



Challenges & Opportunities:

Local Flood Risk Assessments

Oklahoma Floodplain Managers Association Conference - September 17, 2019
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FEMA Region VI



FEMA



FOUR HIGHER RESILIENCY MEASURES TO CONSIDER

- ▶ **ADOPT INTERNATIONAL BUILDING CODES INCLUDING ASCE 24-14 AS FP MANAGEMENT BUILDING REQUIREMENTS RATHER THAN MINIMUM NFIP REQUIREMENTS.**
- ▶ **ADOPT A “NO NET FILL” OR “FULL OR PARTIAL RESTRICTION FOR PLACEMENT OF STRUCTURAL FILL” AS A FLOODPLAIN ORDINANCE ELEMENT.**
- ▶ **ADOPT HIGHER THAN MINIMUM NFIP/FIRM OR FIS STANDARD FOR FLOODPLAIN MANAGEMENT AND DEVELOPMENT.**
- ▶ **MARKET/MANDATE FLOOD INSURANCE IN COMMUNITY, ESPECIALLY PREVIOUSLY FLOOD DAMAGED CLAIMED STRUCTURES.**

ASCE/SEI 24-14 Flood Resistant Design and Construction

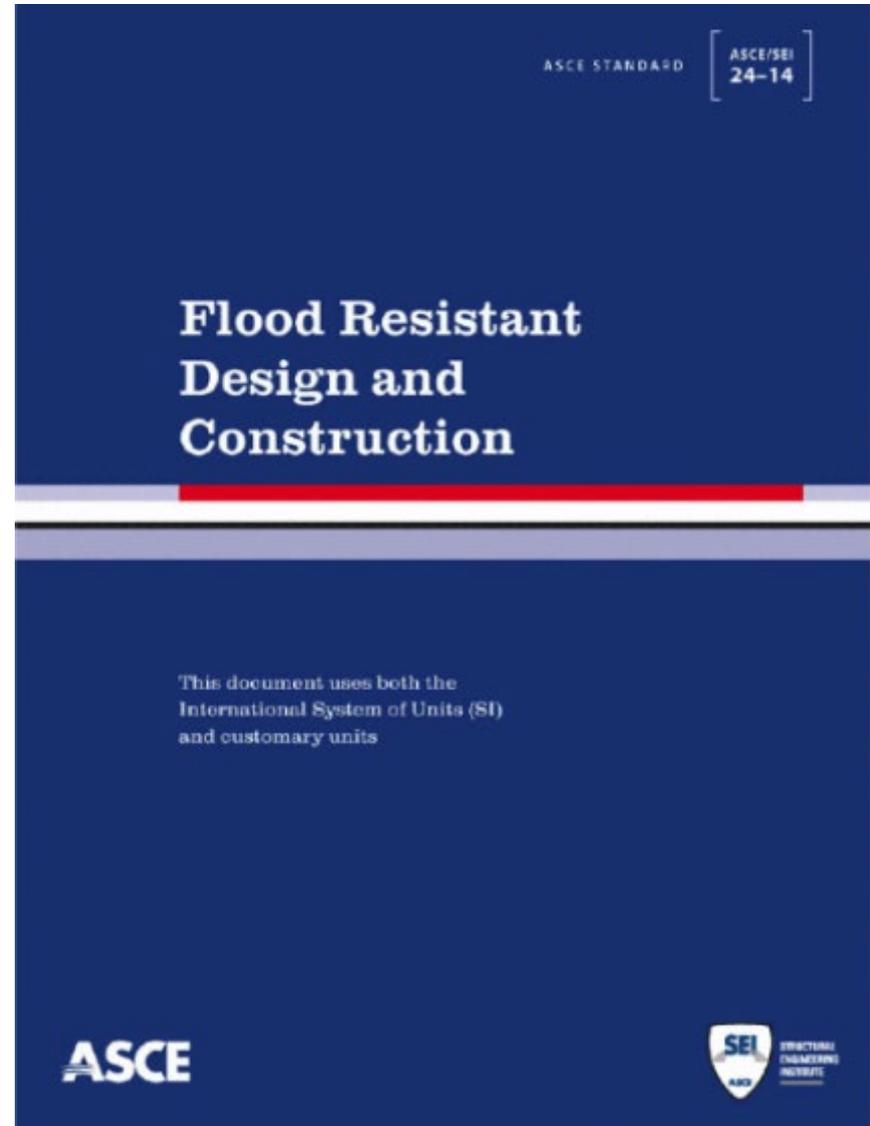
Applies to the design and construction of buildings and structures located in flood hazard areas.

Build to highest of DFE + ASCE 24 Flood Design Class requirements.

DFE from local, State or Federal highest or more restrictive.

Prepared by FEMA Building Science Branch. Content from ASCE 24-14 used with permission from ASCE. Purchase ASCE 24 at:

www.asce.org



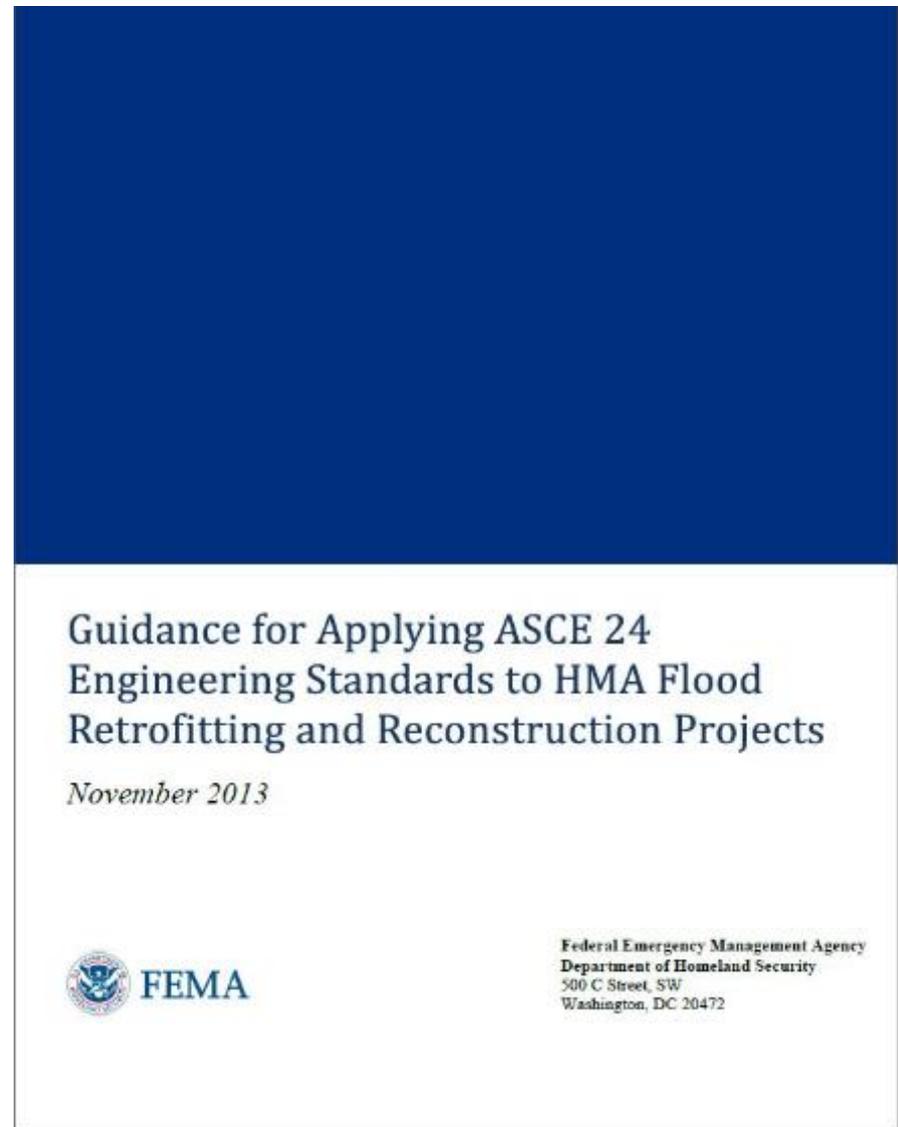
ASCE 24 For Hazard Mitigation Assistance

Applicable to all HMGP FEMA-funded mitigation started since November 2013.

Build to highest of DFE + ASCE 24 Flood Design Class requirements.

DFE from local, State or Federal highest or more restrictive.

[ASCE 24 for HMA Guidance](#)



FEMA Highlights of ASCE/SEI 24-14 Flood Resistant Design and Construction

ASCE 24, is a referenced standard in the *International Codes*® (I-Codes®) series

- ▶ Per IBC 2015 Volume 2 commentary; **Section 1612.4 Design and construction: The design and construction of buildings and structures located in *flood hazard areas*, including *coastal high hazard areas* and *coastal A zones*, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.**
- ▶ FEMA deems ASCE 24 to meet or exceed the minimum National Flood Insurance Program (NFIP) requirements for buildings and structures.
- ▶ The 2015 I-Codes reference ASCE 24-14, while the 2006 through 2012 I-Codes reference ASCE 24-05.
- ▶ A summary of significant technical revisions from ASCE 24-05 to ASCE 24-14 is reproduced on page 6 of the Highlights Technical Fact Sheet.
- ▶ Flood Design Class and the nature of the flood hazard areas are referenced on the table on page 4 of these Highlights.

FEMA Highlights of ASCE/SEI 24-14 Flood Resistant Design and Construction

- ▶ Types of buildings and structures are described in ASCE 24-14, Table 1-1 (see page 5 of these Highlights), and include commercial, residential, industrial, educational, healthcare, critical facilities, and other occupancy types.
- ▶ Highlights Sections of ASCE 24-14 that complement the NFIP minimum requirements are described below:
 - **Building Performance**
 - **Flood Damage-Resistant Materials**
 - **Attendant Utilities and Equipment**
 - **Siting Considerations**
- ▶ ASCE 24 uses ‘design flood’ and ‘design flood elevation’ to acknowledge that some communities adopt flood hazard maps that depict flood hazard areas in addition to Special Flood Hazard Areas shown on FEMA’s Flood Insurance Rate Maps (FIRM).
- ▶ **The (DFE) equals the base flood elevation (BFE) in communities that regulate based on the FIRMs. The DFE is always equal to or higher than the BFE.**

Benefits of ASCE-24 compliance for flood insurance

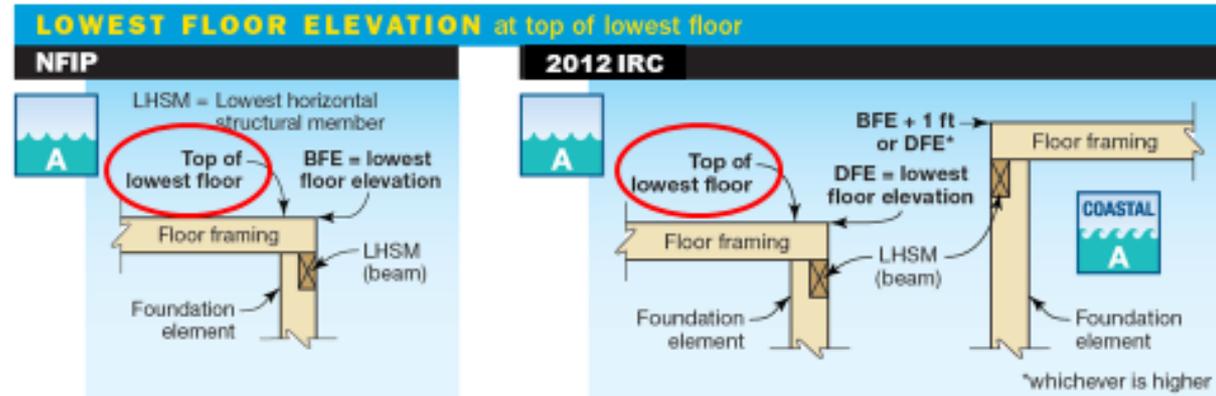
In non-Coastal A zones, +1 or more above BFE rating

In Coastal A zones, +3 LFF above BFE (measure from bottom of lowest horizontal structural member)

In V zones, +1 above BFE rate

Compliance: Elevation

- Zone A: Reference point is the “lowest floor” (assumes enclosure, if any, is compliant)

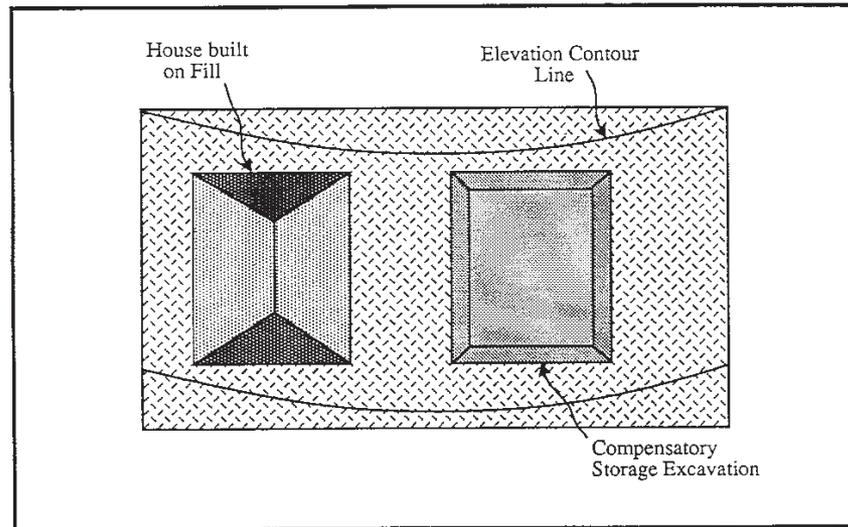
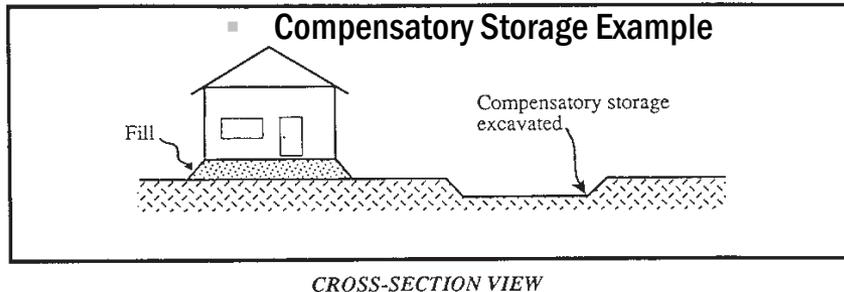


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No Net Fill

- ▶ Add a “No Net Fill” provision in the floodplain ordinance. An example is below:
- ▶ *Policy - Any development that fills or modifies a designated Special Flood Hazard Area must mitigate that development activity volumetrically.*
- ▶ The volume of any proposed fill material or modification below the base flood elevation and above natural grade shall be calculated and documented. Mitigation activities shall restore that volume to achieve an effective “zero net fill” of the pre-development storage capacity of the Special Flood Hazard Area. The development shall accept stormwater during a 100-year (one 1% percent) storm event, both from on-site and off-site, such that post-development conditions provide storage volume equal to the pre-development storage volume, as measured in acre-feet. If the stormwater retention/detention facility is used as a storage mitigation area, the storage volume shall be calculated as the volume above the static water surface elevation of the facility.

Protection of Floodplain Storage Capacity or (PSC) per the National Flood Insurance Program Community Rating System; Coordinator's Manual; FIA-15/2017



- “If fill is placed in the floodplain, an equal amount must be removed from the same elevation to provide a hydraulically equivalent volume of excavation.”
- Elevation on fill above the BFE does meet NFIP regulations.
- Filling substantial portions of the flood fringe, reduces storage and tends to increase peak flows downstream.
- Prohibiting fill or requiring an equal volume of storage will reduce this problem.

Protection of Floodplain Storage Capacity or (PSC) per the National Flood Insurance Program Community Rating System; Coordinator's Manual; FIA-15/2017 (Cont'd)

- Minimum NFIP impacts future flood heights, but does not account for floodplain storage.
- Storage is especially important in flat areas with wide floodplain fringes.
- Constructing a levee removes storage capacity of the fringe forces more water downstream, resulting in higher flood heights.
- Building on fill could be the safest form of floodplain construction, so communities should not summarily enact prohibition of fill, just for CRS credit.
- Find the best solution for **your community!**
- ▶ Example of Regulatory Language:

“Whenever any portion of a floodplain is authorized for development, the volume of space occupied by the authorized fill or structure below the base flood elevation shall be compensated for and balanced by a hydraulically equivalent volume of excavation taken from below the base flood elevation. All such excavations shall be constructed to drain freely to the watercourse. No area below the waterline of a pond or other body of water can be credited as a compensating excavation.”

Protection of Floodplain Storage Capacity or (PSC) per the National Flood Insurance Program Community Rating System; Coordinator's Manual; FIA-15/2017 (cont'd)

- **(PSC) has moved to section 432.a. Development limitations (DL) and credits have been adjusted.**
 - ▶ **The use of fill to elevate buildings has advantages that make it desirable for developers and homeowners.**
 - ▶ **However, there are problems with using fill: it reduces floodplain storage capacity, can deflect waves onto neighboring property, and it has an adverse impact on native vegetation, wetlands, drainage, and water quality.**
 - ▶ **The benefits of using fill accrue to the developer and to the property owner. Conversely, the problems accrue to neighbors, taxpayers, the community, the NFIP, or the environment.**
 - ▶ **Because filling is not a desirable floodplain management activity, this element credits communities that prohibit fill.**

Protection of Floodplain Storage Capacity or (PSC) per the National Flood Insurance Program Community Rating System; Coordinator's Manual; FIA-15/2017 (Cont'd)

- ▶ One method to offset the impacts of the use of fill is to require compensatory storage, but compensatory storage does not compensate for the adverse impact on other natural floodplain functions.
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- ▶ If the regulations only prohibit certain types of buildings, such as residences, the points will be prorated. If buildings are prohibited in parts of the SFHA, such as the floodway, the impact adjustment will adjust the points. Prohibiting critical facilities is credited in Section 432.f, Protection of critical facilities, not under **Development limitations (DL)**.
- ▶ CRS Credits for PSC under DL have many alternatives, we need to educate our communities of all the possible combinations for the benefit of our floodplains.

Slab on Grade

- Blocks floodwaters from former flood area.
- Provides only 4" to 6" above ground prior to flooding
- Decreases infiltration.
- More difficult to fix under floor issues (water leak?)
- Termite vulnerable?
- More costly to modify elevation



Building Science Guidance and Findings

- ▶ Building Science Guidance <https://www.fema.gov/building-science-publications>
- ▶ FEMA P-2022, *Mitigation Assessment Team Report: Hurricane Harvey in Texas*, <https://www.fema.gov/media-library/assets/documents/177700>
- ▶ American Society of Civil Engineers/Structural Engineering Institute
 - ASCE/SEI 24-14
 - FEMA HMA Guidance for Federally Funded work in compliance with ASCE-24 https://www.fema.gov/media-library-data/1398435734359-04a49fe783b3b3a15805d4c2c8e67630/ASCE_24_HMA_Guidance_508.pdf
 - ASCE/SEI 24-14 Flood Resistant Design and Construction <http://www.asce.org/>
- ▶ FEMA Technical Bulletins – <https://www.fema.gov/media-library/collections/4>
- ▶ Highlights of ASCE 24-14:
 - ▶ <https://www.fema.gov/media-library/assets/documents/14983>

RESILIENT DESIGN COSTS

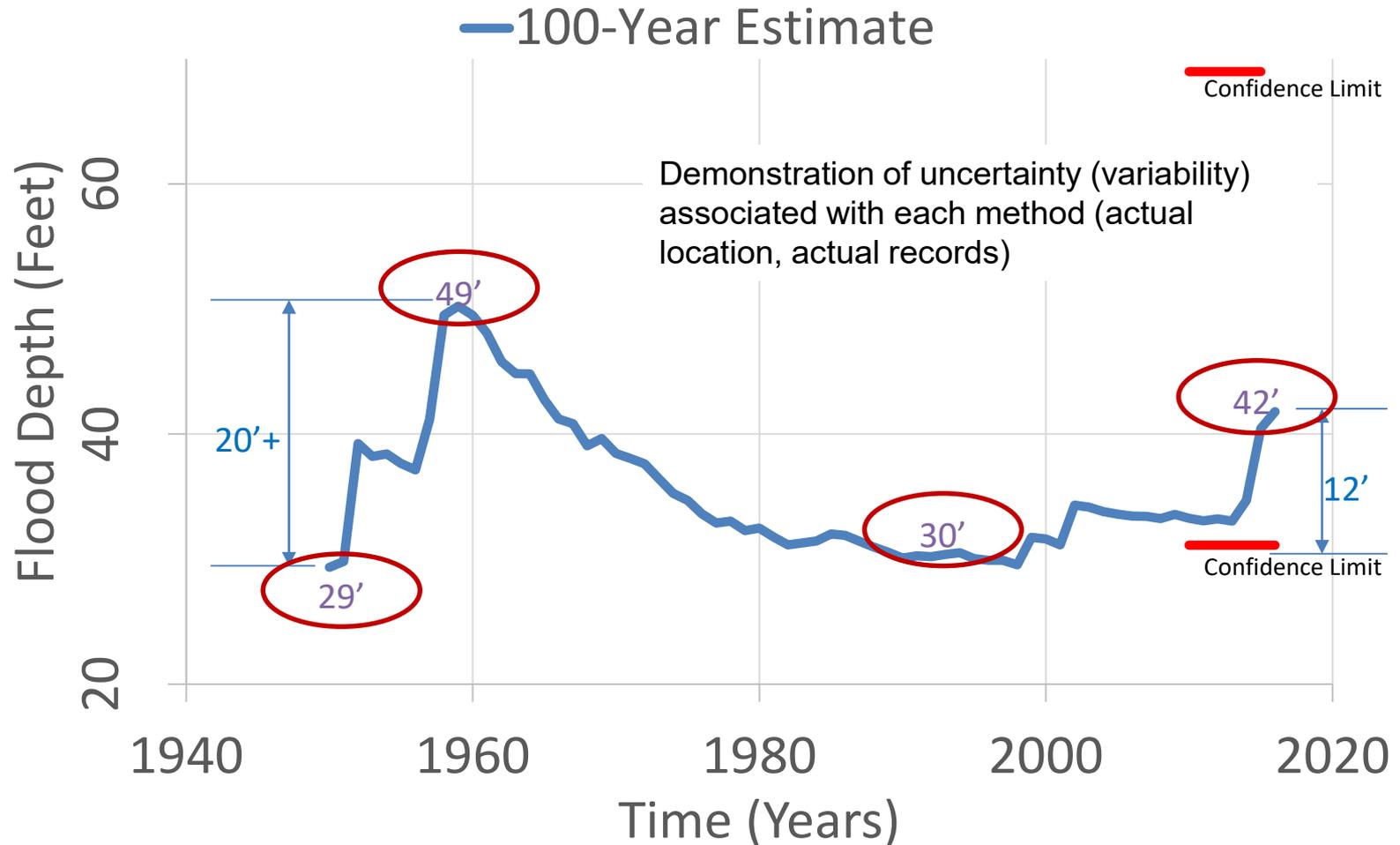
- Per Standard Estimate Concrete Foundation Costs
 - On Ground - \$15,500
 - On Spread Footers/columns 4' - \$22,400
 - On Spread Footers/columns 8' - \$28,800
- Federally insured loans in SFHA still require flood insurance. Annual Premiums –(250K bldg./ 100K contents)
 - On Ground (assume -4' to BFE) **\$13,740**
 - At BFE (0 ft) \$2486
 - At +4 above BFE \$676
 - Std B/C/X premium \$2439
- ADA compliance costs
- Payback on incremental elevation at +4' to BFE
 - Versus -4' rating = 1 year (13,064/13,300)
 - Versus @BFE \leq 2 years (11,254/6,900)



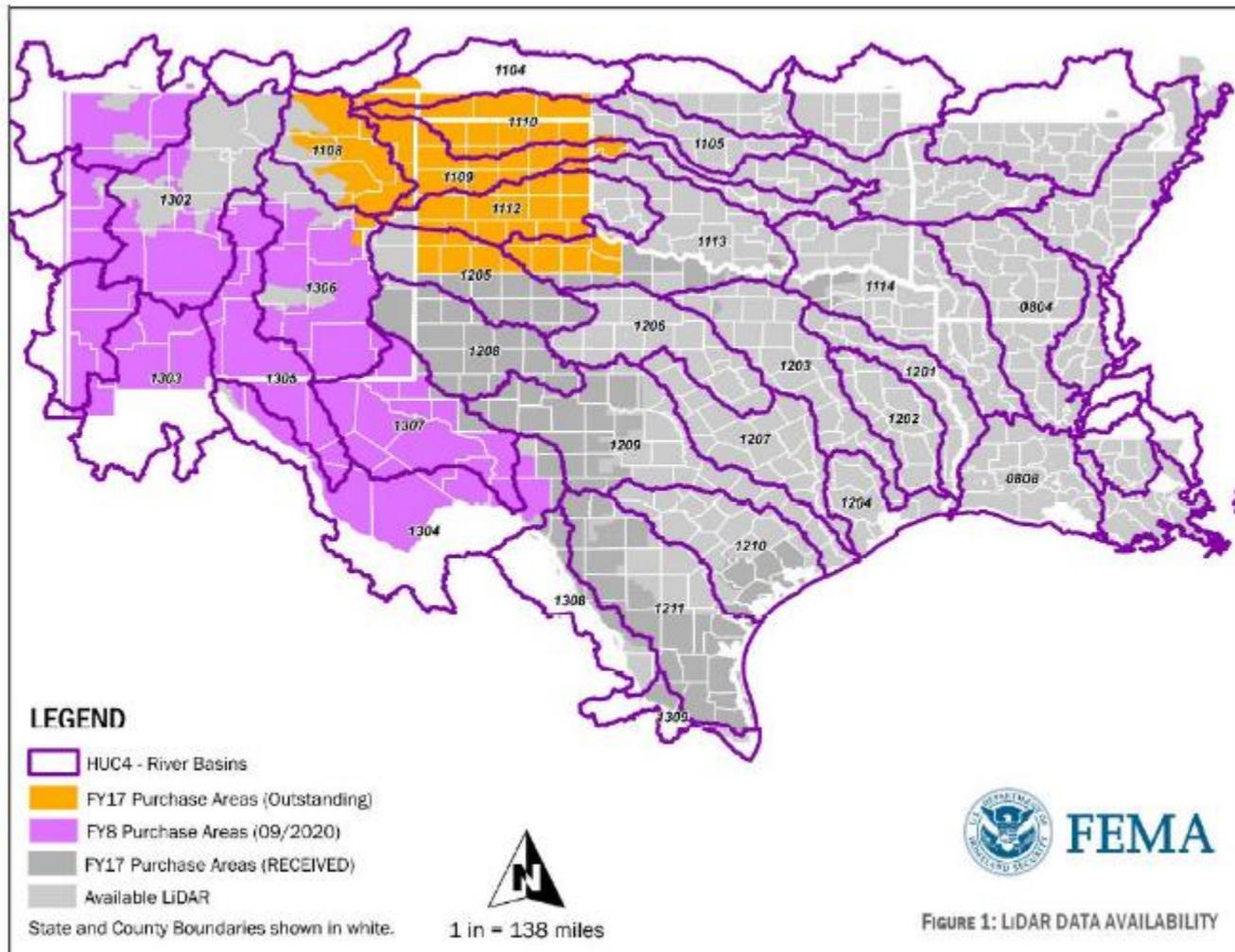
BENEFITS TO COMMUNITY OF OPEN FOUNDATIONS IN FLOOD ZONES

- ▶ **OWNERS** will likely be mandated to buy flood insurance. Therefore, covered should a flood reach the lowest level.
- ▶ If up 4 feet above BFE, lowest flood insurance rates standardly available.
- ▶ In coastal communities, much of flood risk is shallow/sheetflows due to intense rainfall, provides protection against actual flooding.
- ▶ If open foundations, then little change to nearby flooding, keeps data adopted accurate.
- ▶ Community does not lose tax base (structures) at locations.
- ▶ New buildings in accordance with IRC/IBC better built than repaired pre-90s buildings against more risks (wind/water/earthquake)

Climatic Data Update (NOAA Atlas 14)



LIDAR AVAILABILITY

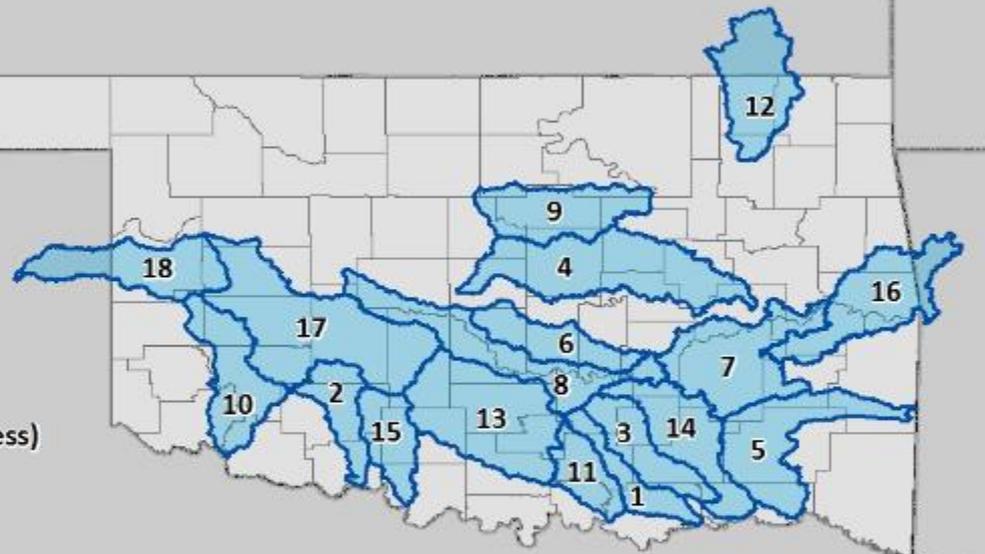


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BASE LEVEL ENGINEERING AVAILABLE

Studies Available on the Estimated Base Flood Elevation (estBFE) Viewer

- 1 Blue
- 2 Gache
- 3 Clear Boggy
- 4 Deep Fork
- 5 Kiamichi
- 6 Little
- 7 Lower Canadian
- 8 Lower Canadian-Walnut
- 9 Lower Cimarron (In Progress)
- 10 Lower North Fork Red
- 11 Lower Washita
- 12 Middle Verdigris
- 13 Middle Washita
- 14 Muddy Boggy
- 15 Northern Beaver
- 16 Robert S. Kerr Reservoir
- 17 Upper Washita
- 18 Washita Headwaters



9/12/2019

<https://webapps.usgs.gov/infrm/estBFE/>



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Local Ordinance & Development Regulations

- ▶ **First line of defense in assuring sound engineering methods, partnered with disaster prevention construction for local development and permitting.**
- ▶ **Low cost higher standards with high rate of return on investment include:**
 - **Local adoption/enforcement of International Building Codes**
 - **Freeboard above current Base Flood Elevation**
 - **Open Space Planning – land conservation, stream buffers and cluster development**
 - **Elevation/Acquisition or Retreat**

Local Ordinance & Development Regulations

- ▶ **Flood losses outside of designated floodplains may occur:**
 - **Local drainage swale, pipe network or detention pond size limitation (local drainage requirements are 25-year or less capacity)**
 - **Intense rainfall inundates and overtakes local drainage systems**
 - **Development activity with no FIRM update through LOMR**
 - **Minimal engineering assessment of development activity (no review of pre and post project conditions).**



Obtain/Maintain Flood Insurance

- ▶ 44CFC, part 206.131(d)(1)(iii)(C)(1) The State may not make a grant for acquisition or construction purposes in a designated special flood hazard area in which the sale of flood insurance is available under the NFIP unless the individual or family obtains adequate flood insurance and maintains such insurance for as long as they live at that property address. The coverage shall equal the maximum grant amount established under § 411(f) of the Stafford Act. If the grantee is a homeowner, **flood insurance coverage must be maintained on the residence at the *flood-damaged property address* for as long as the structure exists if the grantee, or any subsequent owner of that real estate, ever wishes to be assisted by the Federal government with any subsequent flood damages or losses to real or personal property, or both.** If the grantee is a renter, flood insurance coverage must be maintained on the contents for as long as the renter resides at the flood-damaged property address.
- ▶ What happens to the next owner if nobody lets him/her know about the prior loss?
- ▶ Community – What steps can you take to assure that owner is eligible for future help?

SUMMARY

- ▶ RESILIENCY IN 4 ACTIONABLE STEPS.

- ▶ **Adopt Current International Code Council IBC/IRC/IEBC, especially Flood Plain provisions of (ASCE 24-14) into Flood Plain Management Ordinance.**
- ▶ **Open Foundations Only/No Net Fill (Retain flood storage) or Protected Storage Capacity or Complete or Partial Fill Restrictions.**
- ▶ **Use higher/wider standards for floodplain development in Adopted Ordinance than minimum FIRM requirements.**
- ▶ **Push or Mandate Flood Insurance Coverage**
 - **Especially for those “tainted” properties (Disaster assisted in past)**

Questions/Feedback/Reactions?



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