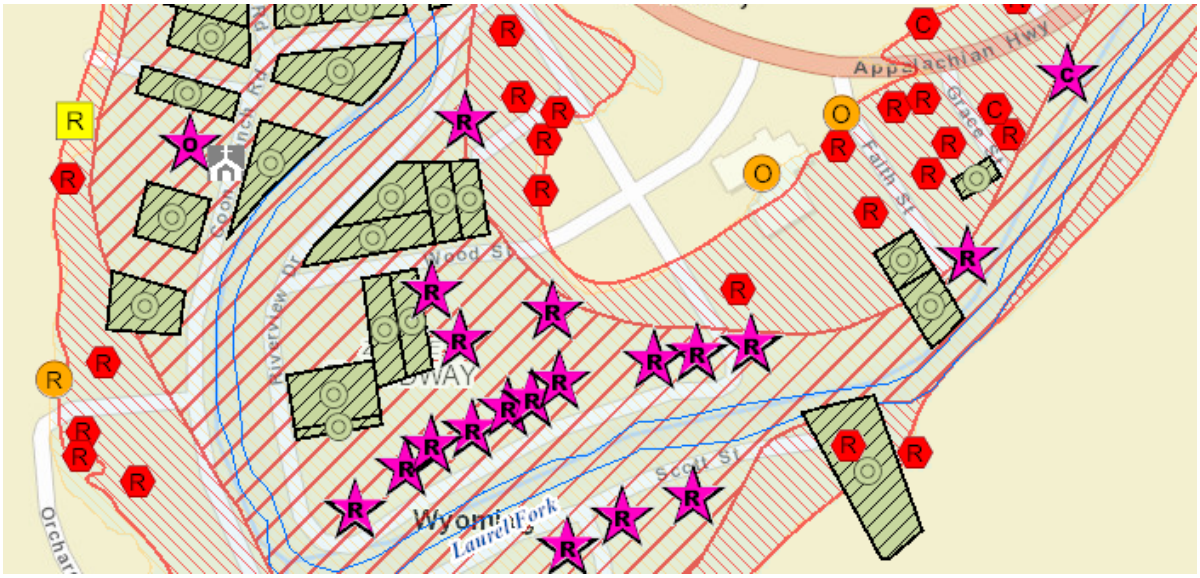
FLOOD RISK ASSESSMENT METHODOLOGY



Support for Hazard Mitigation Plans

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Methodology

Overview

Funded by a FEMA Hazard Mitigation Grant Program (HMGP) and the State Hazard Mitigation Office, building-level flood risk assessments are being completed statewide for a 1% annual chance flood (100-year) event in support of local and state hazard mitigation plans. The building-level flood risk assessments utilize FEMA's Flood Assessment Structure Tool (FAST), a GIS-based, open source utility designed by FEMA's Hazus Program for estimating potential building losses from flood disasters. FAST was built from the ArcGIS Python script developed by Oregon's Department of Geology and Mineral Industries (DOGAMI). A Hazus Level 2 advanced analysis increases the accuracy and precision of an analysis by incorporating user-supplied data relevant to the hazard. The flood model results support local hazard mitigation plans and other flood reduction efforts.

The Hazus utility employs a standardize methodology in which building and water depth inputs utilize Depth Damage Functions (DDFs) to calculate economic damage loss estimates. The proper Depth Damage Function (DDF) is assigned based on the Occupancy Type, Foundation Type, and Number of Stories of each structure. The First Flood Height for each structure point is subtracted from the Water Depth to calculate the Depth-in-Structure flood depth, in feet above ground level.

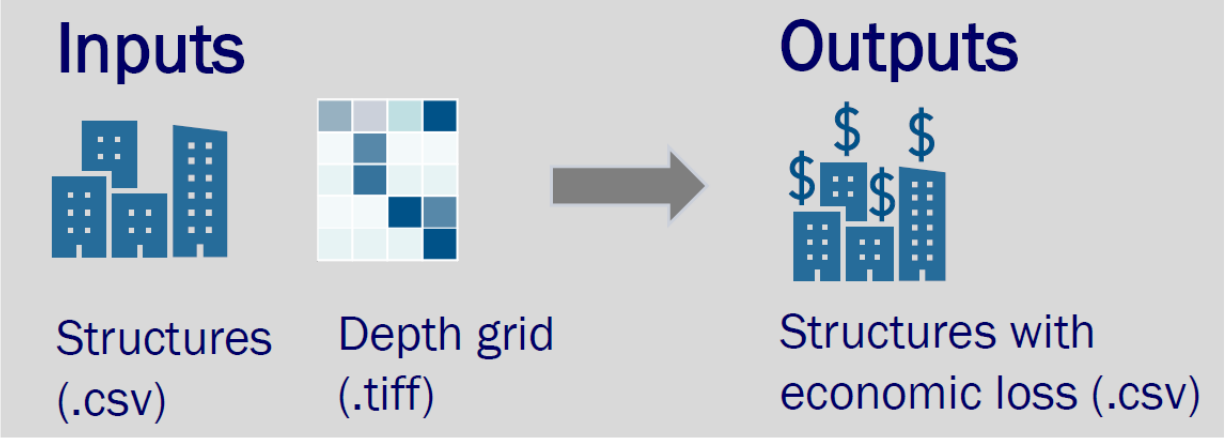


Figure 1. Hazus Building-Level Flood Loss Estimates. Source: FEMA.

The FAST performs a Hazus Flood Model analysis, using the most accurate 100-year depth grid available. It generates damage loss estimates for building, content, and inventory, building debris, and building repair/replacement times. Population displacement estimates are computed from the Residential Occupancy Types and census average household size. All building-level risk assessments are output to tabular reports, geodatabase, and the RiskMAP View of the WV Flood Tool.

The Hazus Program designed FAST to make flood risk assessments quicker, simpler, and more cost effective. FAST provides planners, analysts and policymakers with a free and user-friendly tool to characterize flood risk in their communities using completely open methods and technology.

Building Inventory

Detailed building inventories are developed by pinpointing all primary structures in the high-risk effective and advisory floodplains. Historical and community assets (government buildings, churches) are also inventoried. Essential facilities are inventoried to the 0.2-pecent (500-year) annual chance flood event. Required building characteristics are Occupancy Class, Foundation Type, First Floor Height, Number of Stories, Area, and Replacement Cost. Default values are populated from the most current State Parcel Assessment Database which us updated annually, and then where necessary modified with user-defined values that override the Assessment Database values. User-defined values can be entered for the building address, parcel geometry and assessment identifiers, essential building characteristics, and base flood water depth. Building pictures can be linked to the risk assessment using the unique building identifier.

GIS Specialists use desktop mapping software to pinpoint the building location to the most restrictive flood zone, identify insurable primary structures, match building points to the correct building assessment records, complete missing building attributes, and modify default assessment building values with user-supplied values. The following GIS Reference Layers are used to improve the location accuracy and building attributes: E-911 Addresses, Parcels/Attributes, Aerial Imagery, Building Footprints, Street View Pictures, Elevation Certificates, and other building reference databases. All the building points in the Special Flood Hazard Area and High-Risk Advisory Zones are manually captured, processed, and then quality checked using nine square mile grids. Data error flags are recorded for missing assessment values, parcel misalignments, missing E-911 address numbers, etc. User-supplied values that override the default assessment values are recorded as red text in the building inventory tables. A unique building identifier is formed from concatenating the Parcel ID and Building Address Number.

Water Depth Grids

The Water Depth Grid communicates information about the flood depth for a 1-percent (100-year) annual chance flood. Flood Depth Grids illustrate the flood depth, in feet above the ground surface, to demonstrate the variability of flood depths in flood prone areas. Officials can use depth grids to help individuals visualize the depth of flooding their home might experience; an easier concept than understanding a base flood elevation. The depth grid, combined with an inventory of the built environment, is used by the Hazus Flood Model to determine flood loss potential, by applying the appropriate depth- damage curves. For the Flood Model Analysis, Model-Backed Depth Grids created from engineering software like HEC-RAS are preferred over the less-accurate Hazus Depth Grids. In the WV Flood Tool, the Water Depth is displayed in the (1) Flood Results Query Panel, (2) Flood Risk Layers Menu, and (3) 3D Flood Visualization.

Flood Risk Assessment Products

Flood Risk Products are presented at the building and community levels for each county. Primary products include a Flood Risk Report, Flood Risk Map, Flood Risk Database, Flood Risk Tables, Flood Risk Grids (Water Depth, Water Surface Elevation), Flood Zone Changes resulting from active or future flood map studies, and Building-Level Flood Risk Assessments. Building Exposure information like structure values, occupancy type, owner occupancy, and household population are tabulated per structure. The Hazus Flood Model calculates per structure Building Damage Loss Estimates, Debris Removal, and Restoration Time for a 1% annual chance flood event. The Population Displacement is computed per residential structure from the building inventory and census average household size which provide inputs for Short-Term Shelter Models. Other data layers and products which support floodplain management and risk assessments include dams, levees, landslides, high-water marks, LOMA verified points, elevation certificates, assessment reports, CRS program variables, and 3D flood visualizations. Building Flood Risk Products are viewable in both tabular or graphical formats. Building-level risk assessments are aggregated to the community-level, which in turn can be summarized at the regional and state levels. Risk assessment reports can also be generated at the stream and watershed levels.

Although the Flood Risk Reports and data are organized primarily at the community and building levels, users can access the detailed risk assessments of each structure by viewing the Flood Risk Tables or WV Flood Tool. Mitigation layers (e.g., buyout properties, open space preservation) provide information for communities to identify flood reduction activities. FEMA's Community Engagement Prioritization Tool (CEP-Tool) will be used to rank communities by risk indicators and prioritize for engagement.

Community Exposure and Risk

There are 287 communities (232 municipalities and 55 unincorporated counties), 11 planning regions, and 55 counties.

- Demographic / Social Vulnerability
    - Population Growth
    - Population in SFHA
    - Social Vulnerability (SOVI)
    - Ownership
    - Income
    - Age
- Land Use / Impervious Surfaces
- Historical Flooding
    - Presidential-Declared Disasters
    - Date of Last Disaster
    - High Water Marks
- Insurance Claims
- Insurance Policies

- Flood Zones
    - Stream Miles
    - Regulatory Floodway
    - High-Risk Advisory Zones (Advisory A, Updated AE, Preliminary NFHL)
    - Area in SFHA (aSFHA)
- Structures Summary
    - Buildings in SFHA (counts, values, occupancy class, etc.)
    - Facilities (Essential, Community, Government)
    - Historical
    - Repetitive Loss Structures
    - Dams and Levees
    - Transportation Infrastructure (Roads / Bridges)
- Flood Risk Assessment Summary
    - Building Damage
    - Debris Removal
    - Population Displaced
        - Short-Term Sheltering
        - Companion Pets

Building-Level Exposure

The data variables below identify flood exposure to buildings and communities:

Flood Zones

- Regulatory / Non-Regulatory / Floodway
- High-Risk Advisory Zones / Future Map Conditions
    - Mapped-In SFHA
    - Mapped-Out SFHA
    - No Change SFHA
    - Floodway
- LOMA (Positional Accuracy Verified)
    - Structure Removal
    - Structure Non-Removal
    - Structure Out as Shown
- Flooding Source by Stream Name / Watershed
- Population in SFHA

Water Depth

- Water Depth
- Water Depth-in-Structure
- Water Surface Elevation

Structures

- Building Exposure
- Building Exposure Cost
- Building Occupancy Class (Residential/Commercial/Other)
- Building Owner Occupied / Rental
- Basement / Foundation Type
- First-Floor Height / Lowest Floor
- Building Year / Construction / New Development (Pre-FRIM, Post-FIRM)
- Essential Facilities / Community Assets
- Historical Structure
- Riparian Zone Structure

Building-Level Flood Risk Assessment

Site-specific flood assessments are conducted for a 1% annual chance flood (100-year flood) event. FEMA's OpenHazus Flood Assessment Structure Tool is employed for the Flood Analysis Model.

- Building Damage Percent (Hazus)
- Building Damage Loss U.S. Dollars (Hazus)
- Content and Inventory Loss (Hazus)
- Debris Removal (Hazus)
- Restoration Time (Hazus)
- Population Displacement

Mitigation Opportunities

Factors to identify flood reduction measures and areas of mitigation interest:

- Open Space Preservation / Restore Floodplain to Natural Functions
    - Buyout Properties (Deed-Restricted)
    - Public Lands
    - Private Lands
    - Riparian Zones
- Natural Flood Zone Functions
    - Riparian Zones
    - Wetlands
    - Habitat
    - Permeable Surfaces
- Repetitive Loss Structures
- Community Rating System (CRS) Class
- Adoption of Higher Standards / Building Code Standards
- CAV/CAC Compliance of Last Visit
- Active or Mapping Studies
- Risk Communications

Community Engagement & Field Verification

Field verification and outreach are an important component of the flood risk assessments in support of local hazard mitigation plans. Local officials, planners, emergency managers, or floodplain managers are the primary target audience for community engagement. The Flood Risk Products (Report, Map, Tables, Database) will be provided to each community to verify the risk assessment findings and identify potential mitigation actions. Reports will also be provided to the Regional Planning and Development Councils which are responsible for coordinating local hazard mitigation plans. The Flood Risk Report will provide links to FEMA and State Resource Guides that may include:

- *Reducing Damage from Localized Flooding: A Guide for Communities*
- *Community Rating System Coordinators Manual*
- *WV Floodplain Management Quick Guide*

Communities will be provided with a form or survey to provide feedback on the Flood Risk Report, Maps, and Tables. Important variables for the communities to validate include structure type (e.g., primary, accessory, seasonal, dilapidated) and the foundation type / first floor height of elevated structures. It would be beneficial if communities can provide Finished Construction Elevation Certificates, especially of elevated structures, to verify the first-floor heights, lowest floor elevation, and water depth-in-structure. The Building Inventory follows a cyclic workflow in that new structure-level flood risk assessments can be generated fairly quickly from edits to the building stock or flood depth grids, and then published to the RiskMAP View of the WV Flood Tool. Communities do not need mapping software since the Building-Level

Flood-Risk Assessments can be viewed in a Spreadsheet Table with web links to the WV Flood Tool. Areas of Mitigation Interest should be identified by the communities and submitted to the State via the form or survey. The Areas of Mitigation Interest (AoMI) dataset should capture the mitigation interests of the community and provide targets for future mitigation action.

References

Open-File Report O-18-04, **ArcGIS Python script alternative to the Hazus-MH Flood Model for User-Defined Facilities** by John M. Bauer; ArcGIS® Python® script, library, 28 p. user guide, https://www.oregongeology.org/pubs/ofr/p-O-18-04.htm

FEMA's Natural Hazards Risk Assessment Program (NHRAP), **Hazus Flood Model FEMA Standard Operating Procedure for Hazus Flood Level 2 Analysis**, 2018,https://www.fema.gov/media-library-data/1530821743439-e16c13c1f6266bbe374dc00a00ac9910/Hazus_Flood_Model_SOP_level2analysis.pdf

FEMA's Flood Assessment Structure Tool (FAST), https://github.com/nhrap-hazus/FAST, Hazus User Release Notes Fact Sheet, https://www.fema.gov/media-library-data/1579211964765-77a8d16172c28267e657b2ad02eb8656/FAST_Factsheet.pdf

Appendix 1: Primary Structures

a) PRIMARY STRUCTURES: How many primary structures are in the high-risk flood zones? What are the building count and dollar value by stream name (flood source)?
   i) Primary structures are mapped to high-risk effective and advisory floodplains for a 1-percent annual flood. Essential facilities are mapped the 0.2-percent-annual flood.
   ii) Building Definition: For floodplain management and flood risk assessment purposes, a structure is a walled and roofed building that is principally above ground, as well as a manufactured home. The terms "structure" and "building" are interchangeable in the National Flood Insurance Program (NFIP). For mitigated new construction of residential and non-residential structures, residential buildings built in a floodplain must be elevated above the Base Flood Elevation (BFE), whereas non-residential buildings may be elevated or floodproofed by dry floodproofing or other measures.
      (1) A "Building" is
         (a) A structure with two or more outside rigid walls and a fully secured roof and that is affixed to a permanent site; or
         (b) A manufactured home (a "manufactured home," also known as a mobile home, is a structure built on a permanent chassis, transported to its site in 1 or more sections and affixed to a permanent foundation); or
         (c) A travel trailer without wheels, built on a chassis and affixed to a permanent foundation, that is regulated under the community's floodplain management and building ordinances or laws.
      (2) "Building" does not mean
         (a) A gas or liquid storage tank, a recreational vehicle, a park trailer, or other similar vehicle, except as described above; or
         (b) Outbuildings, garages, carports, accessory structures, or other secondary structures; or
         (c) Secondary structures less than 300 square feet in size and valued at less than $7,000. See the State Model Floodplain Ordinance.
      (3) As part of the State Flood Risk Assessment, all insurable primary structures in high-risk floodplains are inventoried and published to the RISK MAP View of the WV Flood Tool.
         (a) Primary Structures: All insurable primary structures are counted. Accessory Structures as defined above. Primary structures typically are addressable and have a driveway for vehicles.
         (b) Accessory Structures: Accessory structures are not included when counting buildings in the floodplain. For example, a house with a detached garage and shed is counted as one building. The flood insurance policy is based on the elevation of the house. However, if a lot has several principal buildings, each is counted separately because each normally is insured under a separate policy. For example, a motel with three principal buildings counts as three buildings. If one of the three buildings is an unheated bathhouse for the swimming pool and houses only showers and supplies, then the motel would be counted as two buildings. Detached garages, barns, sheds, outbuildings, and other secondary structures are not apportioned but linked to the primary addressable structure and assumed all secondary structures will be covered

by an umbrella insurance policy. Often a flood insurance umbrella policy will cover the primary and accessory structures.

(c) Multiple Structures and Values in a Single Parcel:

(i) Non-Residential Properties with Multiple Buildings: Typically, non-residential properties are not apportioned into separate building values if all the structures are located within the floodplain. This allows the building replacement values to be automatically updated when the new appraisal values of the Tax Year are released. Often these properties are characterized by a single address for the primary structure with secondary buildings (e.g., warehouses, utility buildings, storage units). Floodplain managers, however, must always permit every type of development and structure in the floodplain.

(ii) Mobile Homes: Every mobile home is counted as a primary structure. If the mobile home has an appraised value along with secondary building values, then the secondary building values are included in the total appraised building value. Singlewide and doublewide mobile homes that are not real property and have not appraisal value are given default replacement values according to a county lookup table.

(iii) Source of Building Replacement Values: Assessment Records, BRIM Insurance, RS Means, Neighborhood Values, or any other available sources.

(d) Modified Values: Modified or user-defined values are entered to override default E-records values, data issues, and data gaps.

(i) Parcel Geometry: If there is a parcel shift and the entire building footprint is in another parcel, then the correct parcel identifier is entered in the modified parcel field. The Building Identifier is a combination of the correct 20-character parcel identifier plus the building address number.

(ii) Assessment Records: User-defined inputs are entered to override the assessment data with more accurate values for Occupancy Class, Foundation Code (First-Floor Height), Area, and Replacement Cost. If assessment data elements for a structure are in a neighboring parcel, then the parcel identifier with the values is entered in the modified parcel field.

(iii) E-911 Address: If an E-911 house number does not exist for a structure, then the number "9999" is used. If there are additional missing structures, then the numbering sequence decreases by a step value of one with the next address numbers 9998, 9997, 9996, etc. If an E-911 address exists in a parcel for one structure but not another, then add a suffix to the primary address. As an example, there is a structure in the parcel address with 1140 Snyder Street; however, two other primary insurable structures have no address. If this is the case, then the missing structures are annotated with a letter suffix. Therefore, the two missing structures are identified as 1140A and 1140B.

(iv) **Post FIRM/Pre-FIRM (Building Year): Special Circumstances Due to Map or Regulatory Changes.** A post-FIRM structure that was in full compliance at the time of construction may not meet current floodplain development standards. This can result from a map revision that expands the regulated floodplain 1 area and/or increases the calculated height of the 100-year flood (Base Flood Elevation). It can also result from enactment of stricter standards for floodplain development. *If the site of a post-FIRM structure was not mapped as a Special Flood Hazard Area at the*

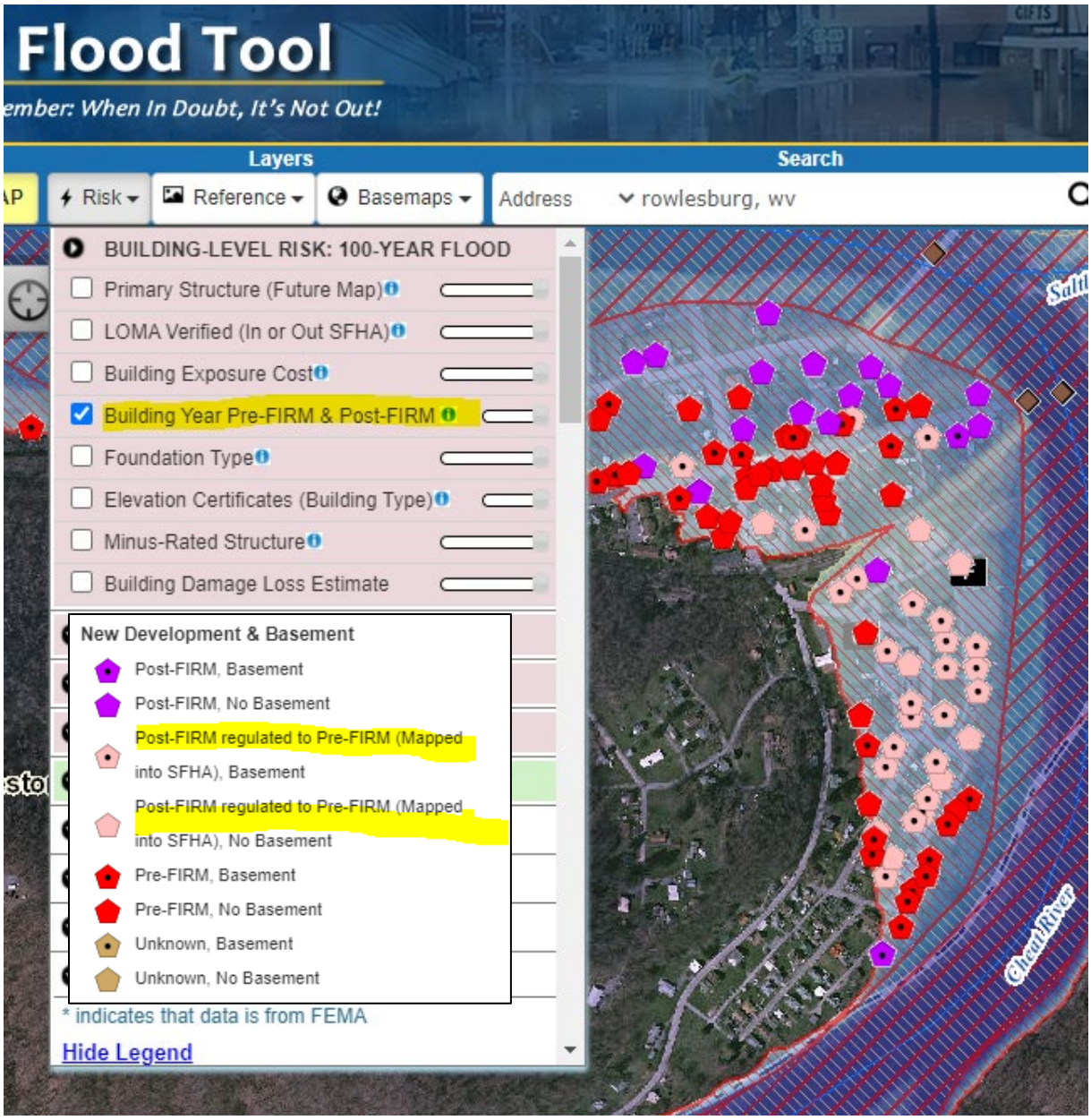
time of construction, then repairs or alterations are regulated as though it is a pre-FIRM structure. A code of "3333" is entered for the Modified Building Year for the status "Post-FIRM regulated to Pre-FIRM (Mapped into SFHA)".

(e) References:

(f) https://www.nh.gov/osi/planning/programs/fmp/documents/nfip-03-existing-structures.pdf

(g) https://www.crystalriverfl.org/sites/default/files/fileattachments/community/page/5301/modification_to_existing_flood_plain_structuresorc.pdf

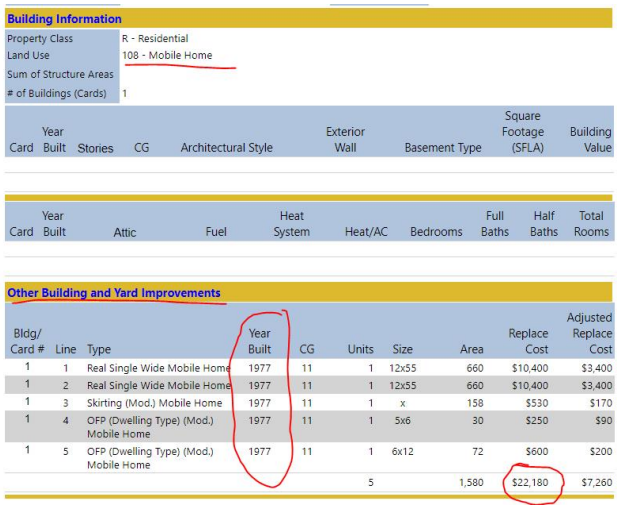
(h) Example – Rowleburg, WV



Appendix 2: Mobile Homes and OBY Assessment Table

OBY Table: Make sure for mobile homes (RES2) that the **Modified Building Year (M-Year)** from the Other Building Yard (OBY) assessment section is being entered in the Building Inventory. All structures should have a building year. If there is no building year listed for a structure, then check the historical aerial imagery for determinations. Historical aerial imagery is also available at https://historicaerials.com/viewer to determine if structures are of Post-FIRM construction.

If you are unsure of the exact year but know that it is Post-FIRM then use the value '9999' for Modified Year. Use the value '1111' for Pre-FIRM. Here is a link to the dividing line for Pre-FIRM/Post-FIRM. Someone can add this to the Google Document.
https://data.wvgis.wvu.edu/pub/RA/_resources/FRA/Pre-FIRM_Post-FIRM_Dividing_Line_20210102.xlsx



Building Information

Property Class	R - Residential
Land Use	108 - Mobile Home
Sum of Structure Areas	
# of Buildings (Cards)	1

Card	Year Built	Stories	CG	Architectural Style	Exterior Wall	Basement Type	Square Footage (SFLA)	Building Value

Card	Year Built	Attic	Fuel	Heat System	Heat/AC	Bedrooms	Full Baths	Half Baths	Total Rooms

Other Building and Yard Improvements

Bldg/ Card #	Line	Type	Year Built	CG	Units	Size	Area	Replace Cost	Adjusted Replace Cost
1	1	Real Single Wide Mobile Home	1977	11	1	12x55	660	$10,400	$3,400
1	2	Real Single Wide Mobile Home	1977	11	1	12x55	660	$10,400	$3,400
1	3	Skirting (Mod.) Mobile Home	1977	11	1	x	158	$530	$170
1	4	OFP (Dwelling Type) (Mod.) Mobile Home	1977	11	1	5x6	30	$250	$90
1	5	OFP (Dwelling Type) (Mod.) Mobile Home	1977	11	1	6x12	72	$600	$200
					5		1,580	$22,180	$7,260

Mobile Home Attributes: If there is no appraisal value for mobile homes then manually enter the Modified Building Replacement Value from the OBY Section. We typically enter the highest value which is generally the Replacement Cost instead of the Adjustment Replacement Cost; however, use situational awareness and building values of similar mobile homes in the neighborhood as a guide.

During the creation of population assessment attributes, parcels where the Mobile Home (LUC) assessment information is in the Other Building and Yard Improvements (OBY) Table, a programming script populates the Building Year, Grade, and Area.

Mobile Home Auto-Population of Attributes: Data processing of parcels that only have only a single mobile home where Land Use Code = 108 Mobile Home. All other instances will have to be done manually where there are multiple structures on a single parcel and values must be apportioned, mobile home parks, or Land Use Code <> 108.

If (LUC = 108 Mobile Home) and (DWELLDAT/COMDAT tables Building Area = Null or Building Year = Null) then Search OBY Table for RM1 (singlewide) or RM2 (doublewide). Populate YEAR and AREA. Use OBY Value or Adjusted Replacement Cost. Singlewide (OBY Code = RM1) and Doublewide (OBY Code = RM2) Trailers
https://mapwv.gov/assessment//Detail/?PID=4108049A000400000000

General Information

Tax Class	Book / Page	Deeded Acres	Calculated Acres	Legal Description
2	5025 / 469	0.365	0.35	SUR LOT 7 FIRECO
			0.35	

Cost Value		Appraisal Value	
Dwelling Value	$0	Land Appraisal	$900
Other Bldg/Yard Values	$4,150	Building Appraisal	$4,200
Commercial Value	---	Total Appraisal	$5,100

Building Information

Property Class	R - Residential
Land Use	108 - Mobile Home
Sum of Structure Areas	
# of Buildings (Cards)	1

Card	Year Built	Stories	CG	Architectural Style	Exterior Wall	Basement Type	Square Footage (SFLA)	Building Value

Card	Year Built	Attic	Fuel	Heat System	Heat/AC	Bedrooms	Full Baths	Half Baths	Total Rooms

Other Building and Yard Improvements

Bldg/ Card #	Line	Type	Year Built	CG	Units	Size	Area	Replace Cost	Adjusted Replace Cost
1	1	Real Single Wide Mobile Home	1970	11	1	12x60	720	$10,990	$3,780
1	2	Skirting (Mod.) Mobile Home	1970	11	1	x	144	$490	$170
1	3	Wood Deck (Mod.) Mobile Home	1970	11	1	6x10	60	$280	$100
					3		924	$11,760	$4,050

Note that churches are also auto populated. If (LUC = 620 Religious) and (DWELLDAT/COMDAT tables Building Area = Null or Building Year = Null) then Search OBY Table Code for EC1 ((Church Exempt) to populate Built Year, Grade, and Area. Use OBY Value or Adjusted Replacement Cost.
https://mapwv.gov/assessment//Detail/?PID=55050004001400010000

Cost Value		Appraisal Value	
Dwelling Value	---	Land Appraisal	$2,500
Other Bldg/Yard Values	$11,810	Building Appraisal	$11,800
Commercial Value	$0	Total Appraisal	$14,300

Building Information	
Property Class	X - Exempt
Land Use	620 - Religious
Use Type	
Living Area	
Cubic Feet	
# of Buildings (Cards)	1
# of Units	

Bldg/ Card	Year Built	Stories	Units	CG	Exterior Wall	Construction Type	Commercial Basement	Square Feet	Building Value

Other Building and Yard Improvements

Bldg/ Card #	Line	Type	Year Built	CG	Units	Size	Area	Replace Cost	Adjusted Replace Cost
1	1	Church Exempt	1970	22	1	12x12	0	$0	$0
1	2	Church Exempt	1970	22	1	23x39	897	$46,520	$11,810
					2		897	$46,520	$11,810

Date of Construction—Manufactured (Mobile) Homes/Travel Trailers. The date of construction for a manufactured (mobile) home is different from a standard building and depends upon the location of the manufactured (mobile) home.

- Mobile Home Parks: For manufactured (mobile) homes located in manufactured (mobile) home parks or subdivisions, the date of construction is the date facilities were constructed for servicing the manufactured (mobile) home site, or the date of the permit, provided that construction began within 180 days of the permit date. This rule applies to all manufactured (mobile) homes even if the manufactured (mobile) home is rated and classified as single family.

- Mobile Homes on Individually Owned Lots: For manufactured (mobile) homes not located in manufactured (mobile) home parks or subdivisions, but located on individually owned lots or tracts of land, the date of construction is the date the manufactured (mobile) home was permanently affixed to the site or the permit date if affixed to the site within 180 days of the date of permit.

Source: https://www.fema.gov/pdf/nfip/prodmanual200610/supprod102006.pdf

Appendix 3: Dilapidated or Vacated Structures

Dilapidated Structures: How to know if a structure is dilapidated, abandoned, or not an active primary structure? No parked vehicles, vehicular tracks, driveway, etc. Review available building pictures but don't totally depend on Google StreetView images that are often older than 10 years. From the assessment records, a low building Appraisal Value or poor Construction Grade may indicate a dilapidated structure.

Mobile Home as Secondary Structure: Mobile homes of low value, poor construction grade, abandoned, inhabitable, and listed in the Other Buildings/Yard Improvements Assessment Section and secondary (outbuildings, garages, car ports) to a higher-valued primary structure on the same parcel can be incorporated with the primary structure represented by the OBY appraisal value. This does not apply to mobile home parks or addressable mobile homes that appear habitable.

Construction Grade Conversion Table

Grade	CG	Construction Grade Quality*
E-	0M	VERY POOR/UNSOUND
E	00	VERY POOR
E+	0P	VERY POOR
D-	1M	POOR
D	11	POOR
D+	1P	POOR
C-	2M	FAIR
C	22	FAIR
C+	2P	FAIR
B-	3M	AVERAGE
B	33	AVERAGE
B+	3P	AVERAGE
A-	4M	GOOD
A	44	GOOD
A+	4P	GOOD
X-	5M	EXCELLENT
X	55	EXCELLENT
X+	5P	EXCELLENT
S-	6M	SUPERIOR
S	66	SUPERIOR
S+	6P	SUPERIOR

*Quality of construction materials graded by appraisers may be subjective and should only be used as a guide

Appendix A: Tables and Figures

Table 1. Flood Risk Products

FLOOD RISK PRODUCT	DESCRIPTION
Flood Risk Report	A narrative or a community's flood risk assessment study to support the floodplain management and flood reduction activities. A Flood Risk Report is published for each county to supplement it Local Hazard Mitigation Plan.
Flood Risk Map	A map that illustrates the overall flood risk for a community. The map can be used as an outreach tool to communicate risk more clearly and to support mitigation planning. The Flood Risk Map is viewable as an interactive map on the WV Flood Tool or as a PDF print-ready static map.
Flood Risk Tables	Excel tables that list per structure the primary building exposure and flood risk assessment attributes for communities to verify. Specific tables for Essential Facilities, Buyout Properties, etc. are also provided to communities for verification. These tables can be used by communities to enhance floodplain management and risk reduction efforts. Share links are included in tables to link records to RiskMAP View of WV Flood Tool.
Flood Risk Database	Provides communities with geospatial information collected during the risk assessment process and offers effective ways to visualize and communicate flood risk. The Flood Risk Assessment GIS (FRAGIS) is the name for West Virginia's flood risk geodatabase.
Flood Risk Community Engagement Form or Survey	Communities are provided with instructions on how to validate and provide feedback on Flood Risk Report, Maps, or Tables. Communities are encouraged to identify Areas of Mitigation Interest (AoMIs) for the State and FEMA to review. The Areas of Mitigation Interest (AoMI) dataset should capture the mitigation interests of the community and provide targets for future mitigation actions.

FLOOD RISK PRODUCT	DESCRIPTION
Flood Depth Grid	Communicates information about the flood depth for a 1-percent (100-year) annual chance flood. Flood Depth Grids illustrate the flood depth, in feet above the ground surface, to demonstrate the variability of flood depths in flood prone areas. Officials can use depth grids to help individuals visualize the depth of flooding their home might experience; an easier concept than understanding a base flood elevation. The depth grid, combined with an inventory of the built environment, is used by the Hazus Flood Model to determine flood loss potential, by applying the appropriate depth-damage curves. Model-backed DEMs are preferred over Hazus-generated depth grids for the Flood Models. In the WV Flood Tool, the Water Depth is displayed in the (1) Flood Results Query Panel, (2) Flood Risk Layers Menu, and (3) 3D Flood Visualization.
Water Surface Elevation Grid (Base Flood Elevation, Flood Height)	Provides the base flood elevations for A Zones. The Water Surface Elevation is an effective tool for evaluating risk when combined with the lowest floor or first-floor elevations for buildings. Base flood heights are important for floodplain management and mitigation activities in determining flood elevations in relation to structure (building, bridges, etc.) elevations. Remember that Flood heights measure elevations above sea level and correspond to a vertical elevation datum, whereas depth grids measure flooding above ground level. Where new mapping has occurred with updated topographic data, Advisory Base Flood elevations (or Advisory Flood Heights) are available for select communities The Water Surface Elevation is displayed in the Flood Results Query Panel of the WV Flood Tool.
Future Flood Zone Changes	High-risk advisory flood zones are generated from new model-backed flood studies or from redelineation mapping. Redelineation is the method of updating effective flood hazard boundaries to match updated topographic data based on the computed water surface elevations from effective models. The public should be informed that these non-regulatory zones will most likely become effective when new Flood Insurance Rate Maps (FIRM) are published, and thus any development in these zones should be regulated to the same standards as effective high-risk flood zones. High-risk advisory zones (Preliminary NFHL, Advisory A, Updated AE) are represented as orange-colored flood zones in the WV Flood Tool. In local floodplain ordinances, communities may choose to adopt high-risk advisory zones as "community-identified floodplains" and regulated the same as the Special Flood Hazard Area of the official FIRM.
Building-Level Flood Risk Assessment	Flood Risk Assessment datasets are developed by pinpointing all primary insurable structures in the Special Flood Hazard Area or 100-year floodplain. Historical and community assets (government buildings, churches) are also inventoried. Essential facilities are inventoried to the 0.2-pecent (500-year) annual chance flood event. Required building characteristics are Occupancy Class, Foundation Type, First Floor Height, Number of Stories, Area, and Replacement Cost. Default values are populated from the State Parcel Assessment Database and modified with user-defined values. Building pictures can be linked to the risk assessment using the unique building identifier. (1) Buildings Exposed to Flooding: An inventory of all buildings exposed to flooding. A replacement value is determined for each primary structure.

FLOOD RISK PRODUCT	DESCRIPTION
	(2) Buildings - Future Map Conditions: Buildings are classified according to LOMA's verified for positional accuracy and non-regulatory flood zones. Categories are Mapped out SFHA (yellow), Mapped in SFHA (orange), No Change (red), and Regulatory Floodway (magenta star). The color symbols have land use category letters for **R**esidential, **C**ommercial, and **O**ther. Buildings "Mapped Out SFHA" should be considered for a LOMA Structure Removed status while Buildings "Mapped out SFHA" should be regulated to the 100-year floodplain standard until new effective maps are published. For buildings in the "Floodway" there should be no development unless a No-Rise Certificate is issued. (3) Buildings - New Development and Basement: The Building Year from Assessment Database is symbolized by FIRM (Pre-FIRM/Post-FIRM/Unknown) and Basement (Basement/No Basement) status. Note: A basement in the assessment database my not be a subgrade basement but a walkout basement. Hence, basement designations from the assessment records should be field verified. An audit of minus rated properties for Pre-FIRM and POST-FIRM structures should be performed and verified with Elevation Certificates or field surveys. (4) Building Damage Loss Estimates (Hazus): The Flood Risk Assessment dataset is generated from FEMA's OpenHazus Flood Assessment Structure Tool (FAST) and presents loss estimates in dollar values and damage percent. The depth grid, combined with an inventory of the built environment, is used by the Hazus Flood Model to determine flood loss potential, by applying the appropriate depth-damage curves, for a 100-year flood event. Besides the Building Damage Percent/Dollars Loss, other model outputs of the FAST Utility site-specific risk assessment include the Contents Damage, Inventory Damage, Debris Removal, and Maximum Restoration Time. Population per building is derived from the assessment Occupancy Type Class (e.g., Residential Single Family, Residential Multi Family) and census average residential household size. Owner-occupied homes are determined from assessment fields Tax Class and Occupancy Class.
Other Risk Layers	Other risk layers displayed in the WV Flood Tool include Dams, Levees, Landslides (other natural hazard), and High-Water Marks.
CRS Program Variables	The building-level inventory provides key program variables for FEMA's Community Rating System (CRS) Program: Buildings in the SFHA (bSF) and Area in the SFHA (aSFHA).
LOMA Verified	Verified positional accuracy of LOMAs. Current and historical LOMAs categorized as Structure Non-Removal, Removal, or Out as Shown.
Elevation Certificates	Elevation Certificates are useful for determining lowest floor elevations for BFE regulatory compliance and for determining first-floor heights for building-level risk assessments.

FLOOD RISK PRODUCT	DESCRIPTION
3D Flood Visualizations	3D Flood Visualizations are rendered from the base flood water depth and building type (residential one- or two-story homes, mobile home, commercial/industrial) to effectively communicate flood risk. By describing the depth-in-structure damage according to varying flood depths, visualizations are easier for non-technical users to understand flood risks to their property in feet of water rather than comprehending the base flood elevation (BFE).
Parcel Assessment Report	Detailed Parcel Assessment Reports provide information of all primary and secondary structures on a single parcel. The reports include parcel and E-911 addresses, building values, primary and secondary structure attributes, parcel history, etc. Both the E-911 site addresses, parcels, and assessment records are integrated from local sources into statewide databases that are beneficial for identifying property locations and building parameters (building cost, year, property class, etc.). The parcel geometry and assessment records are updated annually by the WV Property Tax Division and WV GIS Technical Center, while the statewide addressing and geocoding services are typically updated twice a year by the WV Division of Homeland Security and WV GIS Technical Center.
Mitigation Layer: Areas of Mitigation Interest	The Areas of Mitigation Interest (AoMI) dataset assists communities in determining specific actions to increase their resilience from floods. AoMI identifies currently planned mitigation activities as well as areas of potential future action. It encourages collaboration among communities within the project area by providing with them the basis to assess how various mitigation action scenarios can successfully reduce their collective flood risk. AoMIs are identified by communities as part of the State's Flood Risk Assessment.
Mitigation Layer: Open Space Preservation	Open Space Preservation layers restore the floodplain to its natural function and provides opportunities for credits from FEMA's Community Rating System (CRS). Open Space Preservation layers include Deed Restricted Buyout Properties, Private Lands (Nature Preserves, Land Trust) and Public Lands (state and local lands).

Table 2. Flood Risk Layers (Flood Risk Assessment GIS Geodatabase)

RISK LAYER	CATEGORY	SOURCES
1% Chance Flood Event (100-Year)		

• Flood Depth Grid
  ○ Model-Backed
  ○ Hazus
	Flood Risk Grid	FEMA RiskMAP Restudies, Non-Restudies, Hazus

• Water Surface Elevation Grid
  ○ Base Flood Elevations
  ○ Advisory BFEs
	Flood Risk Grid	FEMA Restudies, Non-Restudies

• Preliminary NFHL ○ Changes Since Last FIRM (CSLF)	Flood Zone Changes	FEMA Preliminary NFHL
• High-Risk Advisory Flood Zones (Non-Regulatory)	Flood Zone Changes	Non-Restudies (Advisory A & Updated AE)

• Future Map Conditions for Buildings
  ○ Map In SFHA
  ○ Map Out SFHA
  ○ No Change
  ○ Floodway
• LOMA Verified
	Building-Level Risk
	
	Flood Zone Changes
		Enhanced Building Inventory, Non-Regulatory Flood Zones

• Buildings Exposed to Flooding
  ○ Building Replacement Cost
  ○ Essential Facilities
  ○ Community Assets
  ○ Historical Structures
	Building-Level Risk	Inventories of buildings and facilities

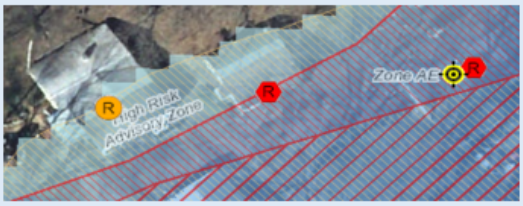
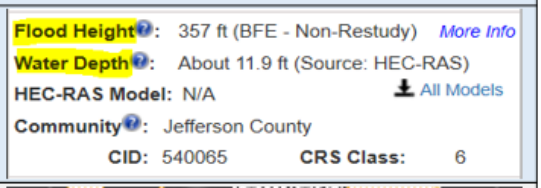
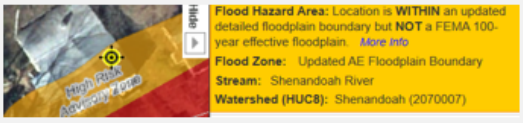
• New Development & Basement
  ○ Pre-FIRM / Post-FIRM
  ○ Basement (First Floor Height)
	Building-Level Risk	WV Building Inventory, WV Assessment Records, Building Pictures

• Building Damage Loss Estimate (Hazus)
  ○ Percent Damage
  ○ Dollars Loss
	Building-Level Risk	Hazus Level 2 Analysis, Enhanced Building Inventory (or UDF), Depth Grids

No Specific Flood Probability Occurrence		
• Levees (FEMA/USACE) • Dams (NID)	Critical Structures	FEMA / USACE
• Landslides	Other Natural Hazards	WV Landslide Inventory, LiDAR-Derived DEMs

Figure 2. Flood Risk Products: Flood Risk Grids, Flood Zone Changes, Risk Per Structure

Flood Risk Products

RISK LAYER	CATEGORY	GRAPHICAL OR TABLE FORMATS
1% Chance Flood Event (100-Year)		
• **Flood Depth Grid** o Model-Backed o Hazus	Flood Risk Grid	
• **Water Surface Elevation Grid** o Base Flood Elevations o Advisory BFEs	Flood Risk Grid	
• **Preliminary NFHL** o Changes Since Last FIRM (CSLF)	Flood Zone Changes	
• **High-Risk Advisory Flood Zones** (Non-Regulatory)	Flood Zone Changes	

Flood Risk Products (Cont.)

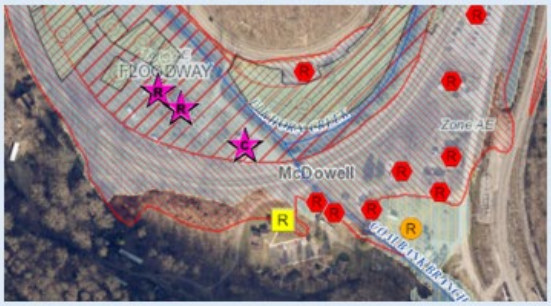
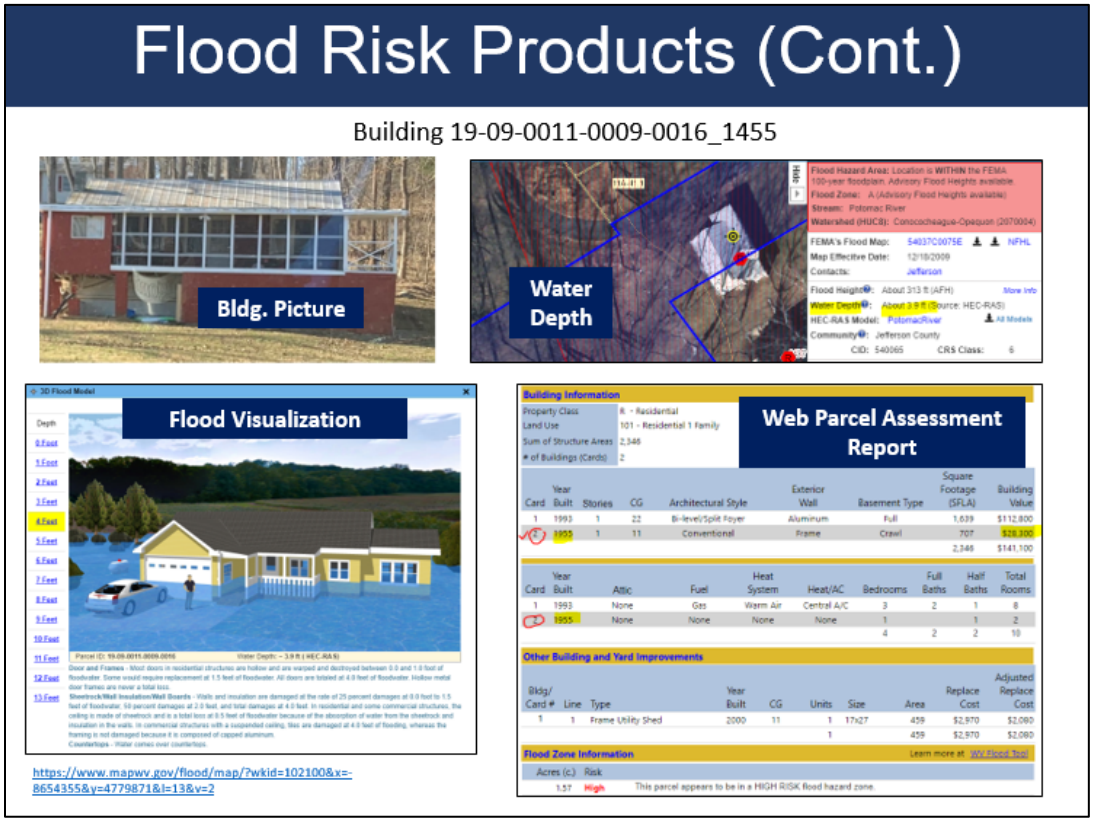
RISK LAYER	CATEGORY	GRAPHICAL OR TABLE FORMATS
1% Chance Flood Event (100-Year)		
• **Buildings: Future Map Conditions** o Map In SFHA (orange) o Map Out SFHA (yellow) o No Change (red) o Floodway (purple)	Building-Level Risk	
• **Buildings: LOMA Verified**	Flood Zone Changes	

Figure 3. Building-Level Flood Risk Products



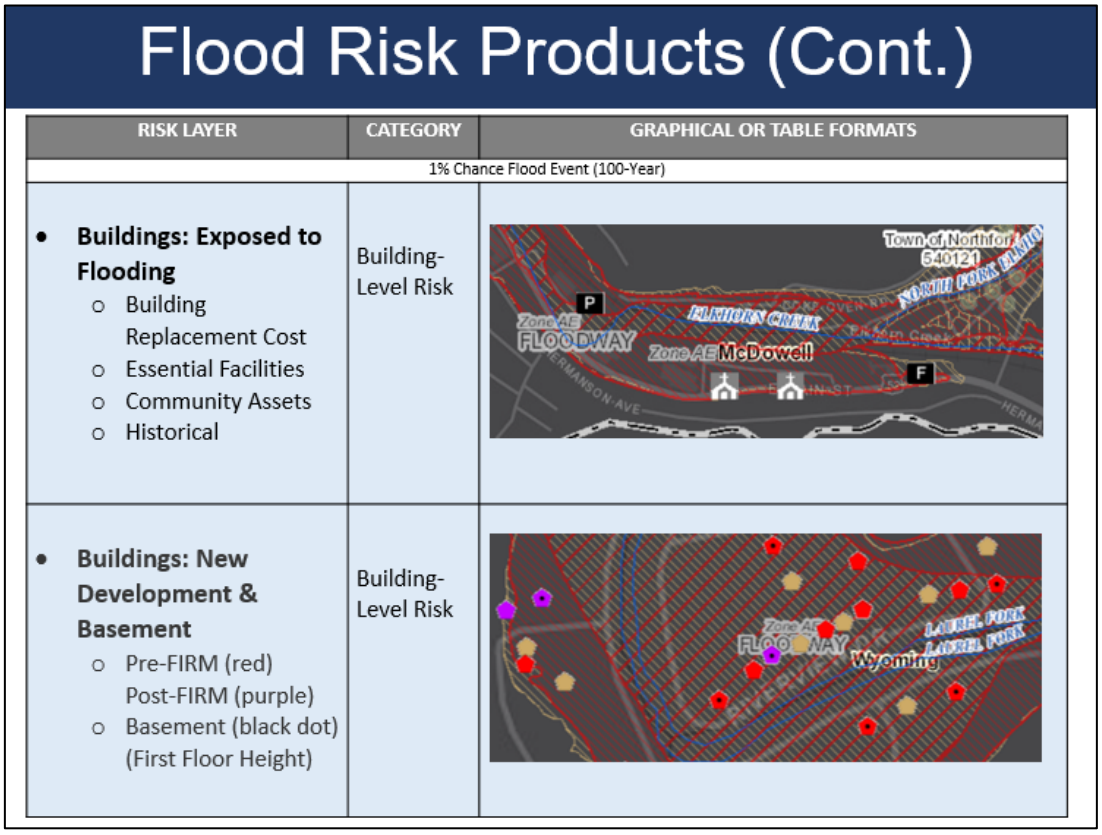
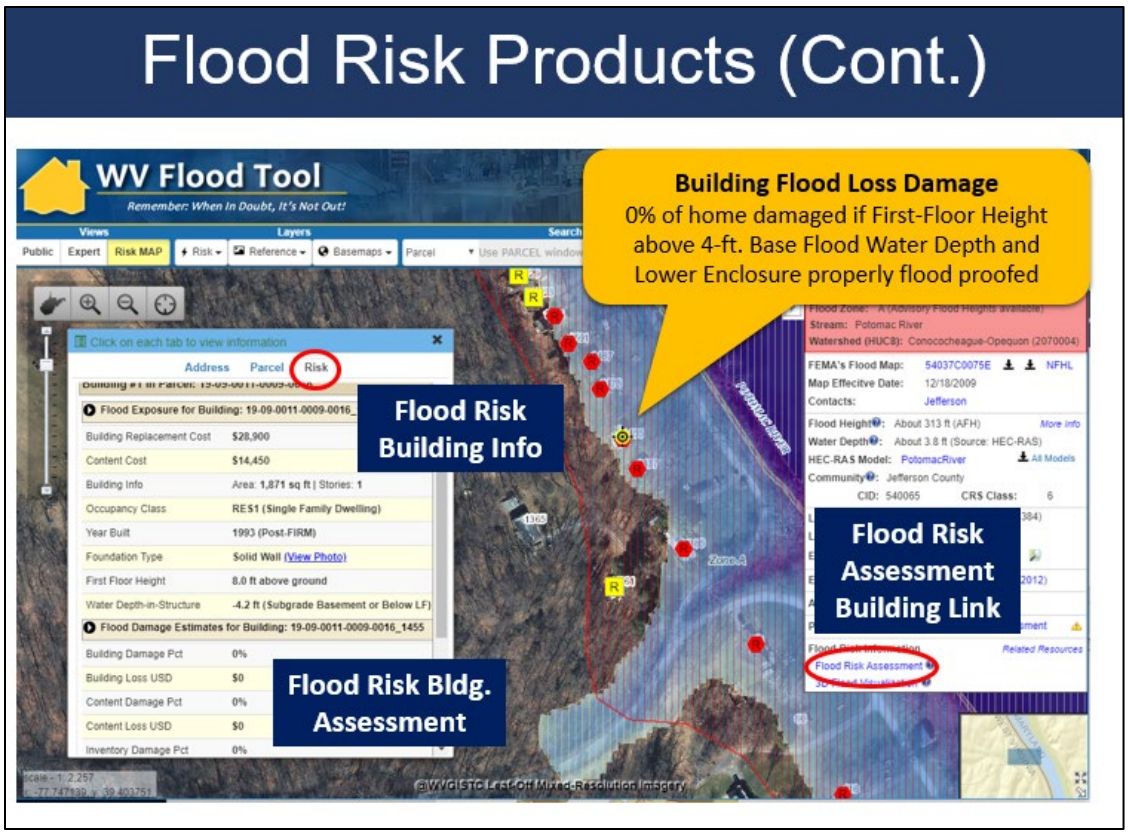


Figure 4. Building-Level Flood Risk Assessments Published to WV Flood Tool



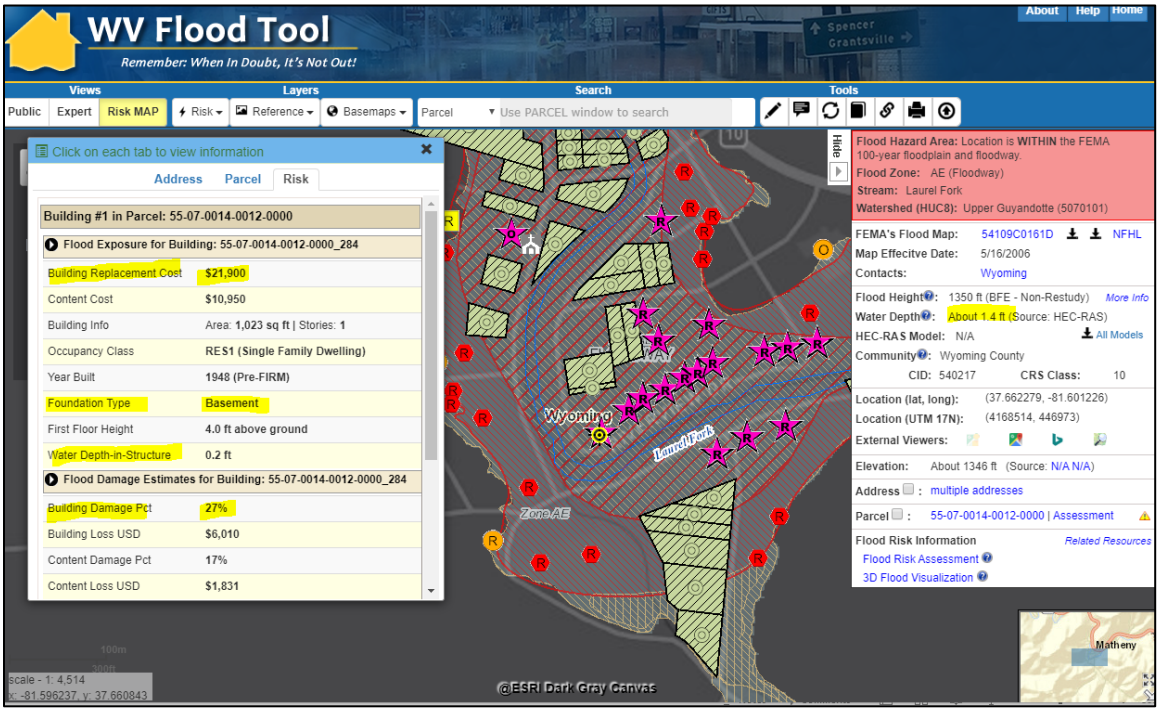
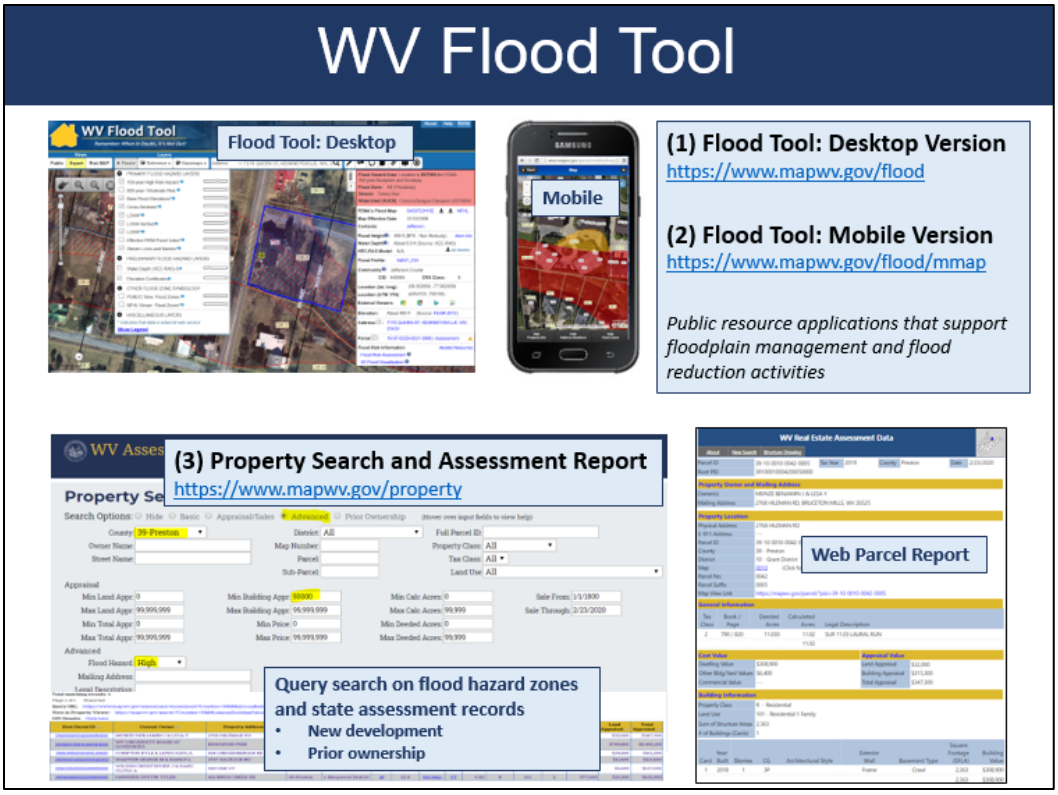


Figure 5. WV Flood Tool, WV Property Viewer, and Web Parcel Assessment Report



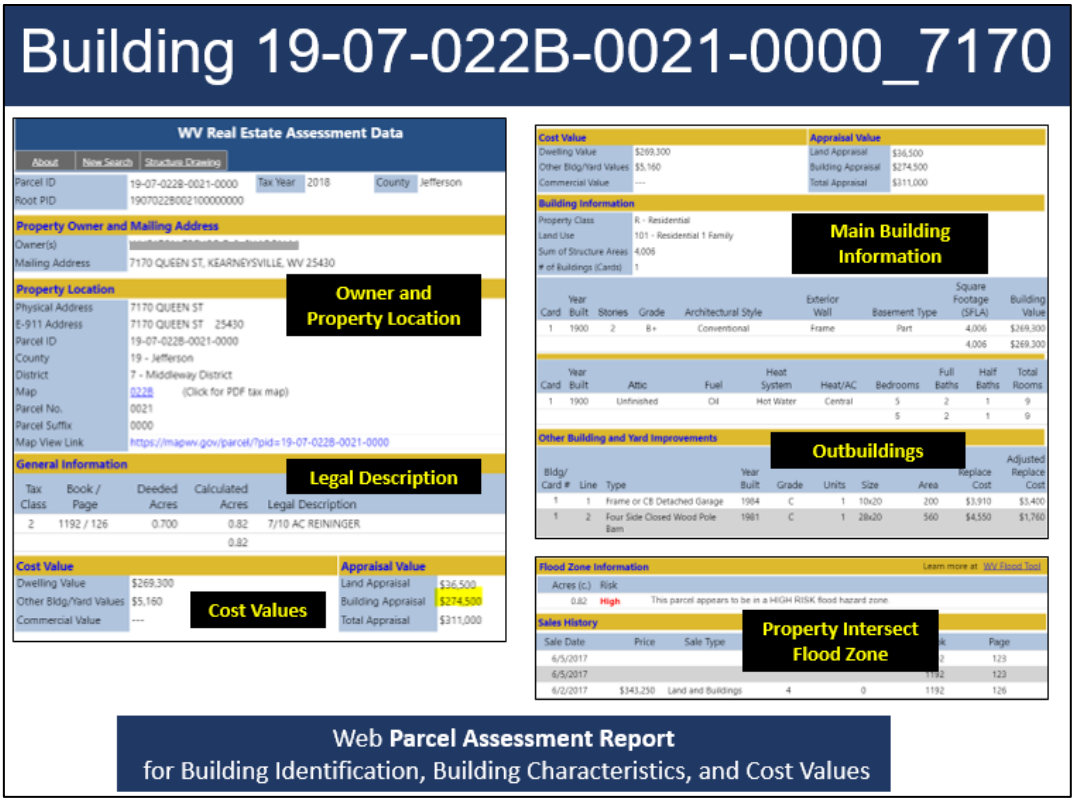


Figure 6. Flood Risk Map. Static Map and WV Flood Tool.

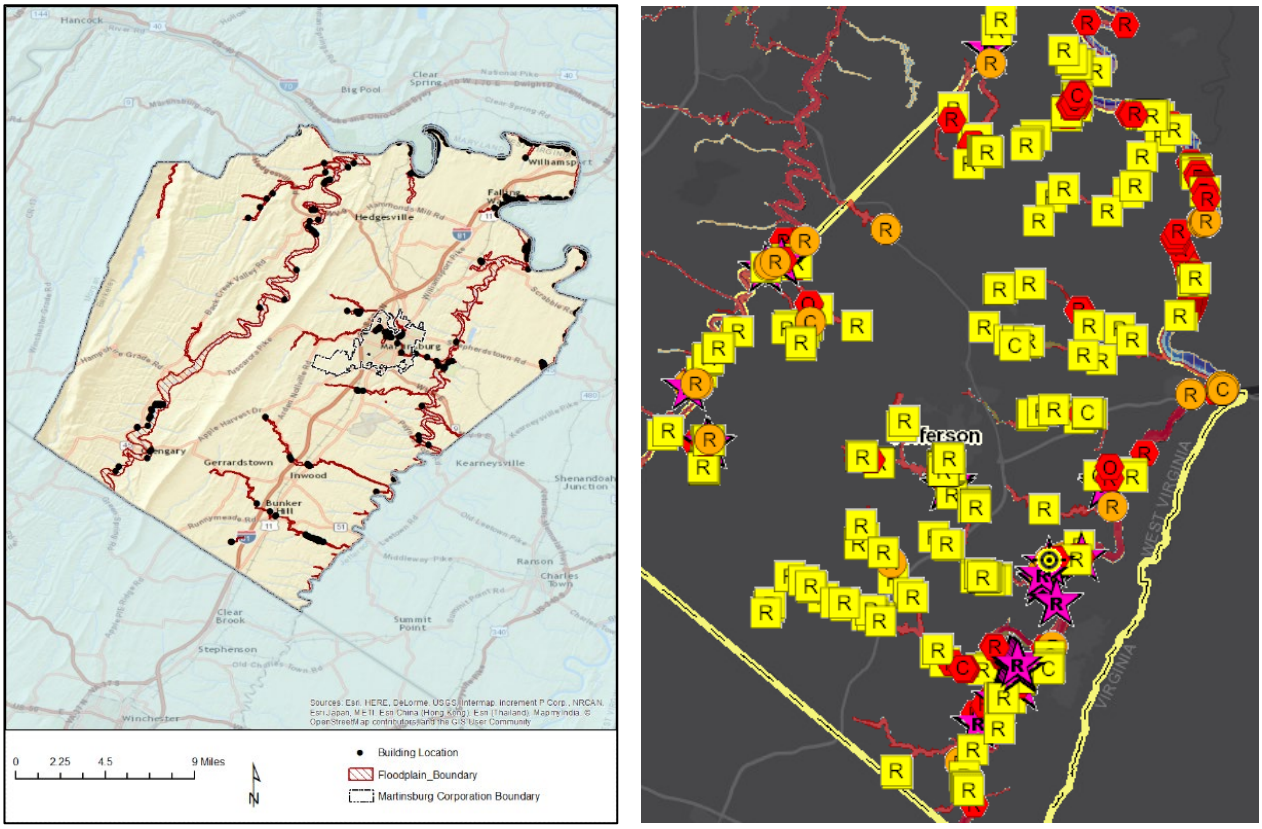


Figure 7. Flood Risk Database. Also known as Flood Risk Assessment GIS (FRAGIS).

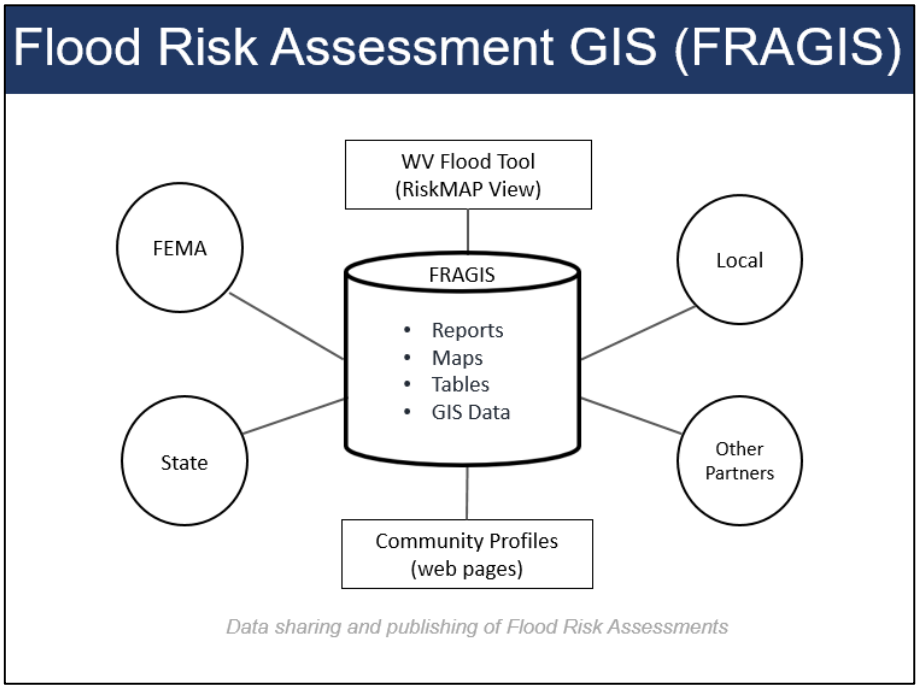


Figure 8. Building-Level Flood Risk Assessment Cycle

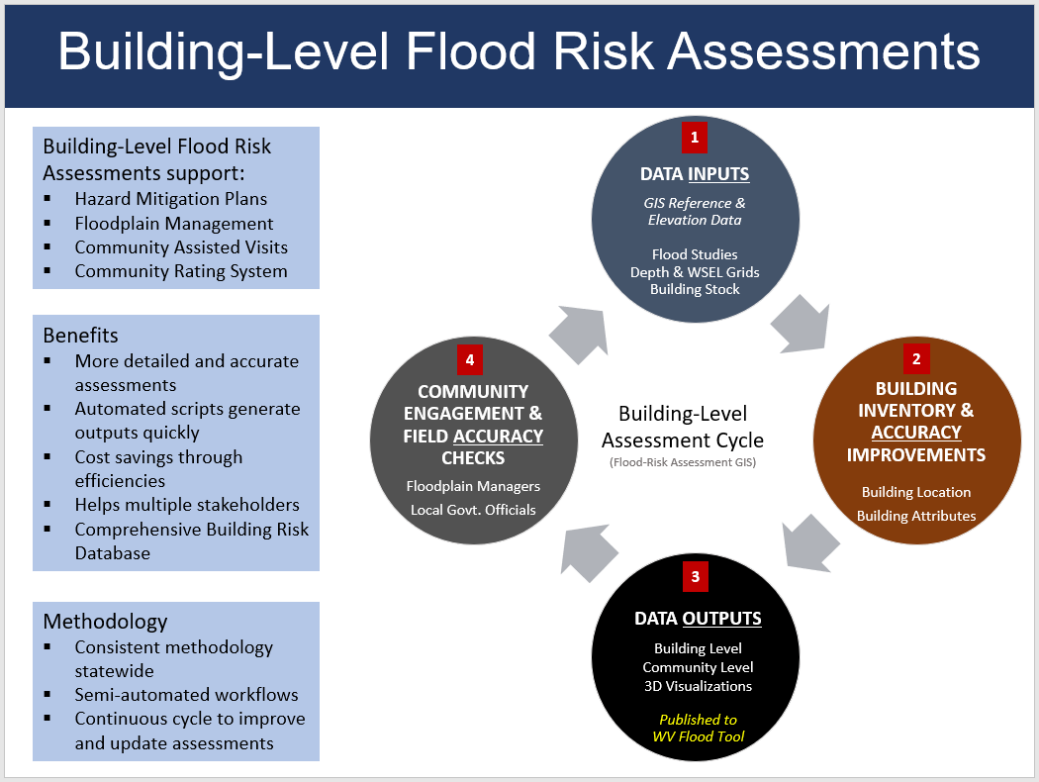


Figure 9. Building Inventory Workflow

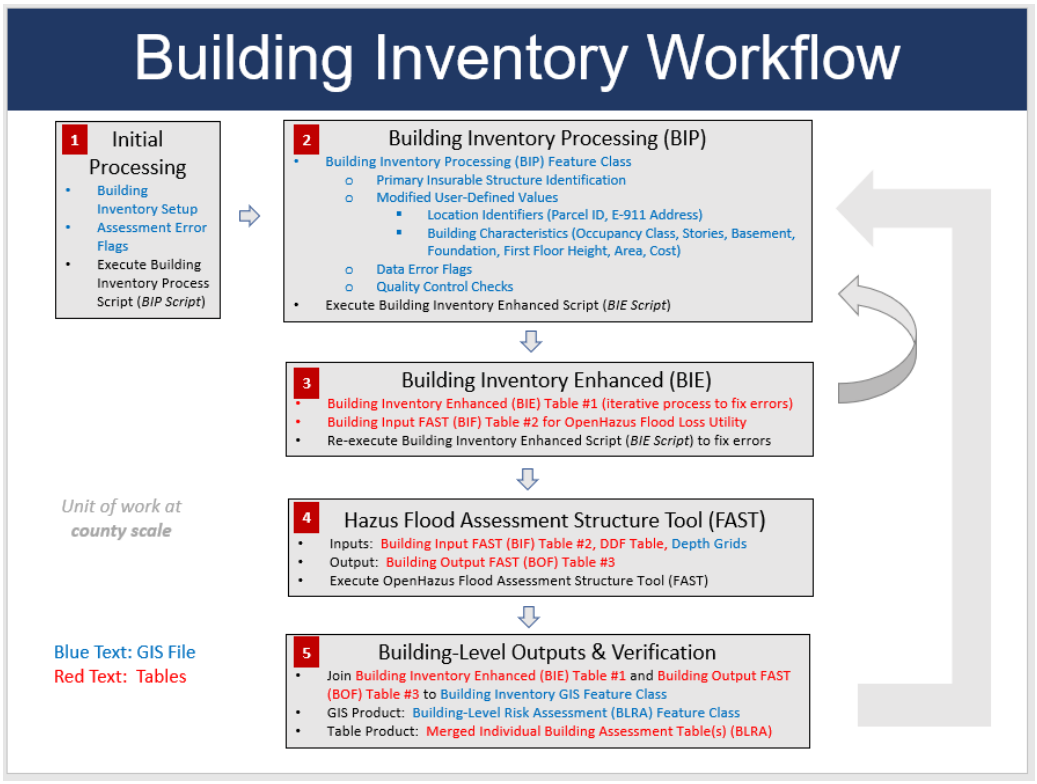


Figure 10. Hazus Flood Loss Flowchart

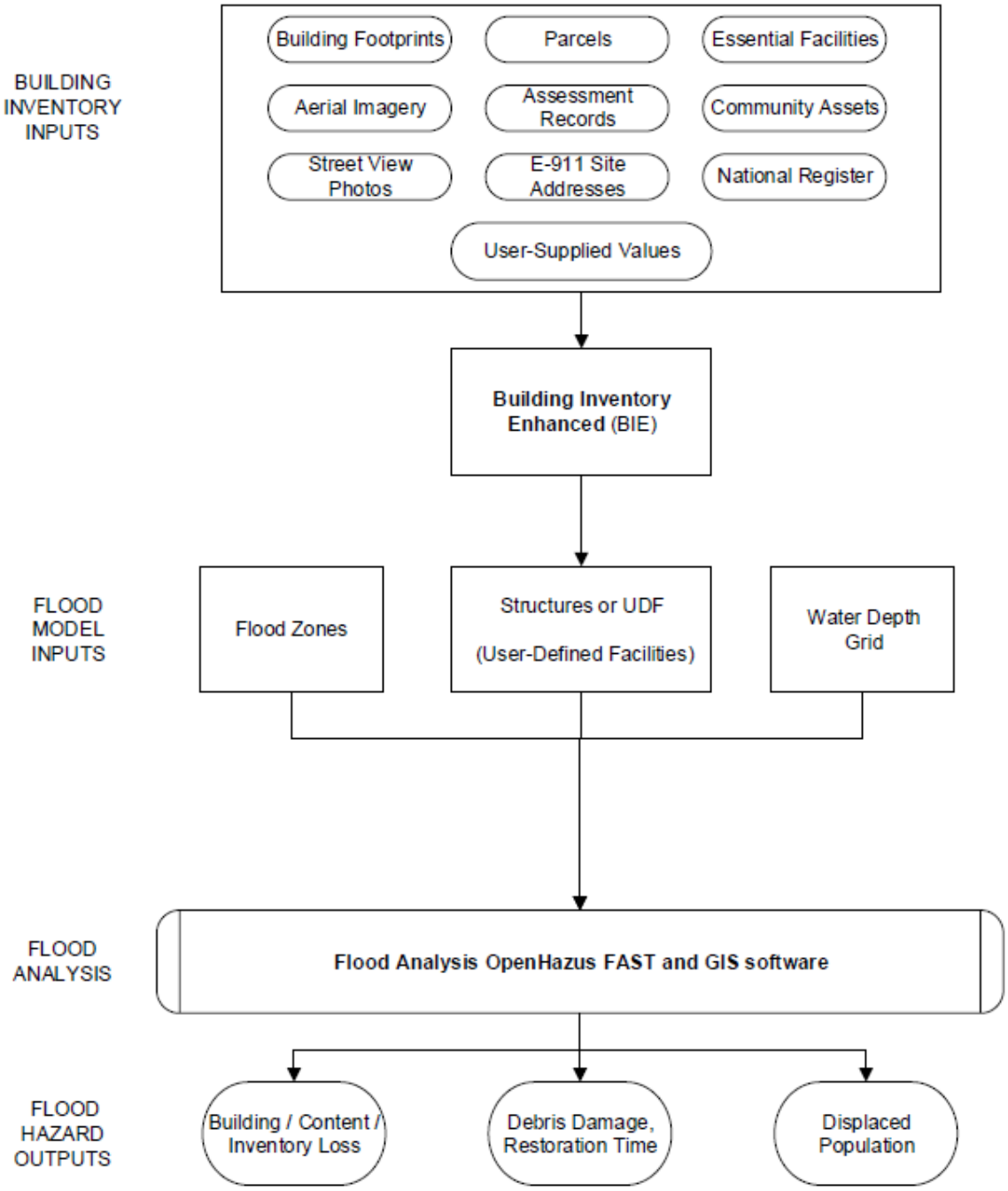


Table 3. Spatial Identifiers. The standardized Building Identifier is a combination of the 20-character parcel identifier and building address number.

Building Spatial Identifiers

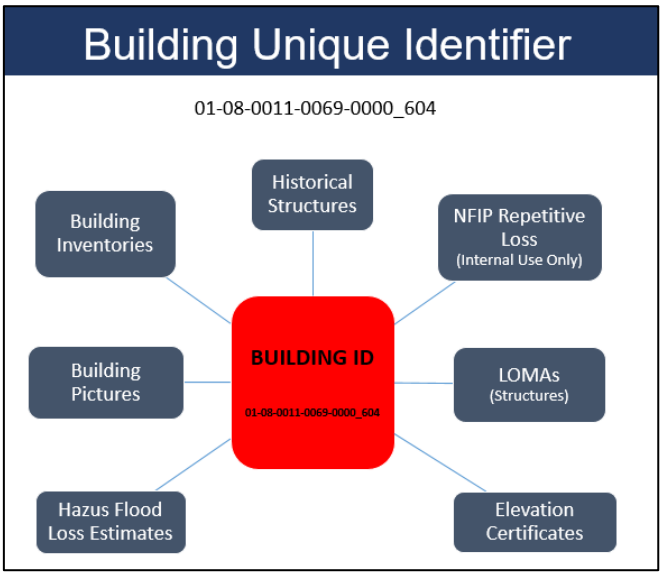
Collect multiple spatial identifiers to verify location

Parcel	01-08-0011-0069-0000
	01 (County) - 08 (District) - 0011 (Map) - 0069 (Parcel) - 0000 (Suffix)
Address	604 S Main St, Philippi, West Virginia, 26416
★ **Building Identifier**	01-08-0011-0069-0000_604
★ **X,Y Coordinate**	39.144752, -80.033529
★ **Google Plus Code (11-digit)**	86FX4XV8+VHF
★ **Share MAP URL Link**	https://www.mapwv.gov/flood/map/?wkid=102100&x=-8909292&y=4742427&l=12&v=1
Share Parcel Assessment URL Link	http://www.mapwv.gov/Assessment/Detail/?PID=01080011006900000000

★ = Unique Identifiers

Notes: Owner Name from assessment records and Building Pictures (elevation certificates) can be helpful for property identification purposes

Proper Building and Property Identifiers are important for exchanging building-level data efficiently among local, state, and federal partners (including UDFs, LOMAs, Mitigated Buyout Properties, Elevation Certificates, Repetitive Loss Structures, etc.)



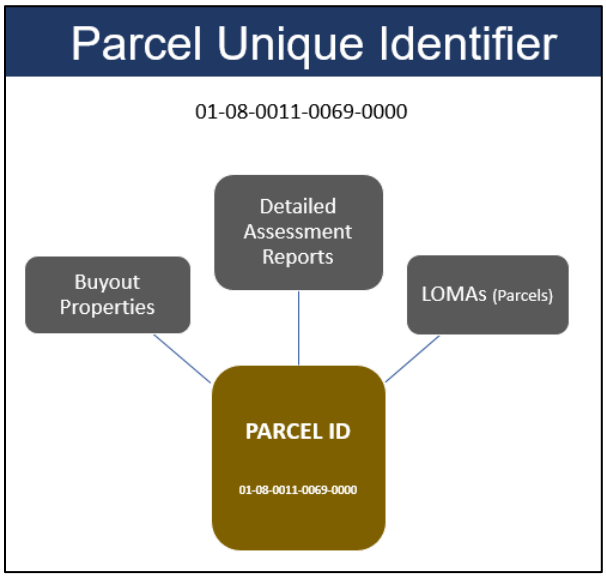


Table 4. Hazus Model Inputs: Building Characteristics. User-defined modified values in red text.

Primary Assessment Source	Hazus Codes	Modified Values (User Defined)	Secondary Sources	Hazus Input	Notes
Basement & Building Year	Foundation LUT (Pre-FIRM, Post-FIRM)	M-Foundation	Elevation Certificates, Building Pictures, Change Detection of aerial imagery acquired during different years	**Foundation Type**	See Foundation Code LUT for descriptions
		M-FFH		**First Floor Height**	
		M-Year		**First Floor Height**	Building Year determines Pre-FIRM and Post-FIRM first flood heights. If specific year is unknown, Pre-FIRM = "1111" and Post-FIRM = "9999".
Land Use	Occupancy Class LUT	M-OccupClass	Building Pictures, Business Directories	**Occupancy Class**	See Occupancy Class LUT for descriptions
Number of Stories		M-Stories	Building Pictures	**Number of Stories**	Unknown Stories value = 1 Story
Building Cost		M-Cost	Neighboring Parcels, RS Means, Insurance Databases	**Cost**	Unknown value for RES2 trailers: Single wide = $23K, Doublewide = $46K
Area		M-Area	Sketch Diagrams, Measure Tools	**Area**	Singlewide Area = 1,000 sq. ft.; Doublewide Area = 2,000 sq. ft. See Mobile Home table for countywide default values for singlewide and doublewide trailers

Table 5. Hazus Mode Inputs: Flood Water Depth

Depth Grid Source	Modified Values	Secondary Sources	Hazus Input
HEC-RAS model-backed & Hazus	M-Depth	FIRM BFE, Elevation Certificate	**Water Depth**

Table 6. Hazus Mode Inputs: Building Point

Mapping Structure Point	Data Sources	Hazus Input Location
Pinpoint primary building in most restrictive flood zone	Building Footprint, Parcel, Site Address, Aerial Imagery, Assessment Records, Verified LOMA, Essential Facility Databases, Business Directories	**Building Point** (Longitude, Latitude). Also known as Hazus User-Defined Facility (UDF)

Table 7. RESIDENTIAL Basement Information from Assessment Records

WV CAMA Assessment Code	Residential Basement Type	Residential Assessment Description	Hazus Foundation Code	Hazus Foundation Description
1	None	NONE to indicate slab construction or no basement	7	Slab-on-Grade
2	Crawl	CRAWL to indicate crawl space to 1/4 basement area	5	Crawlspace
3	Part	PART to indicate 1/4 to 3/4 basement area	4	Basement
4	Full	FULL to indicate 3/4 to full basement area	4	Basement

Table 8. COMMERCIAL Basement Information from Assessment Records

WV CAMA Assessment Floor Level	Commercial Basement Type	Commercial Basement Description	Hazus Foundation Code	Hazus Foundation Description
	None	No "B" or "C" Level values indicate no basement.	7	Slab-on-Grade
C1	Crawl	Crawl Space	5	Crawlspace
B1	Basement	First Basement	4	Slab-on-Grade
B2-B5	Sub-Basement	Second Basement. Up to 5 sub basements	4	Basement

Table 9. Foundation Type, Foundation Code, First Floor Height for Hazus Flood Model

	Foundation Type				First Floor Height		
WV Assessment Record Values for BASEMENT	**Foundation Type**	**Foundation Code**	**Modified-FdtnCode**	**Description**	**FirstFloorHt (PRE-FIRM) ft.**	**FirstFloorHt (POST-FIRM) ft.**	**Modified-FFH**
	Pile	**1**	1	Piles support an elevated structure and consist of multiple columns driven into the ground and embedded several feet below grade.	7.0	8.0	<value>
	Pier	**2**	2	This system is often used on manufactured housing and consists of multiple small piers or post that support the structure and are shallowly embedded into the ground.	5.0	6.0	<value>
	Solid Wall	**3**	3	Load-bearing perimeter walls greater than 4 ft. in height, usually supported by shallow footings.	7.0	8.0	<value>
FULL or **PART** (Residential) **FIRST BASEMENT**, **SUB BASEMENT** (Commercial)	Basement	**4**	4	Structure that has any floor beneath grade.	4.0	4.0	<value>
CRAWL (Residential) **CRAWL SPACE** (Commercial)	Crawlspace	**5**	5	Short load bearing masonry or concrete wall. Default for Trailers RES2 Occupancy Class. If there is no Building Year then an average 3.5 feet is used for the First Floor Height.	3.0	4.0	<value>
	Fill	**6**	6	Soil built up above the ground elevation.	2.0	2.0	<value>
NONE or blank	Slab-on-Grade	**7**	7	Concrete slab resting on the ground. Default if no basement value except for Trailers (RES2 Occupancy Class).	1.0	1.0	<value>

Note: Basement values of assessment records for residential and commercial properties are used to generate Foundation Codes 4 (Basement),5 (Crawlspace), and 7 (No Basement).

Table 10. Hazus Occupancy Class Descriptions

Hazus Label	Occupancy Class	Standard Industrial Codes (SIC)	Description / Notes
Residential			
RES1	Single Family Dwelling		
RES2	Mobile Home		A titled owner of a mobile home, house trailer, or manufactured home has the option to convert their home to real property and obtain a deed in place of a certificate of title if it has been permanently affixed to real property. Owner-occupied property is designated as Tax Class = 2. The following default values are used for missing attributes. Foundation Type = Crawlspace; Single Wide Trailer: Avg. Value = $23,000 and Area = 1,000 sq. ft.; Double Wide Trailer: Value = $46,000 and Area = 2,000 sq. ft.
RES3A	Multi Family Dwelling – Duplex		
RES3B	Multi Family Dwelling – 3-4 Units		
RES3C	Multi Family Dwelling – 5-9 Units		
RES3D	Multi Family Dwelling – 10-19 Units		
RES3E	Multi Family Dwelling – 20-49 Units		
RES3F	Multi Family Dwelling – 50+ Units		
RES4	Temporary Lodging	70	Hotels, motels, boarding houses, sports and recreation camps, recreational vehicle parks and campsites, lodging houses, and hotels open to the public operated by membership organizations for the benefit of constituents
RES5	Institutional Dormitory		
RES6	Nursing Home	8051, 8052, 8059	Skilled or intermediate nursing care facilities providing continuous or non-continuous nursing and rehabilitative services to patients, personal care facilities providing inpatient nursing and rehabilitative services to people with special mental or physical condition
Commercial			
COM1	Retail Trade	52, 53, 54, 55, 56, 57, 59	Establishments selling lumber and a general line of building materials, basic hardware lines, garden supplies, plants and mobile homes, department stores, supermarkets, grocery stores, food stores, fruit and vegetable markets, confectionary stores, dairy product stores, bakeries, motor vehicle and boat dealers, gasoline service stations, clothing, accessory and shoe stores, furniture and household appliance stores, electronics and computer software stores, drug stores, liquor stores, tobacco stores and stands, sporting goods and bicycle stores, book and stationary stores, jewelry stores, camera and photographic supply stores, toy and game shops, gift shops, luggage and leather goods stores, florists, etc.

Hazus Label	Occupancy Class	Standard Industrial Codes (SIC)	Description / Notes
COM2	Wholesale Trade	42, 50, 51	Trucking with or without storage, courier services except by air, general, farm product and refrigerated warehousing and storage, terminal facilities for motor freight transportation, wholesale and distribution of motor vehicles and parts, furniture, electrical appliances, hardware, lumber and wood products, construction materials, office equipment, medical equipment and drugs, metals, coal, minerals, petroleum products, agricultural, industrial and construction machinery, livestock, groceries, food and beverages, paper, clothing, footwear and accessories, plastics, chemicals, etc.
COM3	Personal and Repair Services	72, 75, 76, 83, 88	Laundry and dry-cleaning, photography, beauty and hair styling services, funeral services, tax return preparation services, rental vehicles, automobile parking services, automotive repair and paint shops, car washes, appliance and furniture repair shops, social services, job training and vocational rehabilitation services, child daycare services, and private households
COM4	Business/Professional/Technical Services	40, 41, 44, 45, 46, 47, 49, 61, 62, 63, 64, 65, 67, 73, 78 (except 7832), 81, 87, 89	Railroads establishments, local and suburban transit, school buses, transportation terminals and service facilities, water transportation, air transportation, travel agencies, packing and crating, petroleum pipelines, electric services, water supply, sewerage systems, refuse systems, steam and air conditioning supply, irrigation systems, credit institutions and agencies, mortgage bankers and loan correspondents, dealers and flotation companies, security and commodity exchanges, investment advice, all types of insurance, building operators, real estate agents and managers, land or cemetery sub-dividers and developers, holding and investor companies, advertising agencies, building cleaning and maintenance services, heavy construction equipment rental, medical equipment rental, employment agencies, computer programming services, motion picture production, legal services, engineering and architectural services, research organizations, and management services
COM5	Depository Institutions	60	Federal reserve banks, central reserve depository institutions, commercial banks, saving institutions, credit unions, branches of foreign banks, and non-deposit trust facilities
COM6	Hospital	8062, 8063, 8069	General medical and surgical hospitals, psychiatric hospitals, and specialty hospitals
COM7	Medical Office/Clinic	80 (except 8051, 8052, 8059, 8062, 8063, 8069)	Offices and clinics of doctors of medicine, dentists, osteopathy, chiropractors, optometrists, podiatrists, health practitioners, medical and dental laboratories, home health care services, and kidney dialysis centers
COM8	Entertainment & Recreation	48, 58, 79 (except 7911), 84	Radiotelephone, telephone, telegraph and other message communications, radio or television broadcasting stations, cable and other pay television services, eating and drinking places, theatrical producers, bands, orchestras, actors, and other entertainers, bowling centers, professional sports clubs and promoters, racing including track operations, physical fitness facilities, public golf courses, amusement parks and devices, and membership sports and recreation clubs
COM9	Theaters	7832, 7911	Motion picture theaters except drive-in and dance studios, schools and halls

Hazus Label	Occupancy Class	Standard Industrial Codes (SIC)	Description / Notes
COM10	Parking		
		Industrial	
IND1	Heavy	22, 24, 26, 32, 34, 35 (except 3571, 3572), 37	Fabric, textile, carpets and rugs, logging, structural wood members, mobile homes, prefabricated wood or metal buildings and components, paper and cardboard products, sanitary food containers, plastics, foil and paper bags, glass products, cement, brick and structural clay tile, ceramic tiles, china bathroom accessories, kitchen articles, electrical supplies, wire products, cut stone and products, concrete products, lime, gypsum, mineral wool, metal products, turbines, agricultural, construction, mining and petroleum machinery, industrial patterns and machinery, power-driven hand tools, office machines, building equipment such as elevators, air conditioning and heating machinery, motor vehicles, aircrafts, ships and boats, and railroad equipment
IND2	Light	23, 25, 27, 30, 31, 36 (except 3671, 3672, 3674), 38, 39	Clothing, footwear and accessories, household furniture, office and store furniture and fixtures, public building furniture, household appliances, printing and publishing, tires and other rubber products, plastics products, power generators and transformers, carbon and graphite products, lighting fixtures and equipment, audio and video equipment, electronic components, batteries, laboratory instruments, measuring and controlling devices, surgical and medical instruments, musical instruments, toys and games, sporting and athletic goods
IND3	Food/Drugs/Chemicals	20, 21, 28, 29	Meat products, dairy and creamery, vegetables, canned, dried and frozen food, bakery products, confectionary products, table oils, beverages, pet food, tobacco products, manufactured ice, industrial chemicals, medicinal chemicals, detergents, perfumes and cosmetics, fertilizers, pesticides and other agricultural chemicals, adhesives, explosives, petroleum refining, asphalt, and lubricating oils
IND4	Metals/Minerals Processing	10, 12, 13, 14, 33	Iron, copper, lead, zinc, gold, silver, ferroalloy, uranium, radium and vanadium mining services, steel, aluminum and copper works, surface and underground coal mining and services, petroleum and natural gas exploration and field services, stones, sand and gravel, clay, ceramic, refractory mineral and other nonmetallic mineral services
IND5	High Technology	3571, 3572, 3671, 3672, 3674	Electronic computers, computer storage devices, electron tubes, printed circuit boards, semiconductors and related services
IND6	Construction	15, 16, 17	General contractors of residential and non-residential buildings, operative builders, highway, street, bridge and tunnel construction, water and sewer pipelines, communications and power line construction, demolition and excavation work, masonry and stone work, concrete work, structural steel erection, plumbing, heating and air-conditioning, electrical work, carpentry work, glazing work, painting and paper hanging, water well drilling, and installation of building equipment

Hazus Label	Occupancy Class	Standard Industrial Codes (SIC)	Description / Notes
Agriculture			
AGR1	Agriculture	01, 02, 07, 08, 09	Production of cereals, cotton, tobacco, sugarcane and sugar beets, vegetables, fruits, ornamental nursery products, cattle, hogs, sheep and goats, poultry, horses, dairy farms, soil preparation services, crop planting, protection and harvesting, crop preparation for market, veterinary services, farm labor contractors and management services, landscape counseling and planning, timber and forestry services, fishing and hunting
Religion/Non-Profit			
REL1	Church/Membership Organizations	86	Professional and business membership organizations, labor unions, civic, social and fraternal associations, political organizations, and religious organizations
Government			
GOV1	General Services	43, 91, 92 (except 9221, 9224), 93, 94, 95, 96, 97	United States postal service, executive offices, legislative bodies, courts, legal counsel and prosecution, correctional institutions, public order and safety, public finance, taxation and monetary policy, administration of educational, health, social and general economic programs, administration of veterans' affairs, management of air, water and solid waste, conservation of land, minerals, wildlife and forests, administration of housing programs, urban planning and rural development, regulation and administration of transportation, communications and utilities, regulation of agricultural marketing, space research and technology, national security, and international affairs
GOV2	Emergency Response	9221, 9224	Police and fire protection
Education			
EDU1	Schools/Libraries	82 (except 8221, 8222)	Elementary and secondary schools, libraries, data processing schools, business and secretarial schools, and educational services
EDU2	Colleges/Universities	8221, 8222	Colleges, universities, professional schools, junior colleges, and technical institutes

Table 10A. Occupancy Classifications

LAND USE	STRUCTURE USE or APPEARANCE							STRUCTURE TYPE (Design and Building Materials)			
186 IAS Codes	33 Hazus Building Specific Occupancy Classes			7 Building Classes	3 Building Classes	3 Building Classes	2 Building Classes	12 Building Classes	5 Building Cleasses	4 Building Classes	2 Building Classes
WV Assessment Land Use Codes	**Open Hazus Software Program - Flood Assessment Structure Tool (FAST)**			**7 Hazus Generalized Classes**	**WV Flood Tool: Residential, Commercial, Other**	**Census Housing**	**Structure Use Residential/Non-Residential: NFIP Rating Guidelines, Hazus Flood Loss Models**	**12 Hazus Classes with Residential Breakdown**	**5 Generalized Classes (NFIP Rates)**	**4 Generalized Classes**	**Structure Type Residential/Non-Residential: CRS, SDE, Mitigation Measures**
	Label	**Hazus Occupancy Class**	**Example Descriptions**								
100-213, 314-318 (Living Oriented)		**Residential**		Residential	Residential	Living Quarters 1-unit 2 units 3 or 4 units 5 to 9 units 10 to 19 units 20 or more units Mobile home Permanent Res.	Residential	Single Family Home	Single Family	Residential 1-4 Units	Residential
	RES1	Single Family Dwelling	House					Mobile Home			
	RES2	Mobile / Manufactured Home	Mobile / Manufactured Home					Family 2-3 Units Family 3-4 Units	2-4 Family		
	RES3	RES3A Duplex RES3B 3-4 Units	Family 2-4 Units: Duplex, Multi-Family Small (RES3A, RES3B)								
		RES3C 5-9 Units RES3D 10-19 Units RES3E 20-49 Units RES3F 50+ Units	Other Residential (> 4 Units): Apartment/Condominium, Multi-Family Medium (RES3C to RES3D), Mutli-family Large (RES3E, RES3F)					Multi-Family Residential (> 4 units)	Multi- Family Residential (> 4 units)	Apartments or Group Housing	Non-Residential
	RES4	Temporary Lodging	Hotel/Motel					Non-Residential Business (> 4 units)	Non-Residential Business (> 4 units)		
	RES5	Institutional Dormitory	Group Housing (military, college)			Group Quarters					
	RES6	Nursing Home									
300-399		**Commercial**		Commercial	Commercial	Non-Residential	Non-Residential	Commercial	Commercial	Commercial	
	COM1	Retail Trade	Store								
	COM2	Wholesale Trade	Warehouse								
	COM3	Personal and Repair Services	Service Station/Shop								
	COM4	Professional/Technical Services	Offices								
	COM5	Banks									
	COM6	Hospital									
	COM7	Medical Office/Clinic									
	COM8	Entertainment & Recreation	Restaurants/Bars								
	COM9	Theaters	Theaters								
	COM10	Parking	Garages								
400-471		**Industrial**		Industrial				Industrial			
	IND1	Heavy	Factory								
	IND2	Light	Factory								
	IND3	Food/Drugs/Chemicals	Factory								
	IND4	Metals/Minerals Processing	Factory								
	IND5	High Technology	Factory								
	IND6	Construction	Office								
OBY Table		**Agriculture**		Agriculture	Other			Agriculture	Other Non-Residential	Other Non-Residential	
	AGR1	Agriculture									
620, 604		**Religion/Nonprofit**		Religion/Non-Profit				Religion/Non-Profit			
	REL1	Church/Nonprofit									
600 or 700 series		**Government**		Government				Government			
	GOV1	General Services	Office								
	GOV2	Emergency Response	Police/Fire Station/EOC								
612, 613		**Education**		Education				Education			
	EDU1	Grade Schools									
	EDU2	Colleges/Universities	Does not include group housing								

Table web link: << insert here >>

Table 11. WV Assessment Land Use Codes. 186 LUCs Classified to 33 Hazus Occupancy Class Types

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
1	100	Residential Vacant	UNK	Unknown	UNK	No		
2	101	Residential 1 Family	**RES1**	Residential	RES	Yes	1	**Residential**
3	102	Residential 2 Family	**RES3A**	Residential	RES	Yes	2	**Residential**
4	103	Residential 3 Family	**RES3B**	Residential	RES	Yes	4	**Residential**
5	104	Residential 4 Family	**RES3B**	Residential	RES	Yes	4	**Residential**
6	105	Mixed Residential/Commercial	**RES1**	Residential	RES	Yes	1	TBD
7	106	Condominium (common element)	**RES3A**	Residential	RES	Yes	2	**Residential**
8	107	Condominium (fee simple)	**RES3A**	Residential	RES	Yes	2	**Residential**
9	108	Mobile Home	**RES2**	Residential	RES	Yes	1	**Residential**
10	109	Auxiliary Improvement	UNK	Unknown	UNK	No		
11	110	Salvage Value Building	UNK	Unknown	UNK	No		Non-Residential
12	112	Active Farm (Residential or Commercial)	**RES1, AGR1**	Residential, Agricultural (Other)	RES or AGR	Yes	1	**Residential**
13	113	Inactive Farm (Residential or Commercial)	**RES1, AGR1**	Residential, Agricultural (Other)	RES or AGR	Yes	1	**Residential**
14	114	Conservation easement perpetual	UNK	Unknown	UNK	UNK		
15	115	Unsound Residential Structure	**RES1**	Residential	RES	No	1	**Residential**
16	123	Large Vac Tract - Unknown Potential	UNK	Unknown	UNK	No		
17	200	Vacant Apartment Land	UNK	Unknown	UNK	Yes		
18	201	Residential Structure on Apartment land	**RES1**	Residential	RES	Yes	1	**Residential**
19	211	Apartment-Garden (1-3 stories)	**RES3C to RES3E**	Residential	RES	Yes	5 to 49	Non-Residential RES3C to RES6
20	212	Apartment- High Rise	**RES3F**	Residential	RES	Yes	75	Non-Residential
21	213	Mobile Home Park	**RES2**	Residential	RES	Yes	1	Residential
22	300	Vacant Commercial Land	UNK	Unknown	UNK	No		
23	301	Residential Structure on Commercial Land	**COM1**	Commercial	COM	No		Non-Residential
24	310	Unsound Commercial Structure	**COM1**	Commercial	COM	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
25	314	Hotel/Motel-High Rise	**RES4**	Residential	RES	No		Non-Residential
26	315	Hotel/Motel-Low Rise	**RES4**	Residential	RES	No		Non-Residential
27	316	Nursing Home	**RES6**	Residential	RES	No		Non-Residential
28	318	Boarding and Rooming Houses	**RES4, RES5**	Residential	RES	No		Non-Residential
29	319	Mixed Commercial/Residential	**COM1**	Commercial	COM	Yes	1	TBD
30	321	Restaurant	**COM8**	Commercial	COM	No		Non-Residential
31	323	Food Stand	**COM8**	Commercial	COM	No		Non-Residential
32	325	Franchise Food	**COM8**	Commercial	COM	No		Non-Residential
33	326	Ice House	**COM8**	Commercial	COM	No		Non-Residential
34	327	Bar/Lounge	**COM8**	Commercial	COM	No		Non-Residential
35	328	Night Club/Dinner Theater	**COM9**	Commercial	COM	No		Non-Residential
36	330	Kwik Lube	**COM3**	Commercial	COM	No		Non-Residential
37	331	Auto Dealer-Full Service	**COM1**	Commercial	COM	No		Non-Residential
38	332	Auto Service Garage	**COM3**	Commercial	COM	No		Non-Residential
39	333	Service Station with Bays	**COM3**	Commercial	COM	No		Non-Residential
40	334	Service Station without Bays	**COM3**	Commercial	COM	No		Non-Residential
41	335	Truck Stop	**COM4**	Commercial	COM	No		Non-Residential
42	336	Car Wash-Manual	**COM3**	Commercial	COM	No		Non-Residential
43	337	Car Wash-Automatic	**COM3**	Commercial	COM	No		Non-Residential
44	338	Parking Garage/Deck	**COM10**	Commercial	COM	No		Non-Residential
45	339	Parking Miscellaneous	**COM10**	Commercial	COM	No		Non-Residential
46	340	Super Regional Shopping Mall	**COM1**	Commercial	COM	No		Non-Residential
47	341	Regional Shopping Mall	**COM1**	Commercial	COM	No		Non-Residential
48	342	Community Shopping Center	**COM1**	Commercial	COM	No		Non-Residential
49	343	Neighborhood Shopping Center	**COM1**	Commercial	COM	No		Non-Residential
50	344	Strip Shopping Center	**COM1**	Commercial	COM	No		Non-Residential
51	345	Discount Department Store	**COM1**	Commercial	COM	No		Non-Residential
52	346	Department Store/Anchor Store	**COM1**	Commercial	COM	No		Non-Residential
53	347	Supermarket	**COM1**	Commercial	COM	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
54	348	Convenience Food Market	**COM1**	Commercial	COM	No		Non-Residential
55	349	Medical Office	**COM7**	Commercial	COM	No		Non-Residential
56	351	Bank	**COM5**	Commercial	COM	No		Non-Residential
57	352	Savings Institution	**COM5**	Commercial	COM	No		Non-Residential
58	353	Office Building-Low Rise (1-4 stories)	**COM4**	Commercial	COM	No		Non-Residential
59	354	Office Building-High Rise (>4 stories)	**COM4**	Commercial	COM	No		Non-Residential
60	355	Office Condominium	**COM4**	Commercial	COM	No		Non-Residential
61	356	Retail Condominium	**COM1**	Commercial	COM	No		Non-Residential
62	361	Funeral Home	**COM4**	Commercial	COM	No		Non-Residential
63	362	Veterinary Clinic	**COM7**	Agricultural	AGR	No		Non-Residential
64	363	Legitimate Theater	**COM9**	Commercial	COM	No		Non-Residential
65	364	Motion Picture Theater	**COM9**	Commercial	COM	No		Non-Residential
66	365	Cinema/Theater	**COM9**	Commercial	COM	No		Non-Residential
67	366	Radio/TV/Motion Picture Studio	**COM8**	Commercial	COM	No		Non-Residential
68	367	Social/Fraternal Hall	**REL1**	Religious	REL	No		Non-Residential
69	368	Hangar	**COM4**	Commercial	COM	No		Non-Residential
70	369	Day Care Center	**COM3**	Commercial	COM	No		Non-Residential
71	370	Greenhouse/Florist	**COM1**	Commercial	COM	No		Non-Residential
72	371	Downtown Row Type	**COM4**	Commercial	COM	No		Non-Residential
73	373	Retail-Single Occupancy	**COM1**	Commercial	COM	No		Non-Residential
74	374	Retail-Multiple Occupancy	**COM1**	Commercial	COM	No		Non-Residential
75	375	Retail-Drive Up	**COM1**	Commercial	COM	No		Non-Residential
76	381	Bowling Alley	**COM8**	Commercial	COM	No		Non-Residential
77	382	Skating Rink	**COM8**	Commercial	COM	No		Non-Residential
78	383	Health Spa	**COM8**	Commercial	COM	No		Non-Residential
79	384	Swimming Pool-Indoor	**COM8**	Commercial	COM	No		Non-Residential
80	385	Tennis Club-Indoor	**COM8**	Commercial	COM	No		Non-Residential
81	386	Racquet Club-Indoor	**COM8**	Commercial	COM	No		Non-Residential
82	387	Country Club without Golf Course	**COM8**	Commercial	COM	No		Non-Residential
83	388	Club House	**COM8**	Commercial	COM	No		Non-Residential
84	389	Country Club with Golf Course	**COM8**	Commercial	COM	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
85	390	Amusement Park	**COM8**	Commercial	COM	No		Non-Residential
86	391	Cold Storage Facility	**COM2**	Commercial	COM	No		Non-Residential
87	392	Lumber Storage Facility	**COM2**	Commercial	COM	No		Non-Residential
88	393	Comm Auxiliary Improvement	**COM1**	Commercial	COM	No		Non-Residential
89	395	Truck Terminal	**COM4**	Commercial	COM	No		Non-Residential
90	396	Mini Warehouse	**COM2**	Commercial	COM	No		Non-Residential
91	397	Office/Warehouse	**COM2**	Commercial	COM	No		Non-Residential
92	398	Warehouse	**COM2**	Commercial	COM	No		Non-Residential
93	399	Warehouse-Prefabricated	**COM2**	Commercial	COM	No		Non-Residential
94	400	Vacant Industrial Land	UNK	Unknown	UNK	No		
95	401	Manufacturing	**IND2**	Industrial	IND	No		Non-Residential
96	405	Research & Development	**COM4**	Commercial	COM	No		Non-Residential
97	411	Aircraft Engine Plant	**IND1**	Industrial	IND	No		Non-Residential
98	412	Aluminum & Foil Mfg	**IND4**	Industrial	IND	No		Non-Residential
99	413	Asphalt Plant	**IND3**	Industrial	IND	No		Non-Residential
100	414	Automobile Parts Mfg	**IND1**	Industrial	IND	No		Non-Residential
101	415	Bakery	**IND3**	Industrial	IND	No		Non-Residential
102	416	Bottling Plant	**IND1**	Industrial	IND	No		Non-Residential
103	417	Broom Mfg	**IND2**	Industrial	IND	No		Non-Residential
104	418	Candy Mfg	**IND3**	Industrial	IND	No		Non-Residential
105	419	Cement Mfg	**IND1**	Industrial	IND	No		Non-Residential
106	420	Concrete Mfg	**IND1**	Industrial	IND	No		Non-Residential
107	421	Chemical Mfg	**IND3**	Industrial	IND	No		Non-Residential
108	422	Clay Mfg	**IND1**	Industrial	IND	No		Non-Residential
109	423	Clothing Mfg (exc Leather/Rubber)	**IND2**	Industrial	IND	No		Non-Residential
110	424	Coal Processing	**IND4**	Industrial	IND	No		Non-Residential
111	425	Compressor Station (not Pub.Util)	**IND4**	Industrial	IND	No		Non-Residential
112	426	Dairy	**IND3**	Industrial	IND	No		Non-Residential
113	428	Dental and Medical Lab	**IND3**	Industrial	IND	No		Non-Residential
114	429	Electronic Components Prods. Mfg	**IND5**	Industrial	IND	No		Non-Residential
115	430	Electronic Equipment Mfg	**IND5**	Industrial	IND	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
116	431	Feed & Flower Mfg	**IND3**	Industrial	IND	No		Non-Residential
117	432	Foundry Products	**IND2**	Industrial	IND	No		Non-Residential
118	433	Food Processing	**IND3**	Industrial	IND	No		Non-Residential
119	434	Glass Mfg	**IND1**	Industrial	IND	No		Non-Residential
120	435	Glass Mfg-Special Tools	**IND1**	Industrial	IND	No		Non-Residential
121	436	Grain & Milling Products Mfg	**IND3**	Industrial	IND	No		Non-Residential
122	437	Ice Plant	**IND3**	Industrial	IND	No		Non-Residential
123	438	Leather Products Mfg	**IND2**	Industrial	IND	No		Non-Residential
124	439	Liquified Natural Gas Plant	**IND4**	Industrial	IND	No		Non-Residential
125	440	Logging, Cutting of Timber	**IND1**	Industrial	IND	No		Non-Residential
126	441	Machinery & Equipment Mfg	**IND1**	Industrial	IND	No		Non-Residential
127	442	Meat Packing & Slaughterhouse	**IND3**	Industrial	IND	No		Non-Residential
128	443	Metal Working	**IND6**	Industrial	IND	No		Non-Residential
129	444	Mining, Deep	**IND4**	Industrial	IND	No		Non-Residential
130	445	Mining, Strip	**IND4**	Industrial	IND	No		Non-Residential
131	446	Natural Gas Extracting Facility	**IND4**	Industrial	IND	No		Non-Residential
132	447	Nickel Mfg	**IND4**	Industrial	IND	No		Non-Residential
133	448	Newspaper Plant	**IND2**	Industrial	IND	No		Non-Residential
134	449	Oil & Gas Pipeline (not Public Utility)	**COM4**	Commercial	COM	No		Non-Residential
135	450	Optical Mfg	**IND2**	Industrial	IND	No		Non-Residential
136	451	Paint Mfg	**IND3**	Industrial	IND	No		Non-Residential
137	452	Paper Finishing & Converting	**IND2**	Industrial	IND	No		Non-Residential
138	453	Petroleum Refinery	**IND3**	Industrial	IND	No		Non-Residential
139	454	Pipeline Mfg	**IND1**	Industrial	IND	No		Non-Residential
140	455	Plastics Products Mfg	**IND1**	Industrial	IND	No		Non-Residential
141	456	Plastics Products Mfg - Special Tools	**IND1**	Industrial	IND	No		Non-Residential
142	457	Print Shop	**IND2**	Industrial	IND	No		Non-Residential
143	458	Pulp & Paper	**IND1**	Industrial	IND	No		Non-Residential
144	459	Quarries Incl st&gr, ls, ss,sh,cl	**IND4**	Industrial	IND	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
145	460	Railroad Car Mfg	**IND1**	Industrial	IND	No		Non-Residential
146	461	Rubber Mfg-Tire Recapping	**IND2**	Industrial	IND	No		Non-Residential
147	462	Shoe Mfg	**IND2**	Industrial	IND	No		Non-Residential
148	463	Steel Mill	**IND1**	Industrial	IND	No		Non-Residential
149	464	Steam Generating Plant	**IND1**	Industrial	IND	No		Non-Residential
150	465	Saw Mills-Permanent	**IND1**	Industrial	IND	No		Non-Residential
151	466	Saw Mills-Temporary	**IND1**	Industrial	IND	No		Non-Residential
152	467	Textile Mfg	**IND1**	Industrial	IND	No		Non-Residential
153	468	Tobacco Products Mfg	**IND3**	Industrial	IND	No		Non-Residential
154	469	Woodworking Shop	**IND1**	Industrial	IND	No		Non-Residential
155	470	Wire Products Mfg	**IND1**	Industrial	IND	No		Non-Residential
156	471	Jewelry/Musical Instruments	**IND2**	Industrial	IND	No		Non-Residential
157	600	Vacant Exempt Land	**UNK**	Unknown	UNK	No		Non-Residential
158	601	Cemetery	**UNK**	Unknown	UNK	No		Non-Residential
159	602	Post Office	**GOV1**	Governmental	GOV	No		Non-Residential
160	603	Federal/State Building	**GOV1**	Governmental	GOV	No		Non-Residential
161	604	Other Miscellaneous Exempt	UNK	Unknown	UNK	No		Non-Residential
162	610	Recreational/Health	**COM8**	Commercial	COM	No		Non-Residential
163	611	Library	**EDU1**	Educational	EDU	No		Non-Residential
164	612	School	**EDU1**	Educational	EDU	No		Non-Residential
165	613	College & University	**EDU2**	Educational	EDU	No		Non-Residential
166	620	Religious	**REL1**	Religious	REL	No		Non-Residential
167	630	Auditorium	**COM8**	Commercial	COM	No		Non-Residential
168	640	Hospital	**COM6**	Commercial	COM	No		Non-Residential
169	660	Police or Fire Station	**GOV2**	Governmental	GOV	No		Non-Residential
170	670	Correctional	**GOV1**	Governmental	GOV	No		Non-Residential
171	680	Cultural	**COM8**	Commercial	COM	No		Non-Residential
172	690	Rail/Bus/Air Terminal	**COM4**	Commercial	COM	No		Non-Residential
173	700	Utility Vacant Land	UNK	Unknown	UNK	No		Non-Residential
174	701	Water System	**COM4**	Commercial	COM	No		Non-Residential
175	702	Gas Distribution System	**COM4**	Commercial	COM	No		Non-Residential
176	703	Electric Company	**COM4**	Commercial	COM	No		Non-Residential

			Flood Loss Estimation Models (Based on Structure Use)					(Structure Construction Type)
ID	**CAMA/ Assessment Land Use Code**	**Description**	**Hazus Occupancy Class Type Code**	**Hazus General Occupancy Class**	**Abbrev. General Occupancy Class**	**Hazus Population Displacement Models - People Occupied (Residence)**	**People Per Unit**	**Residential/ Non-Residential**
177	704	Telephone Company	**COM4**	Commercial	COM	No		Non-Residential
178	705	Railroad	**COM4**	Commercial	COM	No		Non-Residential
179	706	Pipeline	**COM4**	Commercial	COM	No		Non-Residential
180	707	Sewage Treatment	**COM4**	Commercial	COM	No		Non-Residential
181	710	Telephone Equipment Building	**COM8**	Commercial	COM	No		Non-Residential
182	715	Telephone Service Garage	**COM8**	Commercial	COM	No		Non-Residential
183	720	Radio/TV Transmitter Building	**COM8**	Commercial	COM	No		Non-Residential
184	721	Wireless Serv Facility on leased land	**COM8**	Commercial	COM	No		Non-Residential
185	722	Wireless Serv Facility with land	**COM8**	Commercial	COM	No		Non-Residential
186	723	Land leased to Wireless Service	**COM8**	Commercial	COM	No		Non-Residential

Table 12. Average Mobile Home Appraisal Values by County. Computed from Tax Year 2019 Assessment Records. Median appraisal values calculated property tax records where LUC = 108. Doublewide trailer appraisal value = singlewide x 2. Singlewide Home Area = 1,000 sq. ft.; Doublewide Area = 2,000 sq. ft.

County	Count	Average Mobile Home Appraisal	Min Bldg. Appraisal	Max Bldg. Appraisal	Median (LUC 108)	Single Wide	Double Wide
Barbour	702	$15,587	$400	$130,100	$12,300	$12,000	$24,000
Berkeley	3,393	$18,707	$100	$180,400	$12,100	$12,000	$24,000
Boone	1,871	$33,459	$300	$193,700	$27,550	$28,000	$56,000
Braxton	1,203	$28,129	$100	$178,400	$19,600	$20,000	$40,000
Brooke	330	$21,420	$200	$102,200	$15,000	$15,000	$30,000
Cabell	1,899	$28,674	$200	$144,100	$25,900	$26,000	$52,000
Calhoun	143	$21,811	$100	$157,300	$10,200	$10,000	$20,000
Clay	510	$13,860	$200	$142,300	$7,000	$7,000	$14,000
Doddridge	225	$16,716	$300	$185,500	$7,000	$7,000	$14,000
Fayette	1,390	$16,466	$100	$152,300	$10,500	$11,000	$22,000
Gilmer	270	$20,539	$100	$171,900	$11,300	$11,000	$22,000
Grant	835	$24,609	$100	$178,400	$19,400	$19,000	$38,000
Greenbrier	1,686	$24,441	$100	$149,500	$17,600	$18,000	$36,000
Hampshire	1,922	$25,989	$200	$147,700	$18,300	$18,000	$36,000
Hancock	311	$12,246	$200	$183,900	$9,000	$9,000	$18,000
Hardy	887	$21,125	$100	$788,000	$12,600	$13,000	$26,000
Harrison	2,139	$41,536	$100	$258,100	$24,300	$24,000	$48,000
Jackson	1,824	$33,915	$100	$208,600	$28,750	$29,000	$58,000
Jefferson	905	$32,361	$500	$307,900	$25,450	$25,000	$50,000
Kanawha	5,903	$32,195	$100	$235,400	$24,800	$25,000	$50,000
Lewis	649	$13,273	$100	$60,600	$10,600	$11,000	$22,000
Lincoln	1,839	$23,160	$100	$222,000	$18,200	$18,000	$36,000
Logan	2,421	$20,570	$100	$105,100	$15,800	$16,000	$32,000
Marion	1,420	$24,879	$100	$163,600	$16,600	$17,000	$34,000
Marshall	514	$17,663	$100	$271,200	$11,500	$12,000	$24,000
Mason	1,092	$17,682	$100	$185,300	$13,650	$14,000	$28,000
McDowell	1,050	$14,360	$100	$74,000	$7,400	$7,000	$14,000
Mercer	3,591	$31,237	$100	$153,600	$26,500	$27,000	$54,000
Mineral	999	$20,437	$100	$140,600	$13,700	$14,000	$28,000
Mingo	2,285	$17,743	$200	$126,100	$13,900	$14,000	$28,000
Monongalia	1,549	$26,246	$100	$219,900	$15,300	$15,000	$30,000
Monroe	929	$23,875	$100	$197,800	$13,700	$14,000	$28,000
Morgan	920	$28,480	$100	$160,600	$20,600	$21,000	$42,000
Nicholas	1,380	$19,957	$100	$243,000	$9,900	$10,000	$20,000

County	Count	Average Mobile Home Appraisal	Min Bldg. Appraisal	Max Bldg. Appraisal		Median (LUC 108)	Single Wide	Double Wide
Ohio	292	$19,748	$200	$98,700		$12,900	$13,000	$26,000
Pendleton	467	$19,737	$100	$304,000		$12,800	$13,000	$26,000
Pleasants	205	$16,768	$100	$92,700		$12,550	$13,000	$26,000
Pocahontas	679	$10,797	$200	$181,800		$7,600	$8,000	$16,000
Preston	1,193	$15,295	$200	$164,600		$12,700	$13,000	$26,000
Putnam	1,359	$15,197	$400	$305,000		$11,450	$11,000	$22,000
Raleigh	3,955	$31,491	$100	$205,300		$25,600	$26,000	$52,000
Randolph	1,017	$21,853	$100	$190,300		$13,100	$13,000	$26,000
Ritchie	574	$32,052	$200	$178,100		$16,600	$17,000	$34,000
Roane	582	$13,725	$300	$86,300		$10,400	$10,000	$20,000
Summers	774	$18,845	$200	$156,800		$11,350	$11,000	$22,000
Taylor	702	$46,681	$100	$238,500		$25,200	$25,000	$50,000
Tucker	284	$23,705	$200	$206,300		$13,300	$13,000	$26,000
Tyler	423	$26,439	$100	$170,900		$13,350	$13,000	$26,000
Upshur	1,120	$27,775	$100	$233,800		$14,300	$14,000	$28,000
Wayne	2,158	$18,928	$100	$181,500		$11,750	$12,000	$24,000
Webster	880	$19,763	$100	$102,600		$12,100	$12,000	$24,000
Wetzel	403	$17,675	$100	$144,300		$13,400	$13,000	$26,000
Wirt	524	$8,962	$100	$81,600		$7,200	$7,000	$14,000
Wood	2,103	$37,984	$200	$229,000		$25,600	$26,000	$52,000
Wyoming	2,244	$20,094	$300	$194,900		$16,000	$16,000	$32,000
Average		$22,670	$156	$186,656		$15,368	$15,418	$30,836

Table 13. Data Issues and Quality Control Measures

Data Category	Data Issue	Validation Check
Building Identifier	Building Identifier not unique	BIE Table
Building Identifier	Building elements missing, incomplete, duplicate	BIE Table
Building Identifier	Parcel ID/Address No. don't correspond correctly to Building-ID	BIE Table
Parcel Geometry	Parcel Geometry misalignment	GIS Map Check
Parcel Geometry	No GIS Parcel Geometry	GIS Map Check
E-911 Address	Site Address wrong	BIE Table, GIS
E-911 Address	Site Address for structure located outside of parcel	GIS Map Check
E-911 Address	No Site Address	BIE Table
E-911 Address	Missing any elements of Full Address (Address Number, Street Name, City, Zip)	BIE Table
E-911 Address	Duplicate Addresses	BIE Table
Imagery	Imagery - No building visible in imagery	GIS Map Check
Assessment Record	Neighboring parcel assessment record matches to parcel with structure. Ensure correct BIE foundation type, occupancy class, etc. from neighboring parcel are copied to parcel with structure.	BIE Table, GIS
Assessment Record	Missing key building attributes: Building Value, Occupancy Class, Foundation Code, Stories, Area	BIE Table
Assessment Record	Sort on highest building values - verify	BIE Table
Assessment Record	Verify with other Essential Facility and Community Asset geodatabases	BIE Table, GIS
Stream Name	Stream Name missing. Update Stream Query Layer.	BIE Table
Water Depth	Sort on highest water depth values - verify	BIE Table
Flood Zone	Building located in most restrictive flood zone	GIS Map Check
Flood Zone	Verify future map conditions of Non-Regulatory High-Risk Advisory Zones	GIS Map Check

Note: All user-supplied values should be red color in Building Inventory Enhanced File. Make sure corresponding Data Issue description codes are selected.

Table 14. Building Inventory Enhanced (BIE) Attributes

Field Name	Description	Category	Sample Data Value
Lat	Latitude	Identification	39.463181
Long	Longitude	Identification	-77.83959
Plus_Code	Google Plus Code (11-Digits)	Identification	87F4F576+75F
Building_ID	Unique Building Identifier	Identification	02-08-0013-0013-0000_801
Building_Type	Primary Building (P Code)	Identification	P
Full_E-911_Address	Complete E-911 Address	Identification	801 TURNER RD, SHEPHERDSTOWN, WV, 25443
GIS_Parcel_ID	GIS Parcel Identifier	Identification	02-08-0013-0013-0000
IAS_ID	Assessment Record Override ID	Identification	
WV_Flood_Tool_Link	WV Flood Tool Link (RiskMAP View)	Identification	https://mapwv.gov/flood/map/?wkid=102100&x=-8665063.574442726&y=4788237.0562021565&l=13&v=2
WV_Parcel_Assessment_Link	WV Detailed Assessment Report	Identification	https://mapwv.gov/Assessment/Detail/?PID=02080013001300000000
CID	FEMA Community Identifier	Community	540065
Community_Name	Community Name	Community	Jefferson County
County	County Name	Community	JEFFERSON COUNTY
Incorporated_Unincorporated	Incorporated or Unincorporated	Community	Unincorporated
Stream_Name	Stream Name	Stream Info	Rockymarsh Run
Watershed_HUC8	Watershed Name (HUC-8)	Stream Info	Conococheague-Opequon (2070004)
Flood_Zone_Designation	Flood Zone Designation (MAP-IN, MAP-OUT)	Flood Zone	Effective 100 yr Zone A (N/A)
Floodway	Floodway (Y/N)	Flood Zone	No
FloodPlainType_RiskLayer	Floodplain Risk Layer Symbol	Flood Zone	Effective A (N/A)
Non_Regulatory	Non-Regulatory High Risk Advisory Zones	Flood Zone	Regulatory
FIRM_Status	Pre-FIRM or Post-FIRM	Flood Zone	Pre-FIRM
Flood_Depth_Value	Flood Depth Value	Flood Zone	N/A
Flood_Depth_Source	Flood Depth Source	Flood Zone	N/A
WSEL_Value	Water Surface Elevation	Flood Zone	N/A
WSEL_Source	Water Surface Elevation Source	Flood Zone	N/A
Ground_Elevation	Ground Elevation	Flood Zone	405.5
Ground_Elevation_Source	Ground Elevation Source	Flood Zone	2012 FEMA Jefferson, Berkeley & Morgan Lidar
Full_Owner_Address	Assessment: Owner Address	Building Info	801 TURNER RD, SHEPHERDSTOWN, WV 25443
Owner_Name_s	Assessment: Owner Name	Building Info	MILLER LEIGHTON B BETTY V
Year_Built	Assessment: Building Year	Building Info	1885
Grade	Assessment: Building Grade	Building Info	C
Property_Class_Code	Assessment: Property Class (R,F,C,I,A,U,X)	Building Info	F
Property_Class_Description	Assessment: Property Class Description	Building Info	Farm
Tax_Class	Assessment: Tax Class (Owner-Occupied = 2)	Building Info	2
Land_Use_Code	Assessment: Land Use Code	Building Info	112
Land_Use_Description	Assessment: Land Use Description	Building Info	Active Farm

Field Name	Description	Category	Sample Data Value
Hazard_Occupancy_Code	Assessment: Hazus Occupancy Class Code	Building Info	AGR1
General_Occupancy_Code	Assessment: Hazus General Occupancy Class	Building Info	Agriculture
Stories	Assessment: Number of Stories	Building Info	2
Exterial_Wall_Type	Assessment: Exterior Wall (Residential or Commercial)	Building Info	Aluminum
Architectural_Style	Assessment: Architectural Style (Residential)	Building Info	Conventional
Structure_Area	Assessment: Structure Area (R or C)	Building Info	1864
Basement_Type	Assessment: Basement Type (R or C)	Building Info	Part
Foundation_Type	Assessment: Foundation Type - Hazus LUT	Building Info	Basement
First_Floor_Height	Assessment: First Floor Height	Building Info	4.0
Dwelling_Value	Assessment: Dwelling Value	Building Info	97400
Commercial_Value	Assessment: Commercial Value	Building Info	0
OBY_Value	Assessment: Out Buildings Value	Building Info	8590
Building_Appraisal	Assessment: Building Appraisal Value	Building Info	106000
Building_Value_Source	Assessment: Building Value Source	Building Info	Assessment (IAS)
Total_Structures	Assessment: Total Structures on Parcel	Building Info	1
Accessory_Structures_Count	Assessment: Owner Name	Building Info	6
Units	Assessment: Number of Untis	Building Info	1
Critical_Infrastructure	Essential Facilities	Other	
Governmental_Building	Governmental Building (F, S, L)	Other	
Historical_Structure	Historical Structure (Yes or No)	Other	
Federal_Land	Federal Land (FED)	Other	
Comments	General Comments	Other	Moved point to flood zone and updated parcel ID / building appraisal
Data_Issue_1	Data Issue Flag 1	Other	
Data_Issue_2	Data Issue Flag 2	Other	
Timestamp	Time Stamps	Other	02/03/2020
Average_Household_Size	Census Average Household Size	Population Displacement	2.6
Residential_Units_FLD	Number of Residential Units	Population Displacement	0
Displaced_Population_FLD_BLD	Population Displaced Per Building	Population Displacement	0

Table 15. Hazus FAST Inputs. Building Input FAST (BIF) Attributes

Input Attribute	Data Type	Range or Length	Notes
UserDefinedFltyId	Text		Unique FAST identifier
OccupancyClass	Text	5	One of 33 Hazus-defined types, e.g., {RES1, RES2, COM3, IND4, AGR1, GOV2, REL1}. Script will skip row if not specified, or if an unrecognized value is provided.
Cost	Long	> 0	Replacement Cost of Structure, in U.S. dollars. Records D51with '0' cost: the script will accept a zero value, but any estimated dollar damage to the structure will be 0. Consider correcting the UDF record or deleting it.
NumStories	Short	≥ 1	Number of Stories. Must be an integer.
FoundationType	Text	{1,2,3,4,5,6,7}	Foundation Type of the building. Text type, per Hazus-MH Flood Model convention. Must be an integer from 1 to 7, inclusively.
FirstFloorHt	Float	≥ 0.0	First Floor Height, in feet. Height can be specified in fractional feet.
Area	Long	> 0	Total Area for the structure, in square feet. Used for Inventory Loss calculation when Inventory Cost is not supplied. Used for debris estimates. Must be greater than 0.
Latitude	Float		Latitude decimal degrees
Longitude	Float		Longitude decimal degrees
Input Attribute	Data Type	Range or Length	Notes
UserDefinedFltyId	Text		Unique FAST identifier
OccupancyClass	Text	5	One of 33 Hazus-defined types, e.g., {RES1, RES2, COM3, IND4, AGR1, GOV2, REL1}. Script will skip row if not specified, or if an unrecognized value is provided.
Cost	Long	> 0	Replacement Cost of Structure, in U.S. dollars. Records D51with '0' cost: the script will accept a zero value, but any estimated dollar damage to the structure will be 0. Consider correcting the UDF record or deleting it.
NumStories	Short	≥ 1	Number of Stories. Must be an integer.
FoundationType	Text	{1,2,3,4,5,6,7}	Foundation Type of the building. Text type, per Hazus-MH Flood Model convention. Must be an integer from 1 to 7, inclusively.
FirstFloorHt	Float	≥ 0.0	First Floor Height, in feet. Height can be specified in fractional feet.
Area	Long	> 0	Total Area for the structure, in square feet. Used for Inventory Loss calculation when Inventory Cost is not supplied. Used for debris estimates. Must be greater than 0.
Latitude	Float		Latitude decimal degrees
Longitude	Float		Longitude decimal degrees

Table 16. Hazus FAST Outputs. Building FAST Outputs (BOF)

Output Attribute	Data Type	Range or Length	Notes
Depth_Grid	Float	≥ 0.0	Flood Depth Grid, in feet.
Depth_in_Struc	Float		Depth-in-Structure Adjusted flood depth grid at the UDF point, in feet. Simple calculation: If the Depth_Grid is a NoData or -9999 value, value is -9999. Else value is Depth_Grid − FirstFloorHt
flExp	Short	{0,1}	UDF is exposed to a flood. Simply 0 or 1. If the UDF is in a flood depth grid, then the value is 1, regardless of depth-in-structure.
SOID	Text	5	Specific Occupancy ID. The Hazus-MH Flood shorthand that compresses OccupancyClass, NumStories, and FoundationType into a concise 4- to 5-character code, e.g. R11N for a RES1, no basement, single story. Used to access the look-up tables where the user does not specify a DDF. XXXX for buildings not in the flood zone.
BDDF_ID	Text	3	Building Depth Damage Function (DDF): If not provided by the user, defaults will be assigned based on Hazus methodology by computing Specific Occupancy ID based on Occupancy Type, Foundation Type, num stories and flood type. If populated by user, the script will check to ensure that only valid DDFs are used.
BldgDmgPct	Float	0 – 100	Building Damage Percentage. Interpolated from the lookup tables, depending on flood depth. Value ranges between 0 and 100. For UDFs outside the flood zone, the value is set to 0.0.
BldgLossUSD	Long	≥ 0	Loss, in US dollars, to the building. Formula: Cost × BldgDmgPct
ContentCostUSD	Long	≥ 0	Content Cost: Building Content Cost, in US dollars. If user supplied a ContentCost attribute, and the record's value is non-null, the value is ContentCost. Otherwise, depending on OccupancyClass, it is calculated at 0.5, 1.0, or 1.5 times the user-supplied building Cost. See Hazus-MH Flood Technical Manual (FEMA, 2011).
CDDF_ID	Text	3	Content Depth Damage Function ID. If not provided by the user, defaults will be assigned based on Hazus methodology by computing Specific Occupancy ID based on Occupancy Type, Foundation Type, num stories and flood type. If populated by user, the script will check to ensure that only valid DDFs are used.
ContDmgPct	Float	0 – 100	Building Content Damage Percentage. Interpolated from the lookup tables, depending on flood depth. Value ranges between 0 and 100. For UDFs outside the flood zone, the value is set to 0.0.
ContentLossUSD	Long	≥ 0	Loss, in US dollars, to the Building Content. Formula: ContDmgPct × ContentCostUSD
InventoryCostUSD	Long	≥ 0	Hazus estimates are provided based on Occupancy Class and Area unless provided by the user. Must be greater than or equal to 0.
IDDF_ID	Text	3	Inventory Depth Damage Function ID. If not provided by the user, defaults will be assigned based on Hazus methodology by computing Specific Occupancy ID based on Occupancy Type, Foundation Type, num stories and flood type. If populated by user, the script will check to ensure that only valid DDFs are used.
InvDmgPct	Float	0 – 100	Building Inventory Damage Percentage. Interpolated from the lookup tables, depending on flood depth. Value ranges between 0 and 100. For UDFs outside the flood zone, the value is set to 0.0. Note that only certain types of OccupancyClass have a standard Inventory Loss function defined.
InventoryLossUSD	Long	≥ 0	Loss, in US dollars, to the Inventory Content. If user supplied an inventory cost attribute, the value is InvDmgPct × InventoryCostUSD. (Note the significant discrepancy between the computed values and Hazus 4.0 loss estimates. Hazus 4.0 does not correctly implement the Inventory Loss calculation at the UDF level.)
Debris_Tot	Long	≥ 0	Total debris, in tons. Combines Finish, Structure, and Foundation debris estimates. Based on Occupancy Class, Square Footage, Foundation Type, and Depth-in-Structure.
Restor_Days_Min	Short	≥ 0	Restoration time, in days — Minimum bound. Note there is no direct Hazus equivalent. The name is identical to what is in the Hazus lookup table. Note that the

Output Attribute	Data Type	Range or Length	Notes
			restoration times assume, like the debris, that a 'substantially damaged' structure (one which experiences > 50% loss) is torn down and replaced.
Restor_Days_Max	Short	≥ 0	Restoration time, in days — Maximum bound. Note there is no direct Hazus equivalent. The name is identical to what is in the Hazus lookup table. Note that the restoration times assume, like the debris, that a 'substantially damaged' structure (one which experiences > 50% loss) is torn down and replaced.
GridName	Text	50	Name of flood depth grid. This may seem redundant, given the output file naming convention, but

Appendix B: Glossary

Refer to the **Glossary** for the WV Flood Tool and Flood Risk Assessments. Also refer to FEMA glossary and definition web pages.

- WV Flood Tool and Flood Risk Assessment Glossary

- FEMA Definitions Site
- FEMA Glossary Site
- FEMA Definitions of FEMA Flood Zone Designations (PDF)
- What Is A Flood Zone?

1% Annual Chance Flood: A one percent annual chance flood event (a.k.a. 100-year flood) has a one percent (1 in 100) chance of being equaled or exceeded during any given year. The one percent annual chance flood was selected in the early 1970s when the National Flood Insurance Program was tasked with mapping all floodplains in the U.S. It was considered a reasonable balance of protection and cost between the 0.5% (1 in 200) to 0.2% (1 in 500) variable reference used at the time by the U.S. Army Corps of Engineers for floodwater control structure design. The term 100 year (or 5 year or 500 year) refers to the expected frequency of return of a given flood event. The area of inundation associated with a given flood event is called the **floodplain** (e.g. 1% floodplain, etc.).

Source: The 100 Year Flood Myth*, Federal Emergency Management Agency, Region 10, handout.*

CAMA/IAS: Computer Assisted Mass Appraisal (CAMA) is the process of using a computer to assist in property tax appraisal and equity evaluation. Administered by the Tax Commissioner, the CAMA system for West Virginia is a centralized Oracle database also known as the Integrated Assessment System (IAS). A number of years ago the State Tax Department purchased real estate mass appraisal software called IAS. This software is installed on the network server in Charleston and is accessed through computers in each County Assessor's Office.