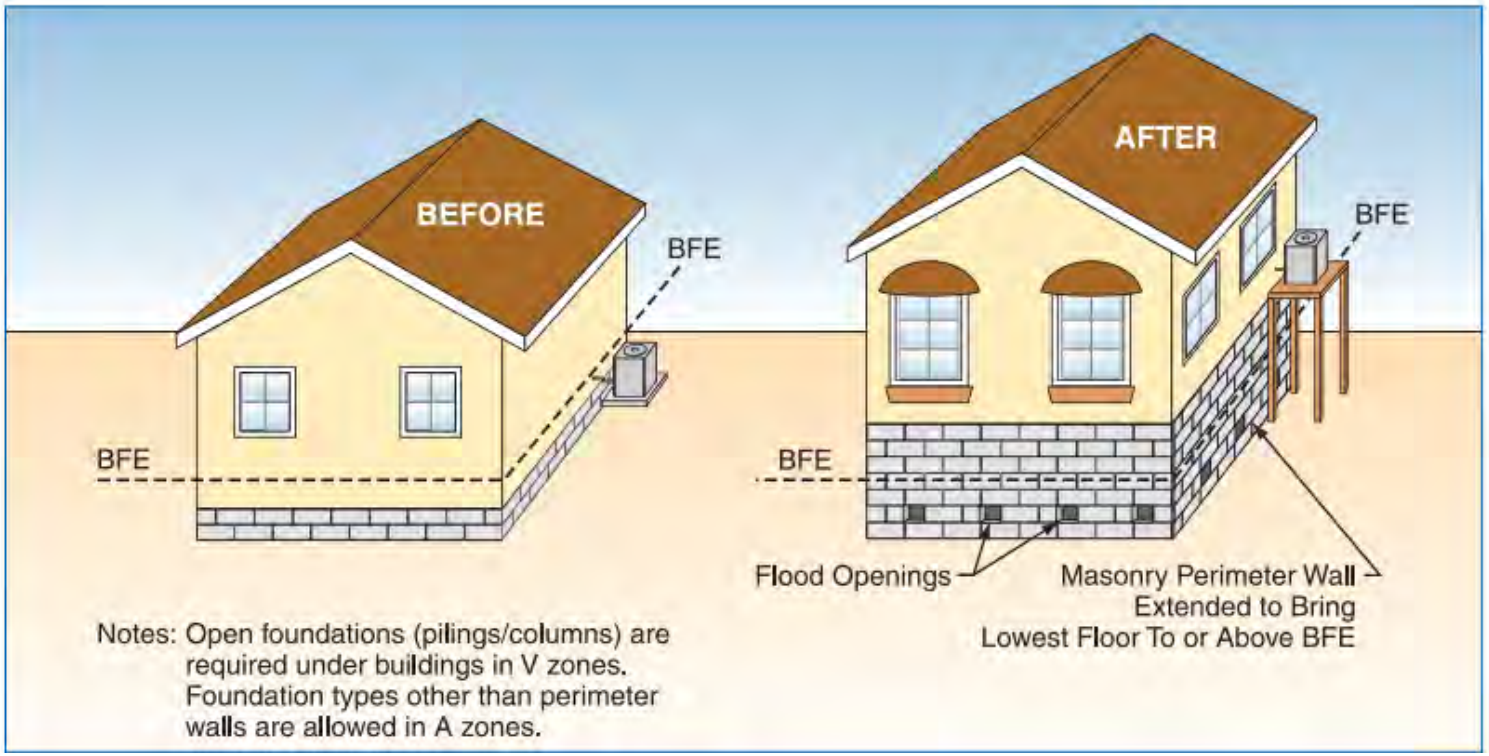
- **RESIDENTIAL** - building or structures and portions thereof where people live or that are used for sleeping purposes on a transient or non-transient basis - including but not limit to 1-family, 2-family, townhouses, condominiums, multifamily dwellings, apartments, congregate residences, boarding houses, lodging houses, rooming houses, hotels, motels, convents, monasteries, dormitories, fraternity houses, sorority houses, vacation time-share properties and institutional facilities: halfway houses, social rehabilitation facilities, alcohol and drug centers, detoxification facilities

- **NON-RESIDENTIAL** – not mentioned above

- **CRITICAL/ESSENTIAL FACILITIES** (required to have 24" freeboard) – Generally structures needed in emergency events (see for full list)

REGULATIONS
Existing Structures: Substantial Improvements

- means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure (or smaller percentage if established by the community) before the "start of construction" of the improvement. This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed



REGULATIONS

Substantial Improvements – VALUE OF WORK

Substantial Improvement Calculation

IMPROVEMENT VALUE / MARKET VALUE

= PERCENTAGE OF IMPROVEMENT

ESTIMATED COST

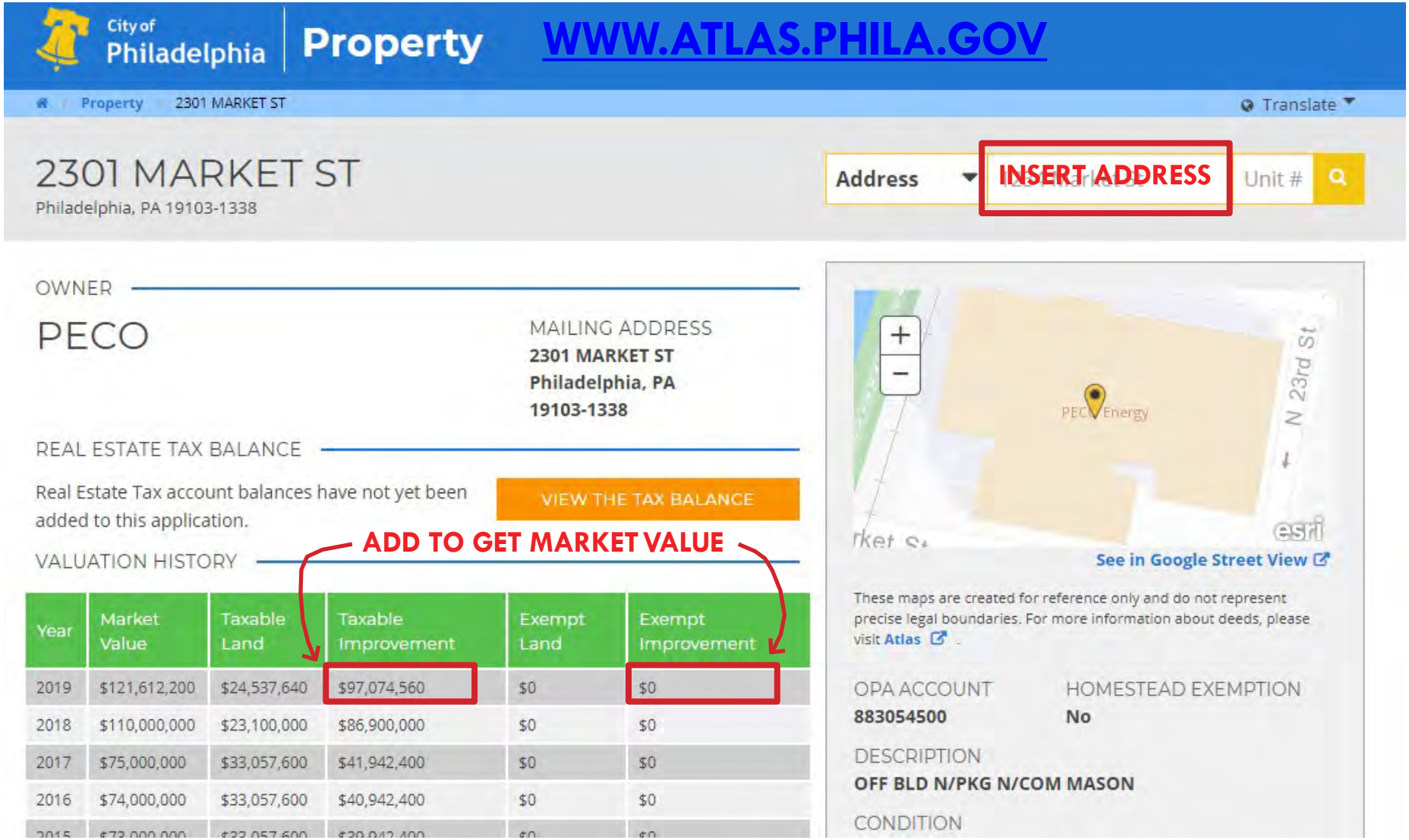
- Materials and labor, including the estimated value of donated or discounted materials and owner or volunteer labor, plus sales tax
- Site preparation related to the improvement or repair (e.g., foundation excavation or filling in basements)
- Demolition and construction debris disposal
- Construction management and supervision
- Structural elements and exterior/interior finishes
- Utility and service equipment

Items that can be excluded:

- Costs to obtain or prepare plans and specifications
- Land survey costs
- Permit fees and inspection fees
- Outside improvements, including landscaping, irrigation, sidewalks, driveways, fences, yard lights, swimming pools, pool enclosures, and detached accessory structures (e.g., garages, sheds, and gazebos)
- Costs required for the minimum necessary work to correct existing violations of health, safety, and sanitary codes

REGULATIONS

Substantial Improvements - MARKET VALUE



REGULATIONS

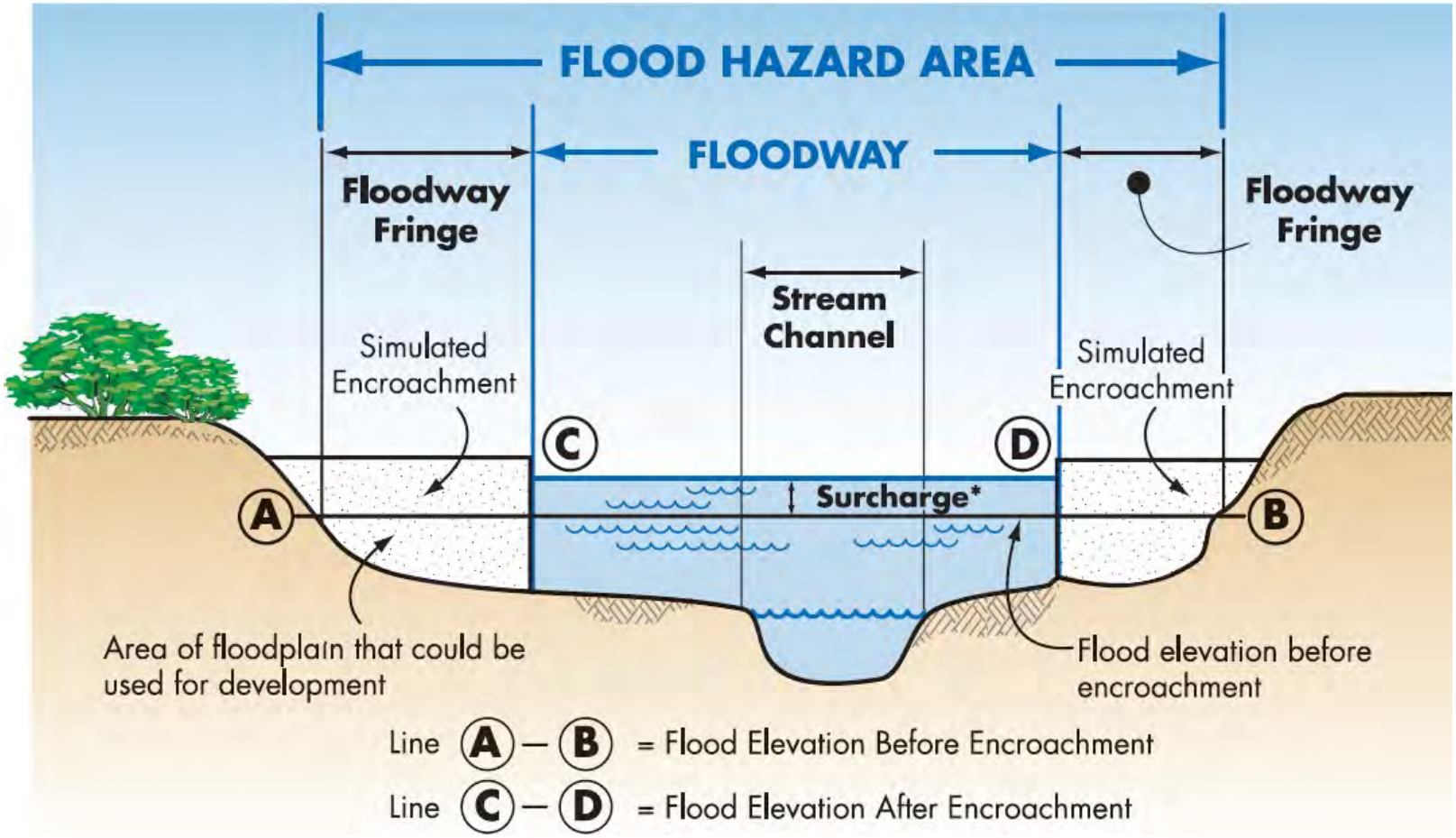
Substantial Improvements - APPRAISAL

TO CHALLENGE THE MARKET VALUE: CERTIFIED APPRAISAL

- Licensed Appraiser in Pennsylvania
- Report
  - Identify intended user (including property owner)
  - Completed less than 1 year before floodplain application
  - "Market Approach" is preferred - for structure only, land must be broken out **(NOTE: to separate the market value of a structure from the value of the land on which it is located, appraisers may need to do more research than is normally undertaken in order to reasonably allocate the total value between the structure and the land) - for multiple buildings on one parcel, each must be assessed for existing market value**
  - "Income Capitalization Approached" is not acceptable
  - All values must be for existing conditions, without any proposed improvements

REGULATIONS
Floodway

- **No Rise** study must be completed, with technical analysis (usually and H&H Study)
- Other local, state, and federal permits apply (DEP, USACE, Submerged Lands License)

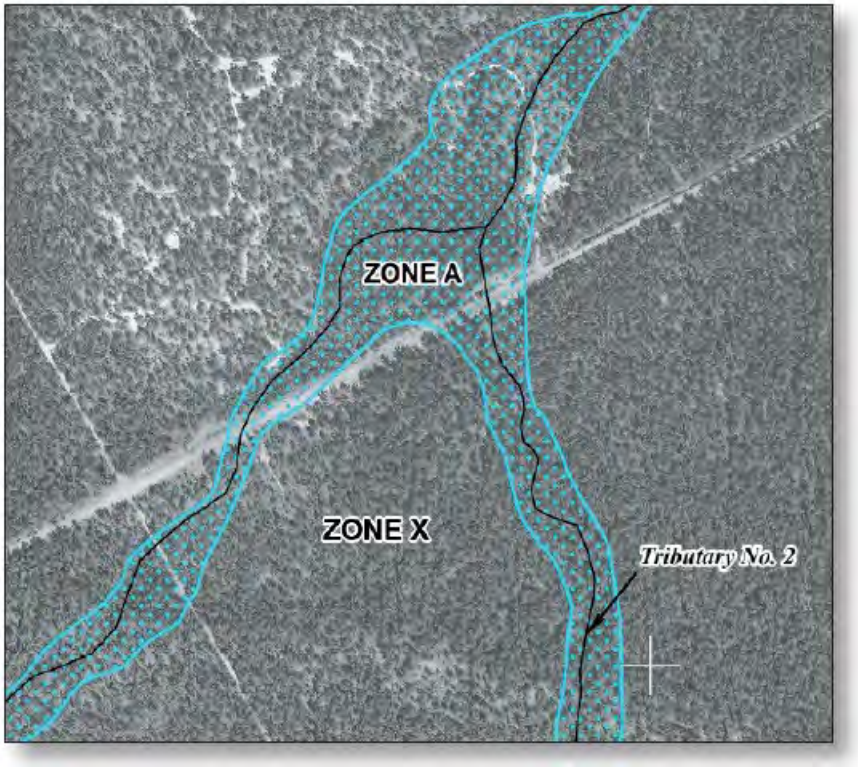


REGULATIONS
Alteration or Relocation of a Watercourse

- Included encroachment, alteration and improvements
- Notification: adjacent municipalities (which may be affected by such action), FEMA and PA-DCED.
- Must not reduce or impede the flood carrying capacity of the watercourse in any way
- No Rise study must be completed, with technical analysis
    - Hydrologic and Hydraulic Study
- Other state and federal permits (obtained before local permit)
- FEMA Letter of Map Change (LOMC)
    - Detailed later in this presentation

REGULATIONS
A Zones

- FEMA uses existing information - not engineering studies - to draw Approximate Zone A boundaries. Information may have been provided by the USACE, other federal agencies, State and local agencies, and historic records.
- For existing single family residential and accessory structures, the City may specify the BFE through contour interpolation, for all other development a Hydrologic and Hydraulic Study must be completed to determine a BFE



REGULATIONS
Residential

- Lowest “livable” floor must be BFE+18”
    - Living room, office, bedrooms, bathrooms, etc.
- If spaces below BFE+18”, can only be used for: parking, building access, and incidental storage.
    - Fully enclosed spaces must be “wet-floodproofed” - allow the automatic entry and exit of floodwater, through **Flood Vents**
    - No bathrooms, offices, bedrooms, furniture, etc.
    - No basements or crawl spaces that are below-grade on all sides
    - **Non-conversion** clause on Certificate of Occupancy for space(s) below BFE+18”
        - Space can never be converted to “livable” space
        - Future underpinning is prohibited
    - Use of **Flood Damage Resistant Materials**

REGULATIONS

Residential - w/ enclosures

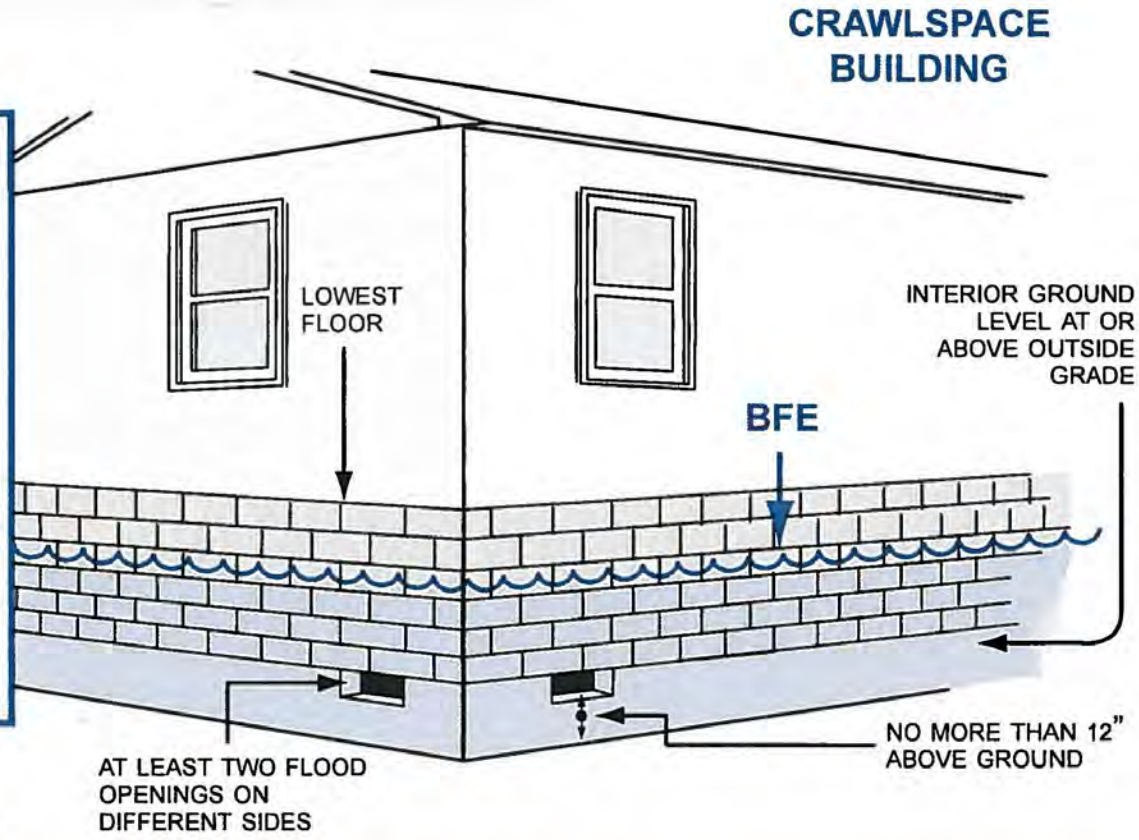
Important

Information

NOTE:

- Total net area of all total openings is 1 sq. in. per sq. ft. of enclosed area.
- A 25' x 45' building needs 1,125 sq. inches of openings.
- Standard ventilation units used in foundation walls must be disabled in the open position to allow water to flow in and out.
- A standard ventilation unit with screen, provides 42 to 65 sq. inches of opening.

ALTERNATIVE: Engineered openings are acceptable if certified to allow adequate automatic inflow and outflow of floodwaters.



Solid perimeter walls can enclose floodprone areas. A crawlspace is a good way to elevate just a couple of feet. In all cases the following are required: flood openings, utilities elevated to or above the BFE, flood resistant materials and limitations on use of enclosures below the lowest floor. Check with the local permit office for details and restrictions.

REGULATIONS

Residential - townhouses w/ flood vents

- Bottom of vent no higher than 12” above adjacent grade
- Vents on at least 2 sides of a structure
- 2 vents per enclosed space
- 1sq/in for every 1sq/ft of enclosed space
- Only vent openings below BFE count

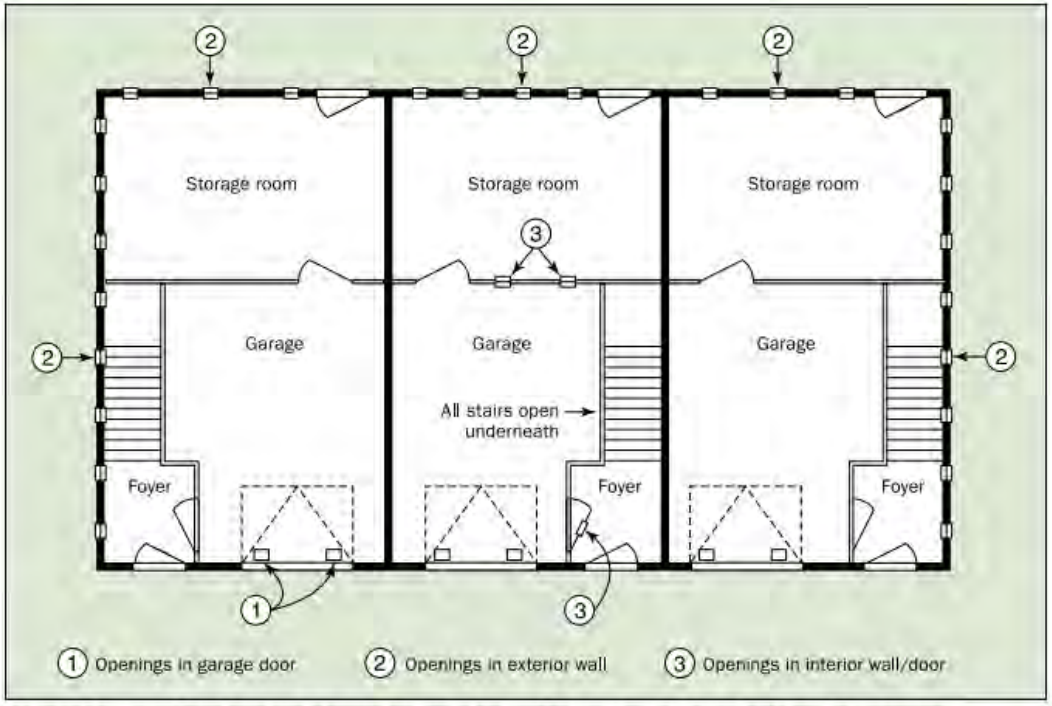
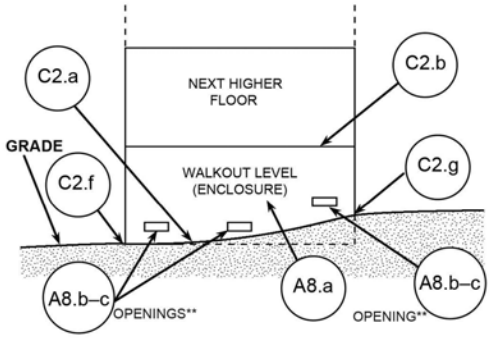


Figure 15: Suggested flood openings in enclosures under elevated townhouses (number of openings for illustration purposes only)

DIAGRAM 7

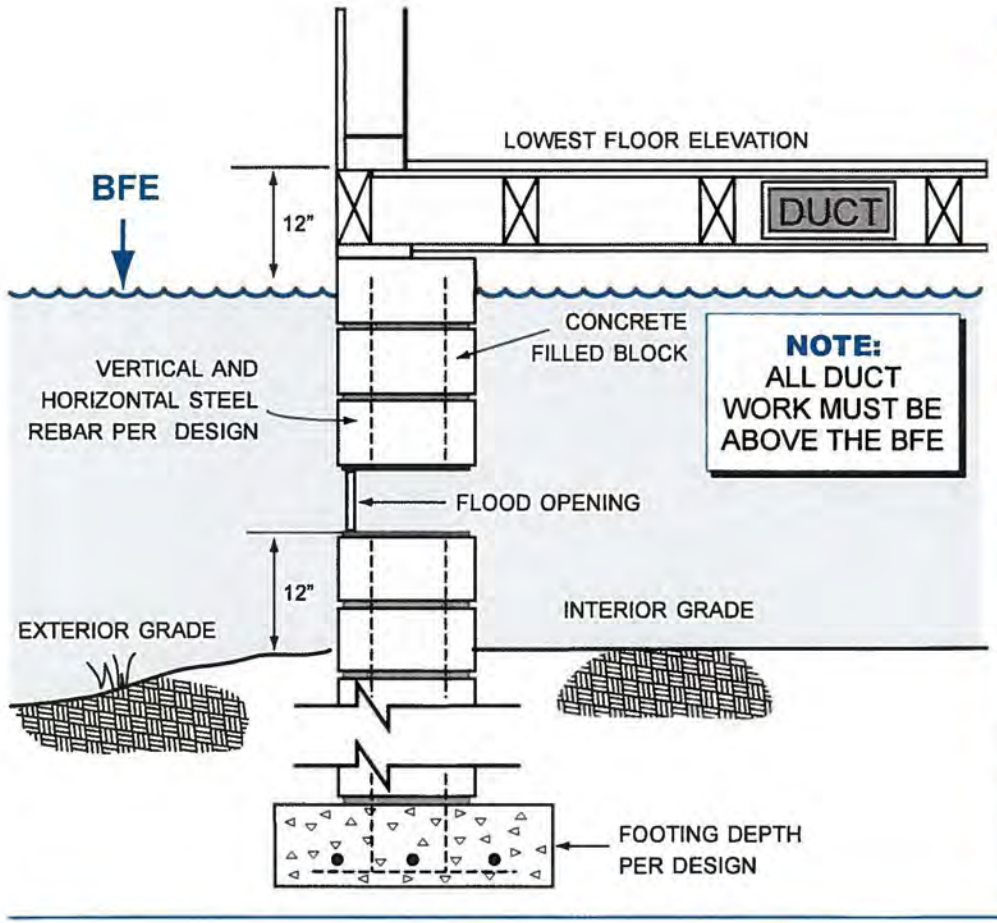
All buildings elevated on full-story foundation walls with a partially or fully enclosed area below the elevated floor. This includes walkout levels, where at least 1 side is at or above grade. The principal use of this building is located in the elevated floors of the building.

Distinguishing Feature – For all zones, the area below the elevated floor is enclosed, either partially or fully. In A Zones, the partially or fully enclosed area below the elevated floor is with or without openings** present in the walls of the enclosure. Indicate information about enclosure size and openings in Section A – Property Information.



1 Openings in garage door
2 Openings in exterior wall
3 Openings in interior wall/door
4 Openings in exterior door

REGULATIONS
Flood Vents - crawl space



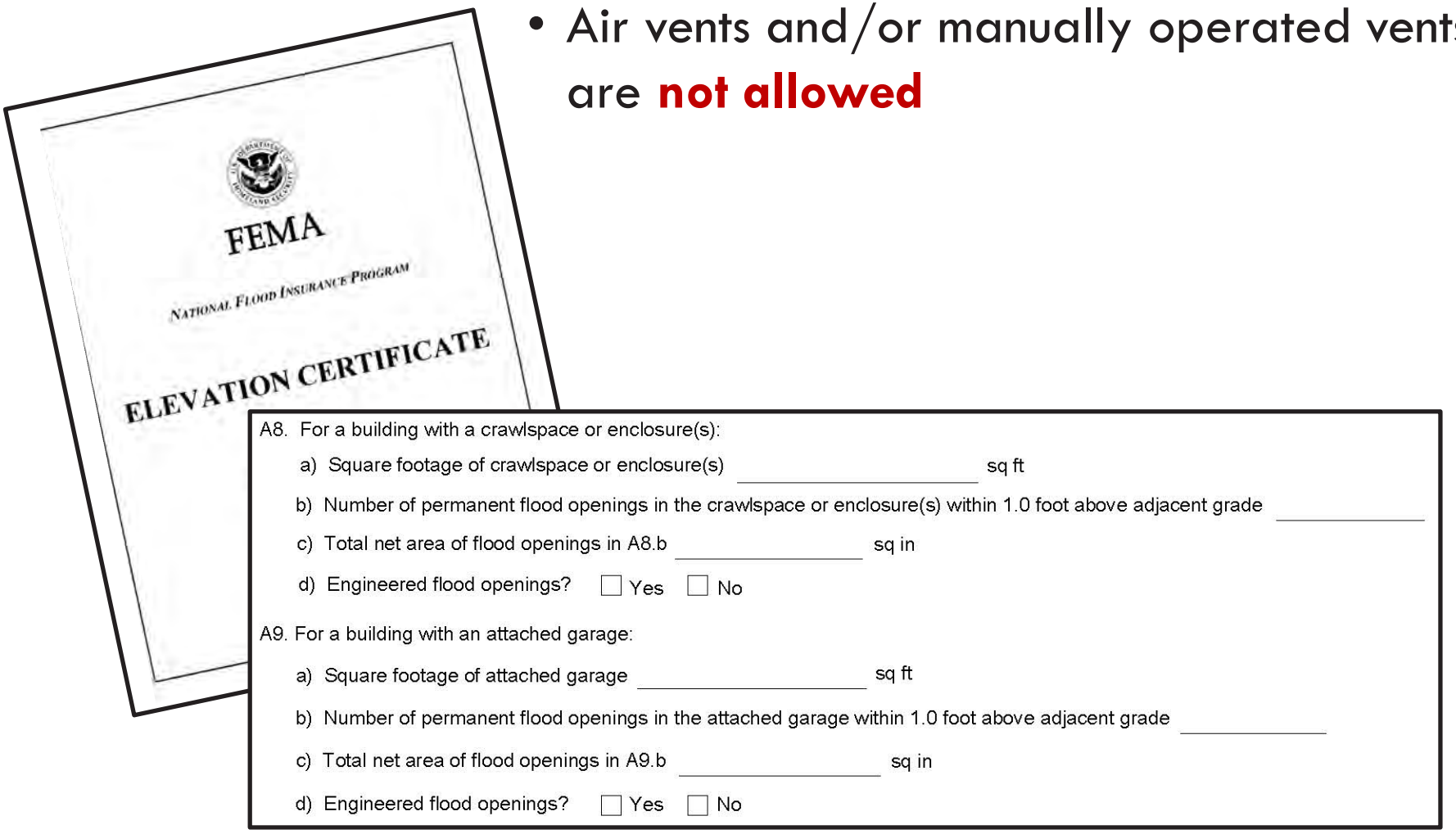
- The Lowest Floor Elevation must be at or above the BFE.
- The bottom of flood openings must be no more than 1 foot above the grade.
- Standard ventilation units must be permanently disabled in the "open" position to allow water to flow in and out.
- Interior and exterior grades should be equal on at least one side.

Calculate Net Flood Opening:

A building that measures 25' x 45' has 1,125 square feet of enclosed crawlspace. Flood vents must provide 1,125 sq. in. of net open area (or have certified engineered openings). If a standard air vent unit provides 60 sq. in. of net open area, then to satisfy the flood opening requirement 19 vent units are required (1,125 divided by 60).

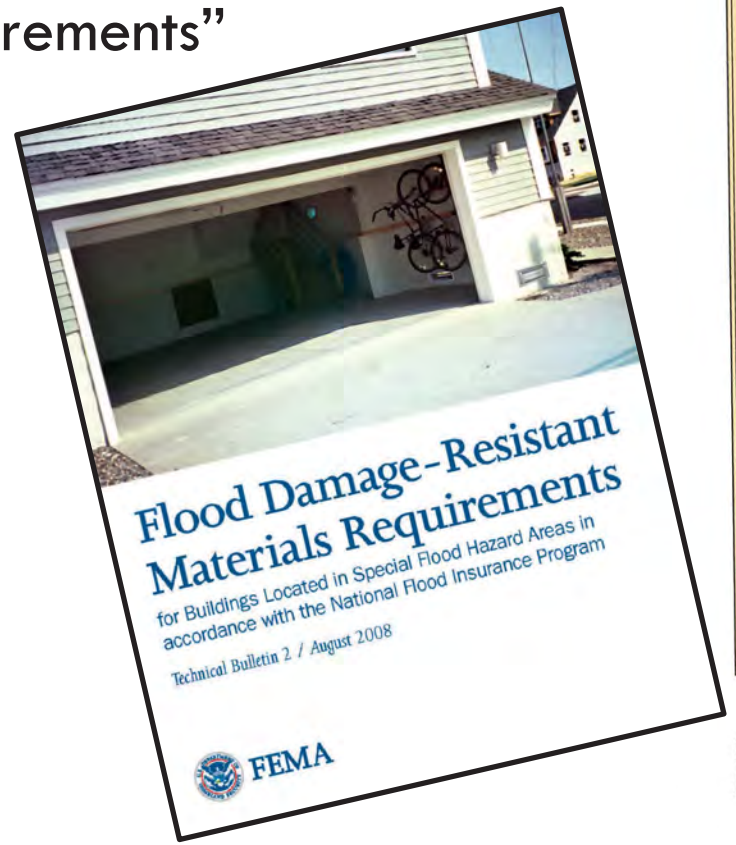
REGULATIONS
Flood Vents - Elevation Certificate

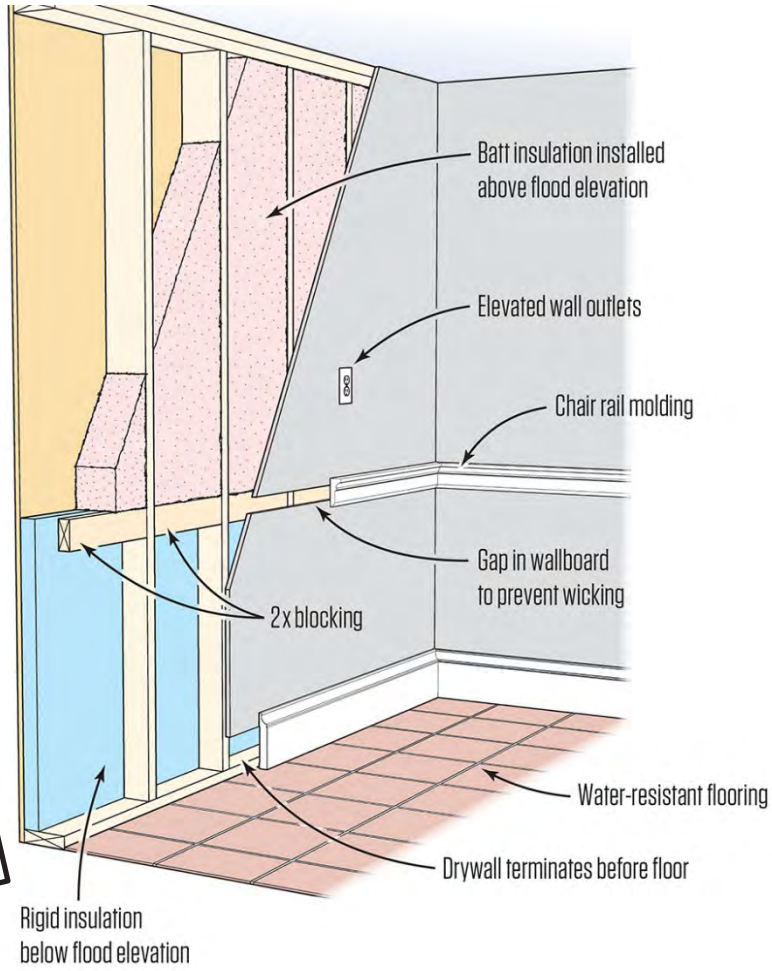
- See A8 and A9 on Elevation Certificate
  - Air vents and/or manually operated vents are **not allowed**



REGULATIONS
Flood Damage Resistant Materials

- any building product [material, component or system] capable of withstanding direct and prolonged (at least 72 hours) contact with floodwaters without sustaining significant damage
- See Table 2 in FEMA Technical Bulletin "Flood Damage-Resistant Material Requirements"





NT

REGULATIONS
Non-Residential

- Option: **Wet-floodproofed** or **Dry-floodproofed**
- If **Wet-floodproofed,** then spaces below BFE+18", can only be used for: parking, building access, and incidental storage.
    - Fully enclosed spaces must be "wet floodproofed" - allow the automatic entry and exit of floodwater, through **Flood Vents**
    - **Non-conversion** clause on Certificate of Occupancy for space(s) below BFE+18"
    - Use of **Flood Damage Resistant Materials**
- If **Dry-floodproofed,** below BFE+18"
    - structure, including utilities and equipment, being watertight with all elements substantially impermeable to the entrance of floodwater and with structural components having the capacity to resist flood loads.
    - typical use up to 3 feet
    - **Not** allowed in Coastal A Zones (along Delaware River)

BUILDING PERMITS
Mixed-Use Structures

Considerations:

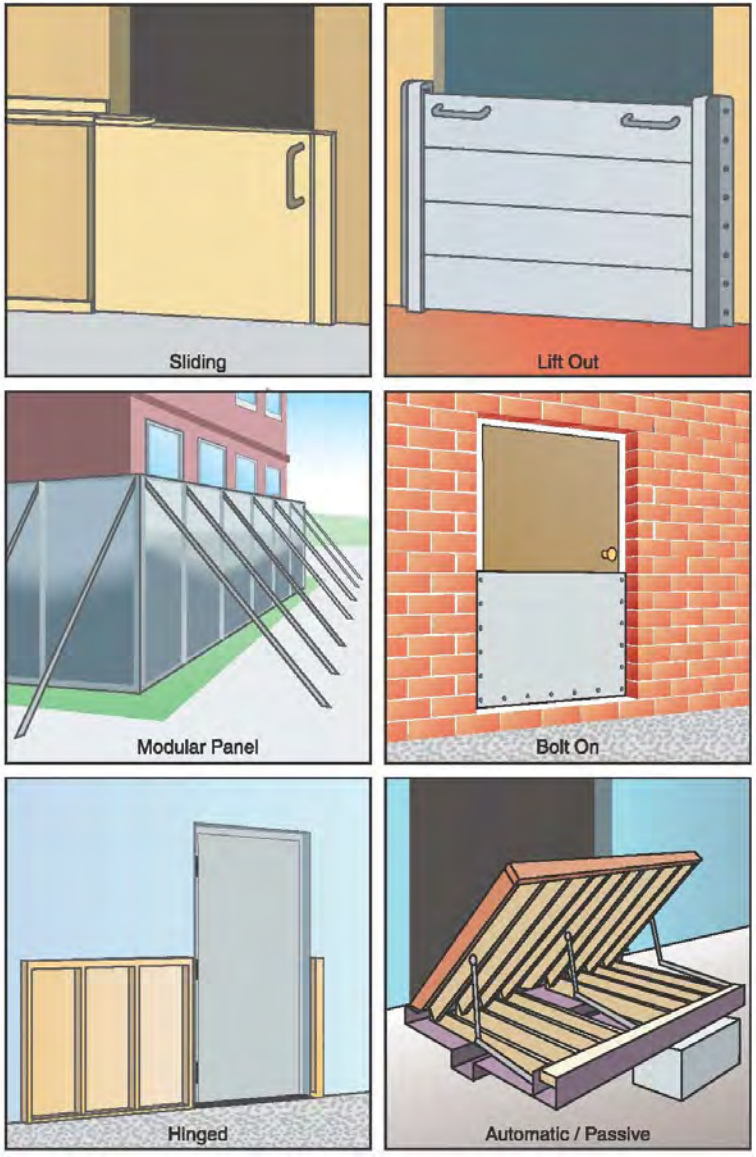
- **Commercial portions:**
  - **Wet-floodproofed**, spaces below BFE+18”, use only as parking, building access, and incidental storage

  or

  - **Dry-floodproofed**, commercial spaces below BFE+18”
- **Residential portions:** must be elevated BFE+18”, including lobbies with furniture, desk attendants, mailboxes, trash receptacles, and resident only facilities (gyms, game rooms, amenity spaces, etc)
  - **Wet-floodproofed**, spaces below BFE+18”, use only as parking, building access, and incidental storage
    - bicycle parking, stairwell enclosure, elevator vestibule, etc.

REGULATIONS

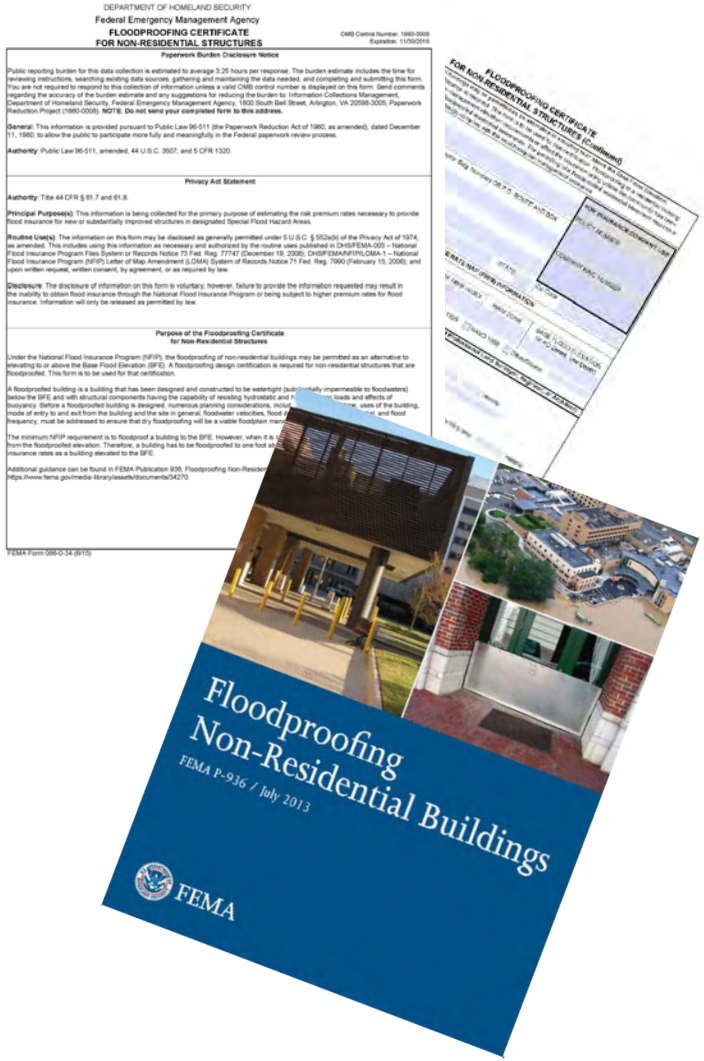
Dry-floodproofing - examples



REGULATIONS

Dry-floodproofing Certificate & considerations

- **Dry-floodproofed considerations:**
  - Building strength
  - Warning time
  - Level of protection
  - Operational
    - Inspection/maintenance plans
    - **Flood Emergency Operation Plan,** see FEMA technical bulletin "Floodproofing Non-Residential Buildings"
  - Seepage
    - Sump pumps
    - Back-flow preventers
  - **Floodproofing Certificate**
    - Must be submitted for Certificate of Occupancy



REGULATIONS
Dry-floodproofing requirements

Flood Emergency Plan that includes:

- Chain of command
- Notification procedures
- Personnel duties
- Location of floodproofing components, install procedures, repair procedures
- Evacuation procedures for building occupants
- Component maintenance procedures during flooding event
- Drill and training program (at least once a year)
- Regular review/update of Flood Emergency Plan

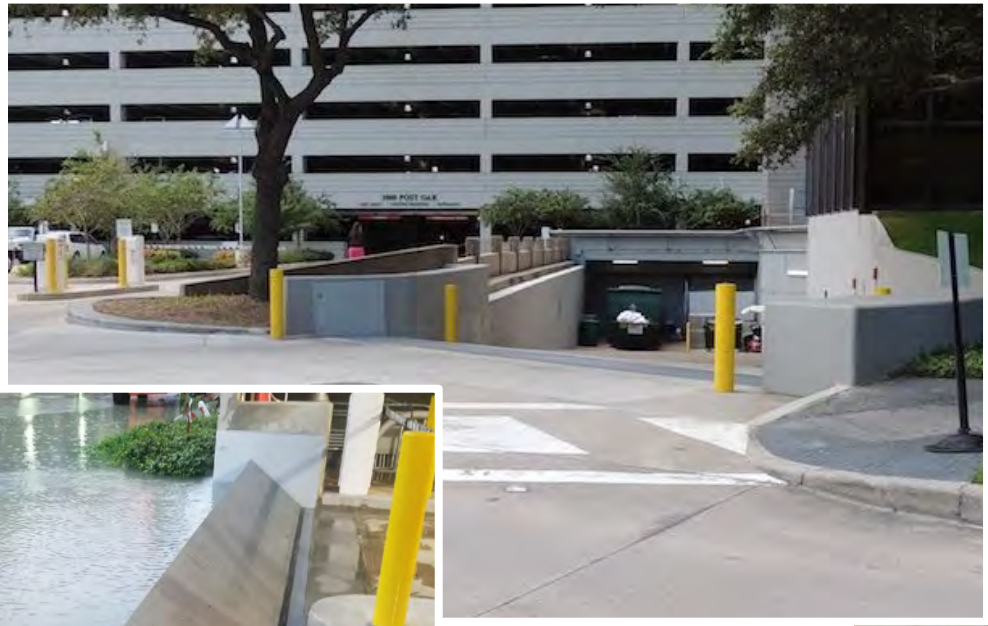
Maintenance Plan (annually):

1. Mechanical equipment such as sump pumps and generators,
2. Flood shields and closures,
3. Walls and wall penetrations, and
4. Levees and berms (as applicable)

REGULATIONS

Below-Grade Parking: Non-residential only

- Must be **Dry-floodproofed,** to BFE+18”
  - **Not** allowed in Coastal A Zones
  - **Not** allowed in fully residential structures (IE. condominium and apartment buildings)



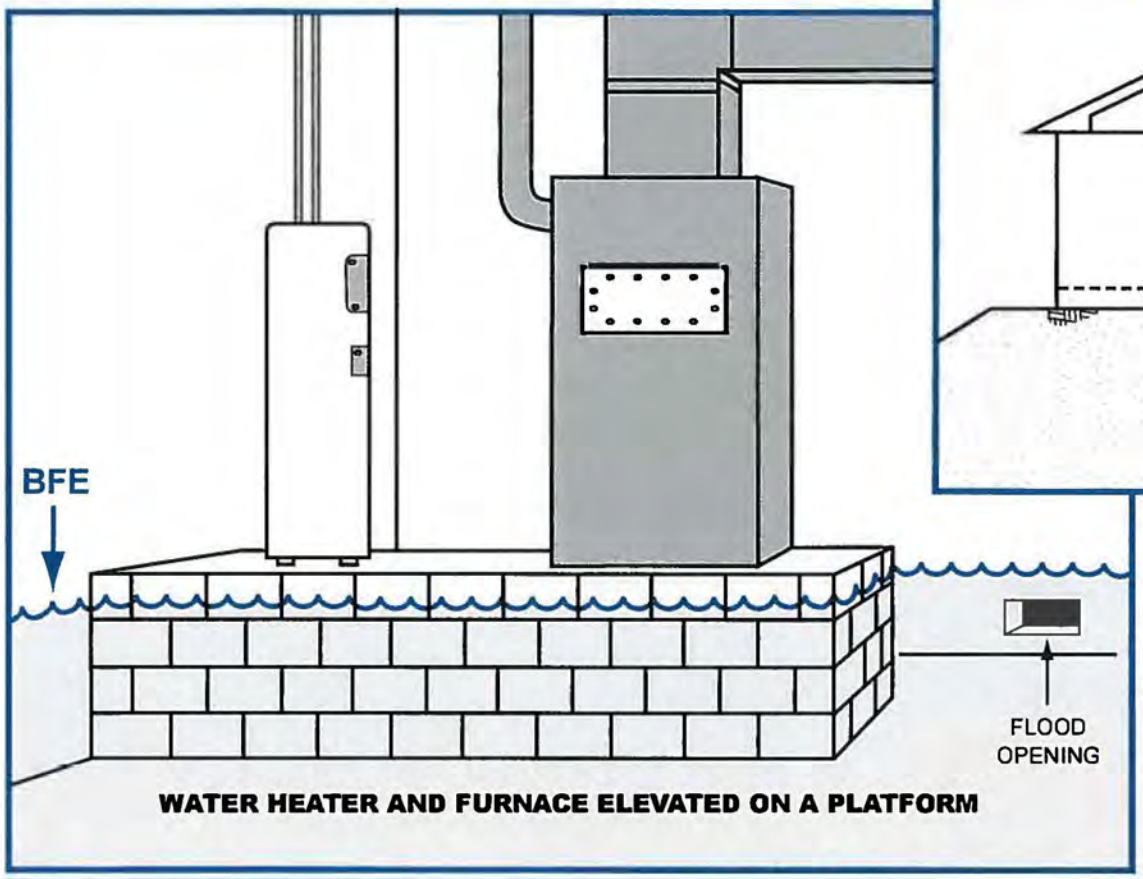
REGULATIONS
Machinery/Equipment

- Mechanical
- Fuel Systems
- Electrical
- Water supply
- Elevator/escalators
- Plumbing
- Transformers
- Generators
- BFE + 18” unless designed to submersible/dry floodproofed/waterproof

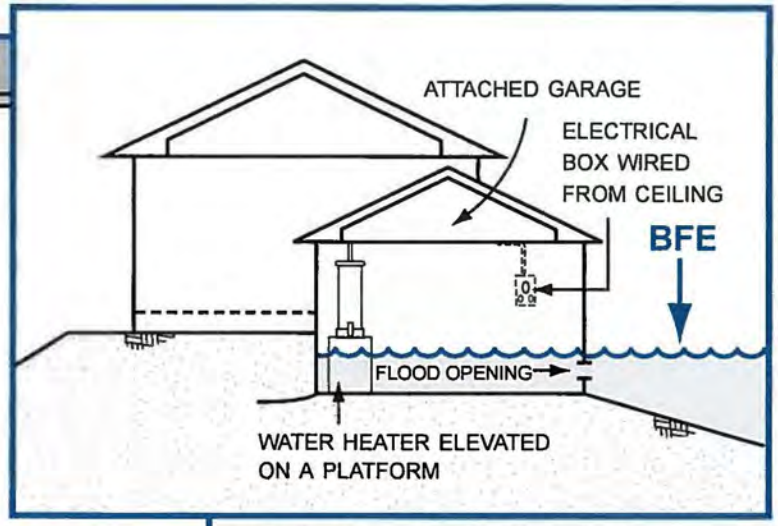
- Systems and components emerging from underground shall be designed to be anchored to resist flood loads and debris impact

REGULATIONS
Machinery/Equipment

Utility Service Inside Enclosures



WATER HEATER AND FURNACE ELEVATED ON A PLATFORM

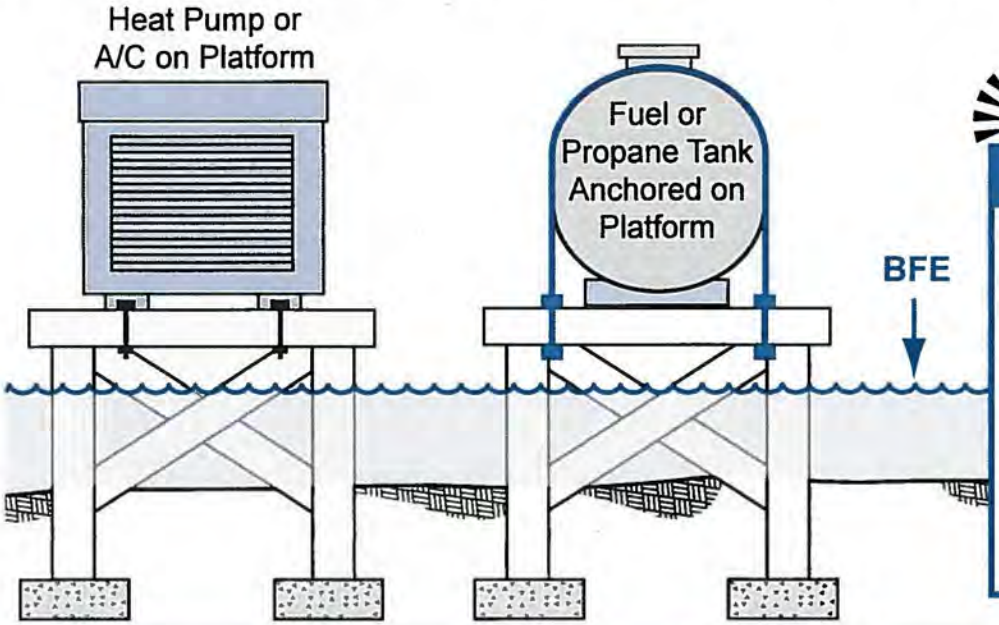


Appliances and mechanical equipment (including duct work) must be elevated to or above the BFE. Utilities (plumbing, electrical, gas lines, heating, ventilating & air conditioning) must be elevated or designed and installed to prevent intrusion of flood waters into their components.

REGULATIONS
Machinery/Equipment

Utility Service / Fuel Tanks

All utilities, appliances, and equipment must be elevated to or above the BFE. Utilities include plumbing, electrical, gas lines, fuel tanks, and heating, ventilating and air conditioning equipment.



Important

Information

For floodplain management purposes, a gas or a liquid storage tank that is principally above ground is considered a structure and must be elevated to or above the BFE.

Fuel and propane tanks may cause explosion and pollution risks during floods. Even shallow water can create significant buoyant forces on tanks so extra care must be taken to ensure that all tanks are appropriately anchored.

Fuel and propane tanks can pose serious threats to people, property, and the environment during flood conditions. Even shallow water can create a large buoyant force on tanks. Videos on "Fuel Tank Flood Hazards" and "How to Anchor Home Fuel Tanks" are available from FEMA Publications at 1-800-480-2520 and "How-To Guides" on anchoring fuel tanks and other flood damage reduction techniques are available at: http://www.fema.gov/library/viewRecord.do?id=3262.

REGULATIONS
Elevators

Shafts below BFE+18”

- Flood vents not required
- All mechanicals elevated to BFE+18”
- Float switch
- Programed for cab to rest on the floor above BFE+18”

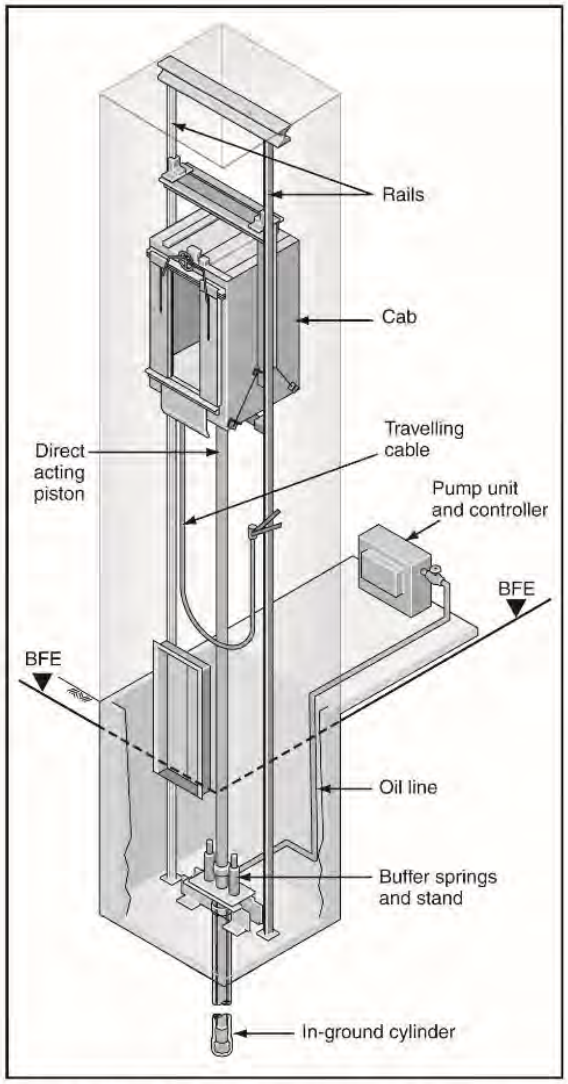


Figure 1. Direct Acting (Holed) Hydraulic Elevator
(Source: Otis Elevator Company)

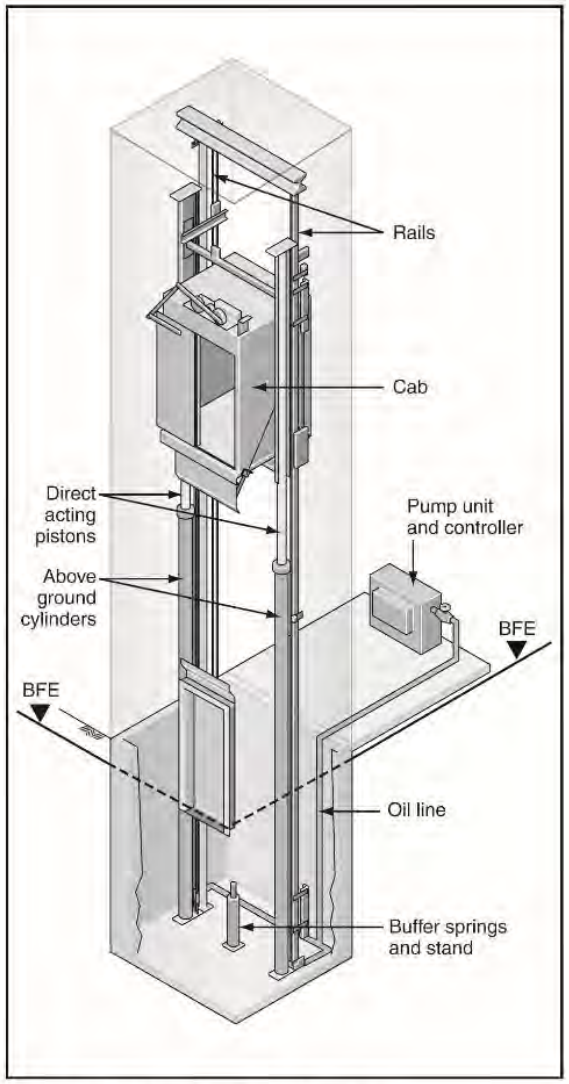


Figure 2. Holeless Hydraulic Elevator
(Source: Otis Elevator Company)

REGULATIONS
Sanitary Systems

- All new or replacement water supply and sanitary sewer facilities and systems shall be located, designed and constructed to minimize or eliminate flood damages and the infiltration of flood waters.
- Sanitary sewer facilities and systems shall be designed to prevent the discharge of untreated sewage into flood waters.
- No part of any on-site waste disposal system shall be located within any identified floodplain area except in strict compliance with all State and local regulations for such systems. If any such system is permitted, it shall be located so as to avoid impairment to it, or contamination from it, during a flood.

REGULATIONS
Streets

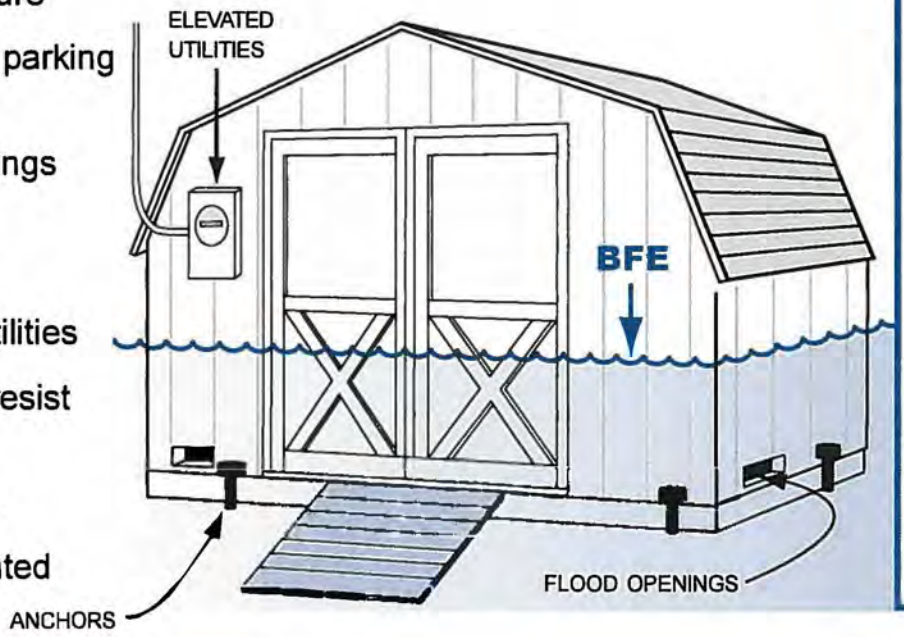
- The finished elevation of all new streets shall be no more than one (1) foot below the Regulatory Flood Elevation
  (PA Model Ordinance- Section 5.03 Design and Construction Standards)

REGULATIONS
Accessory Structures

Accessory Structures

Accessory Structures in a Special Flood Hazard Area:

- Cannot be modified for a different use in the future
- Must be used only for parking or storage
- Must have flood openings
- Must be built of flood resistant materials
- Must have elevated utilities
- Must be anchored to resist floating
- Must not be inhabited
- Must have a documented floor elevation



Terms and Definitions

Accessory (Appurtenant) Structure means a structure that is located on the same parcel of land as a principle structure and whose use is incidental to the use of the principal structure. Accessory structures should be no more than a minimal initial investment, may not be used for human habitation, and must be designed to minimize flood damage. Examples include: detached garages, carports, storage sheds, pole barns, and hay sheds.

Even small buildings are considered "development" and permits or variances with noted conditions are required. **CAUTION!** Remember...everything inside is likely to get wet when flooding occurs.

REGULATIONS
Vehicles/Trailers

Recreational Vehicles

In a Special Flood Hazard Area, a Recreational Vehicle (RV) must:

- Remain on site for fewer than 180 consecutive days, **and**
- Be fully licensed and ready for highway use; **or**
- Meet the permitting, elevation, and anchoring requirements for manufactured homes of the community's Flood Damage Prevention Ordinance.

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 security devices, and has no permanently attached additions.

Important

Information

Camping near the water? Ask the campground or RV Park operator about flood warnings and plans for safe evacuations.

RVs that do not meet these conditions must be installed, elevated, and secured like a manufactured home, including a permanent foundation and tie-down.

REGULATIONS
Seasonal/Temporary Structures

Non-enclosed

- Anchored to withstand the hydrostatic & hydrodynamic loads as well as not become buoyant
- Examples: event tents, pergolas, ice rinks, event stage, etc.

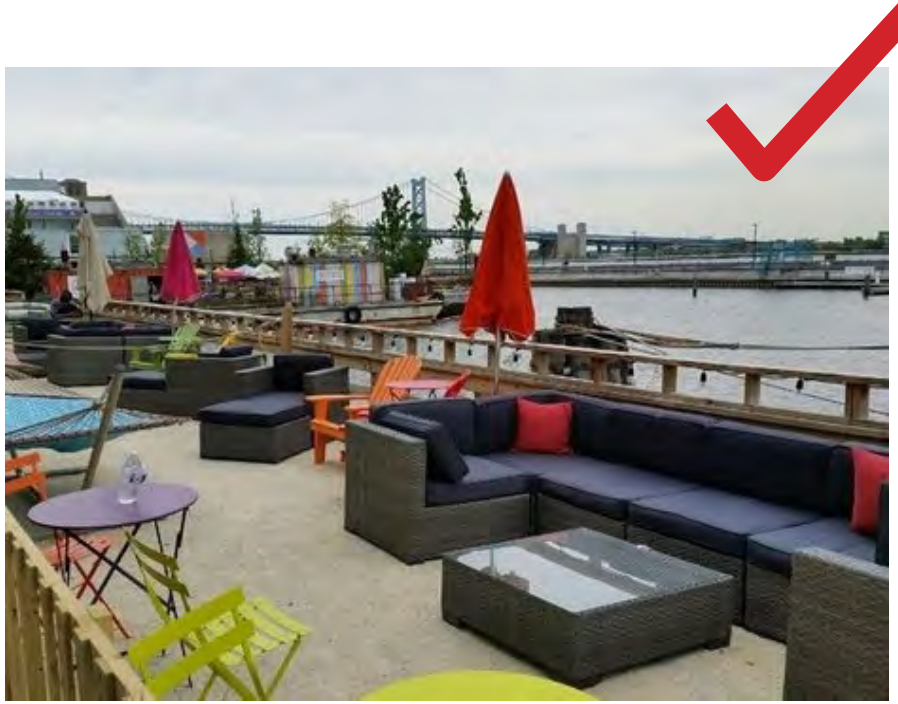
Enclosed

- Anchored to withstand the hydrostatic & hydrodynamic loads as well as not become buoyant
- Parking and Incidental storage use
    - Flood vents
- Use other than parking and incidental storage uses
    - See residential or non-residential standards

REGULATIONS
Storage

Prohibited, unless:

- designed to be easily movable (no equipment required for removing), in the event of a flood (IE. outdoor furniture, items on wheels, etc.),
- anchored to withstand the hydrostatic & hydrodynamic loads as well as not become buoyant
- elevated above BFE+18”



REGULATIONS
Construction Storage/Trailers

Licensed and Road-ready

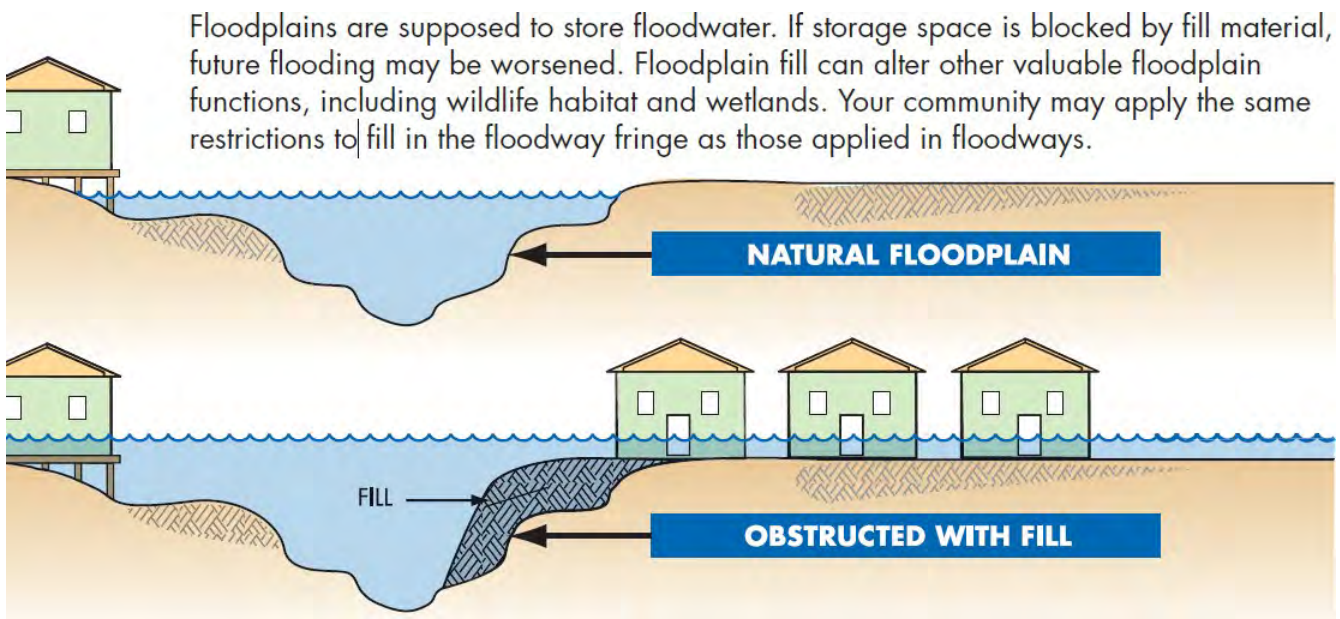
- On site less than 180 days
- Must be on wheels/chassis
- No connected mechanicals (electric service, plumbing, etc)

More than 180 days and/or connected to mechanicals and/or not on wheels/chassis

- Anchored to withstand the hydrostatic & hydrodynamic loads as well as not become buoyant
- Elevated to BFE+18”

REGULATIONS
Fill

- If less than 12”, in-place dry density is not less than 90% of the max. dry density at optimum moisture content determined in accordance with ASTM D 1557Less than 180 days
- If over 12”, then **GEO-TECHNICAL REPORT** (Section 1803 of IBC)
    - Requires Special Inspections
- **Requires** a Zoning Permit, and a Building Permit if over 5,000 SF
- **Requires** a Letter of Map Change [LOMC] if a Hydrologic and Hydraulic study shows any rise in the BFE



REGULATIONS
Historic Structures

- Analysis that elevating and/or floodproofing would remove it from historic designation
    - Singed and seal analysis from an Architect
- Variance **required** (by building codes)
- Mechanicals should be elevated to BFE+18”
- Flood damage resistant materials should be used in areas below BFE+18”

REGULATIONS
Variances

Requirements:

- Applicant conditions
- Applicant technical requirements
- Community's conditions when granting a variance

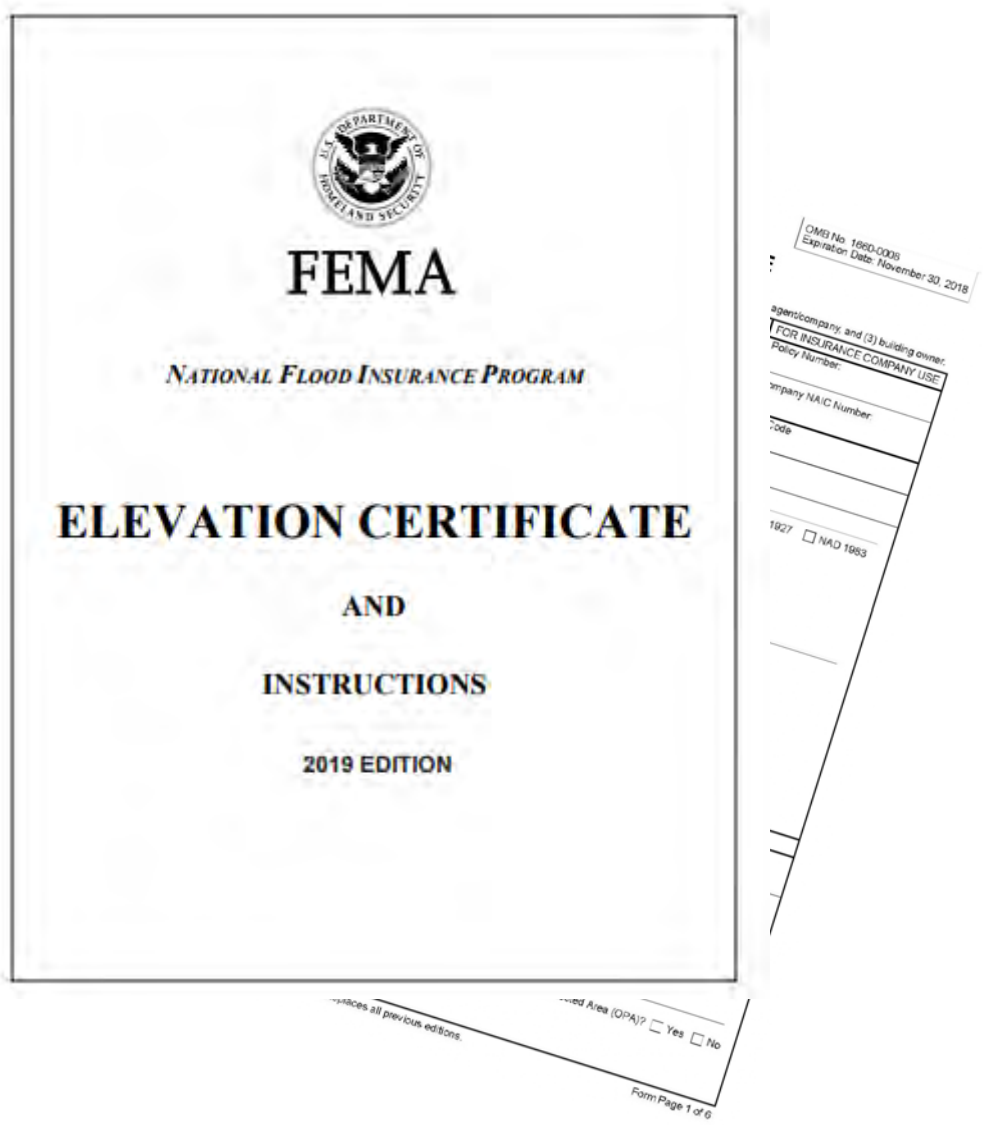
Considerations:

- Annual reporting of variances to State and FEMA
- Community:
  - Liability
  - Cumulative impacts on the floodplain of granting multiple similar variances
  - Variance decision will last the life of the structure
  - NFIP participation impact

ELEVATION CERTIFICATE
Requirements

- **CONFIRM CORRECT EDITION**
- **READ INSTRUCTIONS**
- **REQUIRE 3 TIMES:**
  (see section C on EC)

  1. ***Floodplain/Zoning/Building Permit submission***
  2. ***During construction*** - *Lowest Floor installation* (No vertical work can occur)
  3. ***Final completion,*** prior to Certificate of Occupancy



ELEVATION CERTIFICATE
How to complete fully and correctly

General:

- All lines shall be completed, and when not applicable an "N/A" should be entered
- Should be signed and sealed by a PA licensed surveyor, architect, or engineer
- ***A8-9***: Flood Vents
    - Complete fully per design plans
- ***B9***: Base Flood Elevation
    - Confirm vertical datum (based on FIRM/FIS)
    - Rounded to nearest tenth degree, no whole numbers
    - Should be based from Flood Insurance Study [FIS] when cross sections are available. If, no cross section, then use the Flood Insurance Rate Map [FIRM]

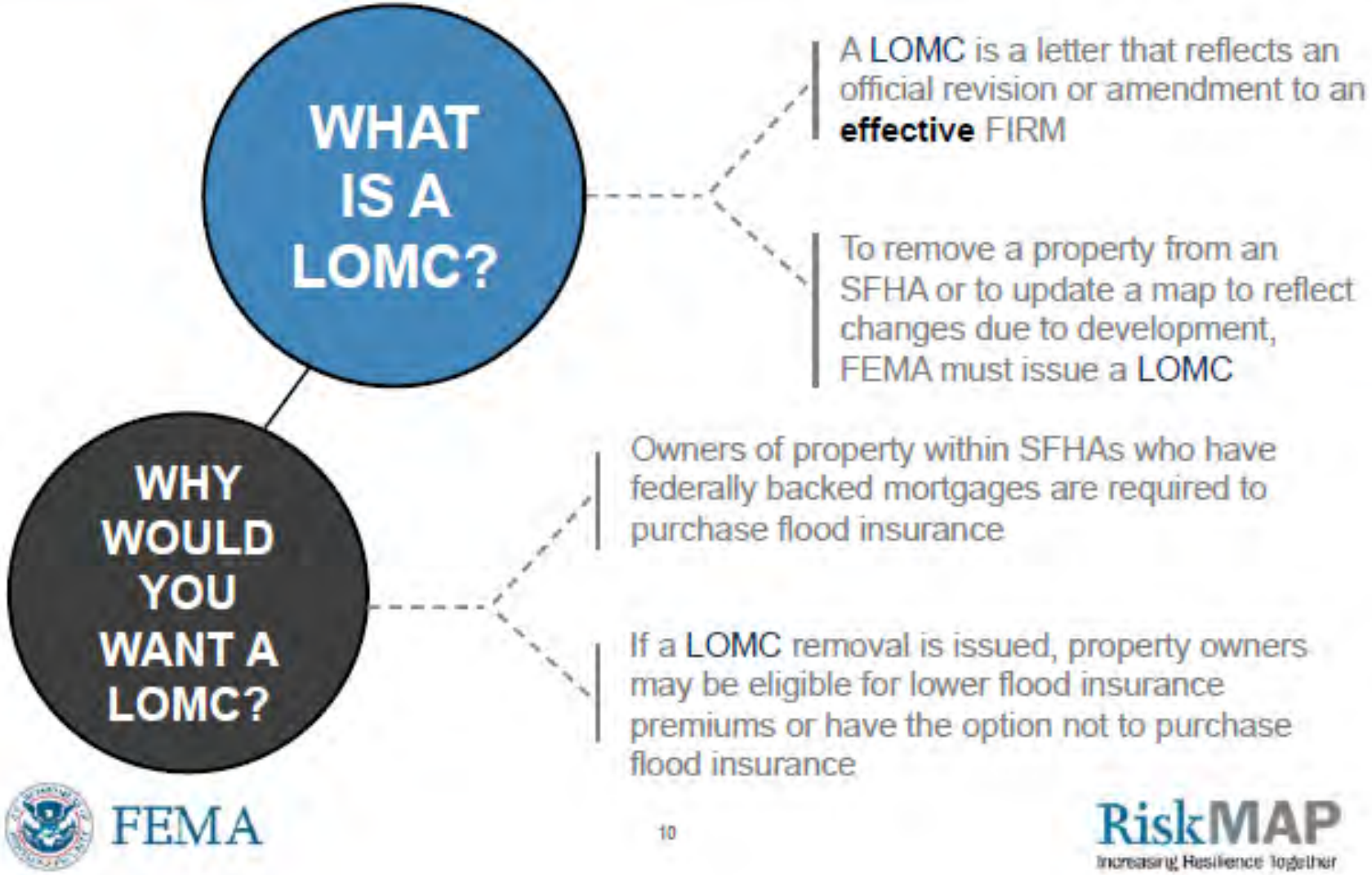
ELEVATION CERTIFICATE
How to complete fully and correctly

- ***C2.a-h***: Structure design elevations (must be in NGVD 29)
  - ***C2.a*** lowest floor elevation of lowest enclosed space (IE. crawlspace (rat slab), basement slab, garage slab (if attached - townhouse/rowhouse)
  - ***C2.c*** is N/A in Philadelphia (No velocity or wave action zones)
  - ***C2.e*** Lowest machinery/equipment should be identified
    - In "Comments" section at bottom of PG2, list lowest elevations of these mechanicals/equipment if applicable: HVAC, electrical, gas, plumbing, elevators, transformer pad, generator, etc.
- **Floodplain Plan Exhibits**: should always illustrate existing and proposed topography (1-foot contours), BFE should be adjusted to actual existing site contours and ***NEVER*** just copied and pasted from a FEMA FIRM map. [always require the use of the best available technical data]

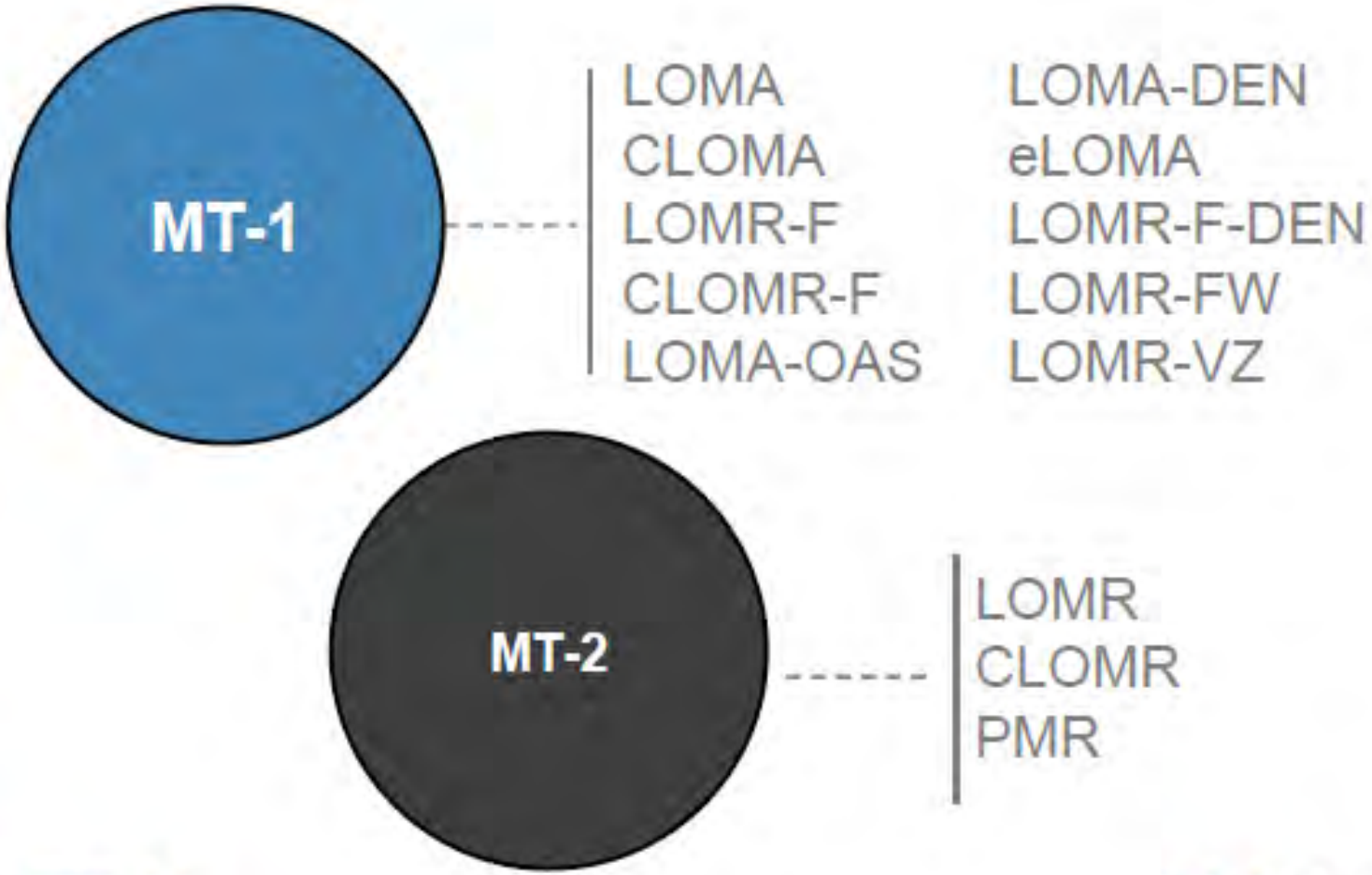
LETTER OF MAP REVISION [LOMC]
Reasons for a Map Change

- **Updated data**
  - Elevation (newer LiDAR or site-specific survey)
  - Flood Study (can cover various geographic sized areas; funded by Federal, State, Local, or private stakeholders)
- **To reflect physical and flood control changes**
  - Fill has been placed
  - New developments or to understand the effects of a proposed development
  - Roadway construction
  - Pier/wharf construction
  - Flood Control Projects (dams, levees, culverts)

LETTER OF MAP REVISION [LOMC]
General



LETTER OF MAP REVISION [LOMC]
General



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RiskMAP
Increasing Resilience Together

LETTER OF MAP REVISION [LOMC]
General

MT-1

- LOMA, CLOMA, LOMR-F, CLOMR-F
- Single or multiple structures or parcels receive a determination letter
- ***Do not result in changes to the physical effective Flood Insurance Rate Map (FIRM)***
- Goal is usually to remove the insurance requirement, local permit requirements may still apply
- Homeowners who successfully remove their homes from the 1% floodplain should be encouraged to keep their flood insurance

MT-2

- LOMR, CLOMR, PMR
- Floodplains, floodways, BFEs, Cross Sections, etc. are revised
- ***Result in an official revision to the physical effective FIRM and/or FIS; therefore, the community must be involved***
- More complicated than an MT-1
- Technical engineering changes resulting from a new study, development, or infrastructure projects.
- New or better data can trigger a LOMR

LETTER OF MAP REVISION [LOMC]
General

- **Reasons for a LOMR:**
  - Modified hydrology (flood discharges)
  - Modified hydraulics (elevations)
  - Better topography (e.g. LiDAR, site-specific survey)
  - Modified floodway
  - New bridges/culverts
  - Channel improvements/flood control projects (levees, dams, culverts)
  - Large developments or roadway projects

- **CLOMR-F/LOMR-F:** Use of Fill: Generally, excavation of basements into fill may expose the structure to residual risk and damage associated with flooding and saturated fill. Designers proposing basements in fill are advised that the elevation requirements of this standard apply to the basement, unless the building and structure is dry-floodproofed in accordance with Section 6.2 See ASCE 24-14 2.4 Use of Fill

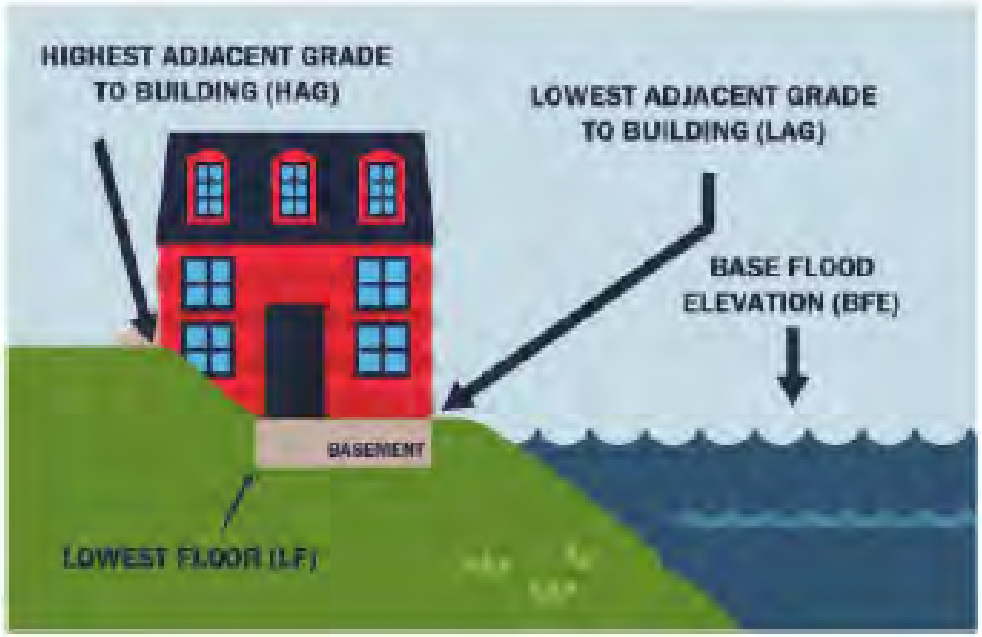
LETTER OF MAP REVISION [LOMC]
General

Permitting

- Lowest Floor Elevation
- Elevation Certificate

LOMC

- Elevation Form
- Lowest Adjacent Grade



FEMA

15

RiskMAP
Increasing Resilience Together

LETTER OF MAP REVISION [LOMC]
General

Community Acknowledgment Form Required (CLOMR-F/LOMR-F):

- Community Official Signs acknowledging:
  - Fill will not be placed in floodway
  - Complies with Endangered Species Act (ESA)
  - Have all necessary federal, state, & local permits
  - Existing and proposed structures will be "reasonably safe from flooding"
  - Supporting documentation is available to submit to FEMA upon request
  - ***Community Officials do not have to sign if they do not concur!***


Department of Licenses and Inspections
CITY OF PHILADELPHIA

FLOOD PROTECTION FORM – LETTER OF MAP CHANGE (FP-LOMC)
2020 Edition (published February 11, 2020)
Expires February 1, 2021
SUBMIT TO FLOODPLAIN MANAGER

FLOOD PROTECTION FORM – LETTER OF MAP CHANGE (FP-LOMC)
This form is for development proposing to modify or change the Special Flood Hazard Area (SFHA) through a Conditional Letter of Map Revision, Letter of Map Revision (CLOMR/LOMR) or Conditional Letter of Map Revision – Fill/Letter of Map Revision – Fill (CLOMR-F/LOMR-F) FEMA Letter of Map Change (LOMC) process. This form can only be completed by a PA Registered Design Professional.

CLOMR-F/LOMR-F must be submitted when:
- Less than 5 acres of fill (more than 12" in depth) without a rise in BFE

CLOMR/LOMR must be submitted when:
- Any rise in BFE
- Sites with more than 50 lots/structures or over 5 acres of fill (more than 12" in depth)
- Development that alterations a watercourse
- Development in SFHA's with no designated floodway (generally along Delaware River)
- Development seaward of the LIMWA line
- Requests involving changes in the mean high tide and/or MHHW
- Requests involving changes in Base Flood Elevations (BFEs)
- Requests involving changes in regulatory floodway boundary delineations
- Requests involving property and/or structures that have been elevated by fill placed within the regulatory floodway, channelization projects, bridge/culvert replacement projects, or other flood control improvements

As part of the FFMA MT-1 or MT-2 application the City must comment and/or sign a "Community Acknowledgement Form". To request the City's

See ***FP-LOMC***

- ***Similar process for CLOMR/LOMR as part of MT-2 applications***
  - ***Additional public comment/appeal period***

LETTER OF MAP REVISION [LOMC]
Resources

- FEMA website: www.fema.gov
- MT-1 Application and instructions
- MT-2 Application and instructions
- FEMA online submissions: www.fema.gov/online-lomc
- FEMA Flood Map Service Center: http://msc.fema.gov
- **FEMA Map Information eXchange (FMIX): 877-FEMA MAP (877-336-2627)**
- **State NFIP Coordinator: Bill Bradfield wbradfield@pa.gov**

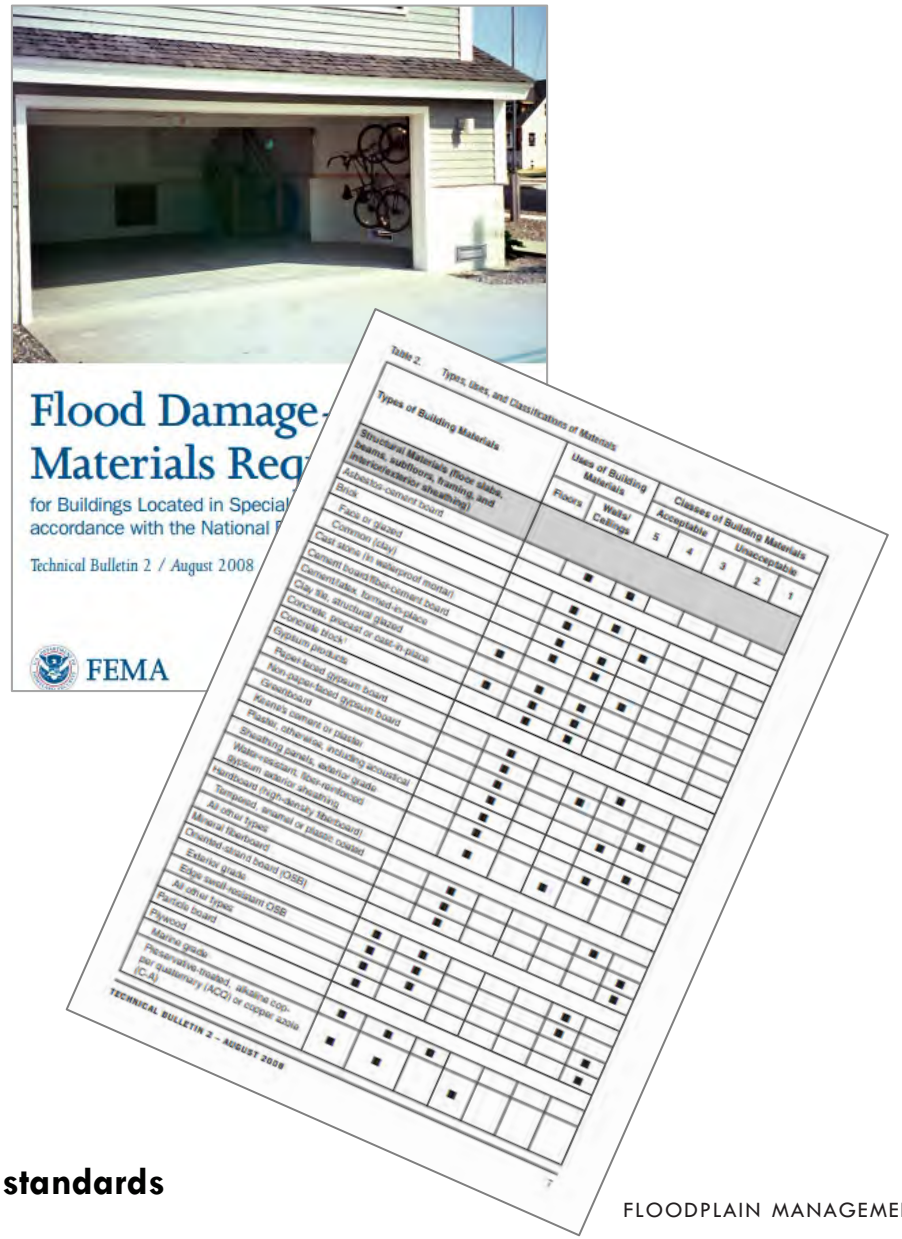
Other resources:

- FEMA Flood Hazard Mapping Frequently Asked Questions
- Flood Map Revision Processes
- LOMA and LOMR-F Processes
- Establishing Effective Dates for LOMRs
- Fee Schedule
- eLOMA information

RESOURCES
FEMA Technical Bulletins

Technical Bulletins:

- **Openings in Foundation Walls and Walls of Enclosures Below Elevated Buildings Flood**
- **Damage Resistant Materials**
- Non-Residential Floodproofing and Certification
- **Elevator Installation**
- Free-of-Obstruction Requirements
- Below-Grade Parking Requirements
- Wet Floodproofing Requirements
- Corrosion Protection for Metal Connectors
- Design and Construction Guidance for Breakaway Walls Below Elevated Buildings in Coastal Zones
- Ensuring that Structures Built on Fill in or Near SGHA are Reasonably Safe from Flooding
- Crawlspace Construction

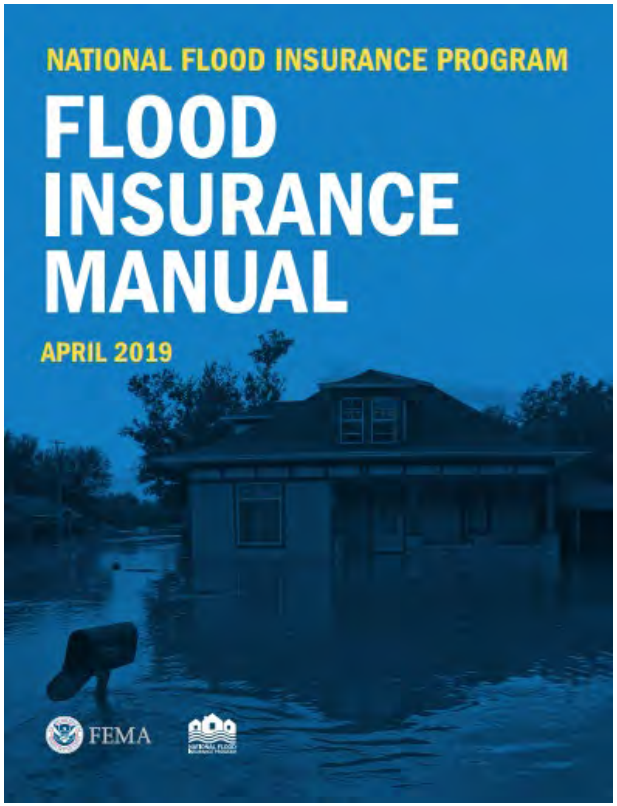


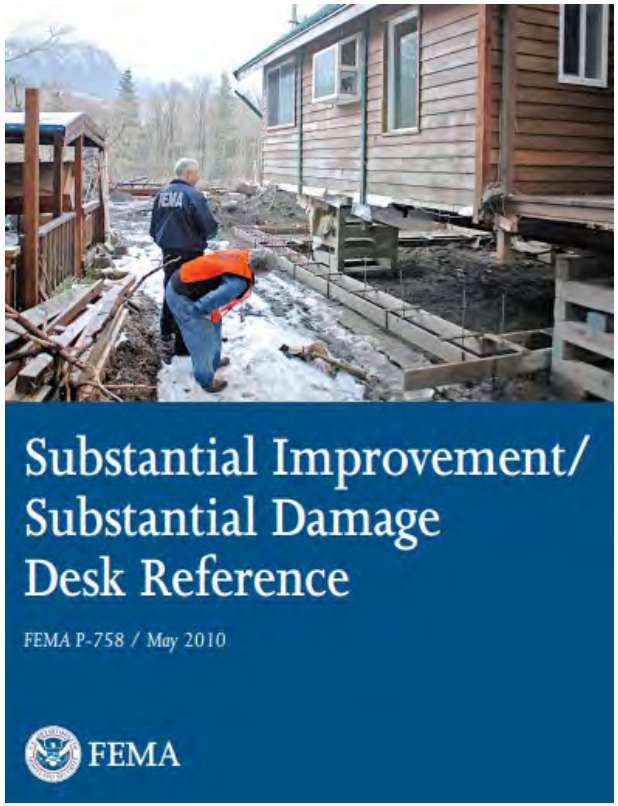
www.fema.gov/nfip-technical-bulletins

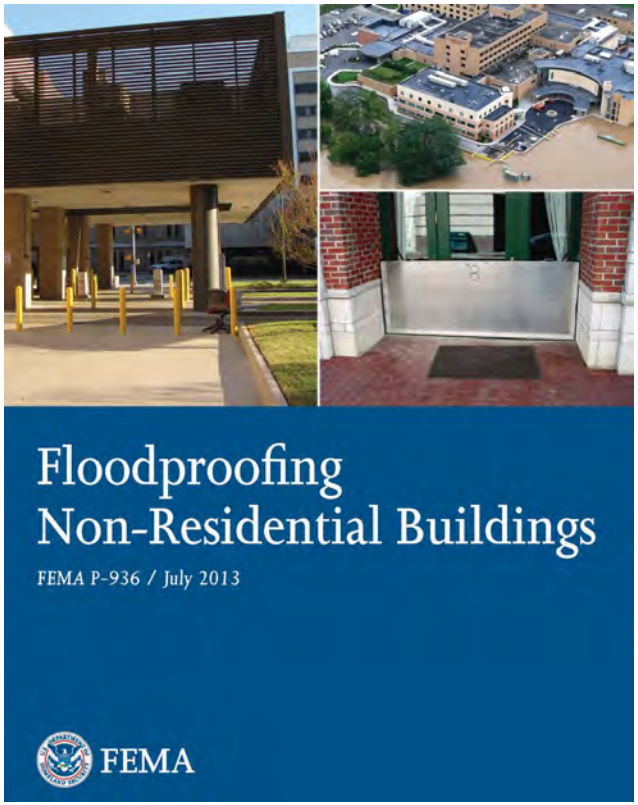
***note all development is subject to local codes/regulations**

***note FEMA Technical Bulletin provide guidance on min. NFIP standards**

RESOURCES
Other FEMA Guidance

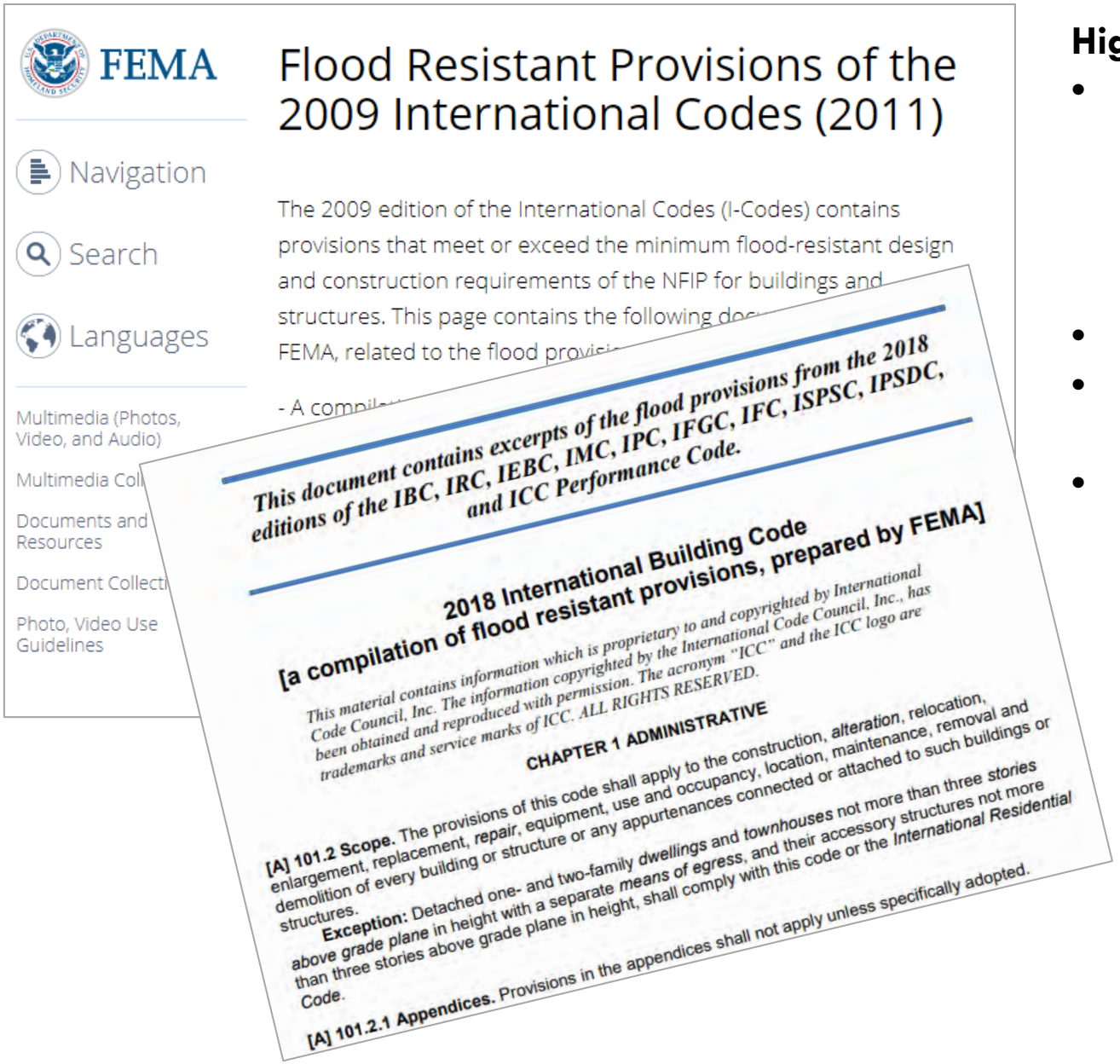






***note all development is subject to local codes/regulations**

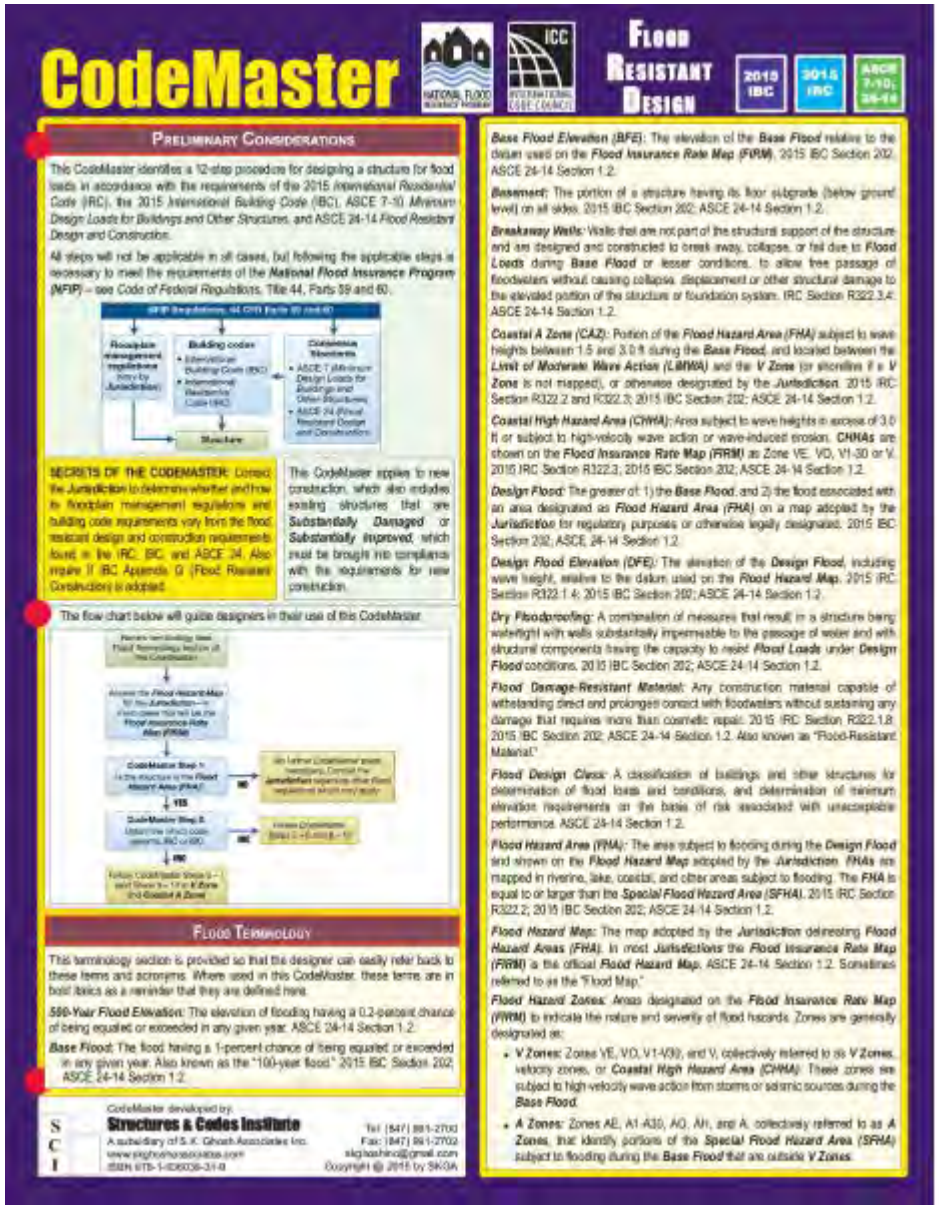
RESOURCES
FEMA + Building Code Provisions



Highlights:

- Published when I-Codes releases any new editions
  - **2009 – Current PA**
  - 2015
  - 2018
- More restrictive code applies
- Local amendments could effect which sections apply
- During building permit review this document can assist in comment/request for information from applicant

RESOURCES
Code Master



CodeMaster

Flood Resistant Design

2015 IBC | 2015 IRC | ASCE 7-10; 24-14

Preliminary Considerations

This CodeMaster identifies a 12-step procedure for designing a structure for flood loads in accordance with the requirements of the 2015 *International Residential Code* (IRC), the 2015 *International Building Code* (IBC), ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and ASCE 24-14 *Flood Resistant Design and Construction*.

All steps will not be applicable in all cases, but following the applicable steps is necessary to meet the requirements of the **National Flood Insurance Program (NFIP)** – see *Code of Federal Regulations*, Title 44, Parts 59 and 60.

SECRETS OF THE CODEMASTER: Consult the Jurisdiction to determine whether and how its floodplain management regulations and building code requirements vary from the flood resistant design and construction requirements found in the IRC, IBC, and ASCE 24. Also inquire if IBC Appendix G (Flood Resistant Construction) is adopted.

The CodeMaster applies to new construction, which also includes existing structures that are ***Substantially Damaged*** or ***Substantially Improved***, which must be brought into compliance with the requirements for new construction.

The flow chart below will guide designers in their use of this CodeMaster.

Flood Terminology

This terminology section is provided so that the designer can easily refer back to these terms and acronyms. Where used in this CodeMaster, these terms are in bold italics as a reminder that they are defined here.

500-Year Flood Elevation: The elevation of flooding having a 0.2-percent chance of being equaled or exceeded in any given year. ASCE 24-14 Section 1.2.

Base Flood: The flood having a 1-percent chance of being equaled or exceeded in any given year. Also known as the "100-year flood." 2015 IBC Section 202; ASCE 24-14 Section 1.2.

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Tel: (847) 891-2702

Fax: (847) 891-2702

skghoshinc@gmail.com

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Base Flood Elevation (BFE): The elevation of the ***Base Flood*** relative to the datum used on the ***Flood Insurance Rate Map (FIRM)***, 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Basement: The portion of a structure having its floor subgrade (below ground level) on all sides. 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Breakaway Walls: Walls that are not part of the structural support of the structure and are designed and constructed to break away, collapse, or fail due to ***Flood Loads*** during ***Base Flood*** or lesser conditions, to allow free passage of floodwaters without causing collapse, displacement or other structural damage to the elevated portion of the structure or foundation system. IRC Section R322.3.4; ASCE 24-14 Section 1.2.

Coastal A Zone (CAZ): Portion of the ***Flood Hazard Area (FHA)*** subject to wave heights between 1.5 and 3.0 ft during the ***Base Flood***, and located between the ***Limit of Moderate Wave Action (LiMWA)*** and the ***V Zone*** (or shoreline if a ***V Zone*** is not mapped), or otherwise designated by the ***Jurisdiction***. 2015 IRC Section R322.2 and R322.3; 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Coastal High Hazard Area (CHHA): Area subject to wave heights in excess of 3.0 ft or subject to high-velocity wave action or wave-induced erosion. ***CHHAs*** are shown on the ***Flood Insurance Rate Map (FIRM)*** as Zone VE, VO, V1-30 or V. 2015 IRC Section R322.3; 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Design Flood: The greater of: 1) the ***Base Flood***, and 2) the flood associated with an area designated as ***Flood Hazard Area (FHA)*** on a map adopted by the ***Jurisdiction*** for regulatory purposes or otherwise legally designated. 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Design Flood Elevation (DFE): The elevation of the ***Design Flood***, including wave height, relative to the datum used on the ***Flood Hazard Map***. 2015 IRC Section R322.1.4; 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Dry Floodproofing: A combination of measures that result in a structure being watertight with walls substantially impermeable to the passage of water and with structural components having the capacity to resist ***Flood Loads*** under ***Design Flood*** conditions. 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Flood Damage-Resistant Material: Any construction material capable of withstanding direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic repair. 2015 IRC Section R322.1.8; 2015 IBC Section 202; ASCE 24-14 Section 1.2. Also known as "Flood-Resistant Material."

Flood Design Class: A classification of buildings and other structures for determination of flood loads and conditions, and determination of minimum elevation requirements on the basis of risk associated with unacceptable performance. ASCE 24-14 Section 1.2.

Flood Hazard Area (FHA): The area subject to flooding during the ***Design Flood*** and shown on the ***Flood Hazard Map*** adopted by the ***Jurisdiction***. ***FHAs*** are mapped in riverine, lake, coastal, and other areas subject to flooding. The ***FHA*** is equal to or larger than the ***Special Flood Hazard Area (SFHA)***. 2015 IRC Section R322.2; 2015 IBC Section 202; ASCE 24-14 Section 1.2.

Flood Hazard Map: The map adopted by the ***Jurisdiction*** delineating ***Flood Hazard Areas (FHA)***. In most ***Jurisdictions*** the ***Flood Insurance Rate Map (FIRM)*** is the official ***Flood Hazard Map***. ASCE 24-14 Section 1.2. Sometimes referred to as the "Flood Map."

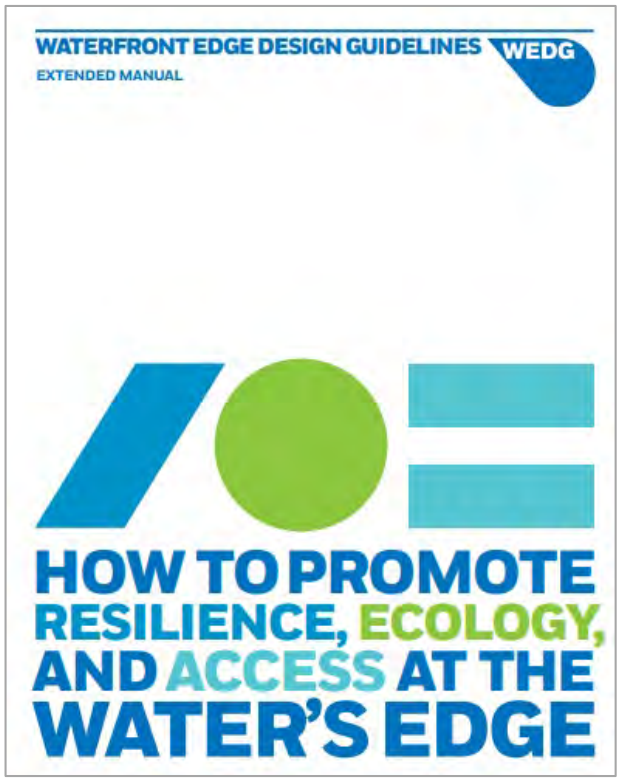
Flood Hazard Zones: Areas designated on the ***Flood Insurance Rate Map (FIRM)*** to indicate the nature and severity of flood hazards. Zones are generally designated as:

- ***V Zones:*** Zones VE, VO, V1-V30, and V, collectively referred to as ***V Zones***, velocity zones, or ***Coastal High Hazard Area (CHHA)***. These zones are subject to high-velocity wave action from storms or seismic sources during the ***Base Flood***.
- ***A Zones:*** Zones AE, A1-A30, AO, AH, and A, collectively referred to as ***A Zones***, that identify portions of the ***Special Flood Hazard Area (SFHA)*** subject to flooding during the ***Base Flood*** that are outside ***V Zones***.

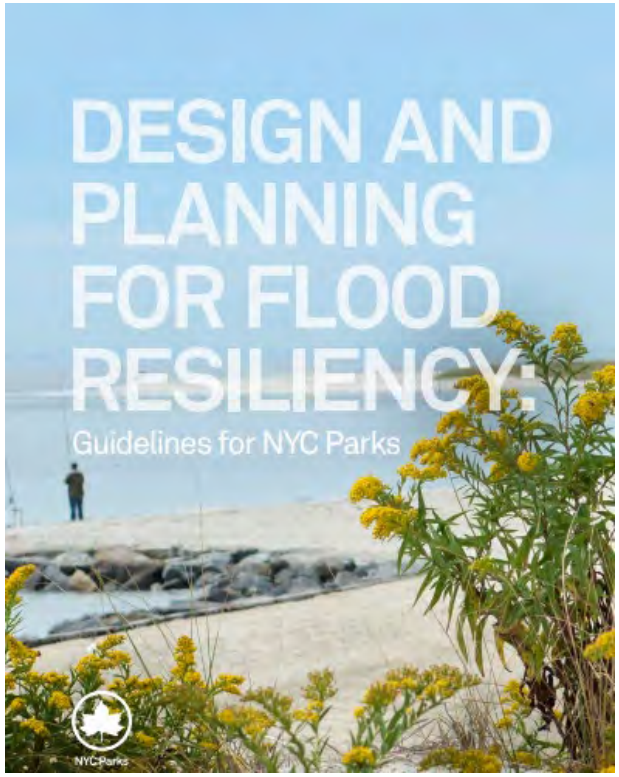
Tips:

- Published when I-Codes releases any new editions
  - **2009 – Current PA**
  - 2015
  - 2018
- For purchase here
- Local amendments could effect which sections apply
- During building permit review this document can assist in comment/request for information from applicant
- 8 concise pages
- Quick guide that can easily sit on your desk

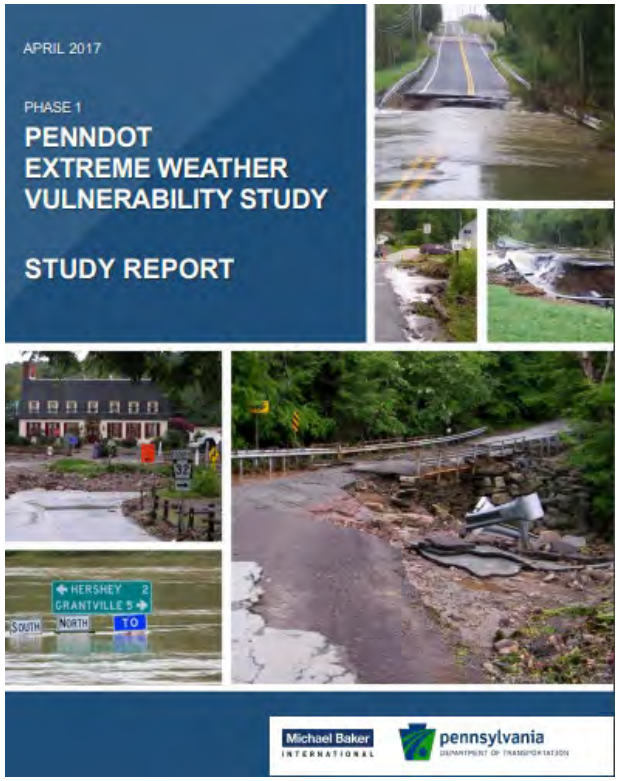
RESOURCES
Other



WATERFRONT EDGE DESIGN GUIDELINES
WATERFRONT ALLIANCE

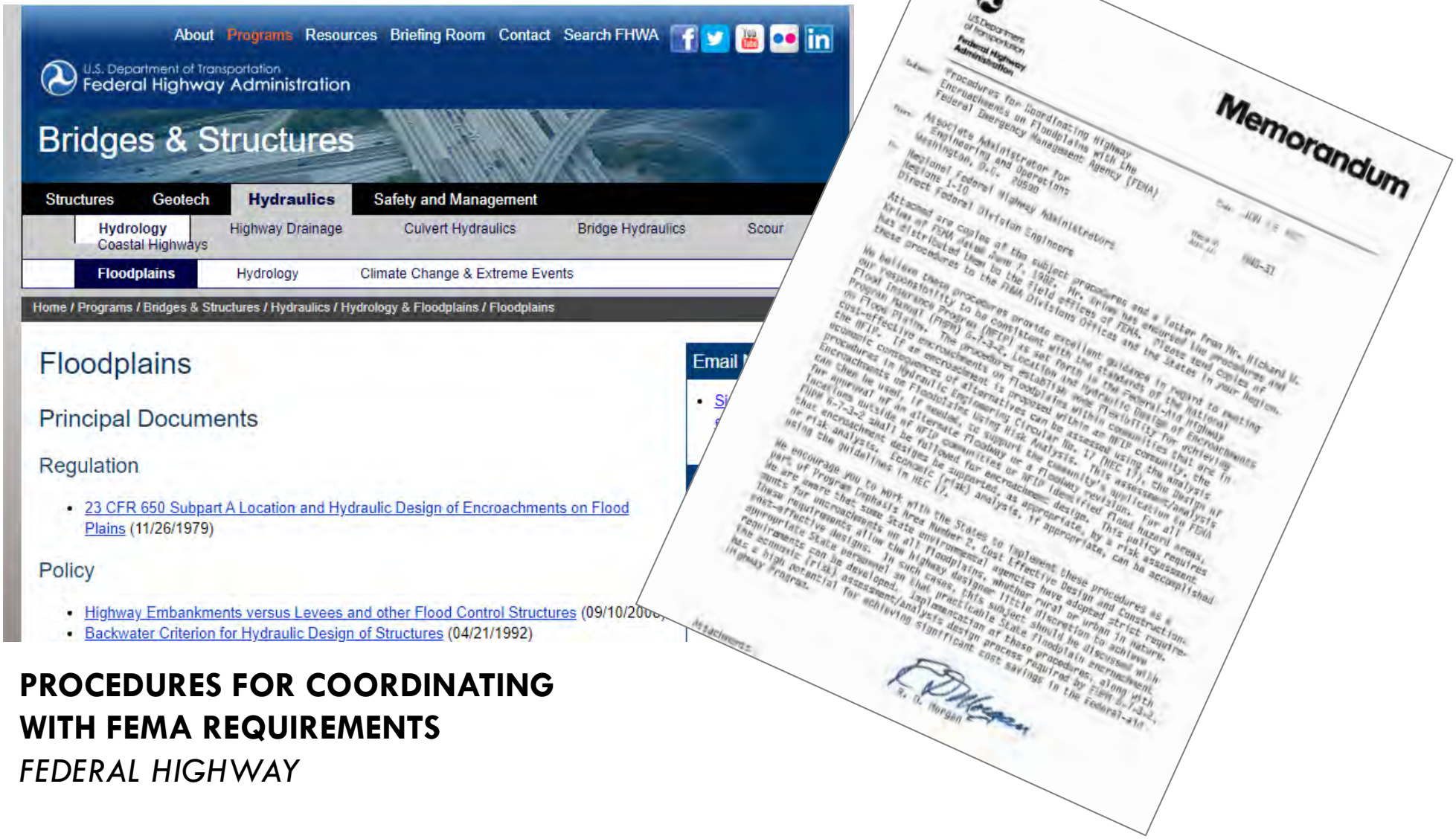


DESIGN AND PLANNING FOR FLOOD RESILIENCY
NYC PARKS DEPARTMENT



EXTREME WEATHER VULNERABILTY STUDY
PENNDOT

RESOURCES
Other



PROCEDURES FOR COORDINATING WITH FEMA REQUIREMENTS

FEDERAL HIGHWAY

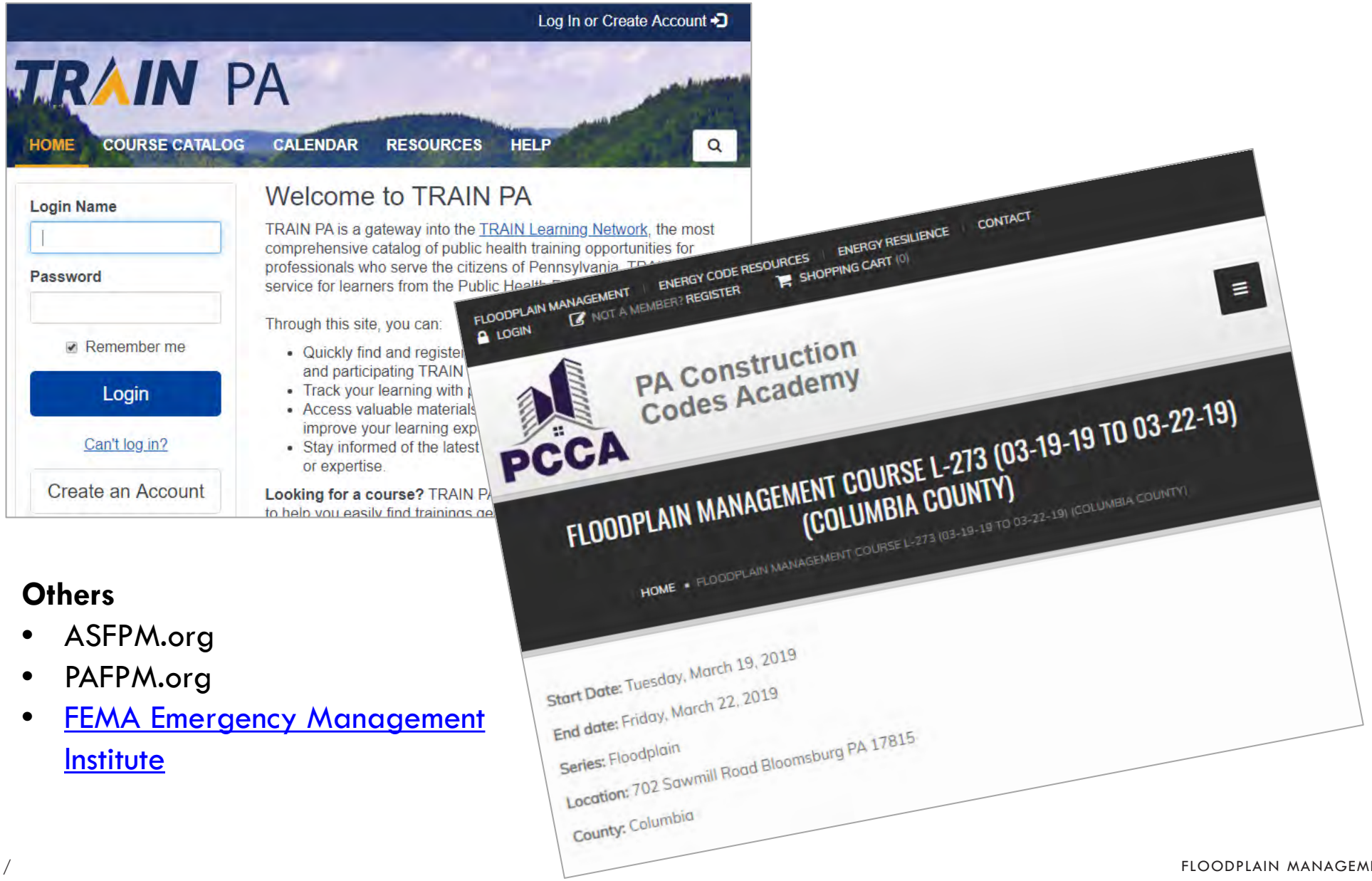
RESOURCES

PA NFIP/Floodplain Management Webpages

Annual Report – MANDATORY

- Mandatory for everyone in PA
- Online Submission
- Due end of February
- Permits and NFIP changes

RESOURCES
Training



Others

- ASFPM.org
- PAFPM.org
- FEMA Emergency Management Institute

RESOURCES
Professional Organizations

National Organization

- Annual Conference
- Training/CEU resources
- Professional certification program (Certified Floodplain Manager)

Pennsylvania Organization

- Annual Conference
- Newsletters
- CFM Exam Offering (Proctor)
- Webinars
- State floodplain training calendar
- Mentorship program (coming soon)

Questions and/or comments?

JOSH LIPPERT, *CFM*
FLOODPLAIN MANAGER
FLOOD@pafpm.org