



# Statewide Flood Risk Assessment & WV Flood Tool – Community Engagement

*(TEIF – Total Exposure in Floodplain)*

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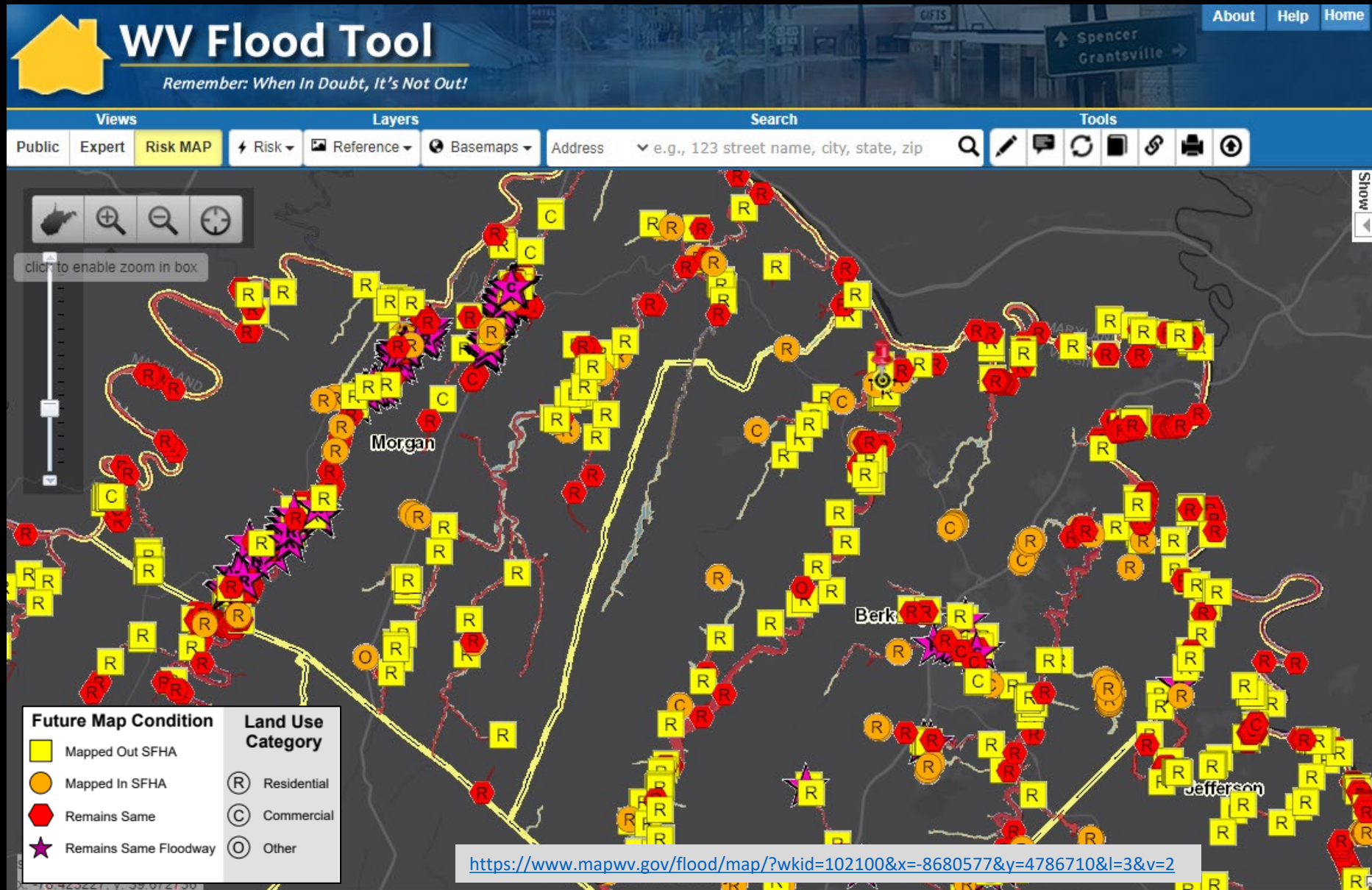
*May 15, 2023  
WV Floodplain Manager Conference*

← *Devastating June 2016 Flood*

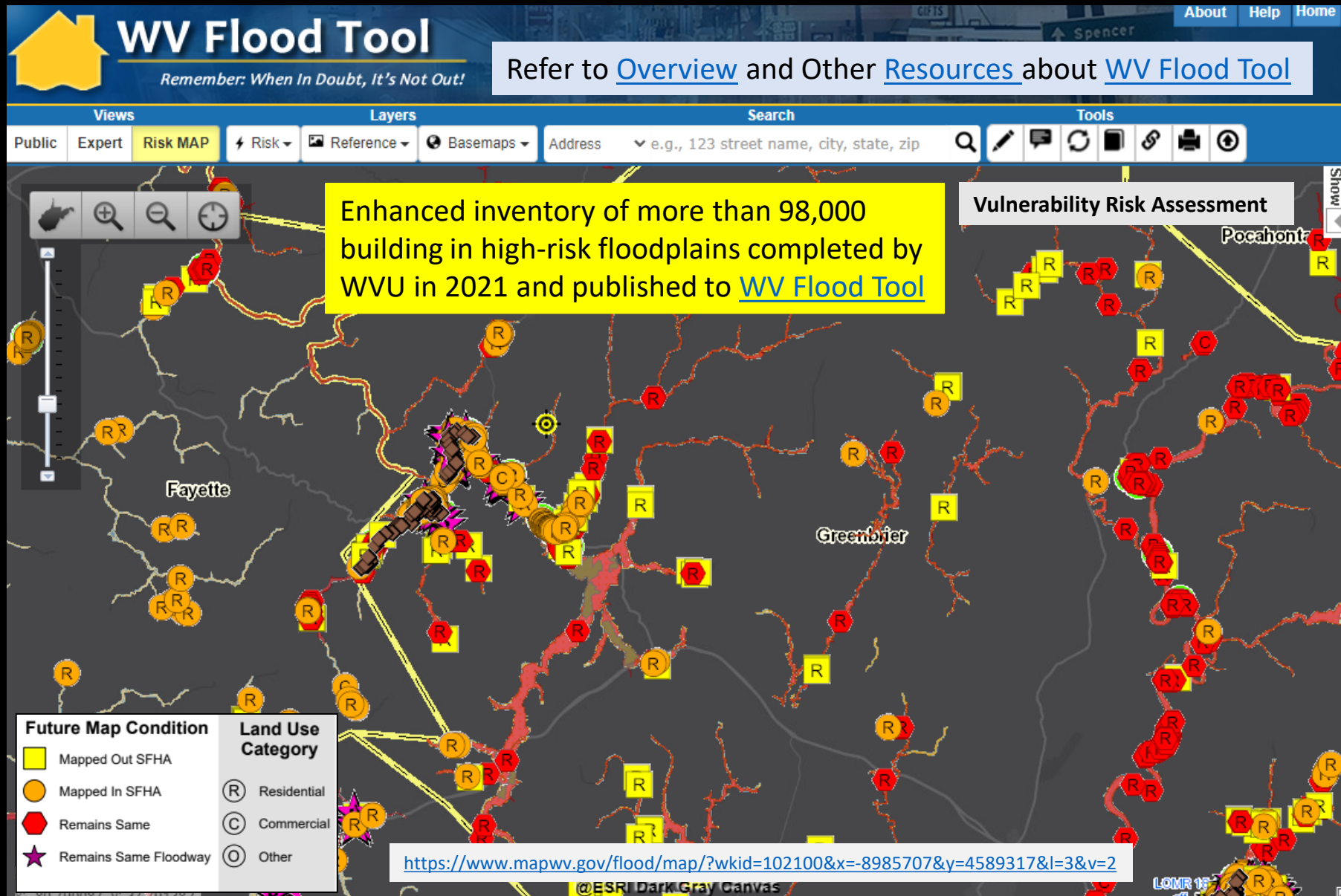
# WV Statewide Risk Assessment

Building Level Risk Assessment  
& New Flood Maps


# 2021 R9 Floodplain Building Inventory



# 2021 R4 Floodplain Building Inventory



# Floodplain Building-Level Risk



## WV Flood Tool

Remember: When In Doubt, It's Not Out!

Views: Public | Expert | **Risk MAP**

Layers: Risk | Reference | Basemaps

Tools: [Icons for search, zoom, print, etc.]

**BUILDING-LEVEL RISK: 100-YEAR FLOOD**

- Primary Structure (Future Map)
- LOMA Verified (In or Out SFHA)
- Building Exposure Cost
- Building Year Pre-FIRM & Post-FIRM
- Foundation Type
- Elevation Certificates (Building Type)
- Minus-Rated Structure
- Building Damage Loss Estimate

**CRITICAL INFRASTRUCTURE**

**FLOOD DEPTH**

**OTHER NATURAL HAZARDS**

**MITIGATED PROPERTIES & OPEN SPACE**

- Mitigated Structure or Tract
- Buyout Parcel (Deed Restricted)
- Public Land (minus Fed. Lands)
- Private Land (Nature Preserves, Land Trusts)

**PRIMARY FLOOD HAZARD LAYERS**

White Sulphur Springs

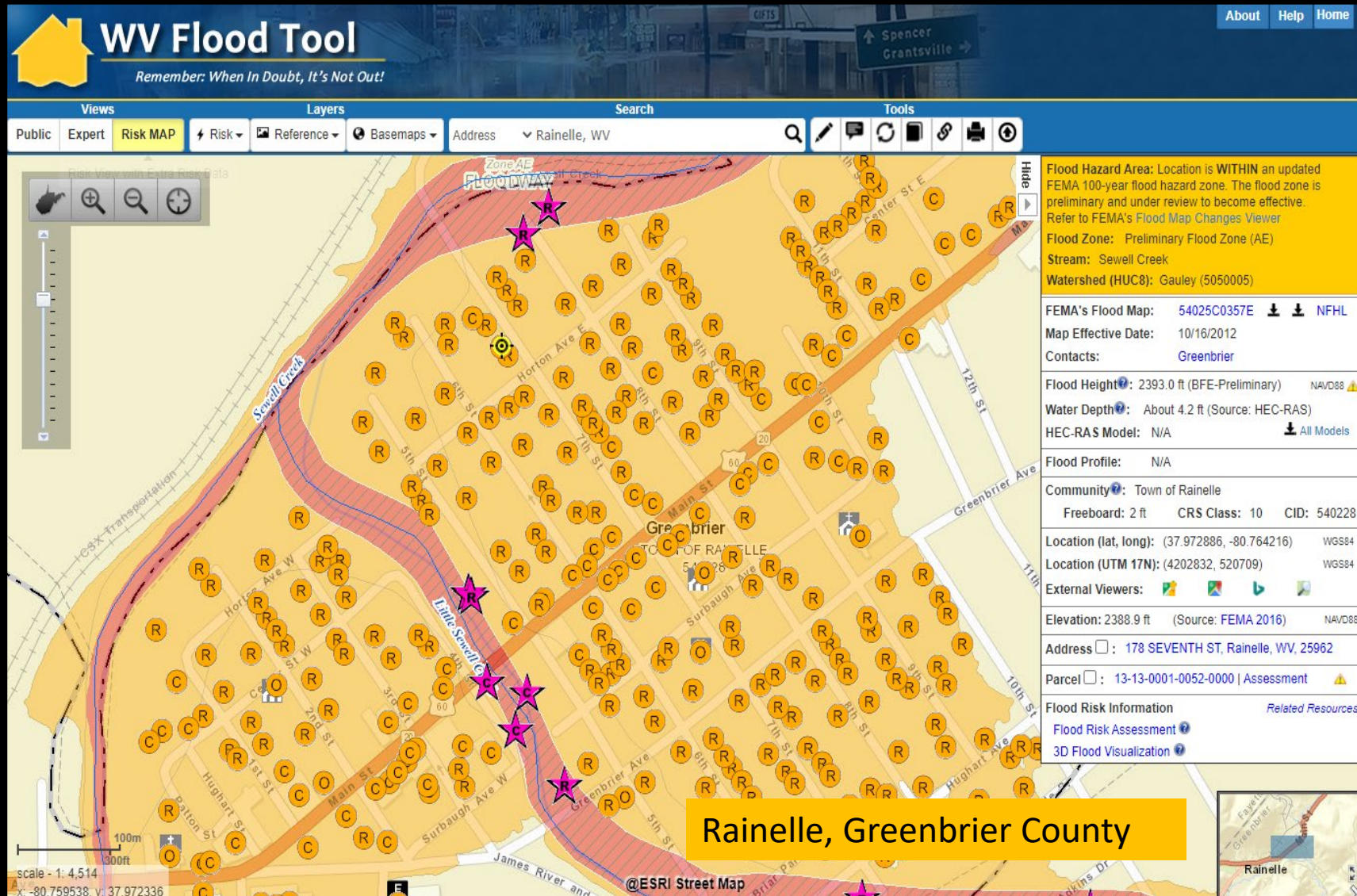
All Risk Assessment and Mitigation Layers are displayed on the RiskMAP View of the WV Flood Tool

High-Risk Effective & Advisory 1%-Annual-Chance (100-Yr) Floodplains

Future Map Condition	Land Use Category
Mapped Out SFHA	Residential
Mapped In SFHA	Commercial
Remains Same	Other
Remains Same Floodway	

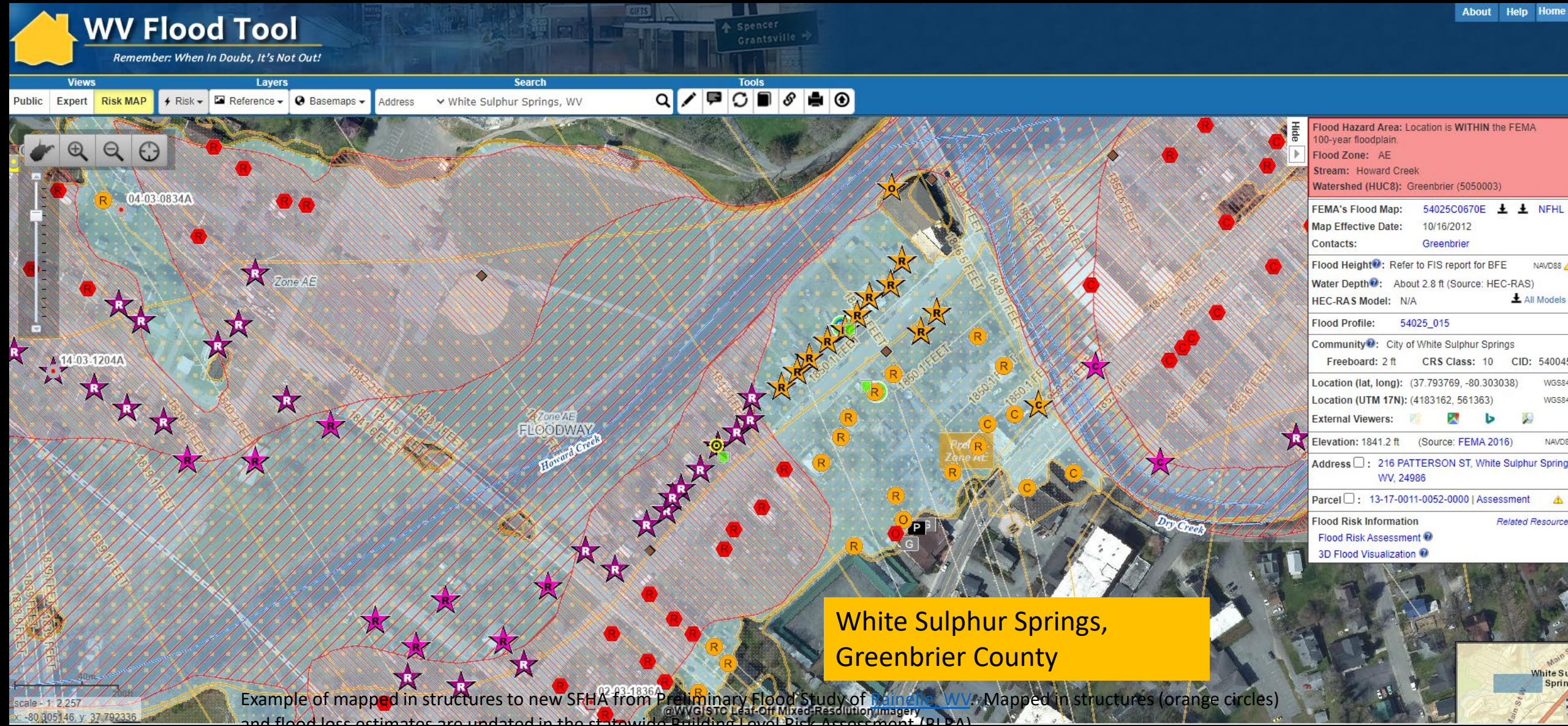
<https://www.mapwv.gov/flood/map/?wkid=102100&x=-8938946&y=4550516&l=9&v=2>

# Preliminary NFHL (Rainelle, WV)



[Rainelle, WV](#)

# Future Building Conditions: Mapped in Floodway



# Draft NFHL (Summers County)

The screenshot displays the WV Flood Tool interface. At the top, there is a navigation bar with 'About', 'Help', and 'Home' links. Below this is a search bar with the address 'Alderson, WV' and various tool icons. The main map area shows a residential area with a yellow 'Draft Flood Zone (AE)' and a red 'Zone AE'. A 'High Risk Advisory Zone' is also indicated. A popup window for 'LOMA 17-03-1031A' is open, displaying the following details:

PROPERTY INFORMATION	VALUE
CATEGORY	LOMA
Case #	17-03-1031A
PROJECT	LOTS 321 & 322 -- 106 SUMMERS STREET
LOT TYPE	Single structure
OUTCOME	Structure removed-Property partially inundated
SFHA Status	LOMA OUT-STRUCTURE REMOVED
DETERMINATION	Removal
DATE	3/27/2017
REVALIDATION	None
CID	540186

Additional information on the right side of the interface includes:

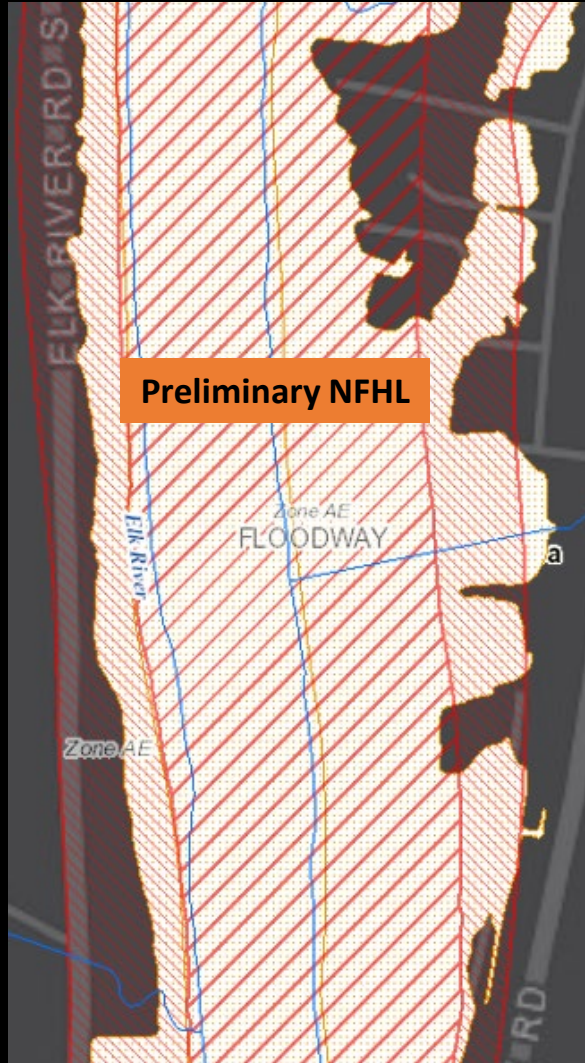
- Flood Hazard Area: Location is WITHIN an updated FEMA 100-year flood hazard zone. The flood zone is DRAFT and under review to become PRELIMINARY.
- Flood Zone: Draft Flood Zone (AE)
- Stream: Greenbrier River
- Watershed (HUC8): Greenbrier (5050003)
- FEMA's Flood Map: 54089C0160C (NFHL)
- Map Effective Date: 2/3/2010
- Contacts: Summers
- Community: Summers County
- Freeboard: 2 ft CRS Class: 10 CID: 540186
- Location (lat, long): (37.729863, -80.665274)
- Location (UTM 17N): (4175895, 529496)
- Elevation: 1544.1 ft (Source: FEMA 2016)
- Address: 204 WEIKLE DR, Alderson, WV, 24910
- Parcel: 45-07-006A-0076-0000 | Assessment
- Flood Risk Assessment: N/A
- 3D Flood Visualization: No Depth Grid Available

At the bottom left, there is a scale of 1:2,257 and coordinates x: -80.662989, y: 37.730461. The bottom center features the text '@WVGISDC Leaf-Of Mixed-Resolution Imagery'.



# High Risk Advisory Zones

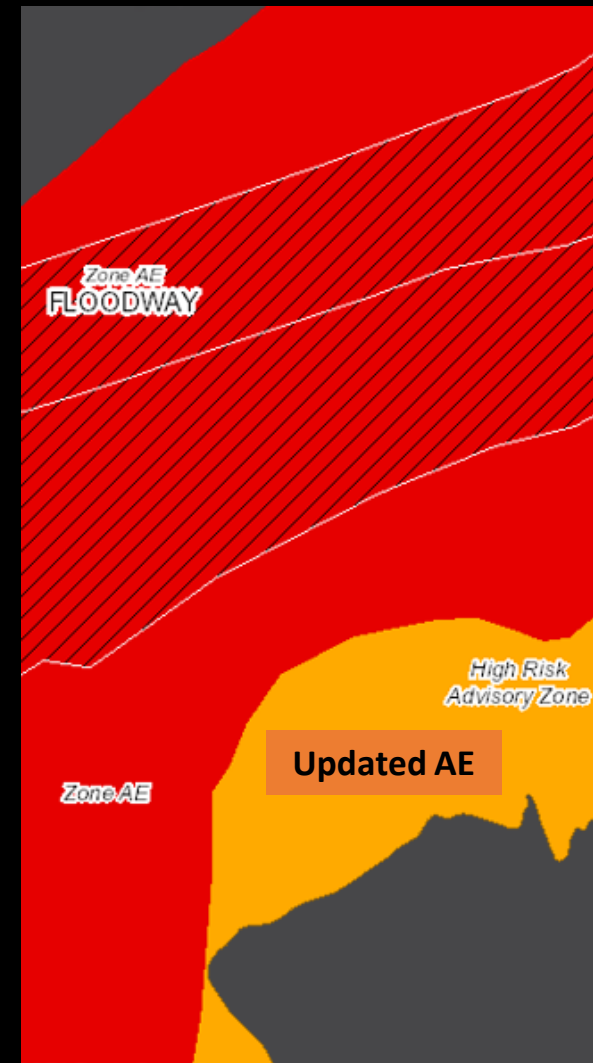
[More info on High-Risk Advisory Zones](#)



Preliminary NFHL



Advisory A



Updated AE

# New FEMA Flood Maps – BFE Change

**WV Flood Tool**  
Remember: When In Doubt, It's Not Out!

Views: Public | Expert | Risk MAP | Layers: Risk | Reference | Basemaps

Flood Elev (ft): 2033.7  
Height above ground (ft): 9

2034 FEET  
2028.4 FEET

3-5  
3-6  
3-7

**FEMA is creating new flood maps for select communities in Region 4 which will alter the floodplain boundaries and base flood elevations. The new flood maps will affect the at-risk building inventories as well. The BFE is increasing 6 feet at this location.**

Tools: Search, Measure, Print, etc.

Flood Hazard Area: Location is WITHIN the FEMA 100-year floodplain and floodway.  
Flood Zone: AE (Floodway)  
Stream: Gauley River  
Watershed (NCCo): Gauley (000005)

FEMA's Flood Map: 54101C0377D | NFHL  
Map Effective Date: 1/6/2012  
Contacts: Webster

Flood Height: Refer to FIS report for BFE | NAVD88  
Water Depth: About 8.0 ft (Source: HEC-RAS)  
HEC-RAS Model: N/A | All Models

Flood Profile: 54101\_048

Community: Webster County  
Freeboard: 2 ft | CRS Class: 10 | CID: 540203

Location (lat, long): (38.363738, -80.592949) | WGS84  
Location (UTM 17N): (4246251, 535561) | WGS84

External Viewers: [Icons]

Elevation: 2025.5 ft (Source: FEMA 2018-20) | NAVD88

Address: N/A

Parcel: 51-04-0003-0007-0000 | Assessment

Flood Risk Information | Related Resources  
Flood Risk Assessment

The June 2016 Flood High-Water Mark was 9.1 feet for Building 51-04-0003-0007-0000\_91 located near the town Camden-On-Gauley (Webster County) on the Gauley River. The Base Flood Elevation is increasing by 6 feet on the new FEMA flood maps for this location.

# WV Building-Level Flood Risk Assessment

## Building-Level Flood Risk Assessments support:

- Hazard Mitigation Plans
- Floodplain Management
- Community Assisted Visits
- Community Rating System

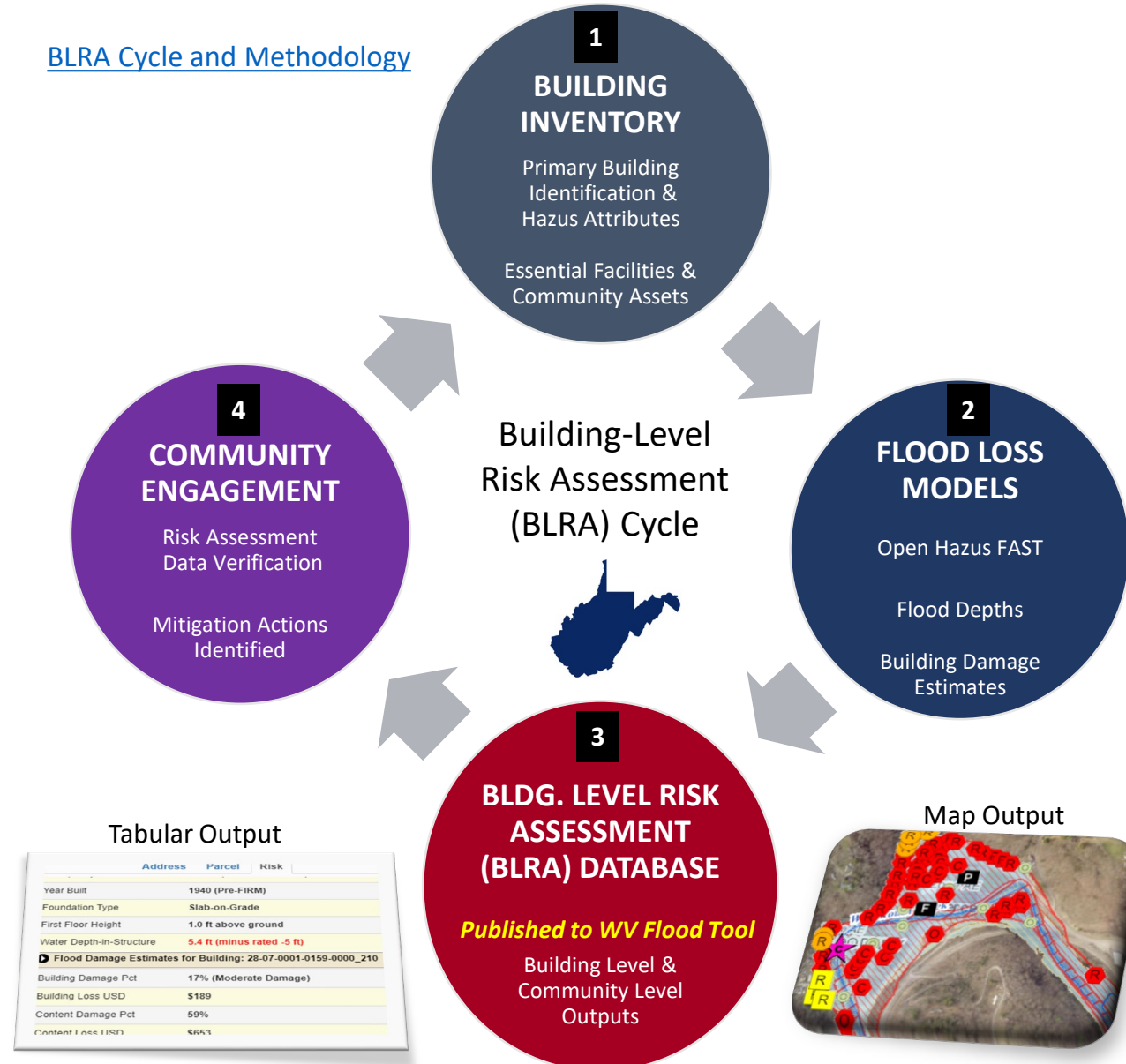
## Benefits

- More detailed and accurate assessments
- Automated scripts generate outputs quickly
- Cost savings through efficiencies
- Helps multiple stakeholders
- Comprehensive Building Risk Spatial Database

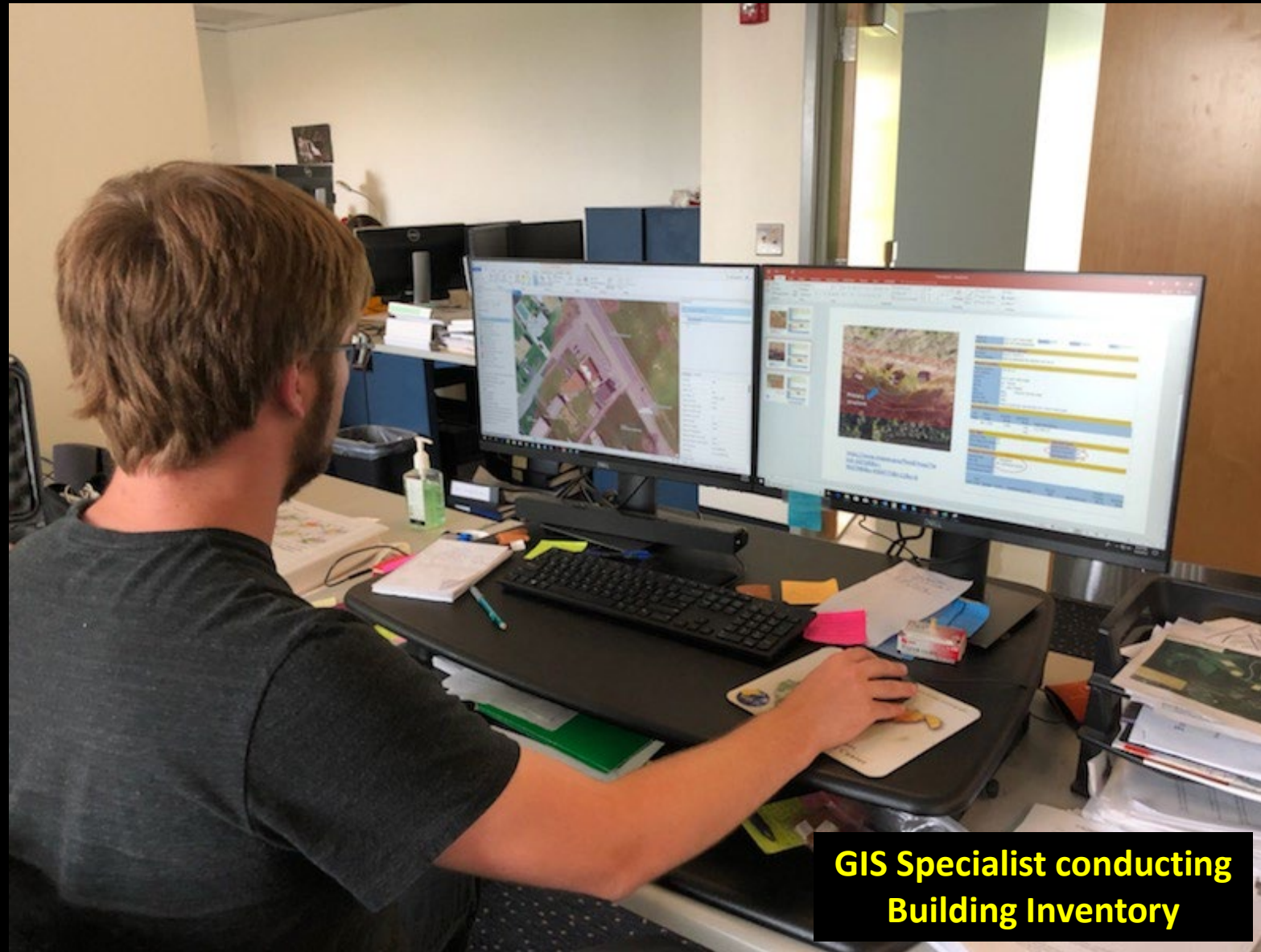
## Methodology

- Consistent methodology statewide
- Semi-automated workflows
- Continuous cycle to improve and update assessments

## BLRA Cycle and Methodology



# Building Inventory



**GIS Specialist conducting  
Building Inventory**

# Access Risk Assessment Info

## Risk Information Index

Risk Assessment Information Index									
1/28/2022									
<a href="#">Data Field Descriptions</a>									
Risk Assessment or Mitigation Layer	REPORT	Key Variable	Community Level (CL)			Building Level (BL) or Feature Level (FL)			
			Table	Graphic		Table	Community Extract	State Extract	Graphic
<b>FLOOD ZONE MAPS &amp; STUDIES</b>									
Flood Zone Breakdown by Length and Area		Zone Length and Area	<a href="#">CL</a>	<a href="#">Yes</a>					<a href="#">GIS</a>
Active Flood Studies and Mapping			<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>				
Model-Backed AZones		<a href="#">Info Sheet</a>	<a href="#">CL</a>	<a href="#">Yes</a>					
<b>FLOODPLAIN BUILDING INVENTORY AND FUTURE MAP CONDITIONS (What at-risk structures are in floodplain?)</b>									
Primary Buildings in High-Risk Effective and Advisory Floodplains – Future Map Conditions		Flood Zone Type	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BLRA</a>			<a href="#">GIS</a>
Verified LOMA Properties Removal Status. Future SFHA Status.		SFHA Status	<a href="#">CL</a>	<a href="#">Yes</a>		<a href="#">BL</a>			<a href="#">GIS</a>
Buildings by Stream Name (Flood Source). Community and stream summaries.		Stream Name	<a href="#">CL</a>	<a href="#">Yes</a>		<a href="#">BLRA</a>	<a href="#">FL</a>	<a href="#">Top List</a>	<a href="#">Yes</a>
<b>SIGNIFICANT STRUCTURES OF IMPORTANCE</b>									
Essential Facilities (0.2% floodplain)	<a href="#">RPT</a>	Facility Type	<a href="#">CL</a>		<a href="#">Yes</a>	<a href="#">BL EC</a>			<a href="#">GIS</a>
Community Assets	<a href="#">RPT</a>	Facility Type	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BL CA</a>			<a href="#">GIS</a>
Historical Community Assets - National Register Areas	<a href="#">RPT</a>	Register Area	<a href="#">CL</a>			<a href="#">NRA</a>			<a href="#">GIS</a>
<b>FLOODPLAIN BUILDING CHARACTERISTICS</b>									
Building Exposure Dollar Value		Building Appraisal, Occupancy	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BLRA</a>	<a href="#">High Value (Top 10%)</a>	<a href="#">Top 100</a>	<a href="#">Yes</a>
Building Single Family (RES1)		Single Family RES1	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BLRA</a>		<a href="#">Top 100</a>	<a href="#">Yes</a>
Building Manufactured Homes (RES2)		Mobile Home RES2	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BLRA</a>		<a href="#">Top 100</a>	<a href="#">GIS</a>
Building Year and FIRM Status (Pre-FIRM/Post-FIRM)		Initial FIRM Date, Building Year	<a href="#">CL</a>	<a href="#">Yes</a>		<a href="#">BLRA</a>			<a href="#">GIS</a>
Building Median Value		Median Value	<a href="#">CL</a>	<a href="#">Yes</a>	<a href="#">Yes</a>	<a href="#">BLRA</a>			<a href="#">GIS</a>
Building Median Year		Building Year	<a href="#">CL</a>	<a href="#">Yes</a>		<a href="#">BLRA</a>			<a href="#">GIS</a>
Foundation Type and Basement		Foundation Type				<a href="#">BLRA</a>			<a href="#">GIS</a>
<b>FLOOD DAMAGE LOSS ESIMATES (1% FLOOD EVENT) (What is degree of Flood Risk?)</b>									

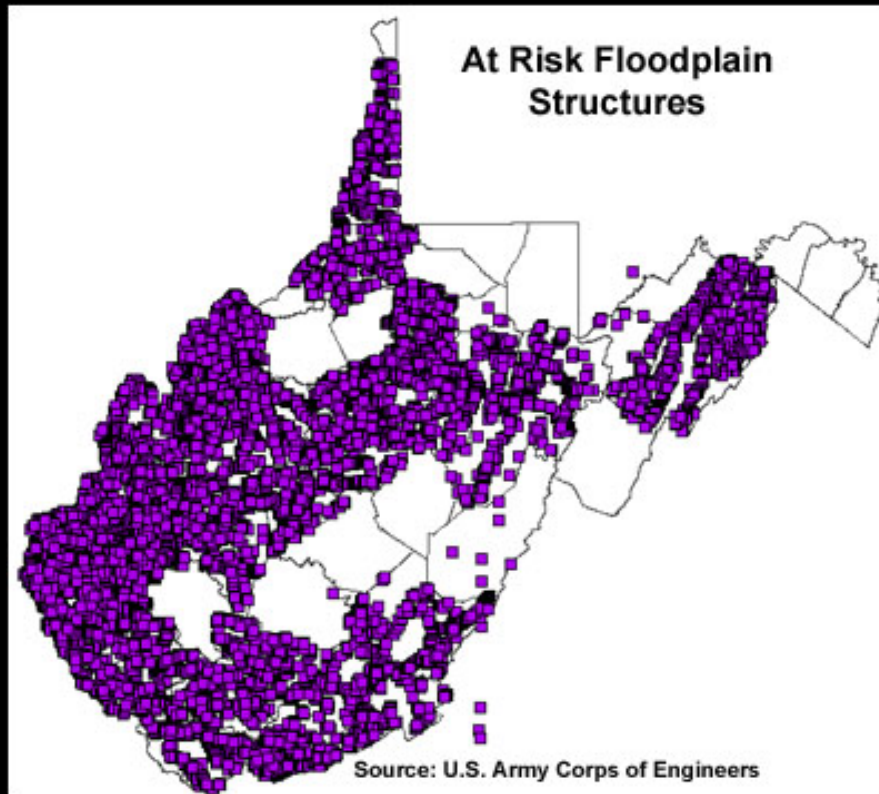
## Building Level Risk Assessment (BLRA) Products

- **GIS Files**
- **Tables (Excel)**
  - Community Level (CL)
  - Building (or Feature) Level (BL) with links to online maps
    - Table Extracts
    - Top Lists
- **Maps**
  - Interactive Web Maps
  - Graphics and Maps
- **Reports (Word Docs)**
- **3D Flood Visualizations**

Most of the risk assessment data can be viewed on the **RiskMAP View** of the [WV Flood Tool](#)

# 2002 USACE Building Inventory

## Building Inventories

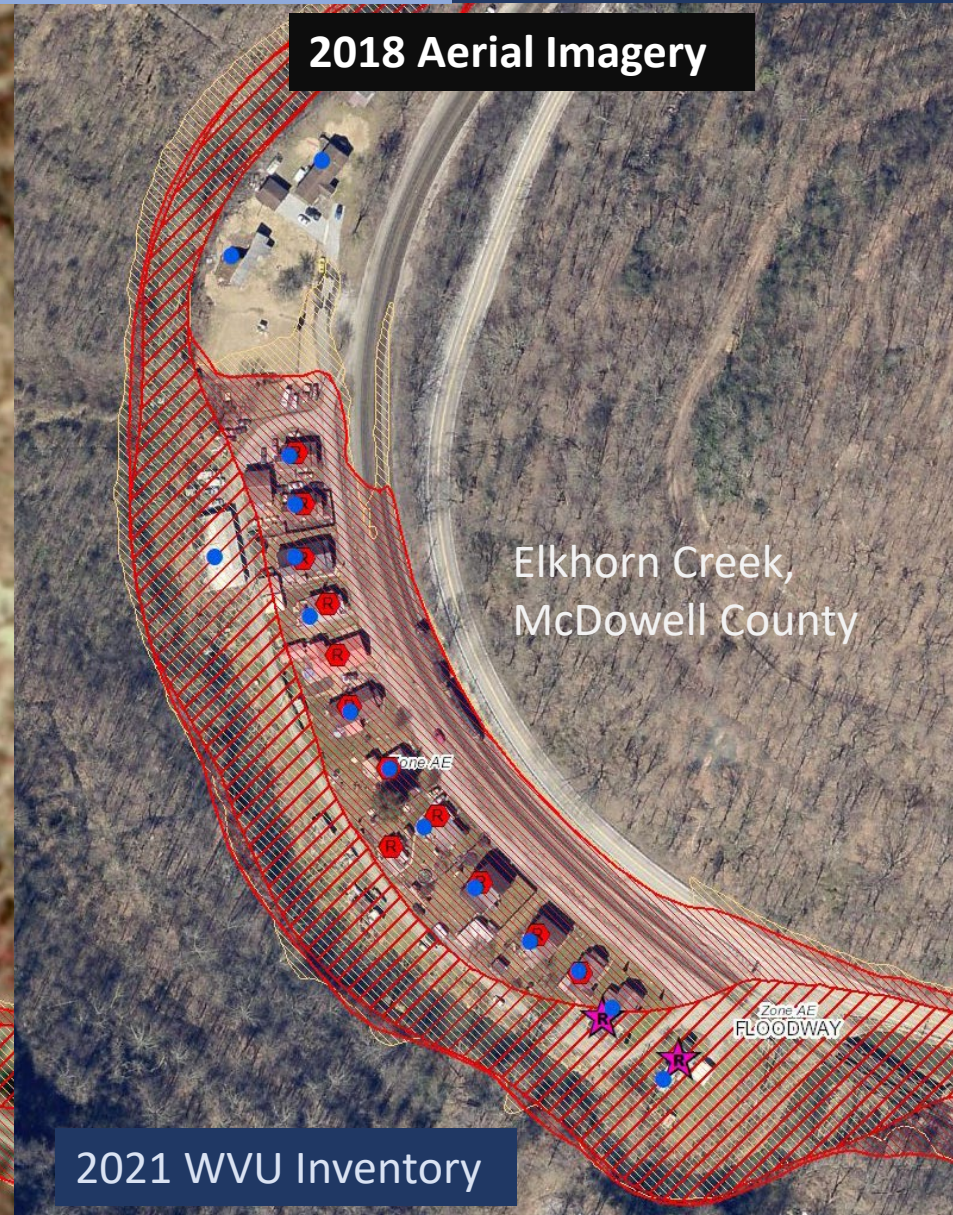
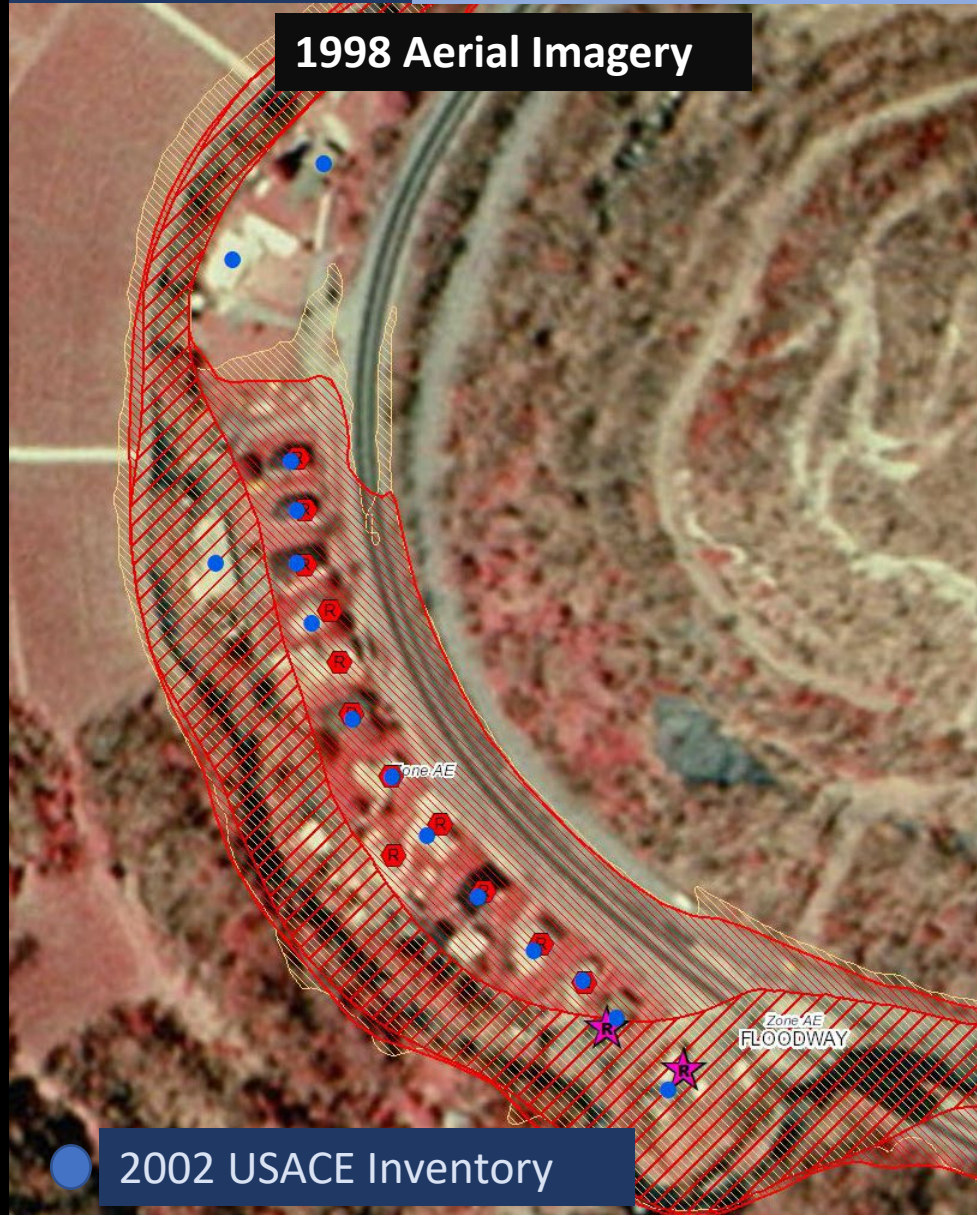


Nearly 20 years ago more than **80,000 structures** in the floodplain were inventoried by the **Pittsburgh District Army Corps of Engineers** using statewide 1996-99 1-meter resolution Digital Orthophoto Quarter Quads. A combination of FEMA's Q3 and DFIRM floodplain data (available for 37 of the 55 counties) was overlaid onto DOQQ's.

<< USACE Inventoried Floodplain Structures >>  
<http://wvgis.wvu.edu/data/dataset.php?ID=230>

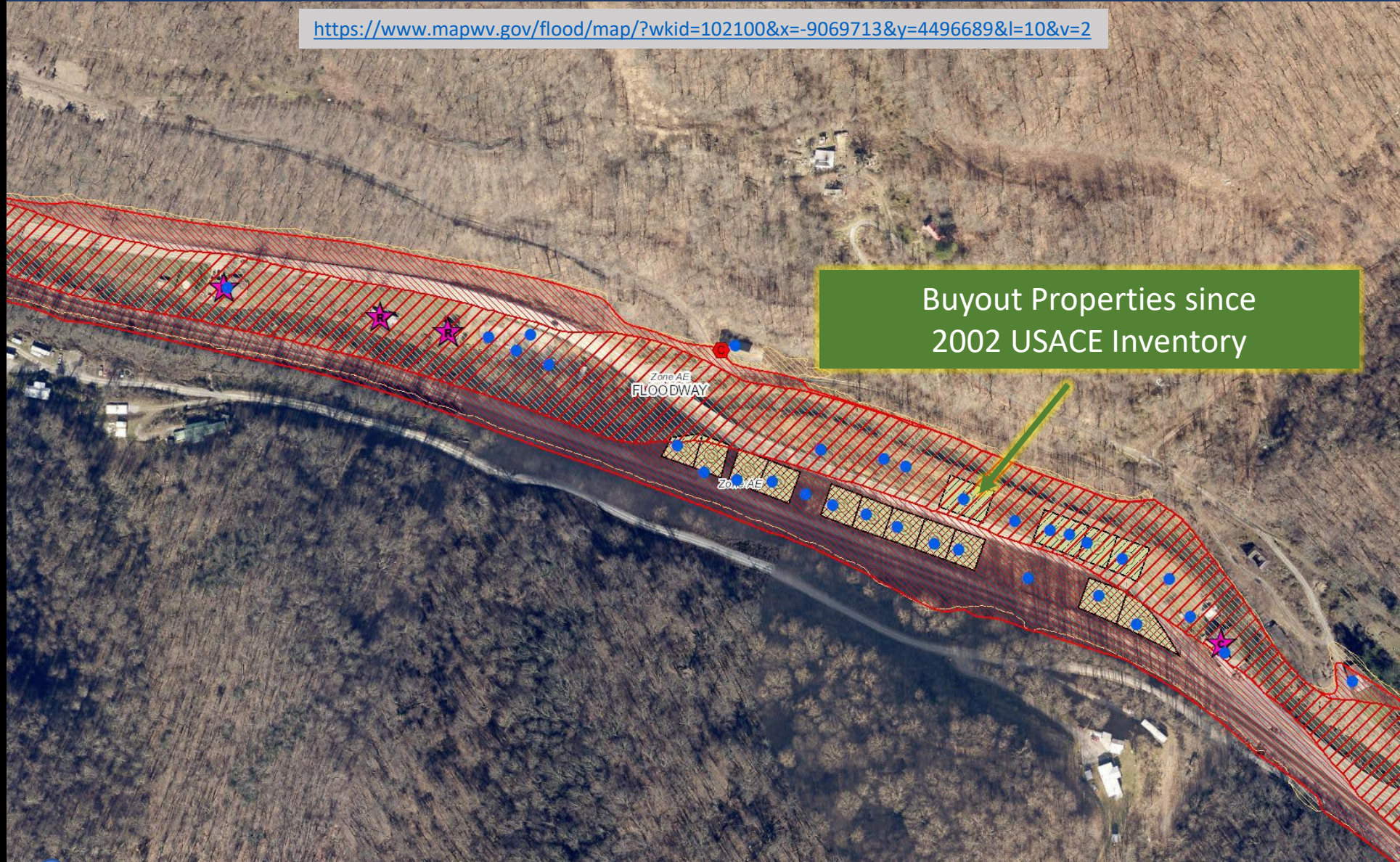
# Statewide Building Inventories

<https://www.mapwv.gov/flood/map/?wkid=102100&x=-9070843&y=4497058&l=11&v=2>



# USACE 2002 Building Inventory

<https://www.mapwv.gov/flood/map/?wkid=102100&x=-9069713&y=4496689&l=10&v=2>



● 2002 USACE Inventory

Elkhorn Creek, McDowell County

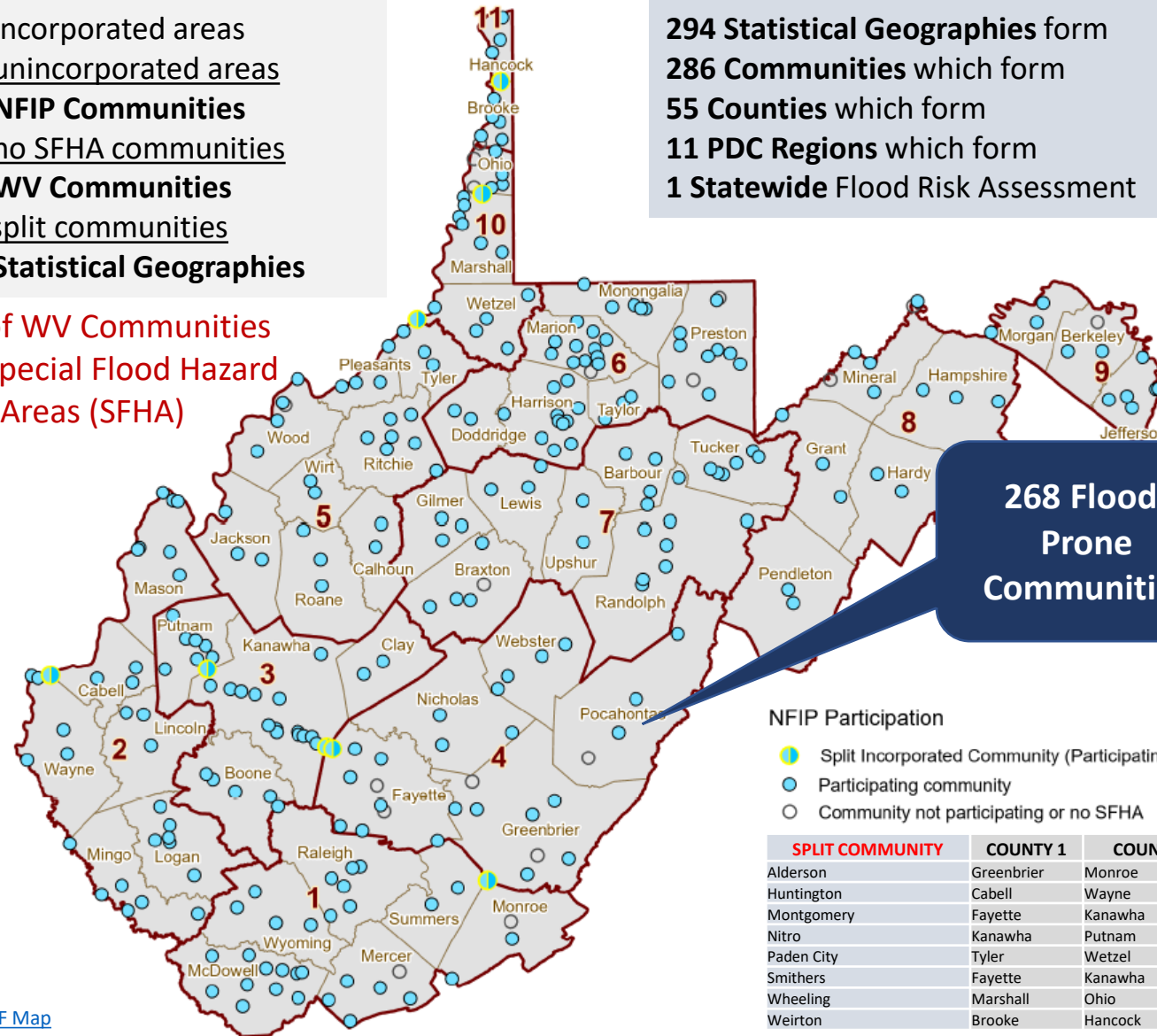


# Statewide Hazard Assessment

213 incorporated areas  
 +55 unincorporated areas  
**268 NFIP Communities**  
 +18 no SFHA communities  
**286 WV Communities**  
 + 8 split communities  
**294 Statistical Geographies**

**294 Statistical Geographies** form  
**286 Communities** which form  
**55 Counties** which form  
**11 PDC Regions** which form  
**1 Statewide Flood Risk Assessment**

94% of WV Communities  
 have Special Flood Hazard  
 Areas (SFHA)



**268 Flood-Prone Communities**

### NFIP Participation

- Split Incorporated Community (Participating)
- Participating community
- Community not participating or no SFHA

SPLIT COMMUNITY	COUNTY 1	COUNTY 2
Alderson	Greenbrier	Monroe
Huntington	Cabell	Wayne
Montgomery	Fayette	Kanawha
Nitro	Kanawha	Putnam
Paden City	Tyler	Wetzel
Smithers	Fayette	Kanawha
Wheeling	Marshall	Ohio
Weirton	Brooke	Hancock

[PDF Map](#)

# Statewide Building Inventory

## Building Estimates

- **84,351 structures in SFHA**
- **13,996 structures in “High-Risk” Advisory (Orange Zones)**
- **354 Essential Facilities in High-Risk Flood Zones**  
(K-12 Schools, 911 Centers, Police/Fire Stations Depts., Hospitals, Nursing Homes)
- **38 Essential Facilities in Regulatory Floodway**
- **503 Essential Facilities total in both high and moderate risk floodplains**

## Buildings Pre-FIRM/Post-FIRM

- **67% are Pre-FIRM (majority)**
- 26% are Post-FIRM
- 7% are unknown

*Based on **Building Year** of assessment data*

**All ESSENTIAL FACILITIES SHOULD BE FIELD VERIFIED**

Community	Buildings in SFHA
Kanawha County*	8,890
Logan County*	5,247
Mingo County*	3,393
Boone County*	3,313
Wheeling**	2,836
Lincoln County*	2,563
McDowell County*	2,408
Raleigh County*	2,252
Mercer County*	2,233
Wyoming County*	2,226
Wayne County*	2,221
Putnam County*	1,902
Cabell County*	1,887
Charleston	1,872
Wood County*	1,562
Fayette County*	1,528
Randolph County*	1,268
Greenbrier County*	1,182
Marion County*	1,162
Huntington**	1,148

# Countywide Building Counts (Top 20)

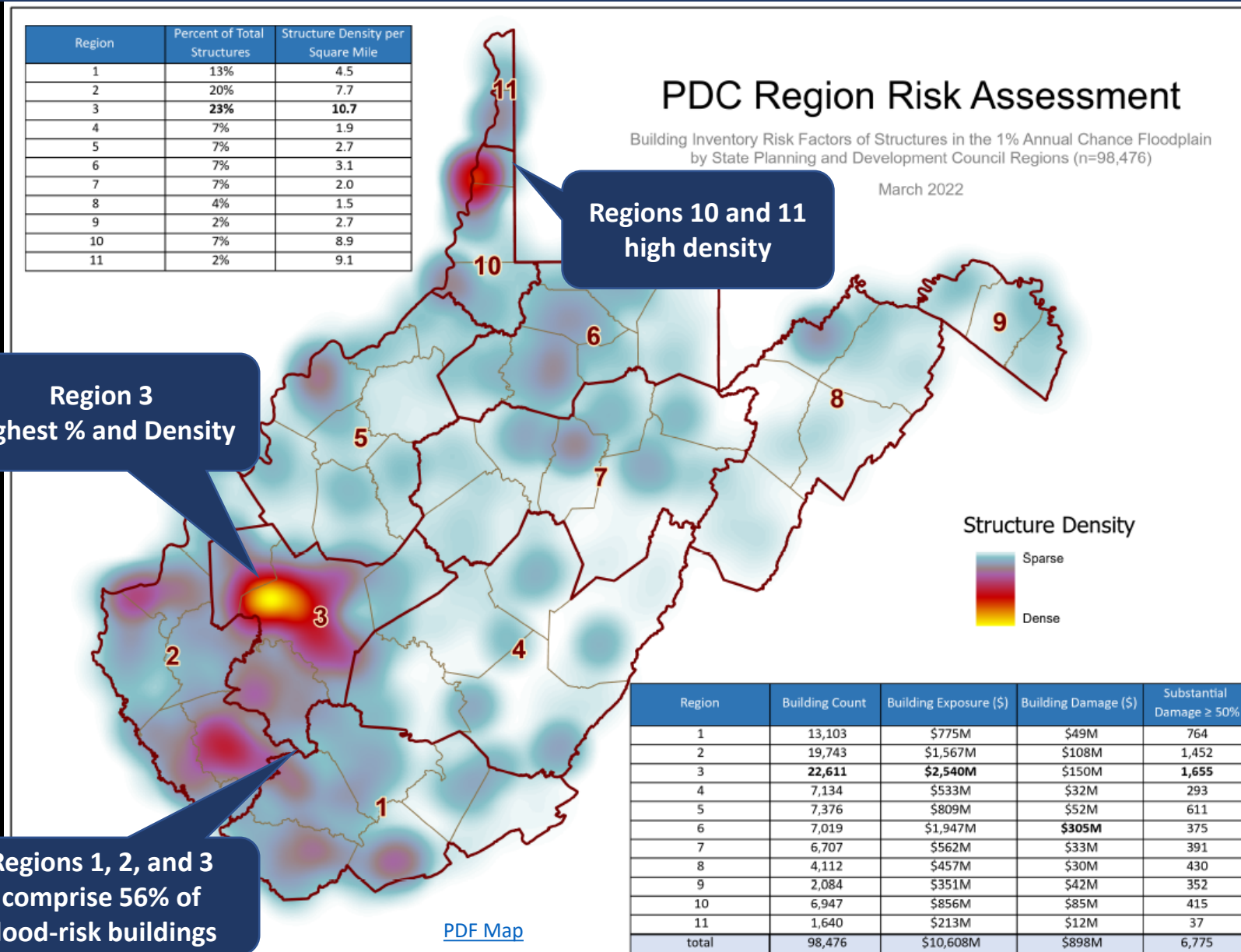
Primary buildings in the **High-Risk effective and advisory 1%-annual chance (100-yr) floodplains**

Rank	County	Region #	BUILDING TYPE				HIGH-RISK FLOOD ZONES			Floodplain Building Ratio
			% Residential	% Commercial	% Other	% Unknown	Effective	Advisory	Total Bldg. Count	
1	KANAWHA	3	89%	7%	3%	1%	12,847	2,071	14,918	15%
2	LOGAN	2	87%	9%	3%	2%	4,539	939	5,478	30%
3	MCDOWELL	1	87%	5%	3%	5%	3,678	1,395	5,073	26%
4	BOONE	3	78%	6%	3%	13%	3,727	1,068	4,795	39%
5	MINGO	2	86%	5%	5%	4%	3,114	749	3,863	24%
6	OHIO	10	85%	9%	5%	0%	3,142	175	3,317	17%
7	WYOMING	1	90%	5%	4%	1%	2,019	1,145	3,164	24%
8	CABELL	2	86%	7%	5%	2%	2,368	518	2,886	7%
9	GREENBRIER	4	78%	8%	12%	2%	1,714	1,004	2,718	12%
10	RALEIGH	1	84%	8%	8%	1%	2,350	363	2,713	6%
11	LINCOLN	2	83%	3%	14%	1%	2,555	91	2,646	22%
12	WAYNE	2	89%	4%	5%	2%	2,421	219	2,640	12%
13	WOOD	5	87%	7%	6%	0%	2,463	103	2,566	6%
14	MERCER	1	89%	6%	4%	1%	2,295	206	2,501	7%
15	PUTNAM	3	85%	5%	10%	0%	2,066	384	2,450	9%
16	WETZEL	10	71%	7%	21%	1%	2,006	91	2,097	21%
17	MASON	2	67%	4%	27%	3%	1,859	95	1,954	13%
18	RANDOLPH	7	78%	7%	11%	4%	1,697	225	1,922	11%
19	HARRISON	6	80%	6%	13%	1%	1,475	409	1,884	5%
20	FAYETTE	4	85%	7%	7%	1%	1,254	551	1,805	7%

Top 5 Counties with **highest building counts**: Kanawha (14,918), Logan (5,478), and McDowell (5,073), Boone (4,795), and Mingo (3,683)

Top 5 counties with **highest percentage of countywide buildings in the high-risk floodplains**: Boone (39%), Logan (30%), McDowell (26%), Wyoming (24%), Mingo (24%), and Lincoln (22%)

# Building Risk by Region

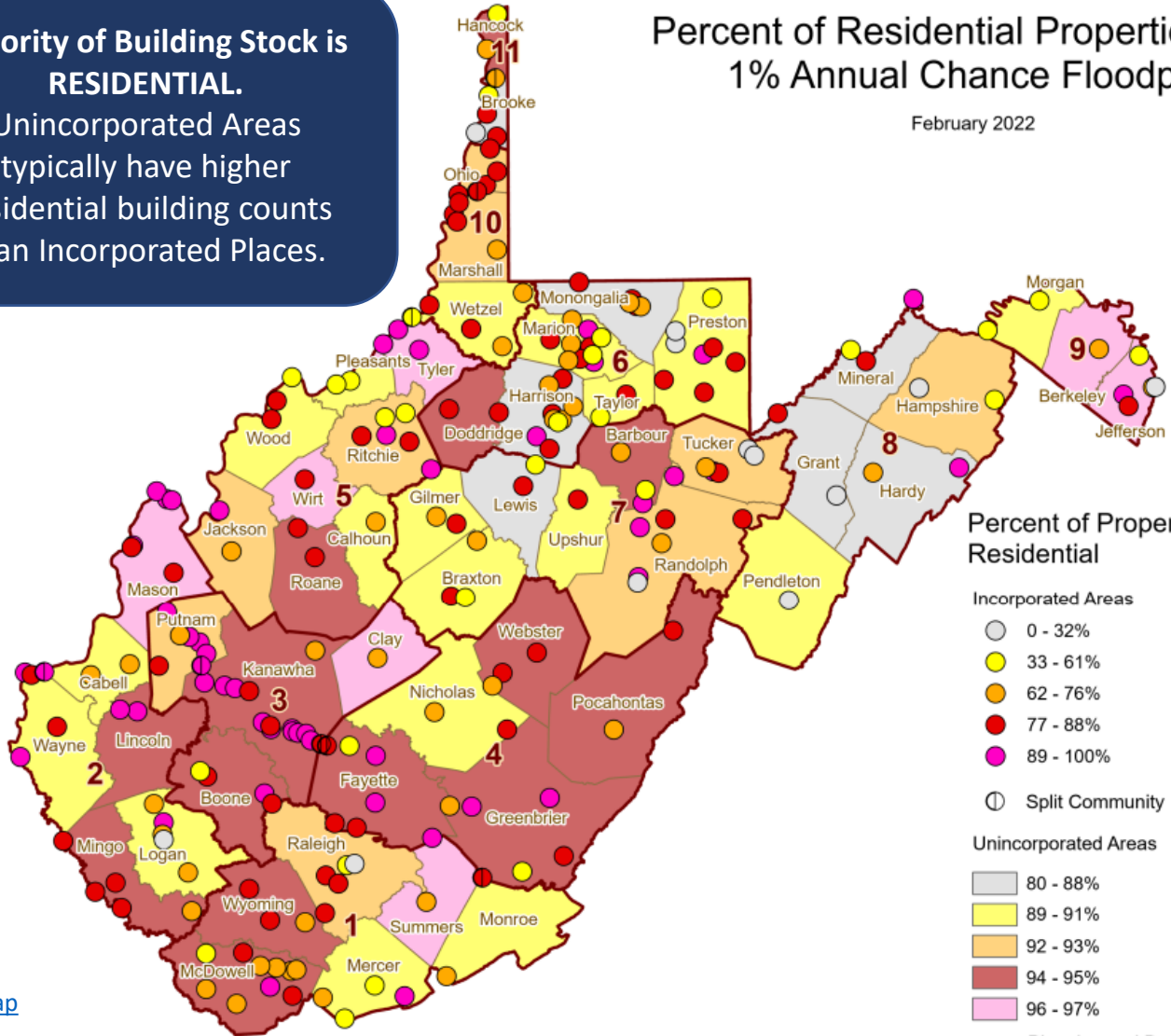


# Residential % of Building Stock

**Majority of Building Stock is RESIDENTIAL.**  
Unincorporated Areas typically have higher residential building counts than Incorporated Places.

## Percent of Residential Properties in the 1% Annual Chance Floodplain

February 2022

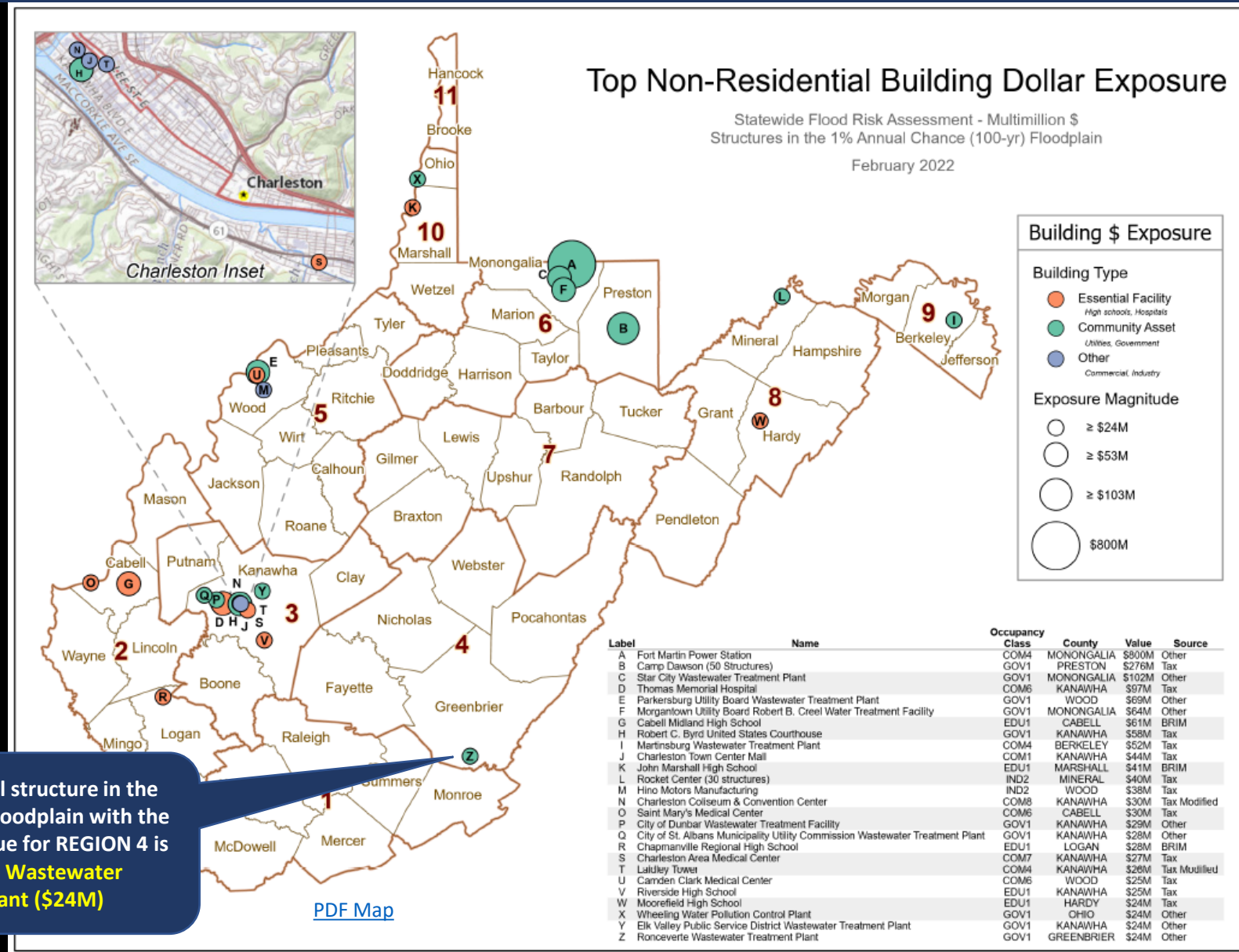


### Percent of Properties that are Residential

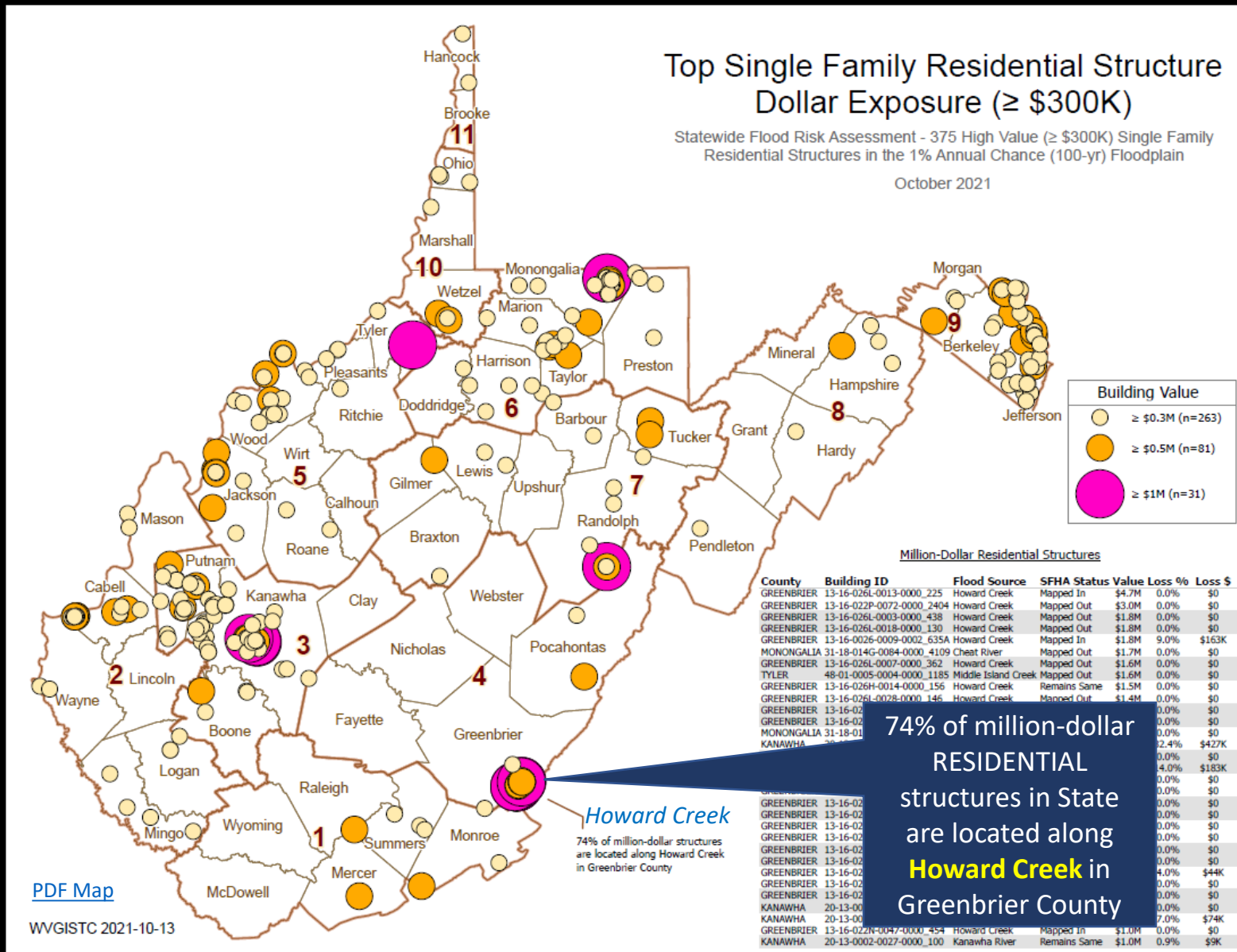
- Incorporated Areas**
  - 0 - 32%
  - 33 - 61%
  - 62 - 76%
  - 77 - 88%
  - 89 - 100%
  - Split Community
- Unincorporated Areas**
  - 80 - 88%
  - 89 - 91%
  - 92 - 93%
  - 94 - 95%
  - 96 - 97%
- Planning and Development Council Region

[PDF Map](#)

# Non-Residential Building Exposure



# Residential: Top Single-Family \$ Exposure



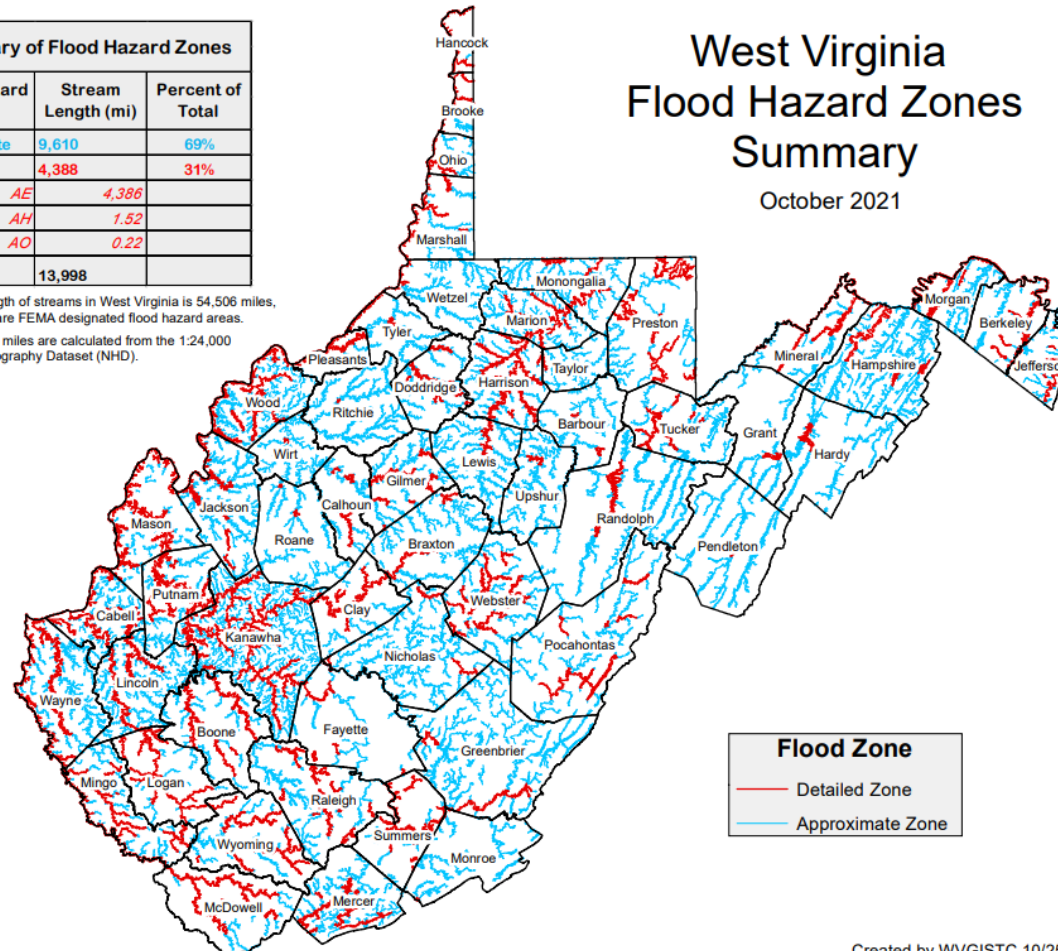
# Building Stock in Flood Zones

Although only 31% of the State has mapped **Detailed Flood Zones** (AE / AO / AH), the **Detailed Flood Zones** contain 65% of the Building Stock Located in SFHA. Most of the buildings are in mapped **Detailed Flood Zones**.

Summary of Flood Hazard Zones		
Flood Hazard Zone	Stream Length (mi)	Percent of Total
Approximate	9,610	69%
Detailed	4,388	31%
AE	4,386	
AH	1.52	
AO	0.22	
<b>Total</b>	<b>13,998</b>	

† The total length of streams in West Virginia is 54,506 miles, of which 38% are FEMA designated flood hazard areas.

†† The stream miles are calculated from the 1:24,000 National Hydrography Dataset (NHD).



[PDF Map](#)

Created by WVGISTC 10/25/2021

## FLOOD HAZARD ZONES

- Stream Miles Length
- 69% Approximate A
- 31% Detailed Zones

## Special Flood Hazard Area

- 84,351 buildings
- 35% in Approximate Zone A
- 65% in Detailed Zone AE (9% in Regulatory Floodway)

## BUILDINGS IN NON-REGULATORY ZONES

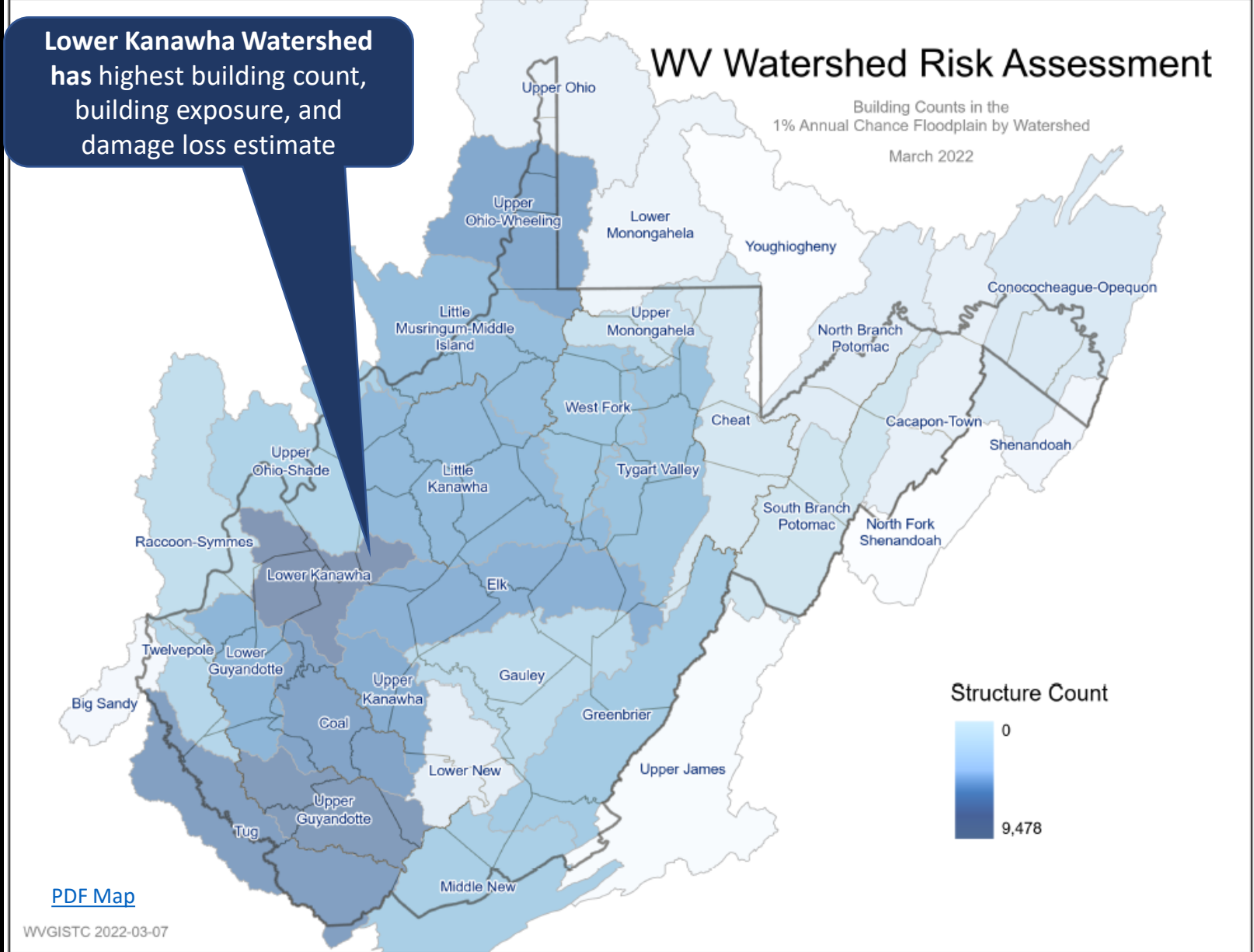
- 13,966 Structures (14%) mapped in High-Risk Zone Advisory A / AE
- 98,317 Total High-Risk

## BUILDINGS IN SHADED X

- Moderate Risk
- 44,415 structures in 500-YR floodplains
- 9,718 structures in Levee Protected Zones



# Building Risk by Watershed



# R4 Building Risk by Flood Source

## Building Counts and Building Exposure \$ Values by Stream Name

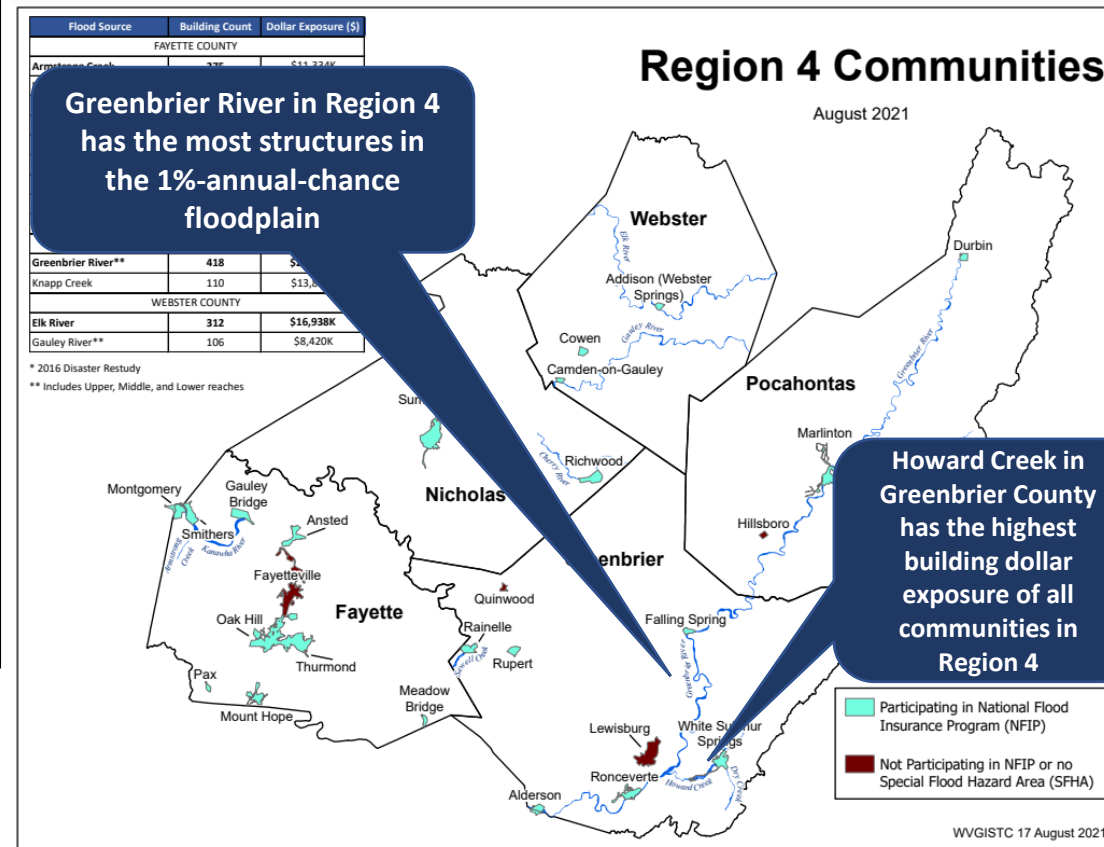
Flood Sources	Building Count	Dollar Exposure (\$)
FAYETTE COUNTY		
Armstrong Creek	275	\$13,334K
Kanawha River	242	\$46,459K
GREENBRIER COUNTY		
Greenbrier River*	528	\$60,728K
Howard Creek*	364	\$94,870K
Sewell Creek*	333	\$14,716K
Dry Creek	197	\$19,183K
NICHOLAS COUNTY		
Cherry River*	374	\$15,719K
POCAHONTAS COUNTY		
Greenbrier River**	418	\$29,097K
Knapp Creek	110	\$13,882K
WEBSTER COUNTY		
Elk River	312	\$16,938K
Gauley River**	106	\$8,420K

Computed for 1% (100-yr) floodplain

\* 2016 Disaster Restudy

RA Tables: [Buildings by River/Stream Name](#)

Greenbrier River totals for Greenbrier and Pocahontas counties:  
946 buildings in 1% floodplain, \$90M dollar exposure

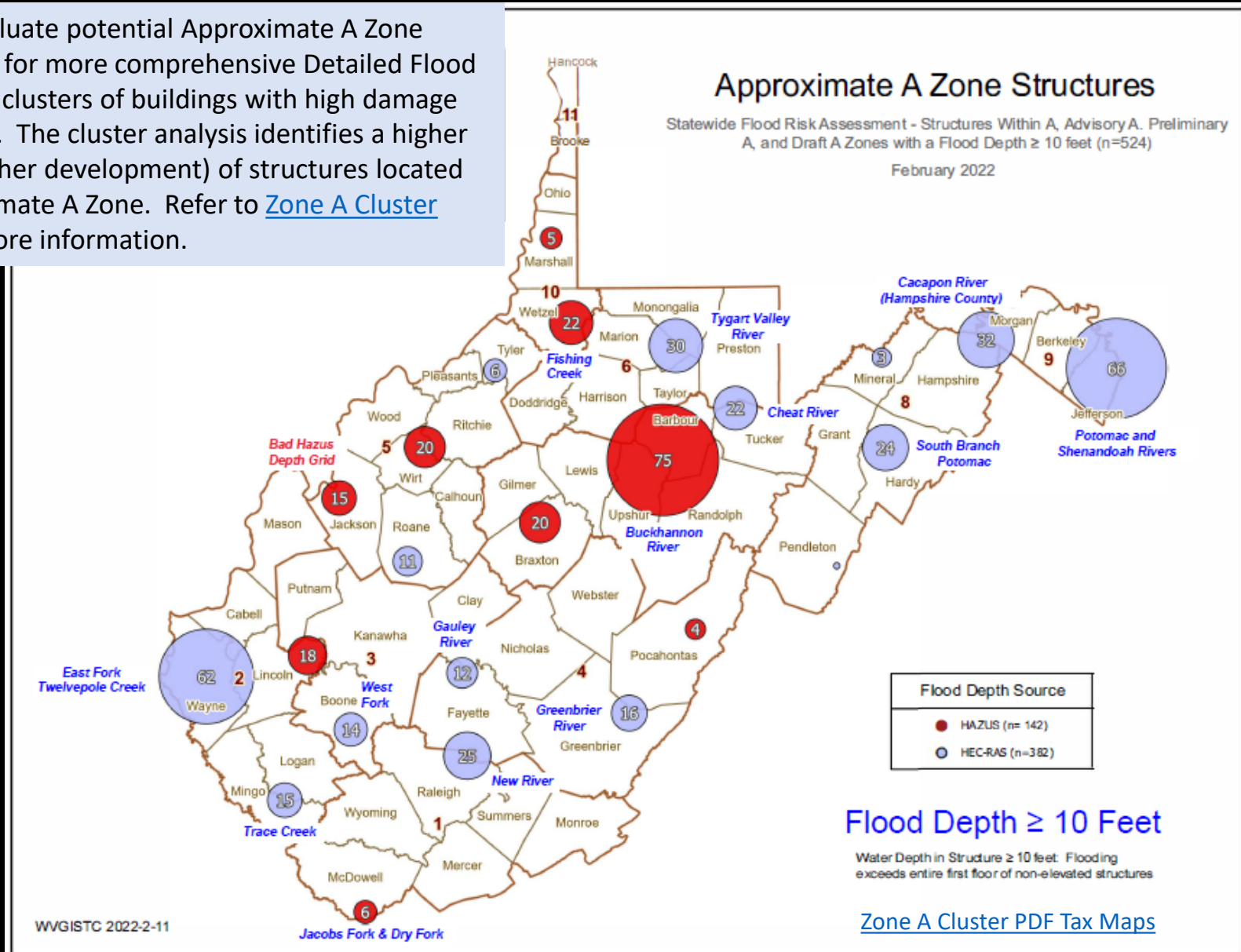


# Zone A Building Cluster Analysis

Flood Map Discovery:  
Zone A conversion to Detailed Zone AE

# Potential Detailed Flood Studies

*Objective:* Evaluate potential Approximate A Zone rivers/streams for more comprehensive Detailed Flood Studies where clusters of buildings with high damage potential exist. The cluster analysis identifies a higher density (or higher development) of structures located in the Approximate A Zone. Refer to [Zone A Cluster Analysis](#) for more information.



# Potential Detailed Flood Studies

Rank	1	2	3	4	5
<b>BUILDING COUNT</b>	<i>Buckhannon</i> 47	<i>East Fork Twelvepole</i> 42	<i>Potomac</i> 38	<i>Shenandoah</i> 31	<i>Cacapon</i> 28
<b>BUILDING DOLLAR EXPOSURE</b>	<i>Shenandoah</i> \$10.7M	<i>Cheat</i> \$3.1M	<i>Buckhannon</i> \$2.0M	<i>Tygart Valley</i> \$2.0M	<i>Potomac</i> \$1.9M
<b>BUILDING DAMAGE LOSS</b>	<i>Shenandoah</i> \$5.5M	<i>Cheat</i> \$1.7M	<i>Potomac</i> \$1.3M	<i>Buckhannon</i> \$1.3M	<i>Tygart Valley</i> \$1.3M
<b>DAMAGE ≥ 50%</b>	<i>Buckhannon</i> 44	<i>East Fork Twelvepole</i> 38	<i>Potomac</i> 35	<i>Shenandoah</i> 25	<i>Cacapon</i> 25

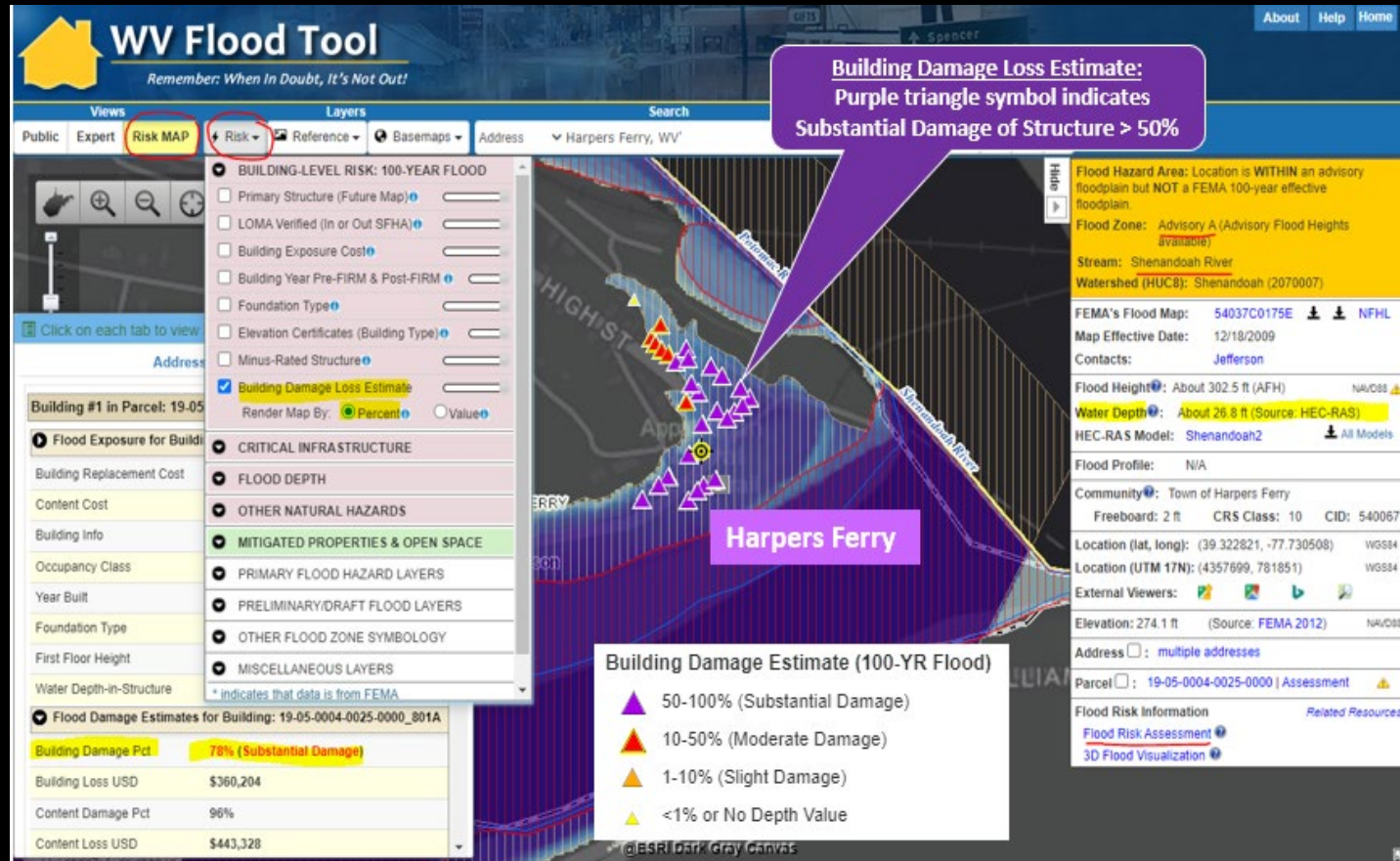
*Water Depth in Structure ≥ 10 feet:* Flooding exceeds entire first floor of non-elevated structures

River/Stream Name	Flood Depth Value (ft.)	Web Link	County	Flood Depth Source	Hazard Occupancy Code	Building Exposure (\$)
Shenandoah River	33.0	<a href="#">FT</a>	JEFFERSON COUNTY	HEC-RAS	COM8	532,300
South Branch Potomac	28.5	<a href="#">FT</a>	HARDY COUNTY	HEC-RAS	RES2	1,710
Gauley River	24.3	<a href="#">FT</a>	FAYETTE COUNTY	HEC-RAS	RES1	9,000
Beech Fork	24.2	<a href="#">FT</a>	WAYNE COUNTY	HEC-RAS	GOV1	496,266
New River	20.6	<a href="#">FT</a>	FAYETTE COUNTY	HEC-RAS	RES1	18,100

*Highest Building Flood Depth for Approximate A Zone Rivers/Streams (table extract).* Sorted on building flood depth. Click on Flood Tool map link to view location.

# Potential Detailed Flood Studies

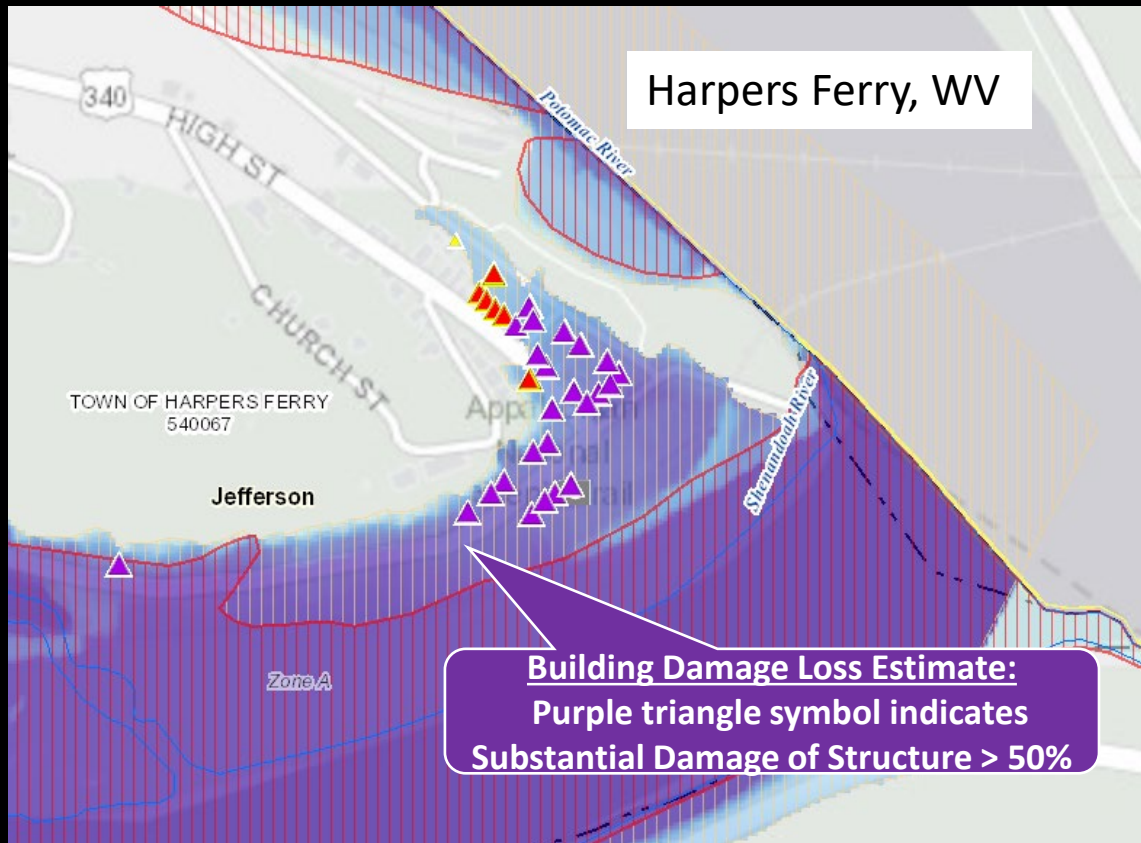
*WV Flood Tool's Risk MAP View – Building Damage Loss Estimate Percent Layer:* In the Risk MAP View of the WV Flood Tool, the risk assessment layer, **Building Damage Loss Estimate (%)**, provides a relationship between high flood depths and flood loss estimates of substantially damaged structures (> 50% damage). High building-level damage percentages typically correlate to structures in Approximate A Zones with high base flood depths for a 1% annual chance flood.



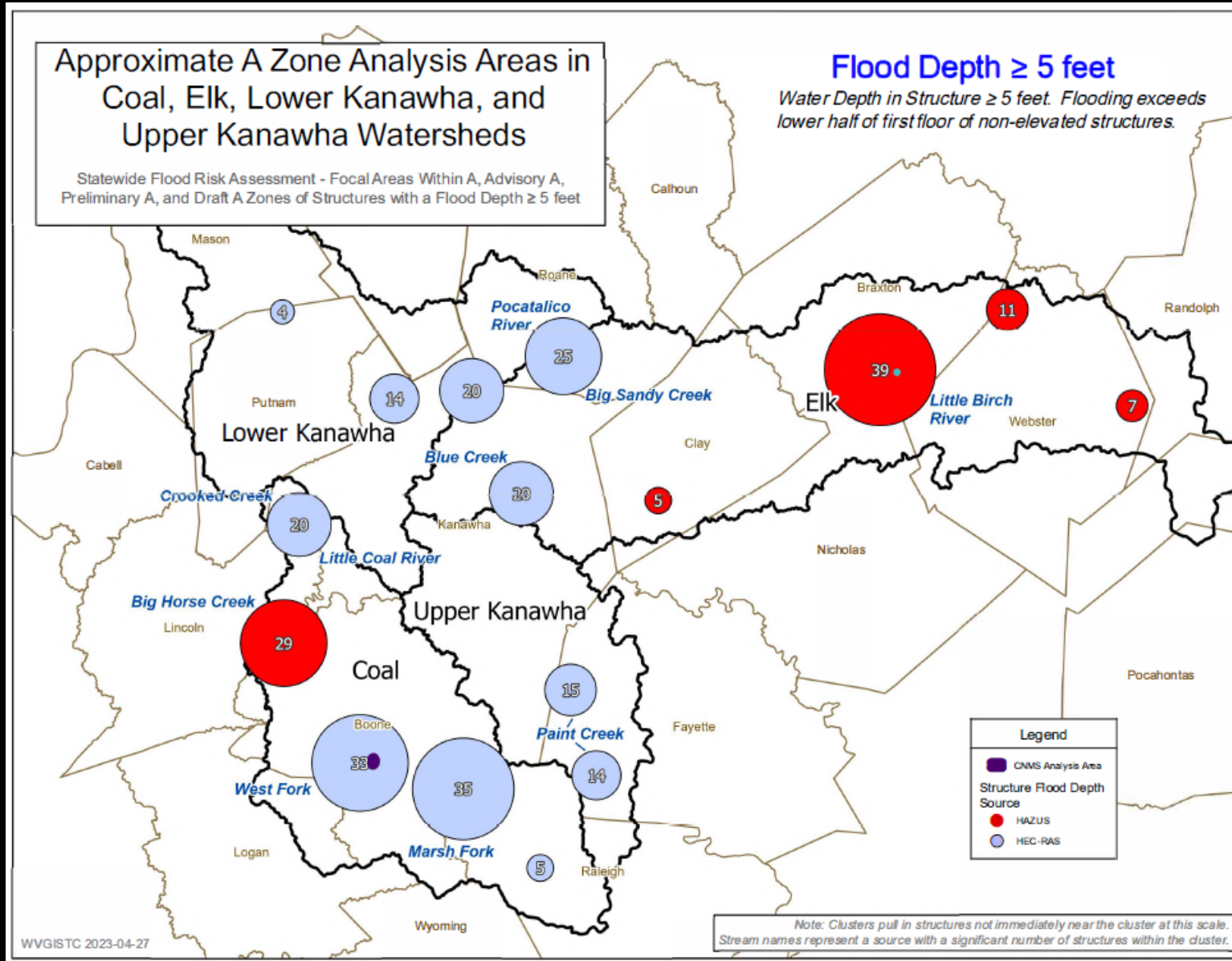
# Potential Detailed Flood Studies

## Shenandoah River (Harpers Ferry) Zone A Cluster

A high-value wastewater treatment plant is associated with the high building exposure values of this Zone A cluster. Building 19-05-0004-0025-0000\_744 has high-water marks on building side.



# Potential Detailed Flood Studies – Kanawha Basin



[Zone A Cluster PDF Tax Maps](#)



# Potential Detailed Flood Studies – Kanawha Basin

Rank	1	2	3	4	5	6
BUILDING COUNT	<i>Marsh Fork</i>	<i>Little Birch River</i>	<i>West Fork</i>	<i>Big Horse Creek</i>	<i>Paint Creek</i>	<i>Blue Creek</i>
	31	28	21	20	18	17
BUILDING DOLLAR EXPOSURE	<i>Pocatalico River</i>	<i>Little Birch River</i>	<i>Marsh Fork</i>	<i>Elk River</i>	<i>Big Horse Creek</i>	<i>West Fork</i>
	\$6.74M	\$1.61M	\$1.45M	\$1.18M	\$778K	\$682K
BUILDING DAMAGE LOSS	<i>Pocatalico River</i>	<i>Little Birch River</i>	<i>West Fork</i>	<i>Marsh Fork</i>	<i>Big Horse Creek</i>	<i>Blue Creek</i>
	\$867K	\$683K	\$460K	\$415K	\$264K	\$238K
DAMAGE ≥ 50%	<i>West Fork</i>	<i>Marsh Fork</i>	<i>Little Birch River</i>	<i>Pocatalico River*</i>	<i>Big Horse Creek*</i>	<i>Blue Creek</i>
	20	17	14	7	7	7
BUILDING DENSITY per mile	<i>West Fork</i>	<i>Marsh Fork</i>	<i>Crooked Creek</i>	<i>Little Birch River</i>	<i>Pocatalico River</i>	<i>Big Horse Creek</i>
	22.1	14.1	11.5	4.7	4.0	3.6
Zone AE Cost per mile	<i>Crooked Creek</i>	<i>West Fork</i>	<i>Marsh Fork</i>	<i>Pocatalico River</i>	<i>Big Horse Creek</i>	<i>Little Birch River</i>
	\$634	\$2,375	\$5,500	\$8,200	\$13,750	\$14,975

*\*Pocatalico River, Big Horse Creek, Blue Creek, and Paint Creek all have 7 structures with damage ≥ 50%*

*Red stream names indicate less accurate HAZUS depth grids*

# WV Risk Assessment – Community Engagement

- Elevation Certificates
- Buyout Properties
- Mitigated Structure Verification
- Potential Structures for Mitigation
- SFHA Outreach Letters to Property Owners
- Preload Structures in FEMA SDE Software

# Buyout Properties - Verification

Buckhannon, WV

**WV Flood Tool**  
Remember: When In Doubt, It's Not Out!

Views: Public Expert **Risk MAP** Risk Reference Basemaps  
Layers: Address: Buckhannon, wv  
Search: Buckhannon, wv  
Tools: [Navigation icons]

**Elevation Certificate of Elevated Structure (Bldg. Diagrams 5-8)**

**Verify MITIGATED STRUCTURE**

**Verify BUYOUT PROPERTY Parcel**

**Flood Hazard Area:** Location is WITHIN the FEMA 100-year floodplain and floodway.  
**Flood Zone:** AE (Floodway)  
**Stream:** Buckhannon River  
**Watershed (HUC8):** Tygart Valley (5020001)

**FEMA's Flood Map:** 54097C0127D [Download](#) [NFHL](#)  
**Map Effective Date:** 9/29/2010  
**Contacts:** [Upshur](#)

**Flood Height:** 1414.7 ft (BFE - Non-Restudy) [NAVD88](#)  
**Water Depth:** About 3.6 ft (Source: HEC-RAS)  
**HEC-RAS Model:** N/A [All Models](#)

**Flood Profile:** 54097\_001

**Community:** City of Buckhannon  
**Freeboard:** 1.5 ft **CRS Class:** 8 **CID:** 540199

**Location (lat, long):** (38.995908, -80.216016) [WGSS4](#)  
**Location (UTM 17N):** (4316614, 567891) [WGSS4](#)

**External Viewers:** [Share](#) [Print](#) [Facebook](#) [Twitter](#)

**Elevation:** 1410.6 ft (Source: [SAMS 2003](#)) [NAVD88](#)  
**Address:** N/A  
**Parcel:** 49-03-0005-0017-0000 | [Assessment](#)

**Flood Risk Information** [Related Resources](#)  
**Flood Risk Assessment:** N/A  
[3D Flood Visualization](#)

Mitigated Buyout Parcels (Deed Restricted)	
<b>Parcel ID</b>	49-03-0005-0017-000
<b>Community</b>	City of Buckhannon
<b>Source Agency</b>	Buckhannon
<b>Project ID</b>	<input type="checkbox"/>
<b>Date Executed</b>	-
<b>Hazard Type</b>	Flood
<b>Current Owner</b>	CITY OF BUCKHANNON
<b>Current Deed</b>	Book: 419   Page: 566   1.62-ac
<b>Parcel Report</b>	<a href="#">Assessment Link</a>
<b>LAT, LON</b>	(38.996039, -80.21613)

Scale: 1:4,514  
x: -80.210920, y: 38.995341  
@ESRI Street Map

# Elevation Certificate of Mitigated Structure

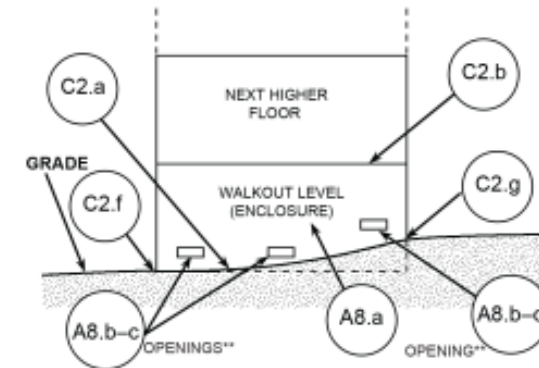
## Elevated Building on Solid Foundation Walls (Full-Story)



**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.

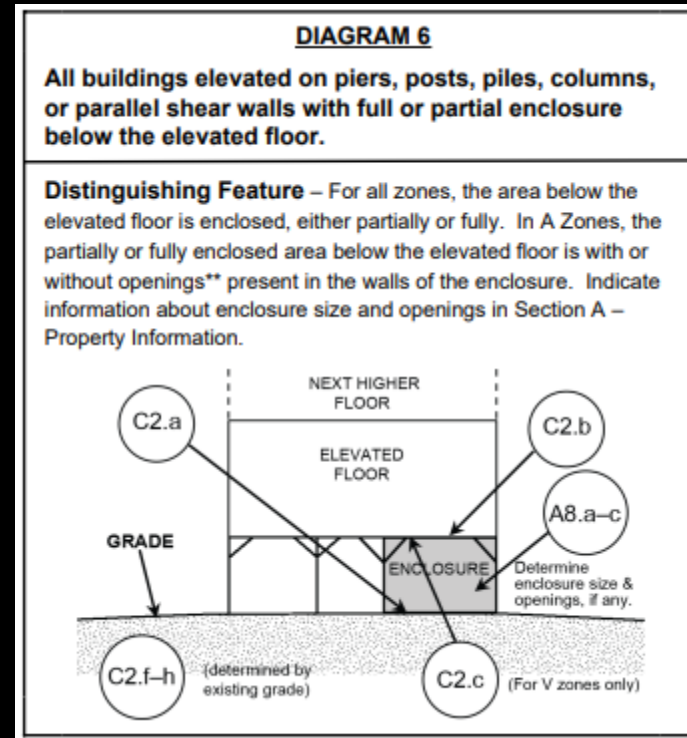


# Mitigated Structure – EC Bldg. #6

Building Diagram 6: Elevated Building with Enclosure (using piers, piles, posts)



Partial Enclosure



# Mitigated Structure – EC First Floor Height - #7

**WV Flood Tool**  
Remember: When In Doubt, It's Not Out!

Views: Public, Expert, Risk MAP, Risk, Reference, Basema

Layers: Flood Hazard Area: Location is WITHIN the FEMA 100-year floodplain. Flood Zone: AE. Stream: Elk River.

**Base Flood Depth is 6.7 ft.**

**Newly built Elevated Structure not shown on aerial imagery**

Flood Elev (ft): 629.54  
Height above ground (ft): 6

Flood Height: Refer to FIS report for BFE  
Water Depth: About 6.7 ft (Source: HEC-RAS)  
HEC-RAS Model: N/A  
Flood Profile: 54039\_065  
Community: Town of Clendenin  
Freeboard: 2 ft CRS Class: 10 CID: 540075  
Location (lat, long): (38.487290, -81.351969)

**SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)**

C1. Building elevations are based on:  Construction Drawings\*  Building Under Construction\*  Finished Construction

\*A1

C2. Ele **Elevation Certificate (Diagram 7)** /AO.

Col  
Ber  
Indi  
631.0 ft. (C2b) – 619.0 ft. (C2f) = 12 ft.

Datum used for building elevations must be the same as that used for the BFE.

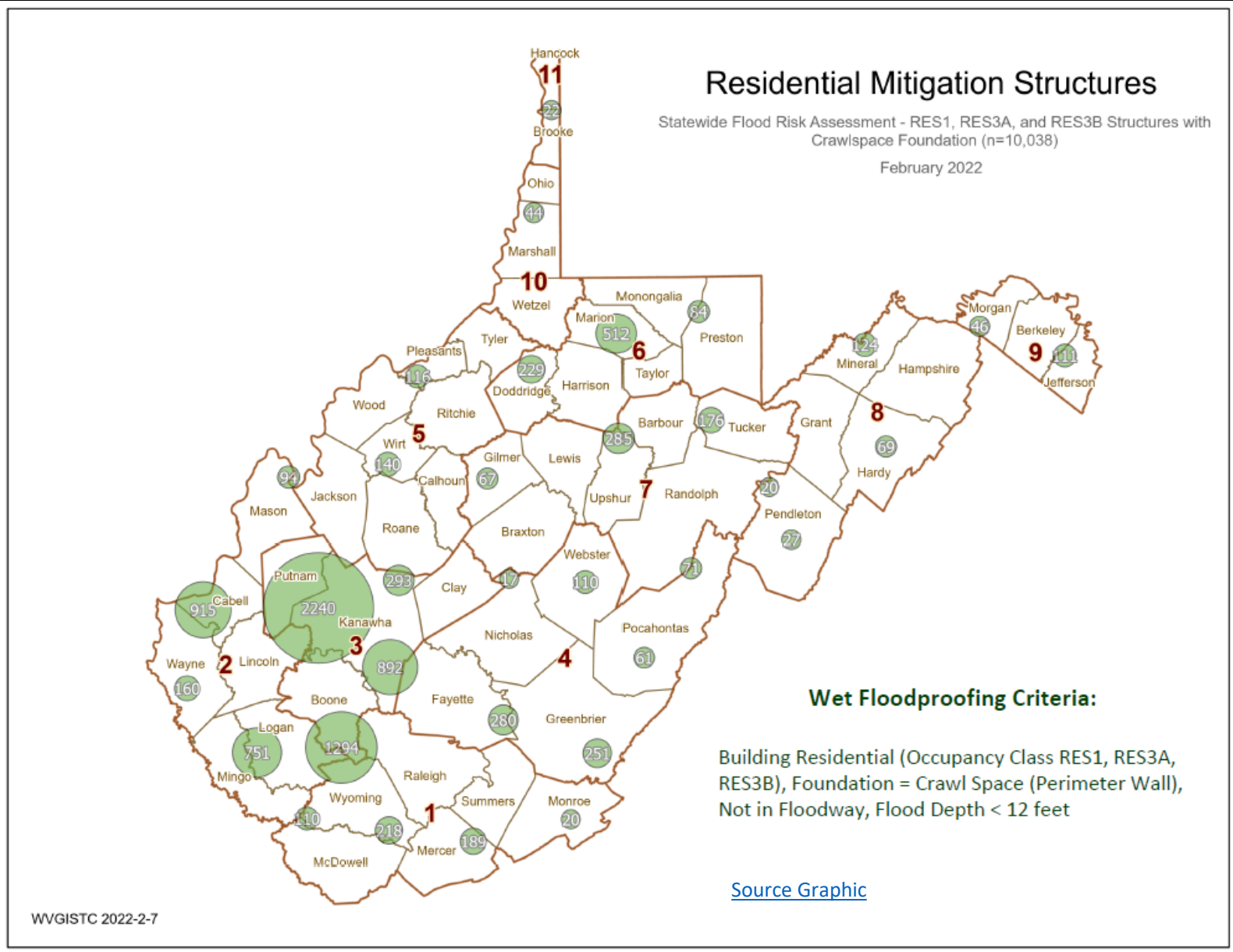
Check the measurement used.

a) Top of bottom floor (including basement, crawlspace, or enclosure floor)	619.0	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
b) Top of the next higher floor	631.0	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
c) Bottom of the lowest horizontal structural member (V Zones only)	N/A	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
d) Attached garage (top of slab)	N/A	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	630.9	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
f) Lowest adjacent (finished) grade next to building (LAG)	619.0	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
g) Highest adjacent (finished) grade next to building (-HAG)	619.4	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	619.0	<input checked="" type="checkbox"/> feet	<input type="checkbox"/> meters

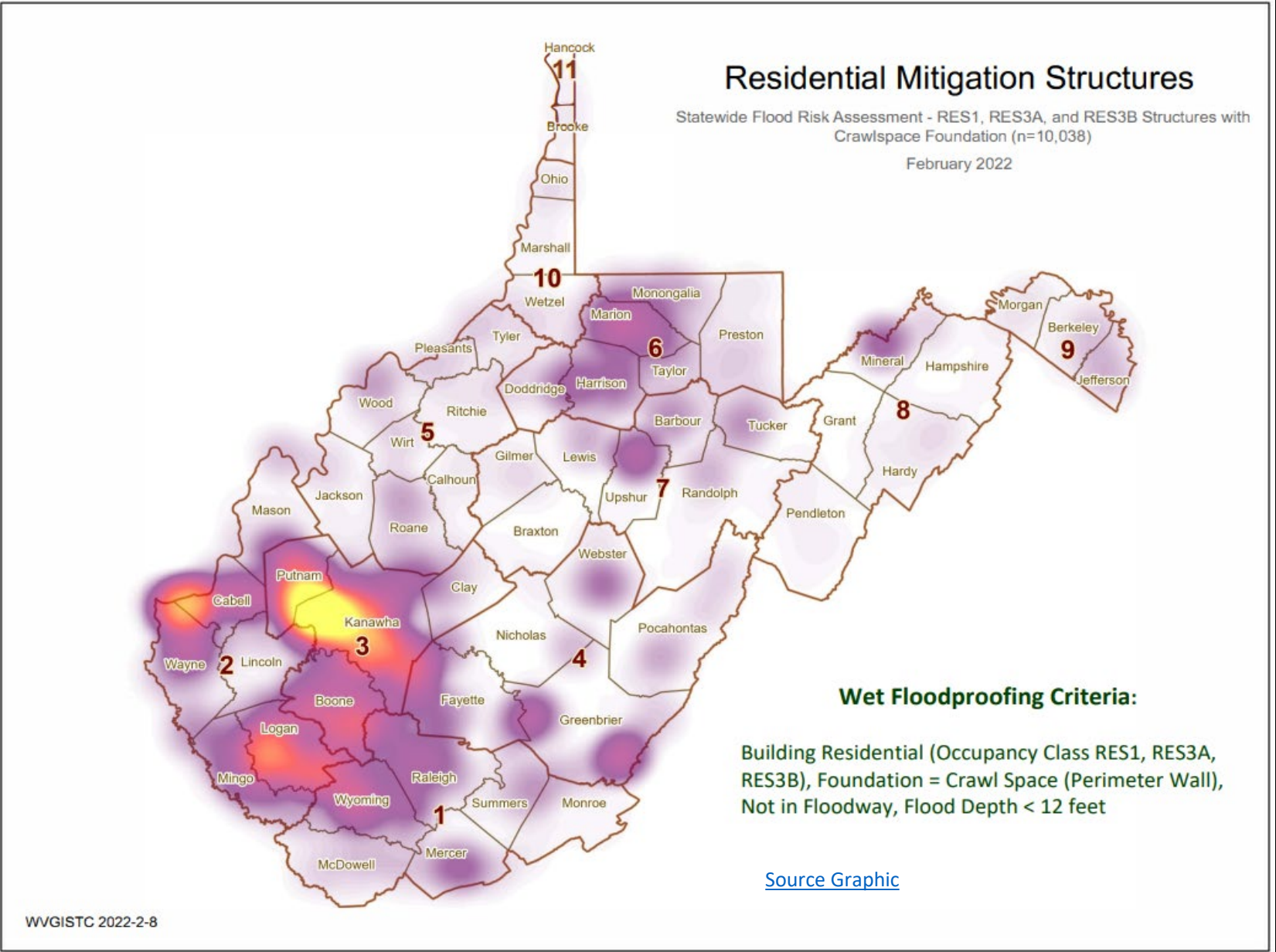
**SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION**



# Potential Structures for Wet Floodproofing



# Potential Structures for Wet Floodproofing





# Community Risk Assessment Data Verification

Use **Building-Level (BL) Tables** to identify **Most Vulnerable Structures**

- [Statewide BLRA \(GIS\)](#)
- [BLRA County Tables](#) organized by region
- [BLRA Data Extract Tables](#): High Building Value, High Damage Loss, **High Minus Ratings**
- [BLRA Statewide Top Lists](#): Building Value, Flood Depth, Damage Loss \$, Damage Loss %, Minus Rated, Mitigated Structures
- [Risk Indicator Matrices](#): Exposure and Damage Loss Matrices of Risk Indicators



# Preload Structures into SDE

Incorporate 1% Floodplain Building Risk Assessment Inventory into **Mitigation** and **NFIP/CRS Management** Activities

**STEP 1: Community preloads Floodplain Properties** into FEMA's Substantial Damage Estimator software

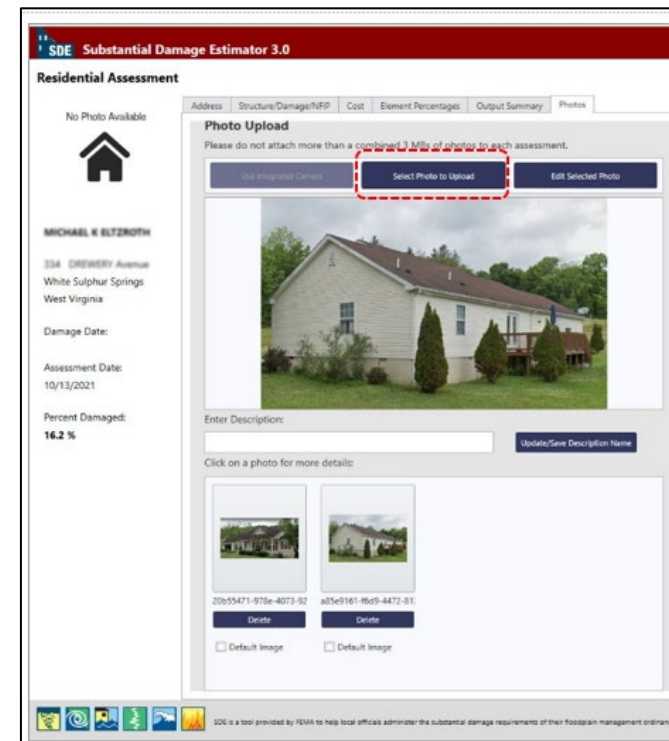


Please Select a Property

Structure Owner Name	Property Address	County/Parish	Parcel Number	Lot Number	Subdivision	Year of Construction
MICHAEL GARFIELD SE...	1836 KOKER Road	Greenbrier	13-04-055E-0010-0000	13-04-055E-0010-0000	Greenbrier County	1960
MICHAEL J HONAKER	381 INGLESDIE Avenue	Greenbrier	13-17-0012-0084-0000	13-17-0012-0084-0000	White Sulphur Springs	1930
MICHAEL J SMITH	156 MAPLE AVE	Greenbrier	13-01-0006-0338-0000	13-01-0006-0338-0000	Alderson	2020
MICHAEL K ELTZROTH	334 DREWERY Avenue	Greenbrier	13-17-0009-0383-0000	13-17-0009-0383-0000	White Sulphur Springs	1918
MICHAEL L ARBOGAST	396 HATFIELD HOLLID...	Greenbrier	13-02-0029-0022-0001	13-02-0029-0022-0001	Greenbrier County	1991
MICHAEL LEE ET ALS B...	6896 TUCKAHOE RD	Greenbrier	13-16-0036-0002-0000	13-16-0036-0002-0000	Greenbrier County	1972
MICHAEL LEE ET ALS B...	0 TUCKAHOE Road	Greenbrier	13-16-0036-0002-0000	13-16-0036-0002-0000	Greenbrier County	1972
MICHAEL PAUL TRAINER	156 99TH Avenue	Greenbrier	13-02-0358-0067-0000	13-02-0358-0067-0000	Greenbrier County	1950
MICHAEL ROBERT ET AL...	349 GREENBRIER Aven...	Greenbrier	13-17-0011-0037-0000	13-17-0011-0037-0000	White Sulphur Springs	1957
MICHAEL SCOTT HILL	691 902 ROCK Trail	Greenbrier	13-06-0019-0001-0000	13-06-0019-0001-0000	Greenbrier County	1999
MICHAEL TOLLEY	324 RIVER CREEK Lane	Greenbrier	13-06-024D-0003-0000	13-06-024D-0003-0000	Greenbrier County	1987
MICHAEL W BRACKENB...	310 MILL CREEK Road	Greenbrier	13-11-055C-0030-0000	13-11-055C-0030-0000	Greenbrier County	1900
MICHAEL W CARRANZ...	252 HOLMES Lane	Greenbrier	13-17-0012-0021-0001	13-17-0012-0021-0001	White Sulphur Springs	1999
MICHAEL W CARRANZ...	262 HOLMES Lane	Greenbrier	13-17-0012-0047-0000	13-17-0012-0047-0000	White Sulphur Springs	1999
MICHAEL W SIMS	425 6TH Street	Greenbrier	13-13-0005-0480-0000	13-13-0005-0480-0000	Rainelle	1975
MICHAEL W SHOCKEY	274 MOUNTAIN Avenue	Greenbrier	13-17-0009-0383-0000	13-17-0009-0383-0000	White Sulphur Springs	1921
MICHAEL WARD	267 LITTLE CREEK Road	Greenbrier	13-02-0040-0028-0000	13-02-0040-0028-0000	Greenbrier County	1970
MICHELLE A DIRCH	153 WOODLAND Ave...	Greenbrier	13-17-0011-0011-0000	13-17-0011-0011-0000	White Sulphur Springs	1964
MICHELLE L DRENEN	191 MEADOW RIVER...	Greenbrier	13-11-055F-0039-0000	13-11-055F-0039-0000	Greenbrier County	1973

Preload using default values.

**STEP 2: Community performs practice Substantial Damage Assessments** for Residential and Non-Residential Properties



Greenbrier County has 2,225 Structures that can be uploaded

[SDE Upload Files and Instructions](#)

# SFHA Map Change Letters



[FEMA Region 3 Toolkit for New Flood Studies](#)

## City of White Sulphur Springs

Date: 10/14/2021

Dear SMITH JOHN:

This letter is a test to show the use of mail merge and I have copied the first two paragraphs from the Local Official letter. I have also copied two paragraphs for demonstration purposes.

*White Sulphur Springs has 68 buildings being mapped into the SFHA*

A multi-year project to re-examine City of White Sulphur Springs's flood zones and develop detailed digital flood hazard maps has been completed. The new maps, also known as Flood Insurance Rate Maps (FIRMs), were just released for public view. The new maps reflect current flood risk based on the latest data and a more accurate understanding of our area's topography. As a result, you and other property owners throughout GREENBRIER COUNTY will have up-to-date, Internet-accessible information about flood risk to your property.

### How will these changes affect you?

Based on the new maps, your property is being mapped into a higher risk flood zone, known as the Special Flood Hazard Area (SFHA). If you have a mortgage from a federally regulated lender and your property is in the SFHA, you are required by Federal law to carry flood insurance when these flood maps are put into effect. We recommend that you use this time to contact your insurance agent to get the most favorable rate and learn about options offered by the National Flood Insurance Program (NFIP) for properties being mapped into higher risk areas for the first time.

You can find your property on the WV Flood tool in one of two ways: first, you can go to the following link in a web browser: <https://mapwv.gov/flood/map/?wkid=102100&x=-8939196.678447664&y=4550352.316266677&l=13&v=2>. Or, you can go to <https://mapwv.gov/> map and enter your address, 177 PATTERSON ST, WHITE SULPHUR SPRINGS, WV, 24986, in the search bar.

Your property is within the Howard Creek flood zone and has a flood depth of 1.0 feet. Its FIRM status is Pre-FIRM.

[Mail Merge Template for SFHA Mapped-in Structures](#)

- Hardy County Risk MAP
- Kanawha County - Elk River PMR
- Greenbrier County Risk MAP

# Detailed Flood Studies

## Greenbrier County Study

- Rainelle
- White Sulphur Springs

# WV Flood Tool's Risk Map View



White Sulphur Springs' *primary structures* viewable on the Risk MAP View of the WV Flood Tool. Symbol letters indicate general occupancy (Residential, Commercial, Other Non-Residential).

Public Expert **Risk MAP** Risk Reference Basemaps Search Address White Sulphur Springs, WV Tools

Click on each tab to view information

Address Parcel Risk

Building #1 in Parcel: 13-17-0008-0139-0000

Flood Exposure for Building: 13-17-0008-0139-0000\_220

Building Replacement Cost	\$23,400	<b>Building Exposure</b>
Content Cost	\$11,700	
Building Info	Area: 1,665 sq ft   Stories: 1	
Occupancy Class	RES1 (Single Family Dwelling)	
Year Built	1949 (Pre-FIRM)	
Foundation Type	Crawlspace <a href="#">(View Photo)</a>	
First Floor Height	3.0 ft above ground	
Water Depth-in-Structure	0.9 ft (minus rated -1 ft)	

Flood Damage Estimates for Building: 13-17-0008-0139-0000\_220

Building Damage Pct	22% (Moderate Damage)	<b>HAZUS Loss Estimate</b>
Building Loss USD	\$5,148	
Content Damage Pct	25%	
Content Loss USD	\$2,925	

### 3D Visualization

220 CENTRAL AVE, White Sulphur Springs, WV, 24986

Depth

- 0 Foot
- 1 Foot
- 2 Feet
- 3 Feet
- 4 Feet
- 5 Feet**
- 6 Feet
- 7 Feet
- 8 Feet
- 9 Feet
- 10 Feet
- 11 Feet
- 12 Feet

Parcel ID: 13-17-0008-0139-0000 Water Depth: ~ 4.8 ft (HEC-RAS) Google Map









Wall and Paintings - Second layer of drywall and paintings damaged  
Electrical - Light switches, fixtures, and main panel would be destroyed at 5.0 feet.

# Community Flood Risk Dashboard

## FLOOD RISK FACTORS

Rainelle,  
WV

Greenbrier  
County

Hazard	 Ratio of Floodplain to Community Area: <b>9.2%</b> Incorporated Community Median: 10.2%		 Federally Declared Flood Disasters in Greenbrier County since 1989: <b>9</b> Statewide County Median: 12	
Exposure	<h3>Physical</h3>  Total Buildings in High-Risk Floodplains: <b>338</b> Incorporated Community Median: 59		<h3>Human</h3>  Estimated Population Residing in High-Risk Floodplains: <b>582</b> Incorporated Community Median: 114	
Vulnerability	 Mobile Homes in Floodplains: <b>14</b> Incorporated Community Median: 5		 Critical Buildings in Floodplains (Essential Facilities and Non-Historical Community Assets): <b>8</b> Incorporated Community Median: 3	
Newly Mapped in Structures: <b>329</b> Newly Mapped out Structures: <b>0</b>	Total Building Value in Floodplains: <b>\$16,120K</b> Incorporated Community Median: \$6,417K	Estimated Population Displaced by Flooding: <b>492</b> Incorporated Community Median: 56	Estimated Population in Need of Short-Term Shelters: <b>123</b> Incorporated Community Median: 12	
Total At-Risk Residential Structures: <b>251</b> Incorporated Community Median: 44	Total Estimated Building Loss: <b>\$997K</b> Incorporated Community Median: \$240K			
 Renters Ratio in Floodplains: <b>39%</b> Incorporated Community Med.: 35%	 Social Vulnerability Index (SVI) of Greenbrier County: <b>0.55</b> Statewide County Median: 0.48			

# FEMA 10% Annual Chance (10-year)

Rainelle, WV



# FEMA 4% Annual Chance (25-year)

Rainelle, WV





# FEMA 2% Annual Chance (50-year)

Rainelle, WV



# FEMA 1% Annual Chance (100-year)

Rainelle, WV



# FEMA 0.2% Annual Chance (500-year)

Rainelle, WV



# Mitigation Reconstruction (Rainelle, WV)

**First Floor Height BELOW: FEMA/FSF 0.2-percent chance (500-yr) floods**

12.2' (FSF 0.2% / 500-Yr)

9.9' (FEMA; 0.2% / 500-Yr)

6.5' (2016 High Water)

3.9' (FEMA 1% / 100-Yr)

Flood Depths marked on Mitigated Structure

FEMA

First Street Foundation (FSF)

USGS 2016 Flood High Water Mark



# Flood Visualization 4 feet



**First Floor Height ABOVE: 1% Chance (100-yr) flood**

# Flood Visualization 7 feet



**First Floor Height ABOVE: 2016 Flood High Water Mark**

# Flood Visualization 10 feet



**First Floor Height BELOW: 0.2% Chance (500-yr) Flood Models**

# Pre-Disaster 2016 Aerial View

White Sulphur Springs  
Imagery of June 2016

Flood  
Resiliency Factors






# Structures Removed Post-Disaster

White Sulphur Springs  
Imagery of June 2016



 Building REMOVED (Vacant Parcel)


# Buyout Parcels (Deed Restricted)

White Sulphur Springs  
Imagery of Oct. 2019



Buyout Property



 ACQUISITION or Buyout Property


# Non-Mitigated Repaired Structures

White Sulphur Springs  
Imagery of Oct. 2019



Substantially Damaged Structure Repaired



 REPAIRED of Substantially Damaged (>50%) Building


# Mitigated Reconstruction

White Sulphur Springs  
Imagery of Oct. 2019



Elevated Structure (with flood vents)

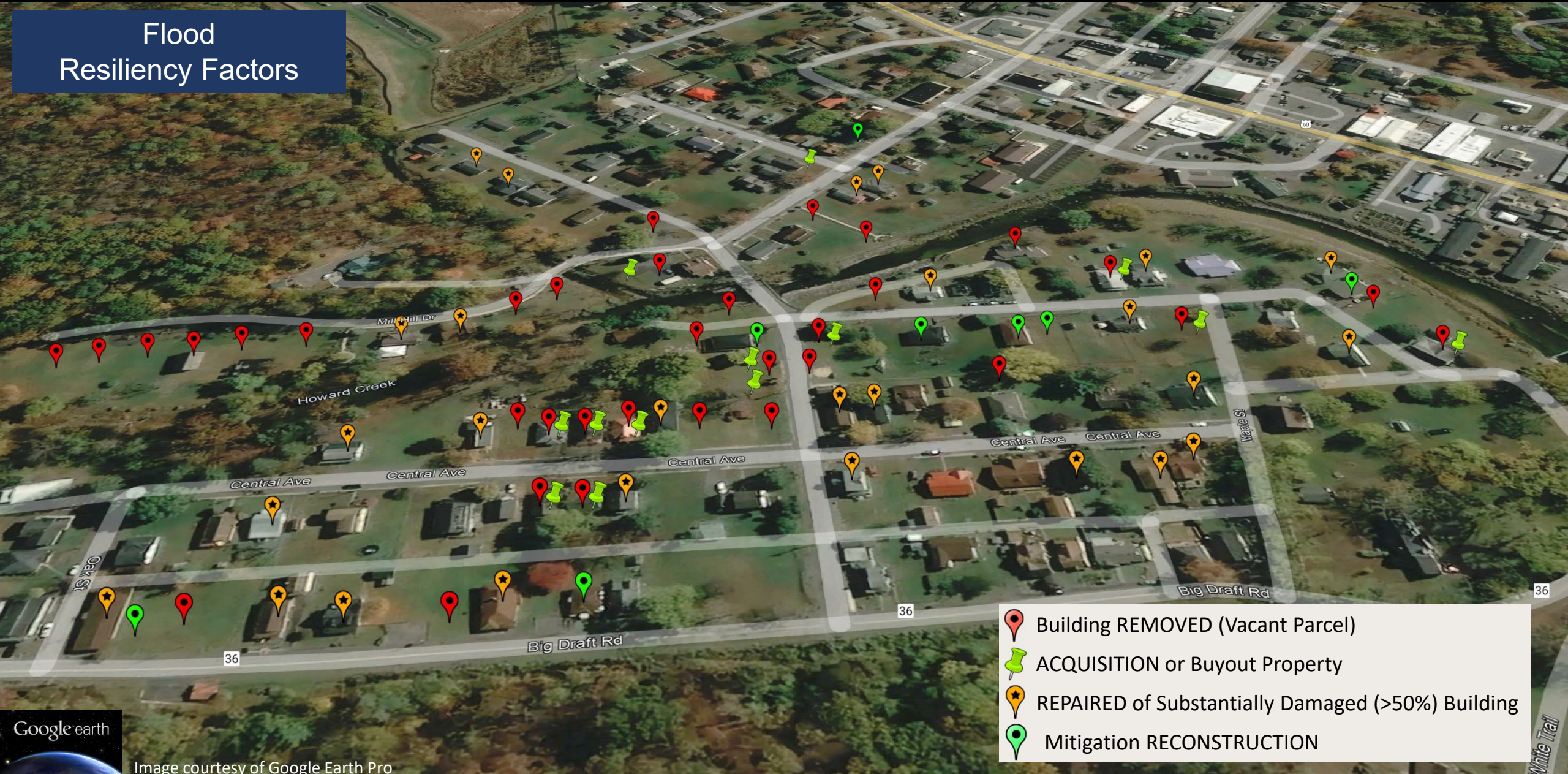


 Mitigation RECONSTRUCTION

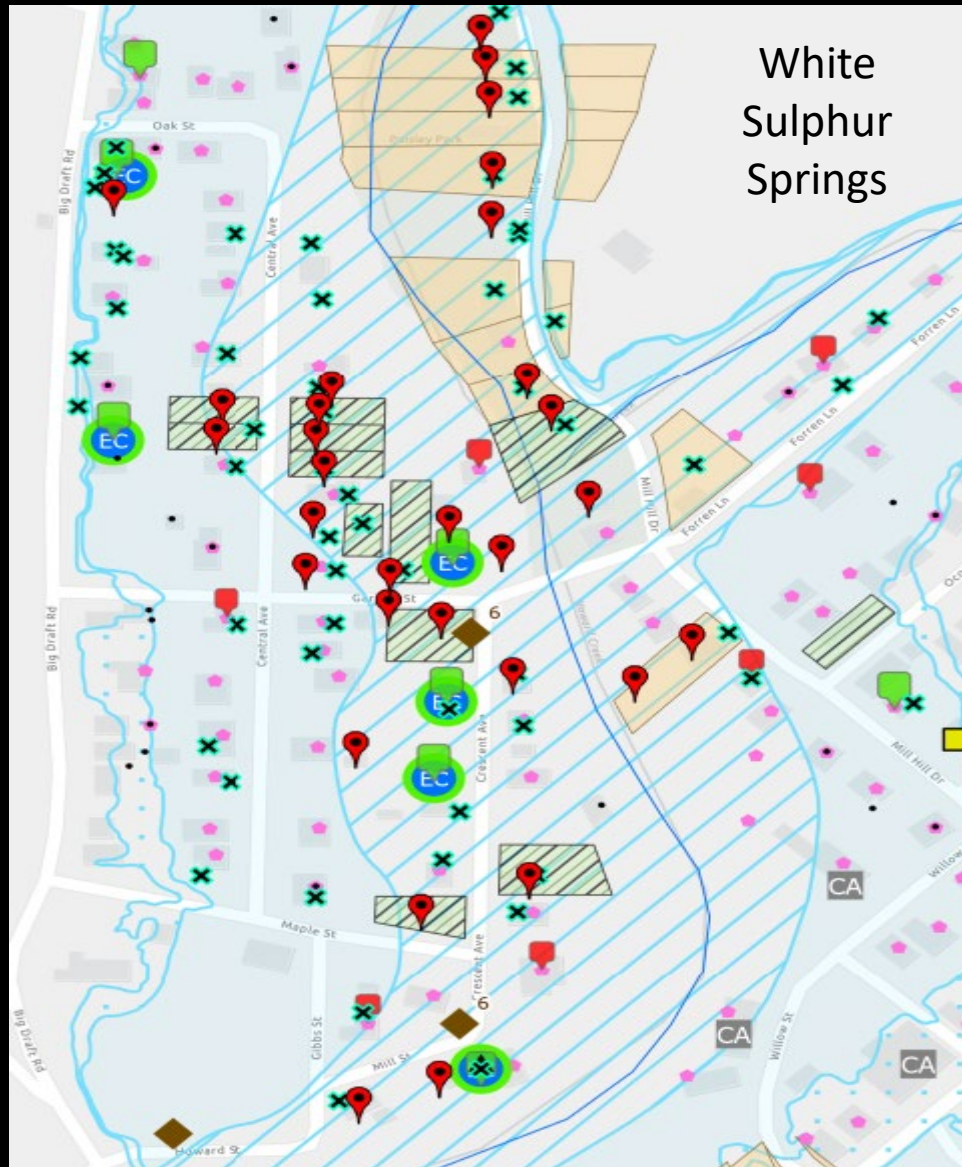
# Mitigated and Non-Mitigated Properties

White Sulphur Springs  
Imagery of Oct. 2019

Flood  
Resiliency Factors



# Flood Mitigation Map



Map

## Damaged or Demolished Buildings

✕ 2016 Substantially Damaged Structure (Field SDE Surveys)<sup>1</sup> (n=89)

📍 Structure Removed Post-2016 Flood (n=49)

## Mitigated Properties

🗨️ Mitigation Reconstruction to DFE\* (n=14)

📍 Mitigation Reconstruction not to DFE\* (n=1)

📍 EC Elevation Certificate (n=12)

▨ Acquisition/Buyout Property (n=16)

🟡 Open Space Preservation (Community-Owned)\*\*\*(n=66)

## Unmitigated Properties

📍 Low Building Value (n=14)

• Repaired Structure\*\* (n=407)

## Significant Structures

🏢 Essential Facility (n=2)

🏠 Community Asset (n=8)

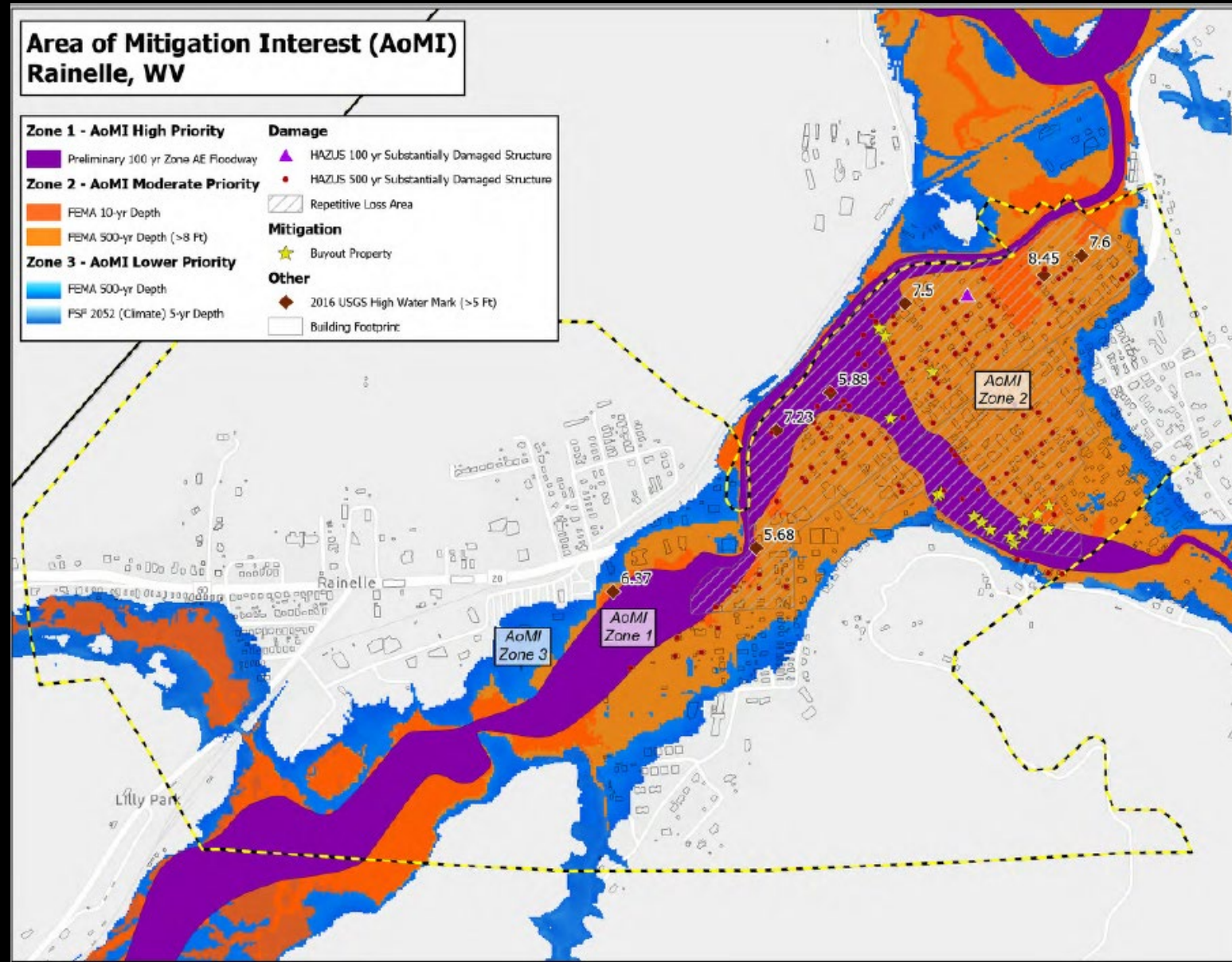
## Vulnerable Structures

🏠 Manufactured Home (n=4)

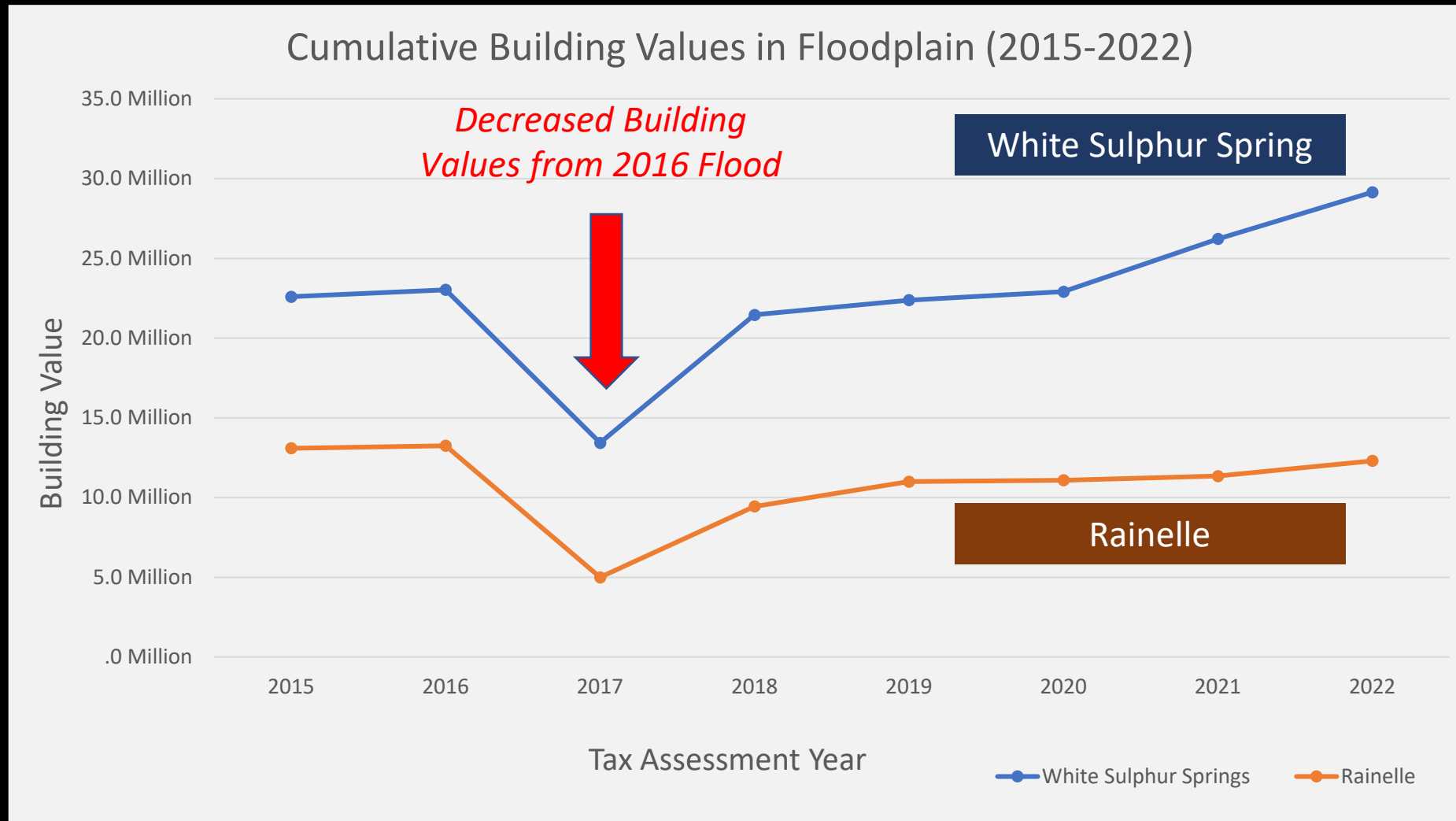
• Subgrade Basement (Full & Part)

Legend

# Areas of Mitigation (AoMI) Interest



# Community Recovery: Building Value Recovery



COMMUNITY	2015	2016	2017	2018	2019	2020	2021	2022
Rainelle (n=326)	13.1 Million	<b>13.3 Million</b>	5.0 Million	9.4 Million	11.0 Million	11.1 Million	11.3 Million	12.3 Million
White Sulphur Springs (n=409)	22.6 Million	<b>23.0 Million</b>	13.4 Million	21.5 Million	22.4 Million	22.9 Million	26.2 Million	29.2 Million