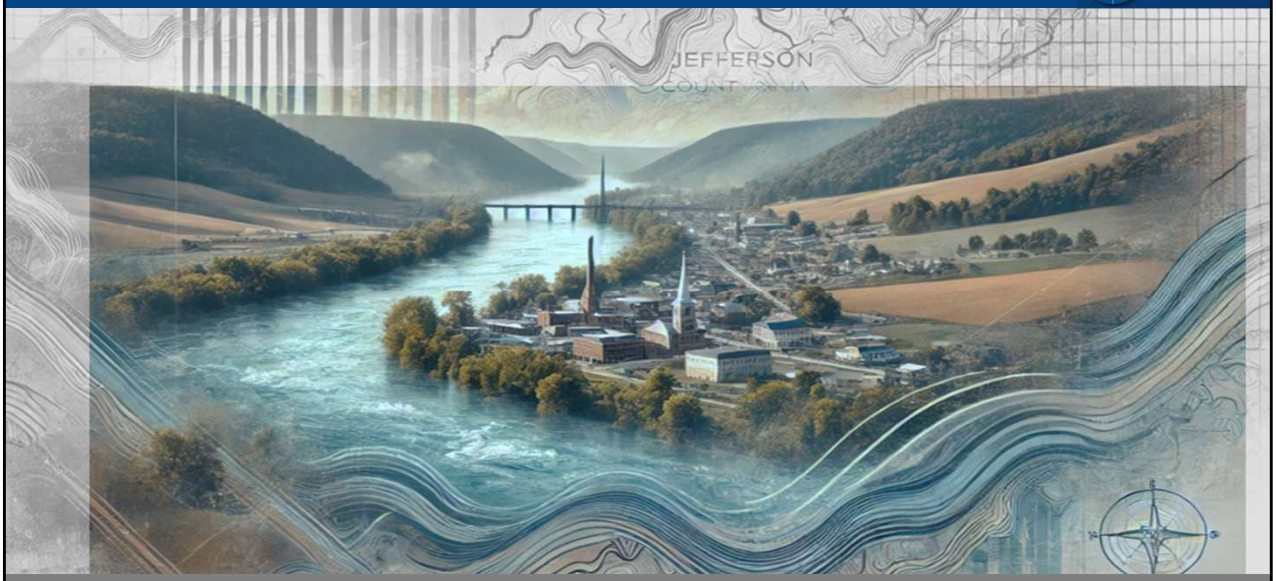
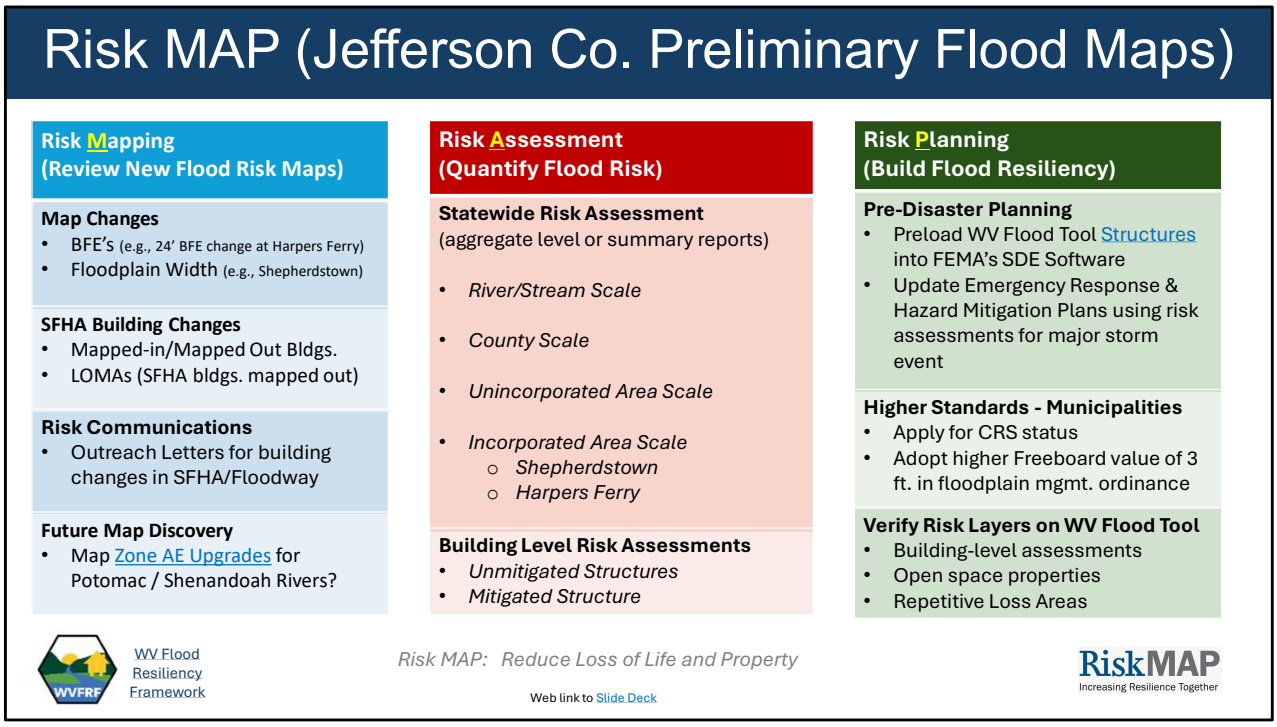
Supplemental Slides (Risk MAP Study)

West Virginia GIS Technical Center



Community Coordination and Outreach (CCO) Meeting, 12/11/2024
Jefferson County, WV and Incorporated Areas

Risk MAP (Mapping, Assessment, Supplemental) Slides prepared by the WV GIS Technical Center at West Virginia University for the **Community Coordination and Outreach** (CCO) meeting to discuss the new preliminary Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) for Jefferson County, WV, issued on September 24, 2024. The CCO meeting was held on December 11, 2024, at the Jefferson County Office of Homeland Security and Emergency Management, 28 Industrial Boulevard, Kearneysville West Virginia, 25430.



This CCO meeting is an opportunity for local government representatives to work with FEMA Region 3, state government representatives, and members of the project team on strategies and resources for public outreach, how to provide comments/appeals to the preliminary information, the ordinance update and adoption process, and other questions/answers related to the National Flood Insurance Program (NFIP) and getting the new FIRMs to effective status.

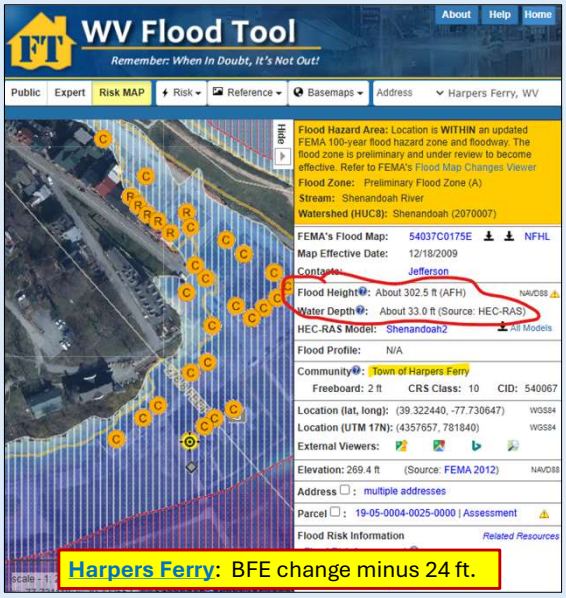
This CCO meeting is organized by the National Flood Insurance Program (NFIP), a voluntary program that works to reduce future flood losses by guiding development away from hazardous areas, and by encouraging communities to:

- Know Your Risk: Identify flood hazards through mapping.
- Insure Your Risk: Provide insurance and outreach measures.
- Reduce Your Risk: Manage floodplains through ordinances, mitigation practice and resiliency efforts.

Community To-Do List

- Review the preliminary FIRM. Make corrections, share comments and submit appeals to FEMA through the community Chief Executive Officer (CEO), when appropriate.
- Reach out to notify residents, businesses and property owners affected by the changes on the FIRM.

Map Changes – Harpers Ferry

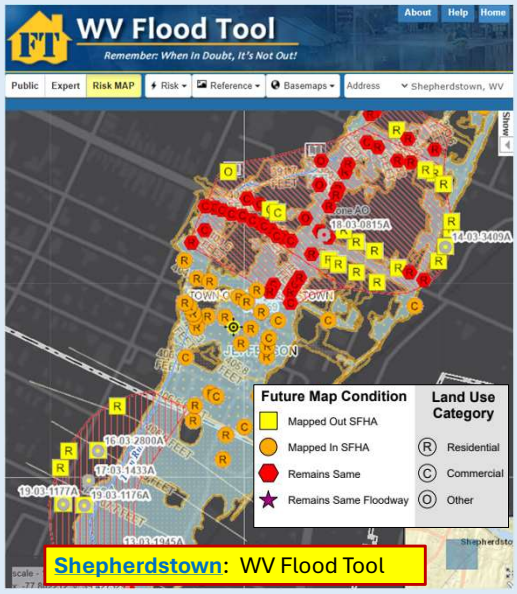


RiskMAP
Increasing Resilience Together

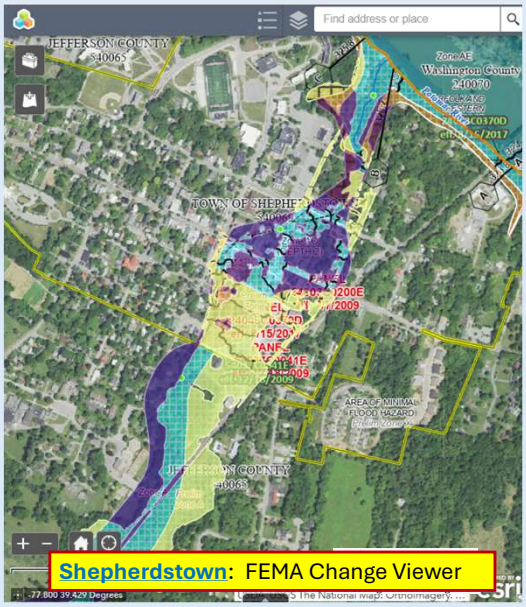
The preliminary FIRM shows flood risk zones in a community, including Special Flood Hazard Areas (SFHAs), subject to inundation by the base (1%-percent-annual-chance) flood. The 1%-annual-chance flood is also referred to as the 100-year flood.

Communities like **Harpers Ferry** should review its preliminary Flood Insurance Rate Map (FIRM) where structures are being mapped into a high-risk Special Flood Hazard Area, and where the base flood elevation is decreasing by 24 feet due to the revised 1%-annual-chance backwater effect where Shenandoah River meets the larger Potomac River.

Map Changes - Shepherdstown



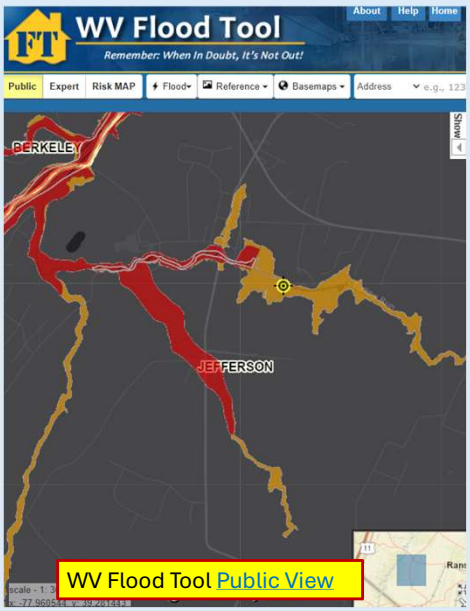
Shepherdstown: WV Flood Tool

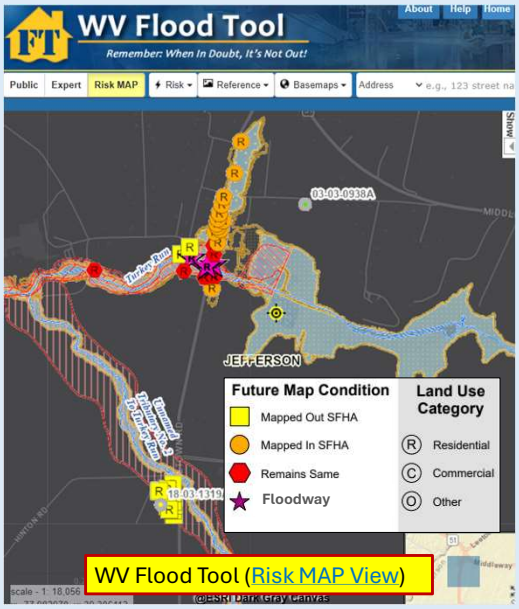


Shepherdstown: FEMA Change Viewer

Preliminary maps show the high-risk floodplain of **Shepherdstown** is changing dramatically, and consequently these floodplain boundary changes between the current 2009 effective and 2024 preliminary flood maps should be viewed using the WV Flood Tool's Risk MAP View (SFHA Building Changes - Building Changes Since Last FIRM) and FEMA's Changes Since Last FIRM (CSLF) Viewer. **Shepherdstown** has nearly 30 structures being mapped into the updated Special Flood Hazard Area, and so it is the community's responsibility to notify property owners and other stakeholders that they will be affected by the map changes.

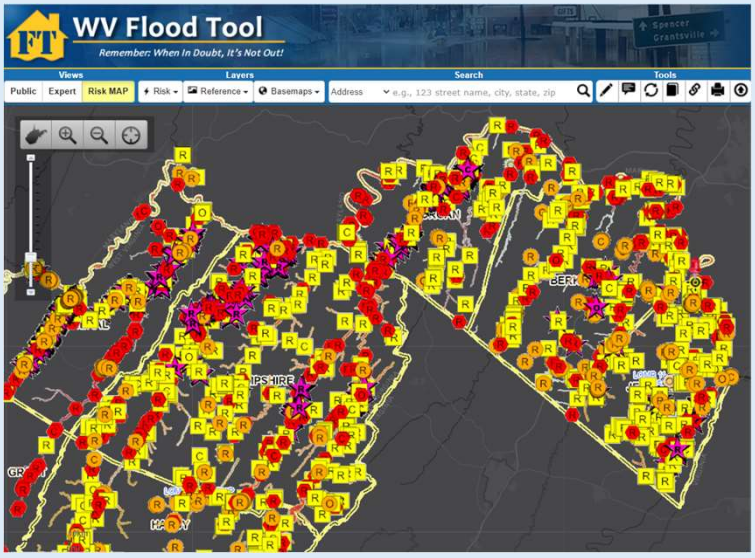
Map Changes – Jefferson County





Preliminary map changes for **Jefferson County Unincorporated** show "mapped-in structures" (orange symbol color) along streams where studies have been extended; or "mapped-out" structures (yellow symbol color) along existing streams due to more accurate topographic data and updated hydrologic/hydraulic flood studies.

Buildings **Mapped-In** / **Out** of Preliminary SFHA



Difference between FEMA's 2009 and 2024 flood studies

Future Map Condition	Land Use Category
Mapped Out SFHA	
Mapped In SFHA	(R) Residential
Remains Same	(C) Commercial
Floodway	(O) Other

RiskMAP
Increasing Resilience Together

The WV Flood Tool's Risk MAP View shows the future building status change according to the new flood maps:

- **Mapped Out SFHA** (yellow square symbol). Communities should notify property owners of map-in SFHA changes. Additionally, these structures may be candidates for LiDAR LOMAS.
- **Mapped In SFHA** (orange circle symbol). Communities should notify property owners of map-out SFHA changes.
- **No Change** - Remains Same in SFHA (red hexagon symbol).
- **Floodway** (star symbol)

SFHA Building Changes: Mapped-In/Out

COMMUNITY IDENTIFICATION		Estimated structures in the Community	Estimated structures in the preliminary flood high hazard area	Estimated structures newly mapped in	Estimated structures newly mapped out
Community Name	Community Type				
Jefferson County*	Unincorporated	20,397	317	55	220
Bolivar	Incorporated	616	4	4	0
Charles Town	Incorporated	3,670	21	4	8
Harpers Ferry	Incorporated	276	31	30	0
Ranson	Incorporated	2,918	50	1	28
Shepherdstown	Incorporated	735	76	29	20
JEFFERSON	**County**	**28,612**	**499**	**123**	**276**

* Unincorporated Area

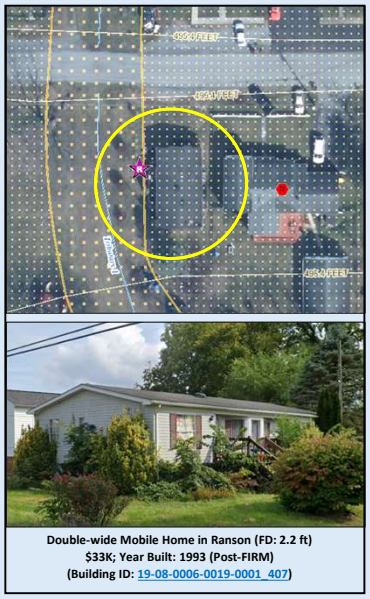
County Net Change in structures: - 153

County Net Change in floodway structures: - 14

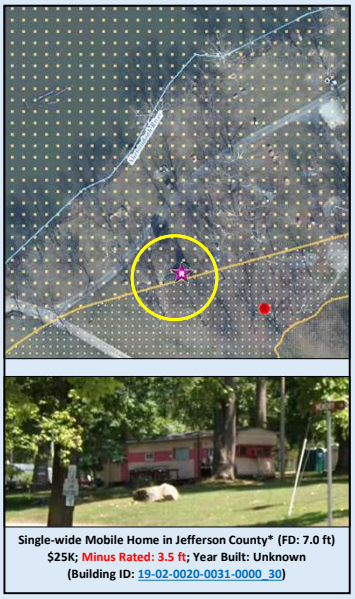
RiskMAP
Increasing Resilience Together

Tax assessment records and aerial imagery allow for a more detailed inventory of primary buildings within the Special Flood Hazard Area and Regulatory Floodway. For **Jefferson county**, the preliminary flood maps reveal a net total of 499 structures in the preliminary SFHA, with 123 structures mapped-in the SFHA and 276 structures (more than double) mapped out. The countywide building net change is minus 153 and minus 14 structures in the preliminary SFHA and Floodway, respectively. Communities should contact the State NFIP Office for technical assistance in mailing notification letters to property owners that will be affected by these map changes.

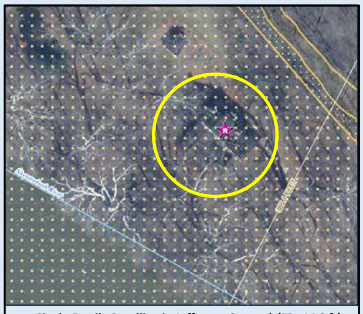
Buildings Mapped into Floodway



Double-wide Mobile Home in Ranson (FD: 2.2 ft)
$33K; Year Built: 1993 (Post-FIRM)
(Building ID: 19-08-0006-0019-0001_407)



Single-wide Mobile Home in Jefferson County* (FD: 7.0 ft)
$25K; Minus Rated: 3.5 ft; Year Built: Unknown
(Building ID: 19-02-0020-0031-0000_30)



Single Family Dwelling in Jefferson County* (FD: 14.0 ft)
$8K; Minus Rated: 10.3 ft; Year Built: 1979 (Pre-FIRM)
(Building ID: 19-06-008F-0007-0000_457)

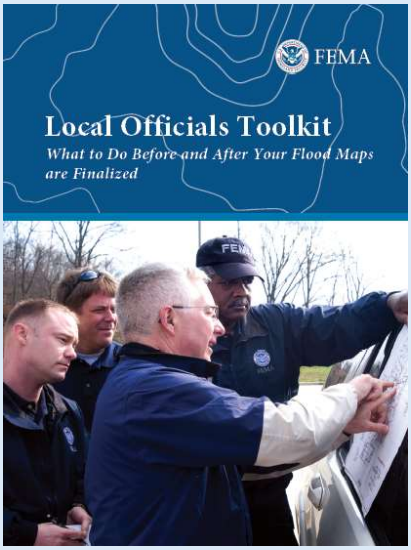
Structures mapped from Floodplain Fringe into Floodway

- FLOOD FRINGE TO FLOODWAY-Res.
- FLOOD FRINGE TO FLOODWAY-Com.
- FLOOD FRINGE TO FLOODWAY-Other

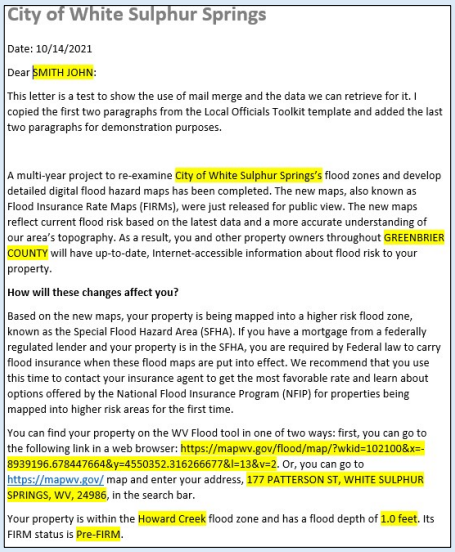
Communities should also notify property owners being mapped into a much higher risk flood zone of the Special Flood Hazard Area (SFHA), known as the **Regulatory Floodway**, or the main channel of the river/stream where floodwaters are likely the deepest and with the highest velocities. Before a local permit can be issued for proposed development in the floodway, a "No-Rise/No Impact" certification must be submitted by a professional engineer licensed in West Virginia to ensure a proposed project won't increase flood levels.

Risk Communications: SFHA Map Change Letters

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



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 the data we can retrieve for it. I copied the first two paragraphs from the Local Officials Toolkit template and added the last two paragraphs for demonstration purposes.

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

Counties which recently sent outreach letters to homeowners:

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

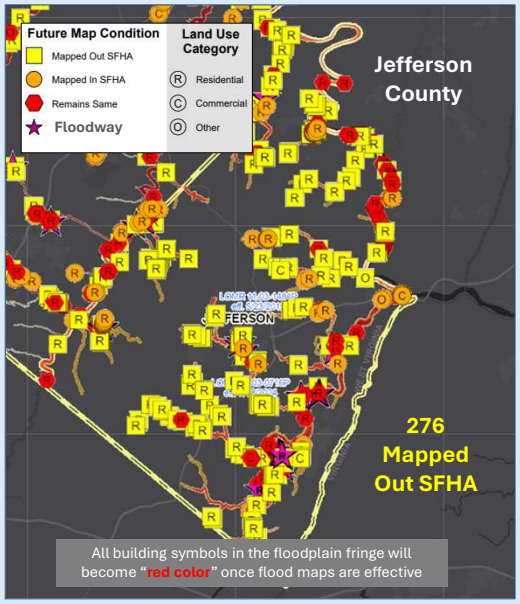
***Jefferson County** and **Shepherdstown** have 55 and 29 buildings, respectfully, mapped into the SFHA*

Communities should contact the State NFIP Office for technical support in creating outreach letters for property owners affected by the map changes. Based on mail merge templates, outreach letters on community letterhead can be generated for all (1) SFHA Mapped-In, (2) Mapped-In Floodway, and (3) SFHA Mapped-Out structures shown on the WV Flood Tool's RiskMAP View (www.mapwv.gov/Flood). All the communities must do is **download the files, then print, validate, and mail the letters**. CRS communities like Jefferson County Unincorporated should be eligible for credit points for this outreach activity.

For the SFHA mapped-out letters, it is important to have this text included in the letter template: "If you do currently have flood insurance, you should not cancel your flood insurance before the new flood maps are officially adopted by the community. Moreover, if you have a federally-backed mortgage, NEVER cancel your flood insurance before consulting your mortgage lender!"

Another useful resource about the Regulatory Update is FEMA's Risk Communication Guidebook for Local Officials.
https://www.fema.gov/sites/default/files/documents/fema_region-6_risk-communications-guidebook_112023.pdf#page=25

SFHA Buildings Changes: LOMAs for Mapped Out



Mapped-out structures of the SFHA may qualify for LOMAs

WV Flood Tool LiDAR LOMA:

Instructions | Guide

Before the preliminary FIRMS become effective, property owners with structures that are mapped out of the SFHA (yellow square symbols on WV Flood Tool's RiskMAP View) may be eligible for a **LiDAR Letter of Map Amendment** (LOMA).

It is estimated that 276 structures are mapped out of the SFHA for the entire county. If applicable, LiDAR data can replace the requirement to submit certified elevation information for LOMAs, which can create a cost savings for property owners requiring mandatory flood insurance. If property owners want to expedite the removal of their structure from the SFHA, then refer to the information links regarding LiDAR LOMAs for more guidance.

River/Stream Building Risk Assessment

MEDIAN BUILDING VALUE: **Town Run** and **Shenandoah River** rank first and fourth, respectively, of 156 major rivers/streams in the state with the highest median value of structures in high-risk flood areas.

#	*STATE CATEGORY RANK*	River/Stream Floodplain	Building Characteristics	*CATEGORY SCORE*
			Building Median Value	
1	1	Town Run	**$247,700**	**100.0%**
2	4	Shenandoah River	**$95,100**	**98.0%**
3	24	Potomac River	$57,300	85.1%

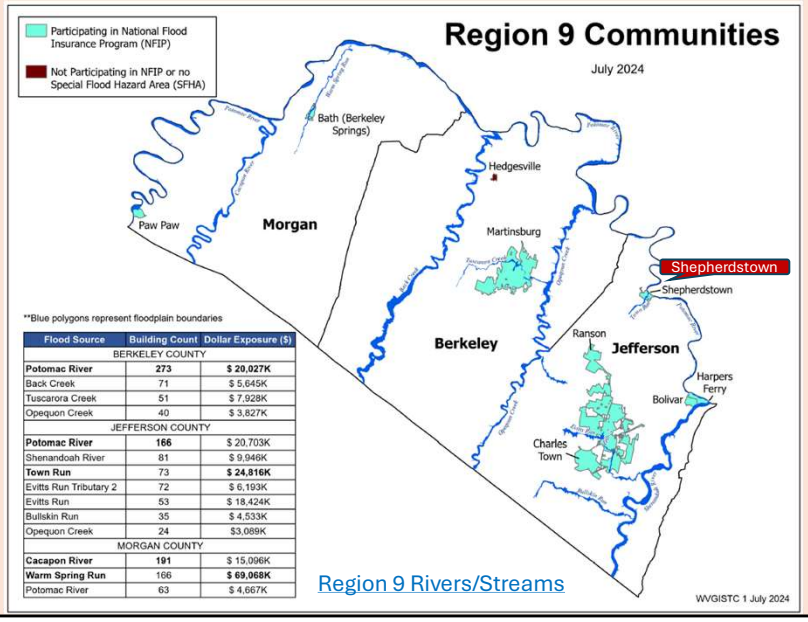
FLOOD DEPTH MEDIAN: Floodplain structures along the **Shenandoah River** have high flood depths compared to 156 other major rivers/streams in the state.

#	*STATE CATEGORY RANK*	River/Stream Floodplain	Floodplain Characteristics		*CATEGORY SCORE*
			Floodplain Length	Flood Depth Median	
1	12	Shenandoah River	30.2 Miles	**7.4 Ft**	**92.9%**
2	2	Potomac River	**143.8 Miles**	**4.5 Ft**	**99.3%**
3	147	Town Run	2.1 Miles	0.2 Ft	5.8%

WV Risk Explorer: Stream Risk Comparison Report

Risk assessment results of 156 major rivers/streams in the state reveal that **Town Run** and **Shenandoah River** have high building values and thus more dollar exposure to flood damage. Both the **Shenandoah** and **Potomac Rivers** have high flood depth medians values (> 4.5 feet) for a 1%-annual-chance (100-yr) flood which translates to a potential for higher damage losses and loss of life.

River/Stream Building Risk Assessment



**Blue polygons represent floodplain boundaries

Flood Source	Building Count	Dollar Exposure ($)
BERKELEY COUNTY		
Potomac River	**273**	**$ 20,027K**
Back Creek	71	$ 5,645K
Tuscarora Creek	51	$ 7,928K
Opequon Creek	40	$ 3,827K
JEFFERSON COUNTY		
Potomac River	**166**	$ 20,703K
Shenandoah River	81	$ 9,946K
Town Run	73	**$ 24,816K**
Evitts Run Tributary 2	72	$ 6,193K
Evitts Run	53	$ 18,424K
Bullskin Run	35	$ 4,533K
Opequon Creek	24	$3,089K
MORGAN COUNTY		
Cacapon River	**191**	$ 15,096K
Warm Spring Run	166	**$ 69,068K**
Potomac River	63	$ 4,667K

Region 9 Rivers/Streams

Top rivers with high building counts in SFHA are **Potomac River** (166), **Shenandoah River** (81) and **Town Run** (73). Town Run has highest building dollar exposure.

A river/stream building risk assessment for Region 9 and Jefferson County reveals that the **Potomac River** has the most structures mapped in the SFHA while **Town Run** has fewer structures but the largest cumulative building value.

Jefferson County Risk Assessment

= Statewide Rank among the Top 5

JEFFERSON COUNTY ranks "very high" or in the **top 20%** of all 55 counties in the state for the five risk indicators below. View Top 20% Risk Indicators Report for county. Click on Risk Factor links for rationales/recommendations.

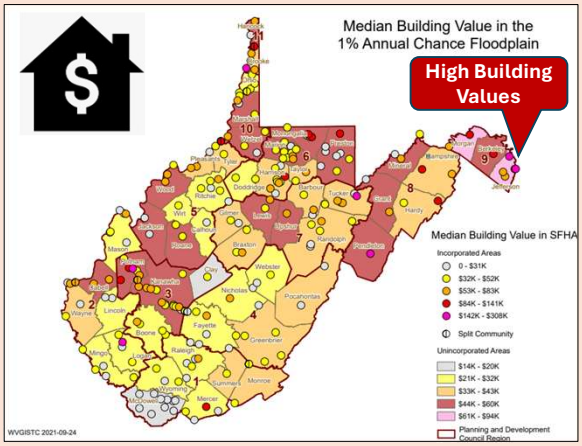
Category	Flood Risk Indicator	Value for Jefferson	Indicator Score (0 - 100%)	Indicator Rating
Building Characteristics	Building Median Value (1)	**$97,450** (Median $42,200)	**100.0%**	**VERY HIGH**
	Bldg. Subgrade Basements Ratio (4)	**49.5%**	**94.4%**	**VERY HIGH**
	Bldg. Year Minus Rated Post-FIRM Ratio	**9.4%**	81.4%	Very High
Community Assets	Community Assets Historical (4)	**120**	**94.4%**	**VERY HIGH**
Building Damage Loss	Bldg. Substantial Damage Ratio	**24.0%**	**90.7%**	**VERY HIGH**

JEFFERSON COUNTY UNINCORPORATED* ranks "very high" or in the **top 20%** of all 55 unincorporated areas in the state for the six risk indicators below. View Top 20% Risk Indicators Report for incorporated area.

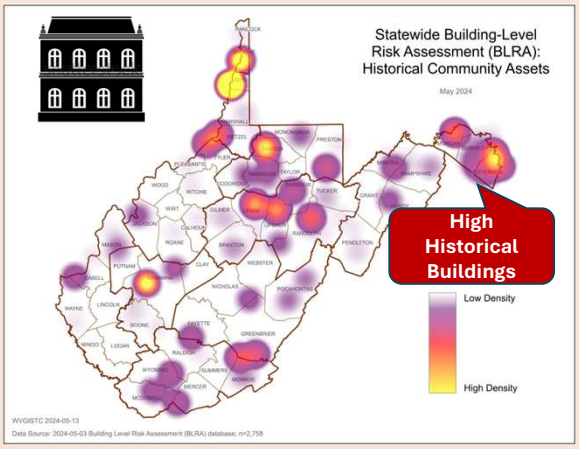
Category	Flood Risk Indicator	Value for Jefferson County* - Unincorporated	Indicator Score (0 - 100%)	Indicator Rating
Floodplain Characteristics	Flood Depth Median (4)	**4.7 Ft**	**94.4%**	**VERY HIGH**
Building Characteristics	Building Median Value (1)	**$93,150** (Median $37,350)	**100.0%**	**VERY HIGH**
	Bldg. Subgrade Basements Ratio (2)	**48.9%**	**98.1%**	**VERY HIGH**
	Bldg. Year Minus Rated Post-FIRM Ratio	**14.5%**	**90.7%**	**VERY HIGH**
Community Assets	Community Assets Historical (1)	**26**	**100.0%**	**VERY HIGH**
Building Damage Loss	Bldg. Substantial Damage Ratio	**29.7%**	**90.7%**	**VERY HIGH**

A Top 20% Risk Indicators Report reveals that **Jefferson County** and **Jefferson County Unincorporated** have structures in the high-risk flood zones that are of high appraisal value and which reside in historical districts. View the WV Risk Explorer report for more information about these risk factors specific to Jefferson County including rationales and recommendations.

Jefferson County Building Risk Assessment



Jefferson County has very high Building Values, or more than double the statewide median value.



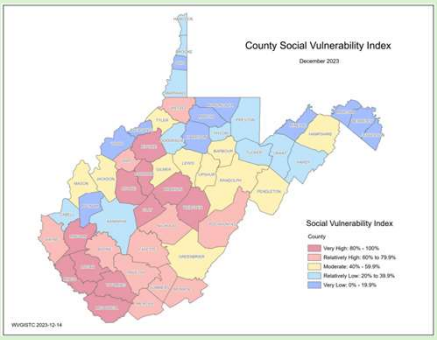
Jefferson County has a high number of Historical Community Assets on the National Register.

Source: Statewide Building-Level Risk Assessment

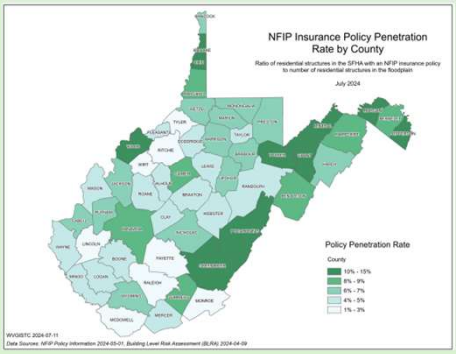
When compared to all 55 counties in the state, for the **Jefferson County** structures located in the Special Flood Hazard Area, these inventoried buildings have high appraisal values, and a large number are designated by the National Register of Historic Places. Graphics of these risk indicators affecting Jefferson County can be discovered from the WV Hazard Library.

Jefferson County Resiliency

(1) Jefferson County has no Essential Facilities in the high or moderate risk floodplains



(2) Jefferson County has the lowest Social Vulnerability Index in the State

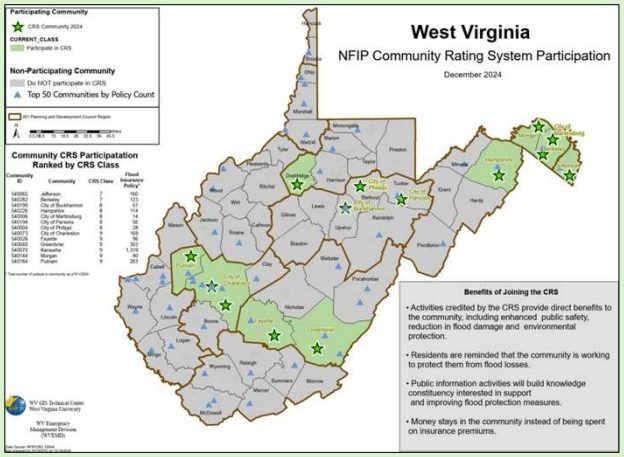


(3) Jefferson County has higher NFIP Insurance Penetration Rate than other counties

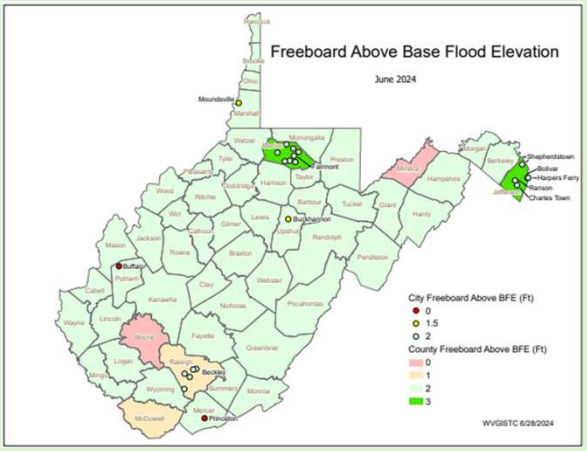
Jefferson County is more resilient to flooding than most other counties in the state because the county has:

- No **Essential Facilities** in high (100-yr) or moderate (500-yr) risk floodplains.
- The lowest **Social Vulnerability Index** in the state.
- Higher **NFIP Insurance Penetration Rate** coverage than other counties.

Jefferson County Unincorporated* Resiliency



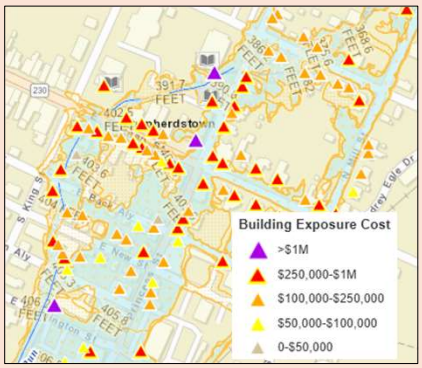
Jefferson County Unincorporated has a high CRS Rating of Class 7



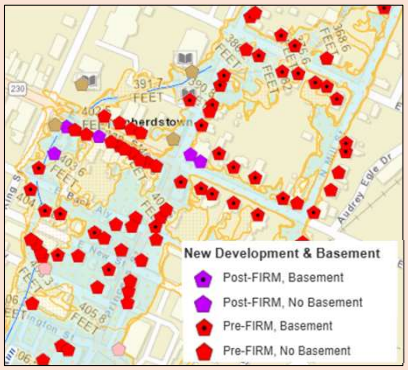
Jefferson County Unincorporated has a high Freeboard safety factor of 3 feet

Jefferson County Unincorporated implements higher standards for floodplain management than all the other 284 incorporated and unincorporated communities in the state

Shepherdstown Risk Assessment



Building Value and **Density.** Median Building Value ranks first of 229 incorporated places in the state. High density of buildings in small area.



Pre-FIRM and **Basements.** Nearly 90% of structures are Pre-FIRM and nearly half have basements.

Historical Buildings. Most building are in the National Historic District.

Refer to online All Risk Indicators Report

Sources: WV Flood Tool's Risk Map View & Statewide Building-Level Risk Assessment

Shepherdstown has a high density of 76 buildings in the high-risk floodplain, nearly all of which are pre-FIRM and within the Shepherdstown Historic District. Shepherdstown ranks very high for the following building risk factors:

- High **Building Dollar Value** and **Density of Structures**. A higher total building value in floodplains can lead to increased insurance costs, while a higher density of buildings per acre in the floodplain signifies a greater physical and human exposure to flooding.
- High number of **Pre-FIRM Structures with Basements**. Pre-FIRM structures are more vulnerable to flooding because they were constructed when a Flood Insurance Rate Map (FIRM) was not in effect and thus were not built according to the regulations and building codes for floodplain development. Subgrade basements can flood quickly, especially in the event of flash floods, leading to structural damage, property loss, and increased recovery costs. Additionally, electrical equipment in basements can increase the risk of electrocution while flooding.
- Higher number of **Historical Buildings**. Historical assets often have significant cultural value, so it is crucial to know how many historical assets are in floodprone areas to aid in allocating resources for flood resilience and emergency response. A designated historic structure can obtain the benefit of subsidized flood insurance through the NFIP even if it has been substantially improved or substantially damaged so long as the building maintains its historic designation. Refer to FEMA's Floodplain Management bulletin of Historic Structures for more information. https://data.wvgis.wvu.edu/pub/RA/_resources/Historic/FEMA_bulletin_historic_structures_2008.pdf

Shepherdstown 3D Flood Movie

Click **here** to view 3D Flood Movie of Shepherdstown

View the narrated 3D flood visualization movie of **Shepherdstown** as an effective way of communicating flood risk and high building values for a major 1%-annual-chance (100-yr) flood event. Shepherdstown, the oldest town in West Virginia, faces flooding from two primary sources: Town Run and the backwater of the Potomac River. The Potomac River borders the eastern edge of the community, while Town Run flows through the town, winding under the historic district. The 1936 flood on Town Run caused maximum flood heights ranging from 1.5 to 2.0 feet in some areas of the town.

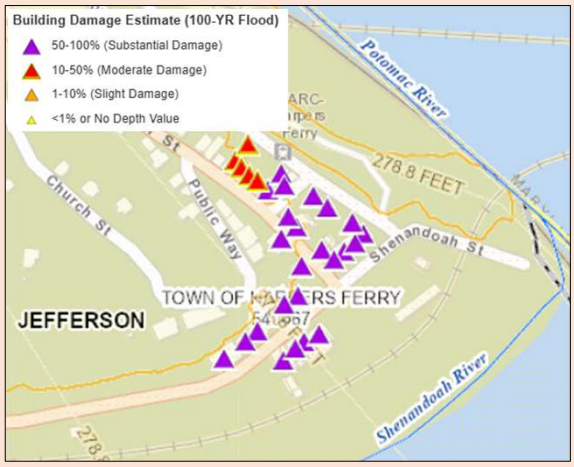
Example Urban Flooding

View Videos of 2021 Morgantown Flooding along *Popenoe Run* on Patteson Drive near WVU stadium that may occur similarly on *Town Run* in Shepherdstown

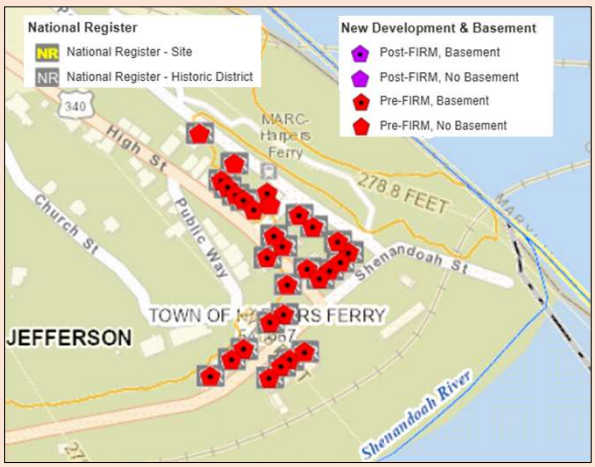
Courtesy of WV Hazard Library

The 2021 Morgantown urban flooding along Popenoe Run on Patterson Driver may occur similarly on Town Run in **Shepherdstown**. According to FEMA's FIS report, flooding from Town Run typically results in shallow overland flow depths of less than 3 feet. However, when the channel capacity is exceeded, floodwaters follow through streets and low-lying areas, and impact regions not directly adjacent to the stream channel. Like the 2021 urban flooding in Morgantown, primary roads in Shepherdstown will likely be flooded during a major storm event. Understanding the town's vulnerabilities, such as the impact of floods on primary roads and high-value structures, is essential for effective flood preparedness and resiliency efforts.

Harpers Ferry Risk Assessment



Building Substantial Damage Ratio highest of all 229 incorporated places in the state



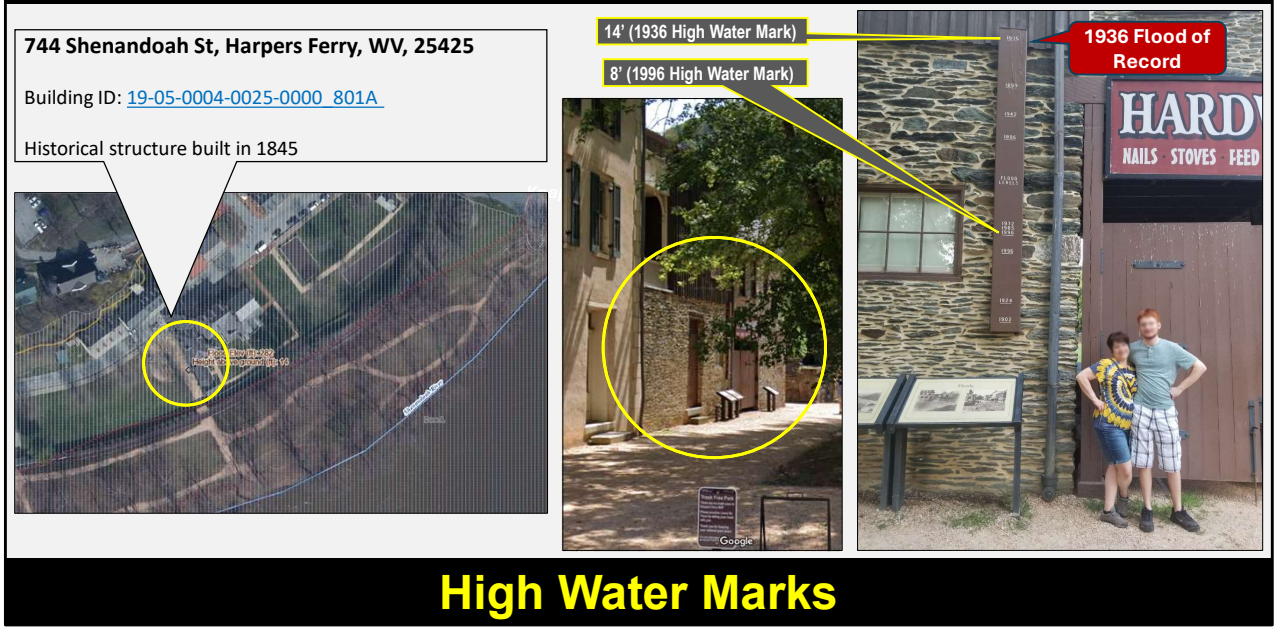
Pre-FIRM Building Ratio highest of all 229 incorporated places in the state

Refer to online All Risk Indicators Report

Sources: WV Flood Tool's Risk Map View & Statewide Building-Level Risk Assessment

The historical buildings located in **Harpers Ferry** are subject to very high flood depths (second floor flooding) and damage from a major flood storm. Fortunately, the historical masonry buildings of Harpers Ferry are more durable and resistant to water damage than other construction materials.

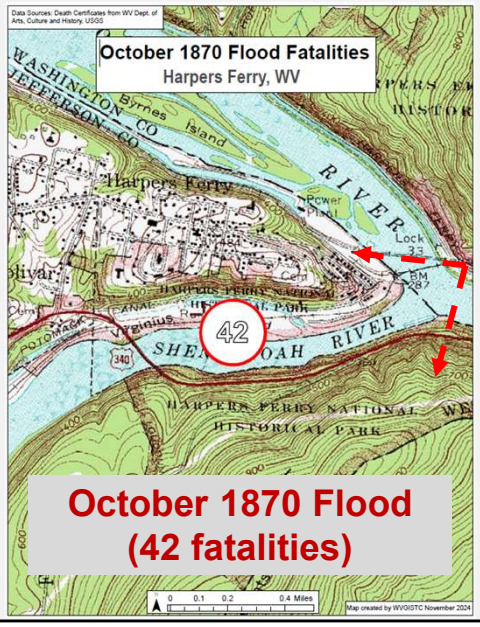
Harpers Ferry Risk Assessment



High Water Marks

Although the damage loss estimates for the structures in **Harpers Ferry** will decrease with the new preliminary flood maps, Harpers Ferry is the lowest point in the state and the town repeatedly floods at the confluence of the Shenandoah and Potomac Rivers. The worst known flood was on March 19, 1936, when the Potomac crested at a record 36.5 feet, more than 18 feet above flood stage.

Historical Flood Research (Harpers Ferry, WV)

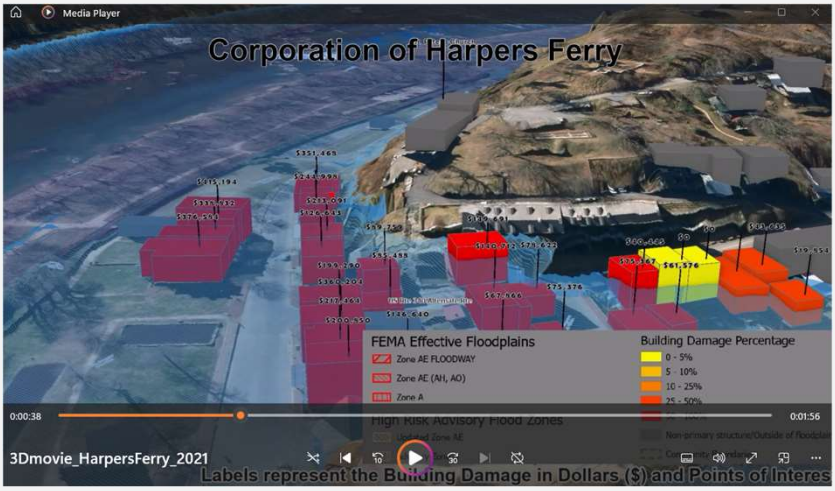


Engraving of the flood in Harpers Ferry, from Harper's Weekly, October 20, 1870
(Image courtesy of Yesterday's America)

Link to WV Flood Fatality Dashboard

Since recorded history, severe floods have ravaged **Harpers Ferry.** The flood of 1870 resulted in the Shenandoah River rising so rapidly that residents were trapped on Virginius Island. Floodwaters swept away much of the island's homes and industry and claimed 42 lives at Harpers Ferry.

Harpers Ferry 3D Flood Movie



Click **here** to view 3D Flood Movie of Harpers Ferry

View the narrated 3D flood visualization movie of **Harpers Ferry** as an effective way of communicating flood risk and high building values for a major 1%-annual-chance (100-yr) flood event occurring at Harpers Ferry. The movies shows damage loss estimates for a 100-year flood event based on FEMA's 2009 flood model.

Utilities in Floodplain (High $ Exposure)

City of Charles Town Wastewater Treatment Plant (FD: 1 ft)
Highest CA Value ($6.8M) in Jefferson County
(Building ID: 19-03-0008-0001-0000_842)
Value source inflation adjusted to 2021

Shepherdstown Water Works Water Treatment Plant (FD: 3 ft)
(Building ID: 19-10-0001-0052-0000_309) ($3.1M)
Value source inflation adjusted to 2021

Harpers Ferry Bolivar PSD Wastewater
Treatment Plant (FD: 1 ft)
(Building ID: 19-05-0004-0025-0000_192) ($462K)
Value source inflation adjusted to 2021

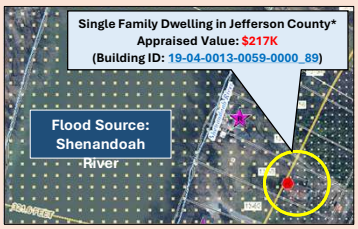
Online Mitigation Resources:

- EPA FLOOD RESILIENCE: Guide for Water/Wastewater Utilities
- Tips for Flood-Proofing Wastewater Treatment Plants
- Flood-Resistant Wastewater Treatment Plant Upgrades

Water and wastewater treatment **utilities** of Jefferson County are high-value assets that provide vital services to nearby communities. These utilities are typically close to flood sources and thus communities should floodproof these structures to minimize damage from future floods. Examples of mitigation measures for *utilities* include:

- Emergency response plan
- Barriers around key assets
- Elevated electrical equipment
- Emergency generators
- Bolted down chemical tanks

Building Flood Profile - Unmitigated



Rivermist Lane, Harpers Ferry

Repetitive Loss Area / Area of Mitigation Interest

BUILDING INFORMATION	
Property Class Type	R - Residential
Land Use	101 - Residential 1 Family
Year Built	1985 Post-FIRM

	HEIGHT (ft.)
BUILDING	
Freeboard (FBD)	3
FLOOD DEPTH	
FEMA 1% (100-Yr)	13.6
FEMA 1%+ (100-Yr+)	16.6
FEMA 0.2% (500-Yr)	19.6

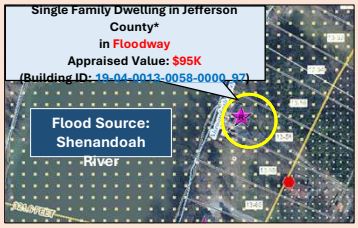
An unmitigated residential structure built in 1985 is located along **Shenandoah River** at 89 RIVERMIST LN, Harpers Ferry, WV, 25425. Based on the new flood study, the flood elevations range from 13.6 feet to 19.6 feet for the 1%-annual-chance(100-yr) and 0.2%-annual-chance (500-yr) flood events. The new Flood Study Profile reveals the following flood elevations for the 100-yr and 500-yr flood frequencies:

- ❑ 13.6 feet for a major 1% annual chance (100-yr) flood event.
- ❑ 16.6 feet for a 1-percent plus annual chance (100-yr) flood. The 1-percent plus flood elevation for a study utilizing rainfall-runoff methodology is defined as a flood elevation derived by using discharges at the upper 84-percent confidence limit for the 1-percent-annual-chance flood. FEMA captures this statistical uncertainty in its 1%+ flood elevations representing the higher 84-percent confidence limit of the statistical error for calculating the 1%-annual-chance event.
- ❑ 19.6 feet for a catastrophic 0.2%-annual-chance (500-yr) flood event.

This structure is a very vulnerable flood risk area along the Shenandoah River. This area has been mapped on the WV Flood Tool's RiskMAP View as a REPETITIVE LOSS AREA / AREA OF MITIGATION INTEREST (AoMI) based on the following criteria:

- Repetitive Loss Structures
- Substantial Damage Estimates
- Mitigated Properties
- High Flood Depths
- High Water Marks
- Similar Topography

Building Flood Profile - Unmitigated



Rivermist Lane, Harpers Ferry

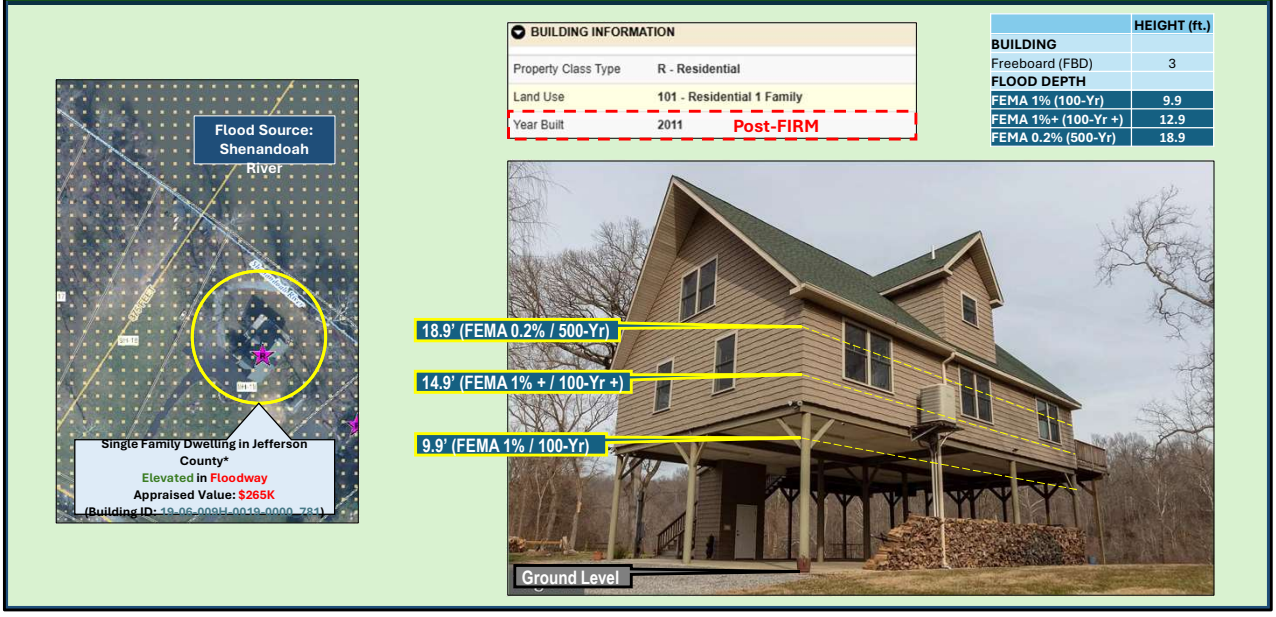
Repetitive Loss Area / Area of Mitigation Interest

BUILDING INFORMATION	
Property Class Type	R - Residential
Land Use	101 - Residential 1 Family
Year Built	1971 Pre-FIRM

	HEIGHT (ft.)
BUILDING	
Freeboard (FBD)	3
FLOOD DEPTH	
FEMA 1% (100-Yr)	13.7
FEMA 1%+ (100-Yr +)	16.7
FEMA 0.2% (500-Yr)	19.7

This one-store residential Pre-FIRM structure located at 97 RIVERMIST LN, Harpers Ferry, WV, 25425 is in the Regulatory Floodway of the **Shenandoah River** and subject to extreme flood depths of 13.7 feet and 19.7 feet for the 1%-annual-chance event (100-yr) and 0.2%-annual-chance event (500-yr) flood events, respectively. To avoid loss of life during a major flood event, residents at this home must evacuate to higher ground away from the structure.

Building Flood Profile – Mitigated to DFE



Built in 2011, this mitigated residential structure at 781 AVON BEND RD, Charles Town, WV, 25414, is elevated to the Design Flood Elevation (DFE) of the FEMA 1%-annual-chance (100-yr) base flood elevation plus 3 feet of freeboard. However, this home is still vulnerable to extreme flooding from a rare, catastrophic 0.2%-annual-chance flood depth of 19 feet. The building appraisal value of this structure is $265,000 on the 2024 tax assessment database, while the total tax appraisal value (building and land) is $406,200 compared to $554,000 on Zillow.

Contact Persons:

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  behrang.bidadian@mail.wvu.edu
- **Annie Mahmoudi**
  anm0050@mail.wvu.edu

West Virginia GIS Technical Center

Contact information if one has questions about the risk assessment slides.

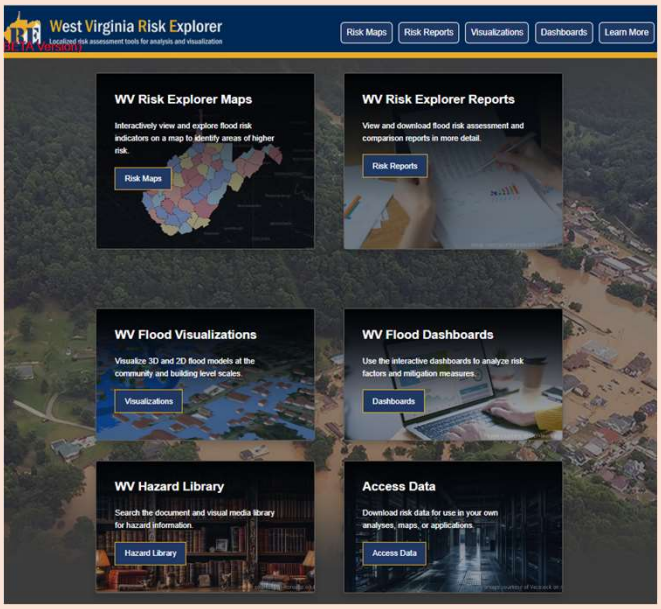
West Virginia Risk Explorer
Localized risk assessment tools for analysis and visualization

Jefferson County 2024

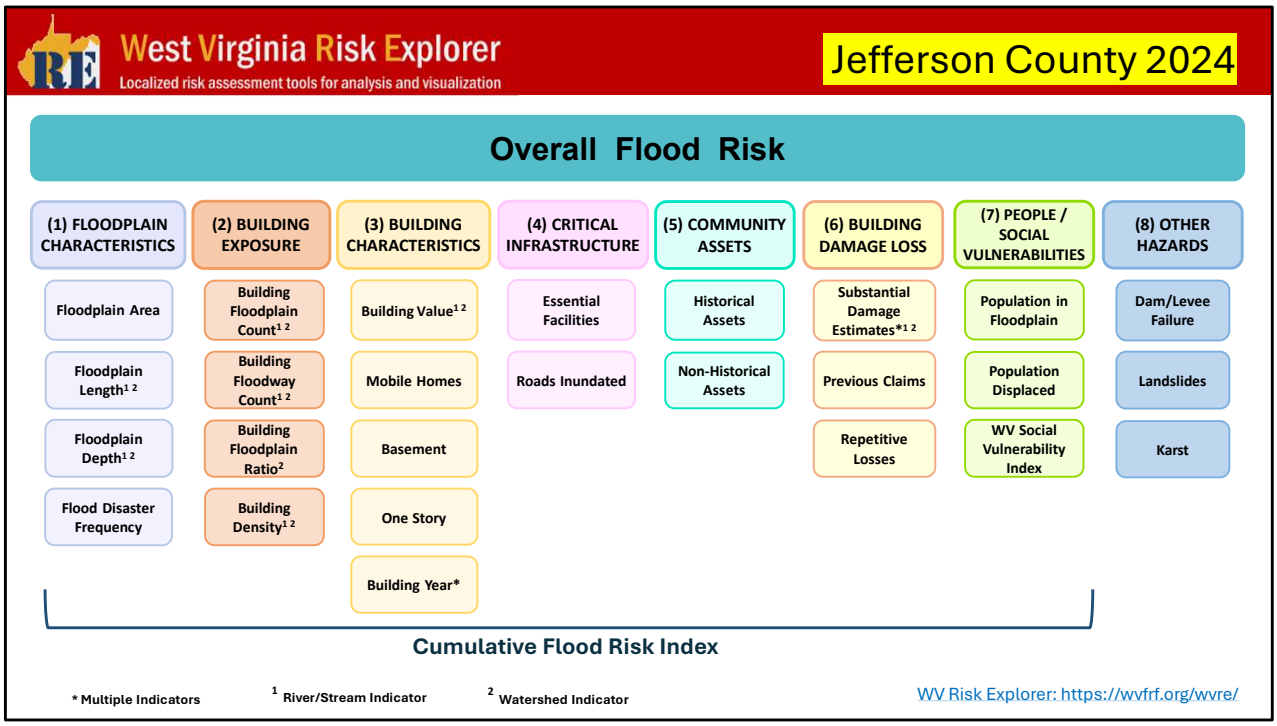
APPENDIX SLIDES

Jefferson County
Risk Assessment

Study Source:
WV Risk Explorer Tool
https://wvfrf.org/wvre/



Jefferson County risk assessment using the **WV Risk Explorer**, a risk tool of the WV Flood Resiliency Framework (www.WVFRF.org)



25 Flood Risk Indicators quantify the overall cumulative risk index of each community. Refer to the WV Risk Explorer Tool for rationales and recommendations of each risk factor.

Flood Risk Assessment
Jefferson County

Link to Flood Risk Comparison Report on WVRE:
https://wvfrf.org/wvre/report/?scaleid=3&entityid=19&type=hierarchy

Cumulative Flood Risk Index:

Table 1a: County Total

STATE INDEX RANK	COUNTY	CUMULATIVE FLOOD RISK INDEX	
		INDEX SCORE	INDEX RATING
48	Jefferson	12.9%	Very Low

Table 1b: Incorporated Places

#	STATE INDEX RANK	INCORPORATED PLACE	COUNTY	CUMULATIVE FLOOD RISK INDEX	
				INDEX SCORE	INDEX RATING
1	100	Harpers Ferry - Incorporated	Jefferson	56.5%	Moderate
2	126	Shepherdstown - Incorporated	Jefferson	45.1%	Moderate
3	173	Ranson - Incorporated	Jefferson	24.5%	Relatively Low
4	183	Charles Town - Incorporated	Jefferson	20.1%	Relatively Low
5	189	Bolivar - Incorporated	Jefferson	17.5%	Very Low

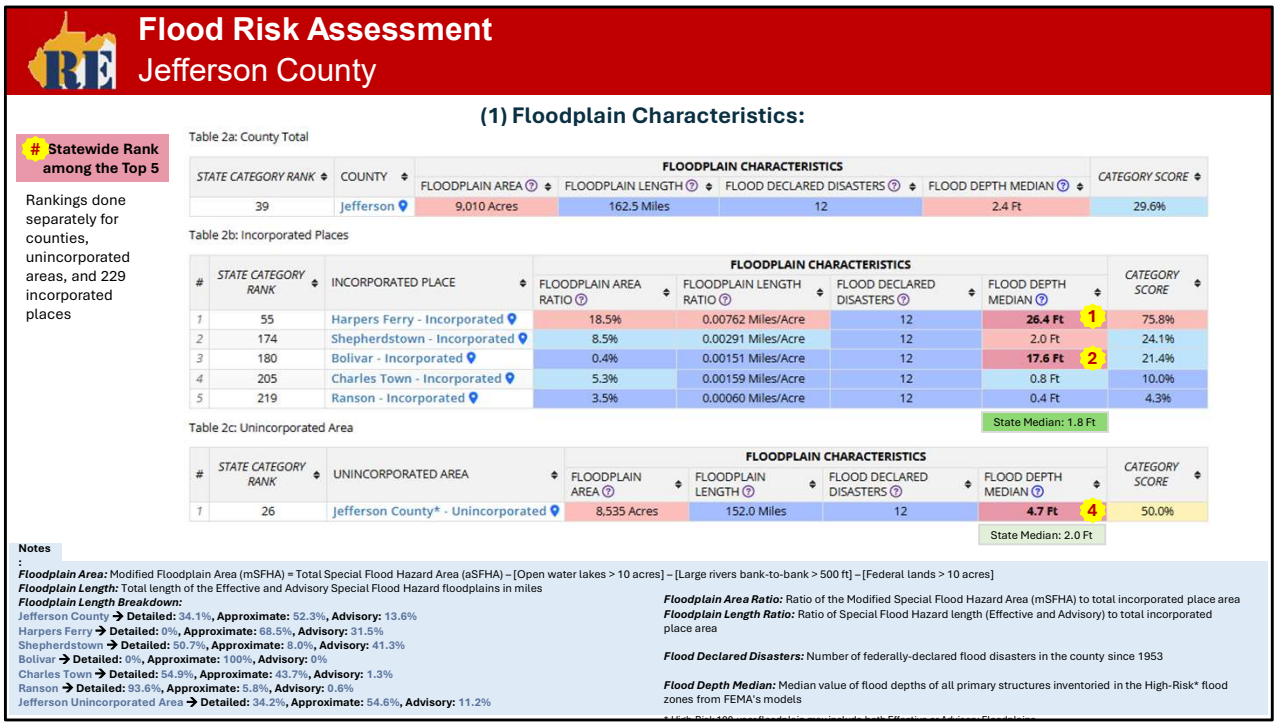
Table 1c: Unincorporated Area

#	STATE INDEX RANK	UNINCORPORATED AREA	CUMULATIVE FLOOD RISK INDEX	
			INDEX SCORE	INDEX RATING
1	40	Jefferson County* - Unincorporated	27.7%	Relatively Low

Risk Index Legend

- **VERY HIGH**: 90% - 100%
- Very High: 80% - 100%
- Relatively High: 60% - 79.9%
- Moderate: 40% - 59.9%
- Relatively Low: 20% - 39.9%
- Very Low: 0% - 19.9%

Cumulative Flood Risk Index report for Jefferson County, Jefferson County Unincorporated, and Incorporated Places. View online report using the WV Risk Explorer Tool.



Flood Risk Assessment
Jefferson County

(1) Floodplain Characteristics:

 # Statewide Rank among the Top 5

Rankings done separately for counties, unincorporated areas, and 229 incorporated places

Table 2a: County Total

STATE CATEGORY RANK	COUNTY	FLOODPLAIN CHARACTERISTICS				CATEGORY SCORE
		FLOODPLAIN AREA	FLOODPLAIN LENGTH	FLOOD DECLARED DISASTERS	FLOOD DEPTH MEDIAN	
39	Jefferson	9,010 Acres	162.5 Miles	12	2.4 Ft	29.6%

Table 2b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	FLOODPLAIN CHARACTERISTICS				CATEGORY SCORE
			FLOODPLAIN AREA RATIO	FLOODPLAIN LENGTH RATIO	FLOOD DECLARED DISASTERS	FLOOD DEPTH MEDIAN	
1	55	Harpers Ferry - Incorporated	18.5%	0.00762 Miles/Acre	12	**26.4 Ft** 1	75.8%
2	174	Shepherdstown - Incorporated	8.5%	0.00291 Miles/Acre	12	2.0 Ft	24.1%
3	180	Bolivar - Incorporated	0.4%	0.00151 Miles/Acre	12	**17.6 Ft** 2	21.4%
4	205	Charles Town - Incorporated	5.3%	0.00159 Miles/Acre	12	0.8 Ft	10.0%
5	219	Ranson - Incorporated	3.5%	0.00060 Miles/Acre	12	0.4 Ft	4.3%
						State Median: 1.8 Ft	

Table 2c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	FLOODPLAIN CHARACTERISTICS				CATEGORY SCORE
			FLOODPLAIN AREA	FLOODPLAIN LENGTH	FLOOD DECLARED DISASTERS	FLOOD DEPTH MEDIAN	
1	26	Jefferson County* - Unincorporated	8,535 Acres	152.0 Miles	12	**4.7 Ft** 4	50.0%
						State Median: 2.0 Ft	

Notes:

Floodplain Area: Modified Floodplain Area (mSFHA) = Total Special Flood Hazard Area (aSFHA) – [Open water lakes > 10 acres] – [Large rivers bank-to-bank > 500 ft] – [Federal lands > 10 acres]

Floodplain Length: Total length of the Effective and Advisory Special Flood Hazard floodplains in miles

Floodplain Length Breakdown:

Jefferson County → **Detailed:** 34.1%, **Approximate:** 52.3%, **Advisory:** 13.6%
Harpers Ferry → **Detailed:** 0%, **Approximate:** 68.5%, **Advisory:** 31.5%
Shepherdstown → **Detailed:** 50.7%, **Approximate:** 8.0%, **Advisory:** 41.3%
Bolivar → **Detailed:** 0%, **Approximate:** 100%, **Advisory:** 0%
Charles Town → **Detailed:** 54.9%, **Approximate:** 43.7%, **Advisory:** 1.3%
Ranson → **Detailed:** 93.6%, **Approximate:** 5.8%, **Advisory:** 0.6%
Jefferson Unincorporated Area → **Detailed:** 34.2%, **Approximate:** 54.6%, **Advisory:** 11.2%

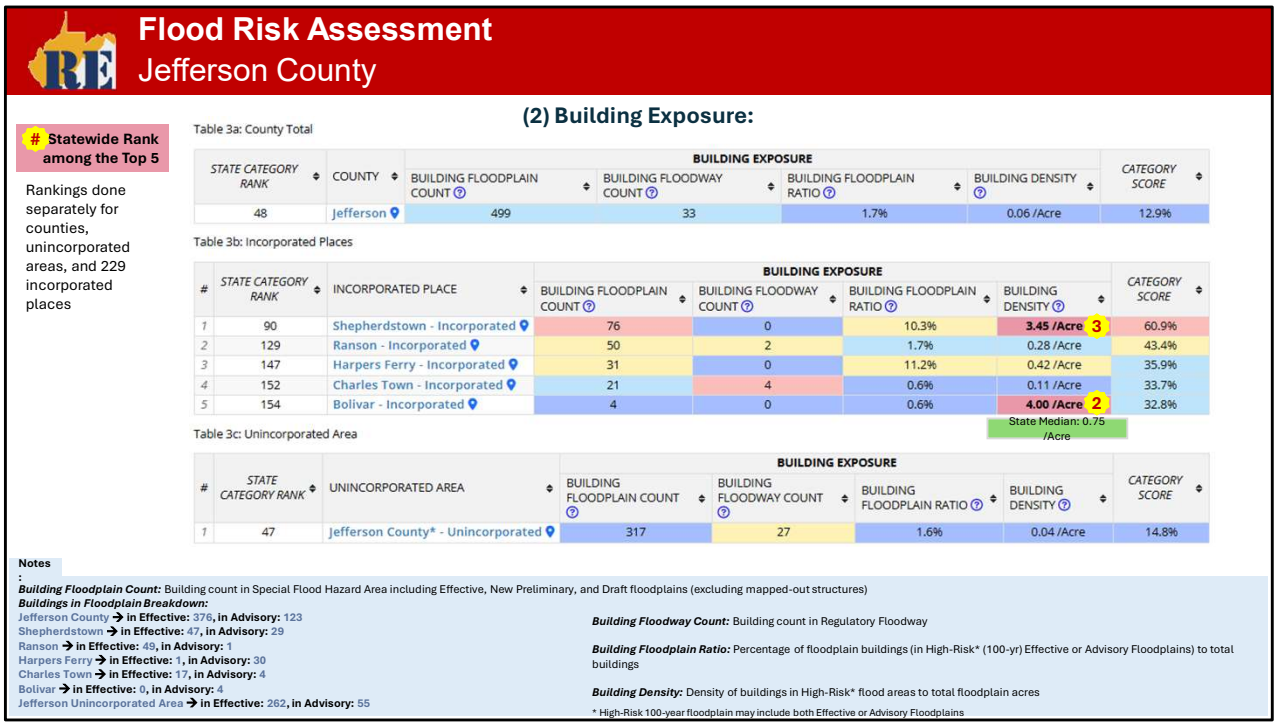
Floodplain Area Ratio: Ratio of the Modified Special Flood Hazard Area (mSFHA) to total incorporated place area

Floodplain Length Ratio: Ratio of Special Flood Hazard length (Effective and Advisory) to total incorporated place area

Flood Declared Disasters: Number of federally-declared flood disasters in the county since 1953

Flood Depth Median: Median value of flood depths of all primary structures inventoried in the High-Risk* flood zones from FEMA's models

Floodplain Characteristics Category. Harpers Ferry and Bolivar have high median flood depths for structures located in the Special Flood Hazard Area.



Flood Risk Assessment
Jefferson County

(2) Building Exposure:

 # Statewide Rank among the Top 5

Rankings done separately for counties, unincorporated areas, and 229 incorporated places

Table 3a: County Total

STATE CATEGORY RANK	COUNTY	BUILDING EXPOSURE: BUILDING FLOODPLAIN COUNT	BUILDING FLOODWAY COUNT	BUILDING FLOODPLAIN RATIO	BUILDING DENSITY	CATEGORY SCORE
48	Jefferson	499	33	1.7%	0.06 /Acre	12.9%

Table 3b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	BUILDING EXPOSURE: BUILDING FLOODPLAIN COUNT	BUILDING FLOODWAY COUNT	BUILDING FLOODPLAIN RATIO	BUILDING DENSITY	CATEGORY SCORE
1	90	Shepherdstown - Incorporated	76	0	10.3%	**3.45 /Acre** 3	60.9%
2	129	Ranson - Incorporated	50	2	1.7%	0.28 /Acre	43.4%
3	147	Harpers Ferry - Incorporated	31	0	11.2%	0.42 /Acre	35.9%
4	152	Charles Town - Incorporated	21	4	0.6%	0.11 /Acre	33.7%
5	154	Bolivar - Incorporated	4	0	0.6%	**4.00 /Acre** 2	32.8%

State Median: 0.75 /Acre

Table 3c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	BUILDING EXPOSURE: BUILDING FLOODPLAIN COUNT	BUILDING FLOODWAY COUNT	BUILDING FLOODPLAIN RATIO	BUILDING DENSITY	CATEGORY SCORE
1	47	Jefferson County* - Unincorporated	317	27	1.6%	0.04 /Acre	14.8%

Notes:

Building Floodplain Count: Building count in Special Flood Hazard Area including Effective, New Preliminary, and Draft floodplains (excluding mapped-out structures)

Buildings in Floodplain Breakdown:

Jefferson County → **in Effective:** 376, **in Advisory:** 123
Shepherdstown → **in Effective:** 47, **in Advisory:** 29
Ranson → **in Effective:** 49, **in Advisory:** 1
Harpers Ferry → **in Effective:** 1, **in Advisory:** 30
Charles Town → **in Effective:** 17, **in Advisory:** 4
Bolivar → **in Effective:** 0, **in Advisory:** 4
Jefferson Unincorporated Area → **in Effective:** 262, **in Advisory:** 55

Building Floodway Count: Building count in Regulatory Floodway

Building Floodplain Ratio: Percentage of floodplain buildings (in High-Risk* (100-yr) Effective or Advisory Floodplains) to total buildings

Building Density: Density of buildings in High-Risk* flood areas to total floodplain acres

* High-Risk 100-year floodplain may include both Effective or Advisory Floodplains

Building Exposure Category. Bolivar and Shepherdstown have a high density of structures in the Special Flood Hazard Area.

Flood Risk Assessment
Jefferson County

 # Statewide Rank among the Top 5

Rankings done separately for counties, unincorporated areas, and 229 incorporated places

Table 4a: County Total

STATE CATEGORY RANK	COUNTY	BUILDING CHARACTERISTICS: BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1-STORY RATIO	BLDG. YEAR PRE-FIRM RATIO	BLDG. YEAR MINUS RATED POST-FIRM RATIO	CATEGORY SCORE
24	Jefferson	**$97,450** 1	13.6%	**49.5%** 4	64.0%	71.1%	9.4%	57.4%
		State Median: $42,200		State Median: 21.6%				

Table 4b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	BUILDING CHARACTERISTICS: BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1-STORY RATIO	BLDG. YEAR PRE-FIRM RATIO	BLDG. YEAR MINUS RATED POST-FIRM RATIO	CATEGORY SCORE
1	116	Shepherdstown - Incorporated	**$213,800** 1	0.0%	45.5%	16.7%	92.4%	1.3%	49.5%
2	125	Ranson - Incorporated	$63,350	13.3%	37.5%	90.0%	67.5%	0.0%	45.6%
3	136	Harpers Ferry - Incorporated	**$188,000** 2	0.0%	**90.3%** 1	3.2%	**100.0%** 1	0.0%	40.7%
4	172	Charles Town - Incorporated	$67,500	0.0%	**63.0%**	37.0%	77.8%	0.0%	25.0%
5	187	Bolivar - Incorporated	$0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
			State Median: $41,500		State Median: 25.5%		State Median: 86.6%		

Table 4c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	BUILDING CHARACTERISTICS: BUILDING MEDIAN VALUE	BLDG. MOBILE HOMES RATIO	BLDG. SUBGRADE BASEMENTS RATIO	BUILDING 1-STORY RATIO	BLDG. YEAR PRE-FIRM RATIO	BLDG. YEAR MINUS RATED POST-FIRM RATIO	CATEGORY SCORE
1	20	Jefferson County* - Unincorporated	**$93,150** 1	15.5%	**48.9%** 2	71.5%	66.7%	**14.5%**	62.9%
			State Median: $37,350		State Median: 19.5%				

Notes:

Building Median Value: Median of appraised values of all primary structures in the High-Risk* 100-year floodplain from the most recent tax assessment data or other building value data sources for tax-exempt structures

Bldg. Mobile Homes Ratio: Percentage of manufactured buildings (occupancy class code RES2) among all single-family structures (RES1 & RES2) in the High-Risk* 100-year floodplain

Bldg. Subgrade Basements Ratio: Percentage of structures with subgrade basements among all primary structures in the High-Risk* 100-year floodplain (may also include walkout basement enclosures)

Building 1-Story Ratio: Percentage of one-story structures among all primary buildings in the High-Risk* 100-year floodplain

Bldg. Year Pre-FIRM Ratio: Percentage of buildings constructed or substantially improved on or before December 31, 1974, or before the effective date of the initial Flood Insurance Rate Map of the community, whichever is late (also including Post-FIRM construction regulated to Pre-FIRM and Unknown FIRM status) among all primary structures in the High-Risk* 100-year floodplain

Bldg. Year Minus Rated Post-FIRM Ratio: Percentage of structures constructed after the FIRM date of which their first floor is more than one foot below the Base Flood Elevation (BFE) among all primary structures in the High-Risk* 100-year floodplain

Building Characteristics Category. Although Bolivar was not ranked because it only has four structures in the high-risk flood zones, all communities in Jefferson County have high building values.

Since Shepherdstown and Harpers Ferry are designated historic districts, nearly all these structures are Pre-FIRM or built before there were effective Flood Insurance Rate Maps.

Based on the tax assessment data, Jefferson County has a percentage of structures with basements, but some of these structures are “walkout” basements instead of “subgrade” basements.

Flood Risk Assessment
Jefferson County

(4) Critical Infrastructure:

Table 5a: County Total

STATE CATEGORY RANK	COUNTY	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
		ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
51	Jefferson	0	4.4%	7.4%

Table 5b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	115	Harpers Ferry - Incorporated	0	31.6%	50.0%
2	160	Shepherdstown - Incorporated	0	7.5%	29.8%
3	168	Bolivar - Incorporated	0	5.9%	26.7%
4	197	Ranson - Incorporated	0	0.9%	14.0%
5	206	Charles Town - Incorporated	0	0.1%	10.0%

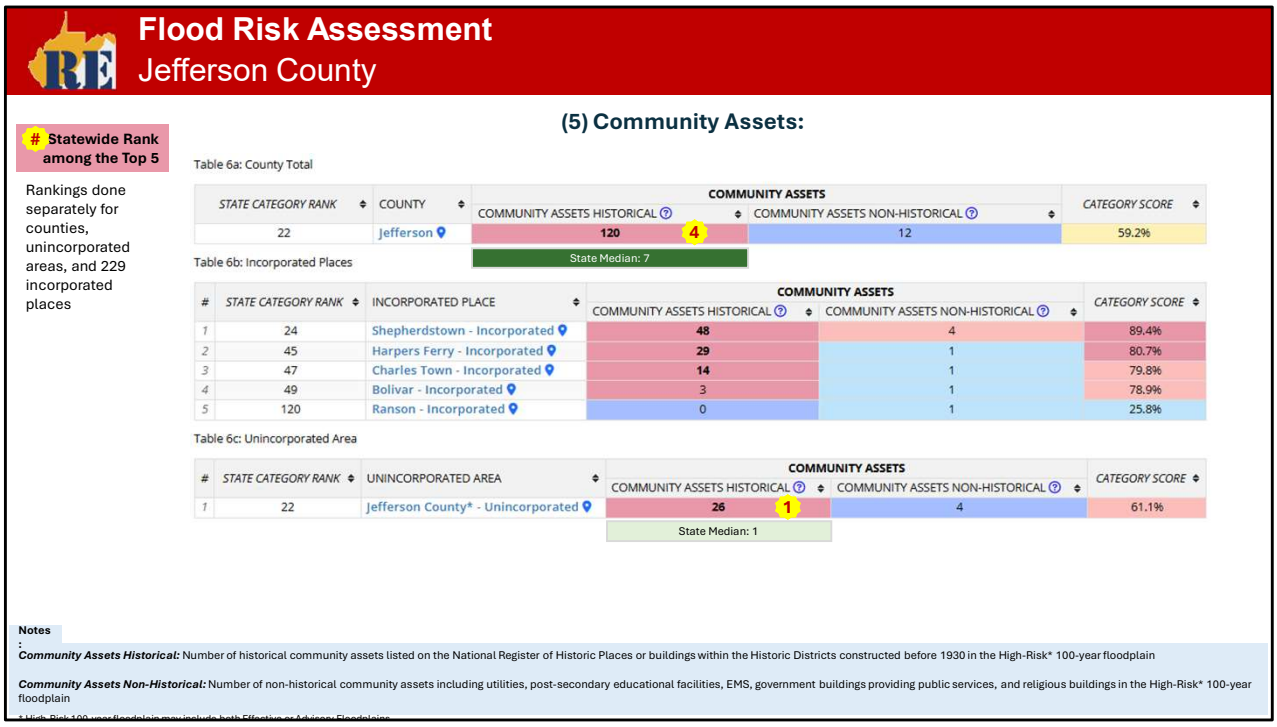
Table 5c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	CRITICAL INFRASTRUCTURE		CATEGORY SCORE
			ESSENTIAL FACILITIES	ROADS INUNDATED RATIO	
1	47	Jefferson County* - Unincorporated	0	4.6%	14.8%

Notes
:
Essential Facilities: Number of essential facilities (including schools, hospitals, nursing homes, police stations, fire department buildings, & E-911 emergency operations centers) which provide critical services to the community in the high (100-year), moderate (500-year), and reduced risk flood zones

Roads Inundated Ratio: Percentage of roads inundated by flood waters of 1 foot or more by a high-risk 1% annual chance (100-year) flood event

Critical Infrastructure. Jefferson County has no essential facilities in the high and moderate flood risk zones.



Community Assets. Jefferson County has a high number of historical structures in the SFHA that are vulnerable to flooding. Jefferson County Unincorporated ranks 1st of all other 55 unincorporated areas in the state.

Flood Risk Assessment
Jefferson County

(6) Building Damage Loss:

 # Statewide Rank among the Top 5

Rankings done separately for counties, unincorporated areas, and 229 incorporated places

Table 7a: County Total

STATE CATEGORY RANK	COUNTY	BUILDING DAMAGE LOSS				CATEGORY SCORE
		BLDG. SUBSTANTIAL DAMAGE COUNT	BLDG. SUBSTANTIAL DAMAGE RATIO	BLDG. PREVIOUS DAMAGE CLAIMS	BLDG. REPETITIVE LOSS STRUCTURES	
26	Jefferson	120	24.0%	163	66	53.7%

Table 7b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	BUILDING DAMAGE LOSS				CATEGORY SCORE
			BLDG. SUBSTANTIAL DAMAGE COUNT	BLDG. SUBSTANTIAL DAMAGE RATIO	BLDG. PREVIOUS DAMAGE CLAIMS	BLDG. REPETITIVE LOSS STRUCTURES	
1	54	Harpers Ferry - Incorporated	24	77.4% 1	11	2	76.7%
2	112	Bolivar - Incorporated	1	0.0%	0	0	51.3%
3	125	Shepherdstown - Incorporated	1	1.3%	2	0	45.6%
4	134	Ranson - Incorporated	0	0.0%	20	6	41.6%
5	181	Charles Town - Incorporated	0	0.0%	3	0	20.1%

State Median: 0.9%

Table 7c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	BUILDING DAMAGE LOSS				CATEGORY SCORE
			BLDG. SUBSTANTIAL DAMAGE COUNT	BLDG. SUBSTANTIAL DAMAGE RATIO	BLDG. PREVIOUS DAMAGE CLAIMS	BLDG. REPETITIVE LOSS STRUCTURES	
1	16	Jefferson County* - Unincorporated	94	29.7%	127	58	72.2%

Notes

Bldg. Substantial Damage Count: Estimated number of primary structures substantially damaged from a 1% annual chance (100-year) flood for which the estimated flood loss is 50% or greater of the building appraised value
Bldg. Substantial Damage Ratio: Percentage of substantially damaged structures to total floodplain structures

Bldg. Previous Damage Claims: Number of previous flood-related insurance claims
Bldg. Repetitive Loss Structures: Number of NFIP-insured structures that have had at least 2 paid flood losses of more than $1,000 each in any 10-year period since 1978

Building Damage Loss. Harpers Ferry has high substantial damage estimates (more than 50% damage to structure) because of high flood depths for a major 1%-annual-chance storm.

Flood Risk Assessment
Jefferson County

(7) People / Social Vulnerabilities:

Table 8a: County Total

STATE CATEGORY RANK	COUNTY	PEOPLE / SOCIAL VULNERABILITIES			CATEGORY SCORE
		POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	
54	Jefferson	2.1%	1.4%	0.0%	1.8%

Table 8b: Incorporated Places

#	STATE CATEGORY RANK	INCORPORATED PLACE	PEOPLE / SOCIAL VULNERABILITIES			CATEGORY SCORE
			POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	
1	168	Shepherdstown - Incorporated	11.2%	3.4%	1.8%	26.7%
2	175	Harpers Ferry - Incorporated	4.8%	4.8%	3.1%	23.6%
3	187	Ranson - Incorporated	2.7%	1.7%	7.0%	18.4%
4	202	Charles Town - Incorporated	0.9%	0.5%	0.9%	11.8%
5	207	Bolivar - Incorporated	0.5%	0.2%	0.4%	9.6%

Table 8c: Unincorporated Area

#	STATE CATEGORY RANK	UNINCORPORATED AREA	PEOPLE / SOCIAL VULNERABILITIES			CATEGORY SCORE
			POPULATION IN FLOODPLAIN RATIO	POPULATION DISPLACED RATIO	WV SOCIAL VULNERABILITY INDEX	
1	54	Jefferson County* - Unincorporated	2.0%	1.4%	1.8%	1.8%

Notes
:
Population in Floodplain Ratio: Percentage of population residing in the High-Risk* Special Flood Hazard Area to total population
Population Displaced Ratio: Estimated percentage of population displaced by a major storm of a 1% annual chance (100-year) probability to total population
WV Social Vulnerability Index: Social vulnerability index developed for West Virginia based on the eight following socioeconomic and demographic indicators:
Poverty Rate, Unemployment Rate, No High School Diploma Ratio, Vulnerable Ages Ratio, Disability Ratio, Population Change Ratio, Median Housing Value, and Mobile Homes Ratio in Total Area

* High-Risk 100-year floodplain may include both Effective or Advisory Floodplains

People / Social Vulnerabilities. Jefferson County has the lowest WV Social Vulnerability Index in the state and thus should be able to recover more quickly from a major flood disaster than most counties in the state.