Recommended Edits to the 4-1-15 Draft Vulnerability Flood Standards
Flood Standards Development Committee Meeting
June 4, 2015

VF-2, Derivation of Contents and Time Element Flood Vulnerability Functions

<mark>Standard</mark>

Professional Team: **Technical/Editorial**

Explanation: Moved contents from VF-2 to VF-1 as in the NFIP and the residential flood world, where it is common to lump structure and contents together and to treat time element losses separately.

Amendatory/Suggested Language:

VF-2 Derivation of ~~Contents and~~ Time Element Flood Vulnerability Functions

A. Development of the ~~contents and~~ time element flood vulnerability functions shall be based on ~~at least one~~some combination of the following: (1) ~~historical data~~post-flood investigations, (2) ~~tests~~technical literature, (3) ~~rational structural analysis~~expert opinion, ~~and~~ (4) ~~site inspections~~laboratory or field testing, and (5) insurance claims data. ~~Any development of the contents and t~~Time element vulnerability functions ~~based on rational structural analysis, site inspections, and tests~~ shall be supported by historical data.

B. ~~The relationship between the modeled residential structure and contents flood vulnerability functions and historical residential structure and contents losses shall be reasonable.~~ (moved to VF-1.F)

~~C.~~B. The derivation of time element flood vulnerability functions ~~derivations~~ and their associated uncertainties shall consider the extent of residential structure damage and the estimated time required to repair or replace the ~~property~~structure.

~~D.~~C. ~~The relationship between the modeled residential structure and t~~Time element flood vulnerability functions ~~and historical residential structure and time element losses shall be reasonable~~shall be derived separately for personal residential building structures, mobile homes, and appurtenant structures.

D. Time element flood vulnerability functions used by the flood model shall include time element coverage claims associated with damage to the infrastructure caused by a flood.

~~D.~~E. The relationship between the modeled time element flood vulnerability functions and historical time element losses shall be justified.

AIR: **Technical**

Problem Statement: Same as Standard VF-1.A. The last sentence currently mandates the development of the content and time element vulnerability functions to be supported by the historical data, which is hard to accomplished because there can be POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: This is a general edit. We suggest updating the standard to require modelers to utilize publically available information to develop vulnerability functions.

Amendatory Language:

A. Development of the contents and time element flood vulnerability functions shall be based on at least one of the following: (1) historical data, (2) tests, (3) rational structural analysis, and (4) site inspections. Historical data, as applicable, shall be considered for development of the residential structure flood vulnerability functions~~Any development of the contents and time element vulnerability functions based on rational structural analysis, site inspections, and tests shall be supported by historical data~~.

AIR: **Technical**

Problem Statement: Standard B and D are problematic due to the scarcity of insurance claims data for flood. The Commission should also be aware that the NFIP policies do not cover time element losses.

Explanation: The suggested change is general in nature. We suggest adding the phrase, "where applicable," that allows modelers to use alternative methodologies in development of content and time element vulnerability functions when historical data is not available.

Amendatory Language:

B. The relationship between the modeled residential structure and contents flood vulnerability functions and historical residential structure and contents losses, where available, shall be reasonable.

D. The relationship between the modeled residential structure and time element flood vulnerability functions and historical residential structure and time element losses, where available, shall be reasonable.

Purpose:

Professional Team: **Technical**

This standard requires the development of personal residential time element flood vulnerability functions to be supported by historical data.

The development of personal residential time element flood vulnerability functions is to be documented with respect to the methods and sources, including any use of insurance claims data, post-flood site investigations, expert opinion, technical literature, and testing data.

This standard allows insurance company data used in personal residential time element flood vulnerability function development to include appropriate insurer or modeling organization adjustments that do not diminish the usefulness of the data.

A reasonable representation of ~~contents and~~ time element flood losses is necessary in order to address policies that cover ~~contents and~~ time element losses.

Policies can provide varying types of time element coverage and insurance policies may pay for time element claims irrespective of flood damage to the insured property.

Relevant Forms: GF-4, Vulnerability Flood Standards Structural/~~Wind~~ Hydraulic/Coastal Engineer Expert Certification

Professional Team: **Technical**

1. Provide a flow chart documenting the process by which the ~~contents~~ time element flood vulnerability functions are derived and implemented.

2. Describe the data and methods used to develop time element flood vulnerability functions ~~for contents coverage~~ associated with personal residential structures.

3. Describe the number of ~~contents~~ time element flood vulnerability functions and whether different ~~contents~~ time element flood vulnerability relationships are used for personal residential structures, mobile home, condo unit owners, and apartment renter unit location.

4. ~~Provide a flow chart documenting the process by which the time element flood vulnerability functions are derived and implemented.~~

5. ~~Describe the data and methods used to develop flood vulnerability functions for time element coverage associated with personal residential structures. State whether the flood model considers both direct and indirect loss to the insured property and explain how each is derived.~~

6. ~~Describe the relationship between residential structure and contents flood vulnerability functions.~~ (moved to VF-1, Disclosure 4)

~~7.~~4. Describe ~~the~~ any relationships between personal residential structure characteristics and time element flood vulnerability functions.

5. State the minimum threshold, if any, at which time element flood loss is calculated (e.g., loss is estimated for residential structure damage greater than 20%). Provide documentation of assumptions and available validation ~~results~~ data to verify the approach used.

6. Indicate whether different personal residential time element flood vulnerability functions are developed for coastal and inland flooding, and if so, describe the differences.

7. Describe whether and how the personal residential time element flood vulnerability functions incorporate depth of flooding (above ground and above lowest floor), duration of flooding, flood

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velocity, wave action (in coastal areas), undermining by erosion or scour, and likelihood of mold following flooding.

8. Describe how modeled time element flood loss costs take into consideration the damage to local and regional infrastructure due to flood events.

9. Describe the assumptions, data, methods, and processes used to develop ~~contents and~~ time element flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.

10. As applicable, describe the nature and extent of actual insurance claims data used to develop the flood model's personal residential time element flood vulnerability functions. Describe in detail what is included, such as, number of policies, number of insurers, date of loss, and number of units of dollar exposure, separated into personal residential and mobile home.

~~10.~~11. Describe any assumptions, data, methods, and processes used to develop and validate ~~contents and~~ time element flood vulnerability functions concerning insurance company claims.

~~11.~~12. Demonstrate that ~~contents and~~ time element flood vulnerability function relationships are consistent with available insurance claims data.

AIR: **Technical**

Problem Statement: Disclosure 6 (5 above) currently asks for documentation of validation results which is problematic because historical data is scarcely available.

Explanation: This suggested change is general. We suggest modifying the requirement to allow disclosure of assumptions and require validation with historical data when it is available.

Amendatory Language:

6. State the minimum threshold at which time element flood loss is calculated (e.g., loss is estimated for residential structure damage greater than 20%). Provide documentation of ~~validation results~~assumptions and validation data as applicable to verify the approach used.

AIR: **Technical**

Problem Statement: Disclosures 11 and 12 ask for insurance company claims, which is problematic due to POTENTIALLY NO DETAILED FLOOD CLAIMS DATA.

Explanation: The suggested edit is general. We recommend adding the phrase, "as applicable", to disclosure 11 and 12 to allow modelers to use alternative resource and research when insurance claims data is not available.

Amendatory Language:

11. As applicable, dDescribe any assumptions, data, methods, and processes used to develop and validate contents and time element flood vulnerability functions concerning insurance company claims.

12. As applicable, dDemonstrate that contents and time element flood vulnerability function relationships are consistent with insurance claims data.

Professional Team: **Technical**

1. The contents and time element flood vulnerability component in the flood model will be reviewed in detail.

2. To the extent that historical data are used to develop mathematical depictions of contents time element flood vulnerability functions, demonstrate the goodness-of-fit of the data to fitted models will be reviewed.

3. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the contents flood vulnerability functions are based;
   b. Assumptions regarding the variability of contents flood losses by size of property;
   c. Regional and statewide application of contents flood coverage assumptions;
   d. Assumptions regarding contents flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;

4. To the extent that historical data are used to develop mathematical depictions of time element flood vulnerability functions, demonstrate the goodness-of-fit of the data to fitted flood models.

5. 3. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the time element flood vulnerability functions are based;
   b. Assumptions regarding the variability of time element flood losses by size of propertypersonal residential structure characteristics;
   c. Assumptions regarding the variability of time element flood losses by flood characteristics;
   cd. Regional and statewide, and coastal and inland, application of time element flood coverage assumptions;
   de. Assumptions regarding time element flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;
   ef. The methods used to incorporate the estimated the time, including uncertainty, required to repair or replace the property due to flooding;
   fg. The methodology and available validation for determining the extent of infrastructure flood damage and its effect on time element costs.;
   h. The assumptions and methods by which available insurance claims data are used to derive time element flood vulnerability functions.

AIR: **Technical**

Problem Statement: Audit 3.b and 5.b ask for assumptions regarding the variability in property size, which is one of many building characteristics considered in contents flood vulnerability functions. We suggest making the language general to accommodate other relevant building characteristics.

Explanation: The first suggested edit is general. We recommend combining b, c and d. Also, modifying the language to be less prescriptive.

Amendatory Language:

3. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the contents flood vulnerability functions are based;
   b. Assumptions regarding the variability of contents flood losses by ~~~relevant building characteristics~~ ~~size of property~~;
   c. Regional and statewide application of contents flood coverage assumptions;
   d. Assumptions regarding contents flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure.

5. Documentation and justification of the following will be reviewed:
   a. The method of derivation and data on which the time element flood vulnerability functions are based;
   b. Assumptions regarding the variability of time element flood losses by relevant building characteristics ~~size of property~~;
   c. Regional and statewide application of time element flood coverage assumptions;
   d. Assumptions regarding time element flood coverage for various occupancies including mobile homes, tenants, and condo unit owners exposure;
   e. The methods used to incorporate the estimated time required to repair or replace the property due to flooding;
   f. The methodology and available validation for determining the extent of infrastructure flood damage and its effect on time element costs.

VF-3, Flood Mitigation Measures

Professional Team: **Technical**

VF-3 Flood Mitigation and Flood Control Measures

A. Modeling of flood mitigation and flood control measures to improve flood resistance of one or more a residential structures, structure's flood resistance and the corresponding effects on flood vulnerability, shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures ordesign, construction techniques and operational considerations that enhance the flood resistance or flood protectionperformance of the residential structures. and its contents and shall consider:The modeling organization shall justify all flood mitigation and flood control measures considered by the model.
    - Wall-to-floor-to-foundation strength and anchorage
    - Opening protection and seepage control
    - On-site flood mitigation measures associated with either the structure or the property (e.g., seawalls, floodwalls, retention ponds, water barriers, etc.)
    - Elevation from ground surface of first level of living area
    - Electrical outlets and mechanical equipment above regulatory flood levels or appropriately flood proofed
    - Restrict use of construction materials that deteriorate when wetted (moistened) as a result of flooding
    - Design of exterior walls and siding to withstand water pressure, flood water and debris impact, and wave loading
    - Use of ceramic tiles, concrete versus carpet and wood for floor covering
    - Lack of basements.

    Flood mitigation measures shall be understood to be those measures undertaken at an individual building level, usually within the building footprint, and may include, but not be limited to such things as:
    - Lowest elevation of habitable space
    - Absence of basement
    - Building resistance to flotation
    - Lateral movement and collapse during design flood
    - Ability of foundation to resist flood conditions and flood loads
    - Wet or dry flood-proofing
    - Use of flood damage resistant materials
    - Permanent elevation or protection of equipment and utilities
    - Temporary elevation or relocation of building contents.

    Flood control measures shall be understood to be those measures undertaken outside the building footprint and on a larger scale, to reduce the presence, depth or energy of flow or waves that affect one or more residential structures. Flood control measures may include, but not be limited to such things as:
    - Location, dimensions, and strength of flood barriers (e.g., dams, levees, floodwalls, seawalls, etc.)
    - Flow diversions, retention ponds and water storage areas, including associated catch basins, channels, culverts, gates, pumps, etc.

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- Intentional or accidental release of water from behind flood barriers or form water storage areas.

B. Application of flood mitigation and flood control measures that enhance the performance of ~~the~~ personal residential structures ~~and its contents~~ shall be justified as to the impact on reducing flood damage whether done individually or in combination.

C. Application of flood mitigation and flood control measures shall consider whether those measures are permanently installed and require no human intervention to activate/implement, or require human intervention.

AIR: **Technical**

Problem Statement: The current list of mitigation measures is prescriptive in requiring all of the measures to be considered in the model.

Explanation: The suggested change is general in nature. We recommend replacing Standard A with simpler language. The modelers will use their own scientific judgment in selecting the appropriate mitigations measures, and the Commission's vulnerability experts will evaluate their appropriateness. The simpler language of the suggested edit will allow the Commission to do this.

Amendatory Language:

A. Modeling of flood mitigation measures to improve a residential structure's flood resistance and the corresponding effects on vulnerability shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include fixtures or construction techniques that enhance the performance of the residential structure and its contents. The modeling organization shall justify all flood mitigation measures considered in the model. ~~and shall consider:~~
    - ~~Wall-to-floor-to-foundation strength and anchorage~~
    - ~~Opening protection and seepage control~~
    - ~~On-site flood mitigation measures associated with either the structure or the property (e.g., seawalls, floodwalls, retention ponds, water barriers, etc.)~~
    - ~~Elevation from ground surface of first level of living area~~
    - ~~Electrical outlets and mechanical equipment above regulatory flood levels or appropriately flood proofed~~
    - ~~Restrict use of construction materials that deteriorate when wetted (moistened) as a result of flooding~~
    - ~~Design of exterior walls and siding to withstand water pressure, flood water and debris impact, and wave loading~~
    - ~~Use of ceramic tiles, concrete versus carpet and wood for floor covering~~
    - ~~Lack of basements.~~

Professional Team: **Editorial**

This standard requires~~Mitigation techniques and approaches~~ that flood mitigation and flood control measures intended to eliminate or reduce flood losses ~~must be~~are accounted for in the flood model as they impact the personal residential exposures in the state of Florida.

It is necessary to account for the total impact that the use of multiple flood mitigation and protection measures will have on flood damage. When multiple ~~flood mitigation~~ measures are used, the combined effect on flood damage must be estimated, and this may not be the sum of the effects of the individual measures.

This standard requires sensitivity of flood losses to effectiveness of building mitigation measures to be considered and flood loss uncertainties to be estimated.

This standard requires failure of flood control measures to be considered, and with (intact flood control) and without (failed flood control) flood loss estimates to be calculated.

Relevant Forms: GF-4, Vulnerability Flood Standards Structural/~~Wind~~ Hydraulic/Coastal Engineer Expert Certification

VF-2, Flood Mitigation and Flood Control Measures – Range of Changes in Flood Damage

VF-3, Flood Mitigation and Flood Control Measures – Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret item)

AF-6, Logical Relationship to Flood Risk (Trade Secret item)

Professional Team: **Editorial**

1. Provide a completed Form VF-2, Flood Mitigation and Flood Control Measures – Range of Changes in Flood Damage. Provide a link to the location of the form [insert hyperlink here]. [form to be developed]

2. A completed Form VF-3, Flood Mitigation and Flood Control Measures – Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret item) [form to be developed] shall be provided during the closed meeting portion of the Commission meeting to review the model for acceptability.

3. Provide a description of all~~the~~ flood mitigation and flood control measures used by the flood model, whether or not they ~~that~~ are ~~not~~ listed in Form VF-2, Flood Mitigation and Flood Control Measures – Range of Changes in Flood Damage.

4. Describe how each flood mitigation measure and each flood control measure is implemented in the flood model. Identify any assumptions, and cite any historical data, technical literature or expert opinion used to support the assumptions and implementation.

5. Describe how personal residential structure and contents losses are affected by performance of flood mitigation and flood control measures. Identify any assumptions. ~~Describe the process used to ensure that multiple flood mitigation factors are correctly combined in the flood model.~~

6. Describe how ~~structural~~ uncertainties in performance of flood mitigation and flood control measures ~~factors~~ are accounted for in the flood model. Identify any assumptions.

7. Describe how the effects of multiple flood mitigation and flood control measures are combined in the flood model. ~~Describe how contents flood mitigation factors are accounted for in the flood model. Identify any assumptions.~~

8. Describe how flood mitigation and flood control measures impact time element losses.

AIR: **Editorial**

Problem Statement: Disclosures 6 and 7 contain terminology that is inconsistent with the rest of the standard. The term "flood mitigation factors" is used instead of the term "flood mitigation measures."

Explanation: This update is editorial. We suggest using consistent terminology for disclosures 6 and 7.

Amendatory Language:

6. Describe how structural flood mitigation ~~factors~~ measures are accounted for in the flood model. Identify any assumptions.

7. Describe how contents flood mitigation ~~factors~~measures are accounted for in the flood model. Identify any assumptions.

Audit

Professional Team: **Editorial**

1. Form VF-2 (Flood Mitigation and Flood Control Measures – Range of Changes in Flood Damage) and Form VF-3 (Flood Mitigation and Flood Control Measures – Mean Flood Damage Ratios and Flood Loss Costs, Trade Secret item) provide the information used in auditing this standard.

2. Implementation of each i~~I~~ndividual flood mitigation or flood control measure~~s~~ will be reviewed, as well as the~~ir~~ effect of each individual measure on flood damage. Uncertainties in performance of individual measures and resulting flood damage will be reviewed. ~~due to use of multiple flood mitigation measures will be reviewed. Any variation in the change over the range of flood footprints for individual and multiple flood mitigation measures will be reviewed.~~

3. Flood m~~M~~itigation and flood control measures used by the flood model that are not listed as required in this flood standard will be ~~disclosed~~ reviewed~~and shown to be theoretically sound and reasonable~~.

4. Implementation of multiple flood mitigation and flood control measures will be reviewed. The combined effects of these measures of flood losses will be reviewed.

~~4.~~5. Reduction or increase in structure, contents and time element losses will be reviewed in light of the ~~F~~flood mitigation and flood control measures used by the flood model ~~for structural, contents, and time element losses will be reviewed~~.

AIR: **Editorial**

Problem Statement: Audit Item 2 contains the term, "flood footprints". In the last Commission meeting on January 29th, it was suggested that "flood extent and depth" be used instead of "flood footprints".

Explanation: This change is editorial. We suggest updating the terminology to be consistent with the Met/Hydro Standards.

Amendatory Language:

1. Individual flood mitigation measures as well as their effect on flood damage due to use of multiple flood mitigation measures will be reviewed. Any variation in the change over the range of flood extent and depth ~~footprints~~ for individual and multiple flood mitigation measures will be reviewed.

Form VF-1: One Hypothetical Flood Event

Professional Team: **Technical**

Form VF-1: ~~One~~ XXX Hypothetical Flood Events

AIR: **Technical**

<div style="text-align:center;">

Form V-1: One Hypothetical Event

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A. Flood depths for 96 geocoded locations and sample personal residential exposure data are provided in the file named *"FormV1Input13.xlsx."* The flood represents a hypothetical flood event. Model the sample personal exposure data provided in the file against these flood depths at the specified locations and provide the damage ratios summarized by flood depths (ft) and construction type.

The sample personal residential exposure data provided consists of four structures (one of each construction type – wood frame, masonry, mobile home, and concrete) individually placed at the geocode latitude and longitude provided. Each location is subjected to a specific flood depth. For completing Part A, Estimated Damage for each individual flood depth range is the sum of ground up loss to all structures subjected to that individual flood depth, excluding demand surge. Subject Exposure is all exposures geocoded locations subjected to that individual flood depth. For completing Part B, Estimated Damage is the sum of the ground up loss to all structures of a specific type (wood frame, masonry, mobile home, or concrete) in all of the flood depths ranges, excluding demand surge. Subject Exposure is all exposures of that specific type in all geocoded locations.

One reference structure for each of the construction types shall be placed at the population centroid of the ZIP Codes. Do not include contents, appurtenant structures, or time element coverages.

Reference Frame Structure:	**Reference Masonry Structure:**
One story Crawlspace foundation Wood framed exterior walls Constructed in 1981	One story Slab foundation Masonry exterior walls No vertical wall reinforcing Constructed in 1981
Reference Mobile Home Structure: Tie downs Single unit Manufactured in 1980	

B. Confirm that the structures used in completing the form are identical to those in the above table for the reference structures. If additional assumptions are necessary to complete this form (for example, regarding structural characteristics, duration), provide the reasons why the assumptions were necessary as well as a detailed description of how they were included.

C. Provide a plot of the Form V-1 (One Hypothetical Event), Part A data.

Form V-1: One Hypothetical Event

Part A

Flood depth (ft)	Estimated Damage/ Subject Exposure
0 – 0.5	
0.6 – 1	
2 – 3	
3 – 4	
4 – 5	
5 – 6	
7 – 8	
9 – 10	

Part B

Construction Type	Estimated Damage/ Subject Exposure
Wood Frame	
Masonry	
Mobile Home	
Concrete	

Form VF-2: Flood Mitigation Measures – Range of Changes in Flood Damage

AIR: **Technical**

A. Provide the change in the zero deductible personal residential reference building damage rate (not loss cost) for each individual mitigation measure listed in Form V-2 (Mitigation Measures – Range of Changes in Damage) as well as for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

B. If additional assumptions are necessary to complete this form (for example, regarding duration), provide the rationale for the assumptions as well as a detailed description of how they are included.

C. Provide this form in Excel format without truncation. The file name shall include the abbreviated name of the modeling organization, the standards year, and the form name. Form V-2 (Mitigation Measures – Range of Changes in Damage) shall also be included in a submission appendix.

Reference Frame Building: One story Crawlspace foundation Wood framed exterior walls Constructed in 1981	**Reference Masonry Building:** One story Slab foundation Masonry exterior walls No vertical wall reinforcing Constructed in 1981
Mitigated Frame Building: First flood height 4ft Flood proofed utilities	**Mitigated Masonry Building:** First floor height 3ft Flood proofed utilities

Reference and mitigated buildings are fully insured building structures with a zero deductible building only policy.

Place the reference building at specified geocode location.

INDIVIDUAL MITIGATION MEASURES		**PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100**									
		FRAME BUILDING					**MASONRY BUILDING**				
		FLOOD DEPTH (FT)					**FLOOD DEPTH (FT)**				
		0.5	1	2	3	4	0.5	1	2	3	4
REFERENCE BUILDING		—	—	—	—	—	—	—	—	—	—
FIRST FLOOR HEIGHT	1 FT. ABOVE GROUND										
	2 FT. ABOVE GROUND										
	3 FT ABOVE GROUND										
FLOOD PROOFED UTILITIES	PROTECTED										
	UNPROTECTED										

MITIGATION MEASURES IN COMBINATION		**PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100**									
		FRAME BUILDING					**MASONRY BUILDING**				
		FLOOD DEPTH (FT)					**FLOOD DEPTH (FT)**				
		0.5	1	2	3	4	0.5	1	2	3	4
BUILDING	MITIGATED BUILDING										

Form VF-3: Flood Mitigation Measures – Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret Item)

AIR: **Technical**

A. Provide the mean damage ratio (prior to any insurance considerations) to the reference building for each individual mitigation measure listed in Form V-3 (Mitigation Measures – Mean Damage Ratios and Loss Costs, Trade Secret item) as well as the percent damage for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

B. Provide the loss cost rounded to three decimal places, for the reference building and for each individual mitigation measure listed in Form V-3 (Mitigation Measurers – Mean Damage Ratios and Loss Costs, Trade Secret item) as well as the loss cost for the combination of the four mitigation measures provided for the Mitigated Frame Building and the Mitigated Masonry Building below.

C. If additional assumptions are necessary to complete this form (for example, regarding duration or surface roughness), provide the rationale for the assumptions as well as a detailed description of how they are included.

D. Provide a graphical representation of the vulnerability curves for the reference and the fully mitigated building.

Reference Frame Building:	**Reference Masonry Building:**
One story	One story
Crawlspace foundation	Slab foundation
Wood framed exterior walls	Masonry exterior walls
Constructed in 1981	No vertical wall reinforcing
	Constructed in 1981
Mitigated Frame Building:	**Mitigated Masonry Building:**
First flood height 4ft	First floor height 3ft
Flood proofed utilities	Flood proofed utilities

Reference and mitigated buildings are fully insured building structures with a zero deductible building only policy.

Place the reference building at the specified geocode location.

Form V-3: Mitigation Measures – Mean Damage Ratios and Loss Costs (Trade Secret Item)

INDIVIDUAL MITIGATION MEASURES		MEAN DAMAGE RATIO										LOSS COSTS	
		FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)						
		0.5	1	2	3	4	0.5	1	2	3	4	ACROSS ALL DEPTHS	
	REFERENCE BUILDING												
FIRST FLOOR HEIGHT	1 FT. ABOVE GROUND												
	2 FT. ABOVE GROUND												
	3 FT. ABOVE GROUND												
FLOOD PROOFED UTILITIES	PROTECTED												
	UNPROTECTED												

MITIGATION MEASURES IN COMBINATION		MEAN DAMAGE RATIO										LOSS COSTS	
		FRAME BUILDING					MASONRY BUILDING					FRAME BUILDING	MASONRY BUILDING
		FLOOD DEPTH (FT)					FLOOD DEPTH (FT)					ACROSS ALL DEPTHS	
		0.5	1	2	3	4	0.5	1	2	3	4		
BUILDING													
	MITIGATED BUILDING												