

VULNERABILITY FLOOD STANDARDS

VF-1 Derivation of Personal Residential Structure Flood Vulnerability Functions

- A. Development of the personal residential structure flood vulnerability functions shall be based on some combination of the following: (1) rational structural analysis, (2) post-flood investigations, (3) technical literature, (4) expert opinion, (5) laboratory or field testing, and (6) insurance claims data. Personal residential structure flood vulnerability functions shall be supported by historical and other relevant data.***
- B. The derivation of personal residential structure flood vulnerability functions and their associated uncertainties shall be theoretically sound and consistent with fundamental engineering principles.***
- C. Residential building stock classification shall be representative of Florida construction for personal residential structures.***
- D. The following flood characteristics shall be used in the derivation of personal residential structure flood vulnerability functions: flood elevation and depth above ground, and wave action in coastal areas.***
- E. The following building characteristics shall be used or accounted for in the derivation of personal residential structure vulnerability functions: lowest floor elevation relative to ground, foundation type, primary construction materials, year of construction, and location (flood hazard zone).***
- F. Flood vulnerability functions shall be separately derived for personal residential building structures, manufactured housing, and appurtenant structures.***
- G. The relationship between the modeled personal residential structure flood vulnerability functions and historical personal residential structure losses shall be justified.***

Purpose: Personal residential structure flood vulnerability functions are to account for both flood and building characteristics. This standard requires the development of personal residential flood vulnerability functions to be supported by historical or other relevant data.

The development of personal residential flood vulnerability functions is to be documented with respect to the methods and sources, including any use of insurance claims data, structural analysis and calculations, post-flood

investigations, laboratory or field testing, expert opinion, and technical literature.

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

Relevant Forms: GF-4, Vulnerability Flood Standards Structural/Hydraulic/Coastal Engineer Expert Certification
VF-1, Hypothetical Coastal Flood Event with Damaging Waves
VF-2, Hypothetical Inland Flood Event
AF-6, Logical Relationship to Flood Risk (Trade Secret item)

Disclosures

1. Provide a flow chart documenting the process by which the personal residential structure flood vulnerability functions are derived and implemented.
2. Describe any assumptions, data, methods, and processes used for the development of the personal residential structure flood vulnerability functions.
3. As applicable, describe the nature and extent of actual insurance claims data used to develop the personal residential structure 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 manufactured housing. Summarize site inspections, including the source, and provide a brief description of the resulting use of these data in development, validation, or verification of personal residential structure flood vulnerability functions.
4. Summarize post-flood investigations including the source, and provide a brief description of the resulting use of these data in development, validation, or verification of personal residential structure flood vulnerability functions.
5. State if the following flood characteristics are considered in the development of the personal residential structure vulnerability functions, and if so, how; if not, explain why: flood velocity, flood-induced erosion, flood-borne debris, salinity (saltwater versus freshwater flooding), flood duration, and likelihood of mold following flooding.
6. State if the following building characteristics are considered in the development of the personal residential structure vulnerability functions, and if so, how; if not, explain why: number of stories, use of each story (e.g., habitable space, parking, storage, other), presence of basement, replacement value of building, structure value by story, square footage of living area, and other construction characteristics, as applicable.

7. Describe the process by which local construction practices, building code, and floodplain management regulation adoption and enforcement are considered in the development of personal residential structure flood vulnerability functions.
8. Describe the development of the flood vulnerability functions for appurtenant structures.
9. Describe the relationship between personal residential structure and appurtenant structure flood vulnerability functions and their consistency with insurance claims data as applicable.
10. Describe the assumptions, data, methods, and processes used to develop personal residential structure flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.
11. Describe the assumptions, data, methods, and processes used to develop personal residential structure flood vulnerability functions for various construction types for renters and condo-unit owners.
12. As applicable, describe any assumptions, data, methods, and processes used to develop and validate personal residential structure flood vulnerability functions concerning insurance company claims.
13. Describe how the duration of a flood is considered. Include consideration of time after flooding before building access and cleanup can begin, and the likelihood of mold after flooding.
14. Describe how the personal residential structure flood vulnerability functions incorporate depth of flooding (above ground and above lowest floor), flood velocity, wave action (in coastal areas), undermining by erosion or scour, flood-borne debris, and salinity of floodwater.
15. Describe how the personal residential structure vulnerability functions are developed for coastal and inland flooding.
16. Provide a completed Form VF-1, Hypothetical Coastal Flood Event with Damaging Waves. Provide a link to the location of the form [insert hyperlink here].
17. Provide a completed Form VF-2, Hypothetical Inland Flood Event. Provide a link to the location of the form [insert hyperlink here].

Audit

1. All personal residential structure flood vulnerability functions will be reviewed.
2. Validation of the personal residential structure flood vulnerability functions and associated uncertainties will be reviewed.

3. Historical data in the original form will be reviewed with explanations for any changes made and descriptions of how missing or incorrect data were handled. For historical data used to develop personal residential structure flood vulnerability functions, the goodness-of-fit of the data will be reviewed. Complete reports detailing flooding conditions and damage suffered for any test data used will be reviewed. A variety of different structure classes will be selected from the complete rational structural analyses and calculations to be reviewed. Original post-flood investigation reports will be reviewed. Other technical literature and expert opinion summaries will be reviewed.
4. Copies of any papers, reports, and studies used in the development of the personal residential structure flood vulnerability functions shall be available for review.
5. Multiple samples of personal residential structure flood vulnerability functions for personal residential structures, manufactured housing, and appurtenant structures will be reviewed. The magnitude of logical changes among these items for given flood events and validation materials will be reviewed.
6. Justification of the personal residential structures construction classes and characteristics used will be reviewed.
7. Documentation and justification for all modifications to the personal residential structure flood vulnerability functions due to building codes and their enforcement will be reviewed. If age of personal residential structure is used as a surrogate for building code or floodplain management regulation, complete supporting information for the number of age groups used as well as the year(s) of construction that separates particular group(s) will be reviewed.
8. The effects on personal residential structure flood vulnerability from local and regional construction characteristics and building codes will be reviewed.
9. How the claim practices of insurance companies are accounted for when claims data for those insurance companies are used to develop or to verify personal residential structure flood vulnerability functions will be reviewed. Examples include the level of damage the insurer considers a loss to be a total loss, claim practices of insurers with respect to concurrent causation, or the impact of public adjusting.
10. The percentage of damage at or above which the flood model assumes a total structure loss will be reviewed.
11. Documentation and justification for the method of derivation and data on which the personal residential structure flood vulnerability functions are based will be reviewed.
12. Form VF-1, Hypothetical Coastal Flood Event with Damaging Waves, will be reviewed.
13. Form VF-2, Hypothetical Inland Flood Event, will be reviewed.

VF-2 Derivation of Personal Residential Contents Flood Vulnerability Functions

- A. Development of the personal residential contents flood vulnerability functions shall be based on some combination of the following: (1) post-flood investigations, (2) technical literature, (3) expert opinion, (4) laboratory or field testing, and (5) insurance claims data. Contents flood vulnerability functions shall be supported by historical and other relevant data.***
- B. The derivation of personal residential contents vulnerability functions and their associated uncertainties shall consider the extent of personal residential structure damage.***
- C. Contents flood vulnerability functions shall be derived separately for personal residential building structures, manufactured housing, and appurtenant structures.***

Purpose: Personal residential contents flood vulnerability functions are to account for flood, contents and building characteristics. This standard requires the development of personal residential flood vulnerability functions to be supported by historical or other relevant data.

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

This standard allows insurance company data used in contents 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 flood losses is necessary in order to address policies that cover contents losses.

Relevant Forms: GF-4, Vulnerability Flood Standards Structural/Hydraulic/Coastal
Engineer Expert Certification
AF-6, Logical Relationship to Flood Risk (Trade Secret item)

Disclosures

1. Provide a flow chart documenting the process by which the personal residential contents flood vulnerability functions are derived and implemented.
2. Describe any relationships between personal residential contents flood vulnerability functions and personal residential structure flood vulnerability functions.

3. As applicable, describe the nature and extent of actual insurance claims data used to develop the personal residential contents 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 manufactured housing.
4. Describe any assumptions, data, methods, and processes used to develop and validate the personal residential contents flood vulnerability functions.
5. Describe the number of contents flood vulnerability functions and whether different personal residential contents flood vulnerability functions are used for personal residential structures, manufactured housing, and condo unit owners and apartment renter unit location.
6. Describe any relationships between personal residential structure classification and characteristics, and contents flood vulnerability functions.
7. Describe any relationships between flood characteristics and personal residential contents flood vulnerability functions.
8. State the minimum threshold, if any, at which contents flood loss is calculated (e.g., contents loss is estimated for residential structure damage greater than 20%). Provide documentation of assumptions and available validation data to verify the approach used.
9. Indicate whether different contents flood vulnerability functions are developed for coastal and inland flooding, and if so, describe the differences.
10. Describe the assumptions, data, methods, and processes used to develop contents flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.

Audit

1. All personal residential contents flood vulnerability functions will be reviewed.
2. Validation of the personal residential contents flood vulnerability functions and associated uncertainties will be reviewed.
3. Documentation and justification of the following aspects or assumptions related to personal residential contents flood vulnerability functions will be reviewed:
 - a. The method of derivation and data;
 - b. Variability of contents flood losses by personal residential structure classification and characteristics;
 - c. Variability of contents flood losses by flood characteristics;
 - d. Regional and statewide, and coastal and inland, application of contents flood coverage;

- e. Contents flood coverage for various occupancies for personal residential structures.
4. Historical data in the original form will be reviewed with explanations for any changes made and descriptions of how missing or incorrect data were handled. For historical data used to develop personal residential contents flood vulnerability functions, the goodness-of-fit of the data will be reviewed. Complete reports detailing flood conditions and damage suffered for any test data used will be reviewed. Original post-flood investigation reports will be reviewed. Other technical literature and expert opinion summaries will be reviewed.
 5. Copies of any papers, reports, and studies used in the development of the personal residential contents flood vulnerability functions shall be available for review.

VF-3 Derivation of Personal Residential Time Element Flood Vulnerability Functions

- A. Development of the personal residential time element flood vulnerability functions shall be based on some combination of the following: (1) post-flood investigations, (2) technical literature, (3) expert opinion, (4) laboratory or field testing, and (5) insurance claims data. Time element vulnerability functions shall be supported by historical and other relevant data.***
- B. The derivation of personal residential time element flood vulnerability functions and their associated uncertainties shall consider the extent of personal residential structure and/or contents damage and the estimated time required to repair or replace the structure.***
- C. Personal residential time element flood vulnerability functions shall be derived separately for personal residential building structures, manufactured housing, and appurtenant structures.***

Purpose: This standard requires the development of personal residential time element flood vulnerability functions to be supported by historical or other relevant 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 investigations, expert opinion, technical literature, testing data, and other relevant 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 personal residential time element flood losses is necessary in order to address policies that cover 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 Form: GF-4, Vulnerability Flood Standards Structural/Hydraulic/Coastal Engineer Expert Certification

Disclosures

1. Provide a flow chart documenting the process by which the personal residential time element flood vulnerability functions are derived and implemented.
2. Describe any assumptions, data, methods, and processes used to develop and validate personal residential time element flood vulnerability functions.
3. As applicable, describe the nature and extent of actual insurance claims data used to develop the 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 manufactured housing.
4. Describe the number of personal residential time element flood vulnerability functions and whether different time element flood vulnerability relationships are used for personal residential structures, manufactured housing, and condo unit owners and apartment renter unit location.
5. Describe any relationships between personal residential structure classification and characteristics and personal residential time element flood vulnerability functions.
6. State the minimum threshold, if any, at which personal residential 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 data to verify the approach used.
7. Indicate whether different personal residential time element flood vulnerability functions are developed for coastal and inland flooding, and if so, describe the differences.
8. Describe whether and how building characteristics and flood characteristics are incorporated into the personal residential time element flood vulnerability functions.
9. Describe whether and how personal residential time element flood vulnerability functions take into consideration the damage to local and regional infrastructure, or personal residential time element losses resulting from a governmental mandate associated with flood events.
10. Describe the assumptions, data, methods, and processes used to develop time element flood vulnerability functions for unknown personal residential construction types and for when some primary characteristics are unknown.

Audit

1. All personal residential time element flood vulnerability functions will be reviewed.

2. Validation of the personal residential time element flood vulnerability functions and associated uncertainties will be reviewed.
3. Documentation and justification of the following aspects or assumptions related to personal residential time element flood vulnerability functions will be reviewed:
 - a. The method of derivation and data;
 - b. Variability of time element flood losses by personal residential structure classification and characteristics;
 - c. Variability of time element flood losses by flood characteristics;
 - d. Regional and statewide, and coastal and inland, application of time element flood coverage;
 - e. Time element flood coverage for various occupancies for personal residential structures;
 - f. The methods used to estimate the time, including uncertainty, required to repair or replace the property due to flooding.
4. Historical data in the original form will be reviewed with explanations for any changes made and descriptions of how missing or incorrect data were handled. For historical data used to develop personal residential time element flood vulnerability functions, the goodness-of-fit of the data will be reviewed. Complete reports detailing flooding conditions and damage suffered for any test data used will be reviewed. Original post-flood investigation reports will be reviewed. Other technical literature and expert opinion summaries will be reviewed.
5. The methodology and available validation for determining the extent of infrastructure flood damage and governmental mandate and their effect on personal residential time element costs will be reviewed.

VF-4 Flood Mitigation Measures

- A. Modeling of flood mitigation measures to improve flood resistance of personal residential structures, the corresponding effects on flood vulnerability, and their associated uncertainties shall be theoretically sound and consistent with fundamental engineering principles. These measures shall include design, construction, and retrofit techniques that enhance the flood resistance or flood protection of personal residential structures. The modeling organization shall justify all flood mitigation measures considered by the model.**
- B. Application of flood mitigation measures that enhance the performance of personal residential structures shall be justified as to the impact on reducing flood damage whether done individually or in combination.**
- C. Application of flood mitigation measures shall consider whether those measures are permanently installed and require no human intervention to activate/implement, or require no human intervention.**

Purpose: This standard requires that flood mitigation measures intended to eliminate or reduce flood losses are accounted for in the flood model as they impact personal residential exposures.

Flood mitigation measures are those measures undertaken at an individual building level, usually within the building footprint, and may include, but not be limited to such things as:

- Strengthening foundation
- Strengthening foundation to building connection
- Wet and/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
- Temporary flood protection measures.

It is necessary to account for the total impact that the use of multiple flood mitigation measures will have on flood damage. When multiple 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.

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

- VF-3, Flood Mitigation Measures, Range of Changes in Flood Damage
- VF-4, Flood Mitigation Measures, Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret item)
- AF-6, Logical Relationship to Flood Risk (Trade Secret item)

Disclosures

1. Provide a completed Form VF-3, Flood Mitigation Measures, Range of Changes in Flood Damage. Provide a link to the location of the form [insert hyperlink here].
2. A completed Form VF-4, Flood Mitigation Measures, Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret item) shall be provided during the closed meeting portion of the Commission meeting to review the model for acceptability.
3. Provide a description of all flood mitigation measures used by the flood model, whether or not they are listed in Form VF-3, Flood Mitigation Measures, Range of Changes in Flood Damage.
4. Describe how each flood mitigation 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 measures. Identify any assumptions.
6. Describe how uncertainties in performance of flood mitigation measures are accounted for in the flood model. Identify any assumptions.
7. Describe how the effects of multiple flood mitigation measures are combined in the flood model.
8. Describe how flood mitigation measures impact time element losses.

Audit

1. Form VF-3, Flood Mitigation Measures, Range of Changes in Flood Damage and Form VF-4, Flood Mitigation Measures, Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret item) will be reviewed.
2. Implementation of each individual flood mitigation measure will be reviewed as well as the effect of each individual measure on flood damage. Uncertainties in performance of individual measures and resulting flood damage will be reviewed.
3. Implementation of multiple flood mitigation measures will be reviewed. The combined effects of these measures on flood losses will be reviewed.

Form VF-1: Hypothetical Coastal Flood Event with Damaging Waves

- A. Sample personal residential exposure data for 7 reference structures as defined below and 51 flood depths (0-25 feet at half foot increments) are provided in the file named “*VFEventFormsInput15.xlsx*.”

Model the sample personal residential exposure data provided in the file versus the flood depths and provide the damage ratios summarized by flood depth and construction type.

For completing Part A, Estimated Damage for each individual flood depth is the sum of ground up loss to all structures in the flood depth range, excluding demand surge. For completing Part B, Estimated Damage is the sum of the ground up loss to all structures of a specific type (wood frame, masonry, or manufactured housing) in all of the flood depth ranges, excluding demand surge.

Contents, appurtenant structures, or time element coverages are not included. All utility equipment is assumed to be at the lowest floor level.

Reference Structures

Wood Frame	Masonry	Manufactured Housing
#1 One story Crawlspace foundation Top of foundation wall 3 feet above grade	#4 One story Slab foundation Top of slab 1 foot above grade Unreinforced masonry exterior walls	#6 Manufactured post 1994 Dry stack concrete foundation Pier height 3 feet above grade Tie downs Single unit
#2 Two story Slab foundation Top of slab 1 foot above grade 5/8” diameter anchors at 48” centers for wall/slab connections	#5 Two story Concrete pile foundation Concrete slab Top of pile 8 feet above grade Reinforced masonry exterior walls	#7 Manufactured post 1994 Reinforced masonry pier foundation Pier height 6 feet above grade Tie downs Single unit
#3 Two story Unbraced timber pile foundation Top of pile 8 feet above grade Wood floor system bolted to piles		

- B. Confirm that the structures used in completing the form are identical to those in the above table for the reference structures.
- C. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a description of how they are included.
- D. Provide a plot of the Form VF-1, Part A data.

Form VF-1: Hypothetical Coastal Flood Event with Damaging Waves

Part A

Flood depth (feet) above ground level	Estimated Damage/ Subject Exposure	Flood depth (feet) above ground level	Estimated Damage/ Subject Exposure
0			
1.5		13	
1		13.5	
1.5		14	
2		14.5	
2.5		15	
3		15.5	
3.5		16	
4		16.5	
4.5		17	
5		17.5	
5.5		18	
6		18.5	
6.5		19	
7		19.5	
7.5		20	
8		20.5	
8.5		21	
9		21.5	
9.5		22	
10		22.5	
10.5		23	
11		23.5	
11.5		24	
12		24.5	
12.5		25	

Part B

<u>Construction Type</u>	<u>Estimated Damage/ Subject Exposure</u>
Wood Frame	
Masonry	
Manufactured Housing	

Form VF-2: Hypothetical Inland Flood Event

A. Sample personal residential exposure data for 7 reference structures as defined below and 51 flood depths (0-25 feet at half foot increments) are provided in the file named “VFEventFormsInput15.xlsx.”

Model the sample personal residential exposure data provided in the file versus the flood depths and provide the damage ratios summarized by flood depth and construction type.

For completing Part A, Estimated Damage for each individual flood depth is the sum of ground up loss to all structures in the flood depth range, excluding demand surge. For completing Part B, Estimated Damage is the sum of the ground up loss to all structures of a specific type (wood frame, masonry, or manufactured housing) in all of the flood depth ranges, excluding demand surge.

Contents, appurtenant structures, or time element coverages are not included. All utility equipment is assumed to be at the lowest floor level.

Reference Structures		
Wood Frame	Masonry	Manufactured Housing
#1 One story Crawlspace foundation Top of foundation wall 3 feet above grade	#4 One story Slab foundation Top of slab 1 foot above grade	#6 Manufactured post 1994 Dry stack concrete foundation Pier height 3 feet above grade Tie downs Single unit
#2 Two story Slab foundation Top of slab 1 foot above grade 5/8” diameter anchors at 48” centers for wall/slab connections	#5 Two story Slab foundation Top of slab 1 foot above grade	#7 Manufactured post 1994 Reinforced masonry pier foundation Pier height 6 feet above grade Tie downs Single unit
#3 Two story Unbraced timber pile foundation Top of pile 8 feet above grade Wood floor system bolted to piles		

B. Confirm that the structures used in completing the form are identical to those in the above table for the reference structures.

C. If additional assumptions are necessary to complete this form, provide the rationale for the assumptions as well as a description of how they are included.

D. Provide a plot of the Form VF-2, Part A data.

Form VF-2: Hypothetical Inland Flood Event

Part A

Flood depth (feet) above ground level	Estimated Damage/ Subject Exposure	Flood depth (feet) above ground level	Estimated Damage/ Subject Exposure
0	_____		_____
1.5	_____	13	_____
1	_____	13.5	_____
1.5	_____	14	_____
2	_____	14.5	_____
2.5	_____	15	_____
3	_____	15.5	_____
3.5	_____	16	_____
4	_____	16.5	_____
4.5	_____	17	_____
5	_____	17.5	_____
5.5	_____	18	_____
6	_____	18.5	_____
6.5	_____	19	_____
7	_____	19.5	_____
7.5	_____	20	_____
8	_____	20.5	_____
8.5	_____	21	_____
9	_____	21.5	_____
9.5	_____	22	_____
10	_____	22.5	_____
10.5	_____	23	_____
11	_____	23.5	_____
11.5	_____	24	_____
12	_____	24.5	_____
12.5	_____	25	_____

Part B

<u>Construction Type</u>	<u>Estimated Damage/ Subject Exposure</u>
Wood Frame	_____
Masonry	_____
Manufactured Housing	_____

**Form VF-3: Flood Mitigation Measures
Range of Changes in Flood Damage**

- 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-3, Flood Mitigation Measures, Range of Changes in Flood Damage, as well as for the combination of the mitigation measures.
- B. If additional assumptions are necessary to complete this form, 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 VF-3, Flood Mitigation Measures, Range of Changes in Flood Damage, shall also be included in a submission appendix.

Reference Structures

Wood Frame	Masonry
Two story Unbraced timber pile foundation Top of pile 8 feet above grade Wood floor system bolted to piles	One story Slab foundation Top of slab 1 foot above grade

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

Place the reference structures at the following locations:

Gulf of Mexico

Latitude: 27.9957517

Longitude: -82.8277373

St. Johns River

Latitude: 29.4777005

Longitude: -81.6739088

**Form VF-3: Flood Mitigation Measures
Range of Changes in Flood Damage**

INDIVIDUAL MITIGATION MEASURES		PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100											
		WOOD FRAME STRUCTURE					MASONRY STRUCTURE						
		FLOOD DEPTH (FT) ABOVE GROUND					FLOOD DEPTH (FT) ABOVE GROUND						
		7	9	11	13	15	1	2	3	4	5		
	REFERENCE STRUCTURE	—	—	—	—	—	—	—	—	—	—	—	—
FIRST FLOOR HEIGHT	Elevate Floor 1 Foot						—	—	—	—	—	—	—
	Elevate Floor 2 Feet						—	—	—	—	—	—	—
	Elevate Floor 3 Feet						—	—	—	—	—	—	—
FLOOD PROOFED UTILITY EQUIPMENT	Elevate or Protect 1 Foot												
	Elevate or Protect 2 Feet												
	Elevate or Protect 3 Feet												
STRENGTHEN FOUNDATION	Bracing of Timber Pile Foundation						—	—	—	—	—	—	—
TEMPORARY PROTECTION	Sandbags or Equivalent 1 Foot	—	—	—	—	—							
	Sandbags or Equivalent 2 Feet	—	—	—	—	—							
	Sandbags or Equivalent 3 Feet	—	—	—	—	—							
FLOOD PROOFING	Wet												
	Dry	—	—	—	—	—							
MITIGATION MEASURES IN COMBINATION		PERCENTAGE CHANGES IN DAMAGE ((REFERENCE DAMAGE RATE - MITIGATED DAMAGE RATE) / REFERENCE DAMAGE RATE) * 100											
		WOOD FRAME STRUCTURE					MASONRY STRUCTURE						
		FLOOD DEPTH (FT) ABOVE GROUND					FLOOD DEPTH (FT) ABOVE GROUND						
		7	9	11	13	15	1	2	3	4	5		
STRUCTURE	Mitigated Structure Utility Equipment Elevated 2 Feet Above Flood, Bracing and Wet Flood Proofing						—	—	—	—	—	—	—
	Mitigated Structure Utility Equipment Elevated 2 Feet Above Floor, and Sandbags	—	—	—	—	—							

**Form VF-4: Flood Mitigation Measures
Mean Flood Damage Ratios and Flood Loss Costs
(Trade Secret Item)**

- A. Provide the mean damage ratio (prior to any insurance considerations) to the reference structure for each individual mitigation measure listed in Form VF-4, Flood Mitigation Measures, Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret Item), as well as the percent damage for the combination of the mitigation measures.
- B. Provide the loss cost rounded to three decimal places, for the reference structure and for each individual mitigation measure listed in Form VF-4, Flood Mitigation Measures, Mean Flood Damage Ratios and Flood Loss Costs (Trade Secret Item), as well as the loss cost for the combination of the mitigation measures.
- C. If additional assumptions are necessary to complete this form, 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 fully mitigated structures.

Reference Structures

Wood Frame	Masonry
Two story Unbraced timber pile foundation Top of pile 8 feet above grade Wood floor system bolted to piles	One story Slab foundation Top of slab 1 foot above grade

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

Place the reference structures at the following locations:

Gulf of Mexico

Latitude: 27.9957517

Longitude: -82.8277373

St. Johns River

Latitude: 29.4777005

Longitude: -81.6739088

**Form VF-4: Flood Mitigation Measures
Mean Flood Damage Ratios and Flood Loss Costs
(Trade Secret Item)**

Part A

INDIVIDUAL MITIGATION MEASURES		MEAN DAMAGE RATIO									
		WOOD FRAME STRUCTURE					MASONRY STRUCTURE				
		FLOOD DEPTH (FT) ABOVE GROUND					FLOOD DEPTH (FT) ABOVE GROUND				
		7	9	11	13	15	1	2	3	4	5
	REFERENCE STRUCTURE	—	—	—	—	—	—	—	—	—	
FIRST FLOOR HEIGHT	Elevate Floor 1 Foot						—	—	—	—	
	Elevate Floor 2 Feet						—	—	—	—	
	Elevate Floor 3 Feet						—	—	—	—	
FLOOD PROOFED UTILITY EQUIPMENT	Elevate or Protect 1 Foot										
	Elevate or Protect 2 Feet										
	Elevate or Protect 3 Feet										
STRENGTHEN FOUNDATION	Bracing of Timber Pile Foundation						—	—	—	—	
TEMPORARY PROTECTION	Sandbags or Equivalent 1 Foot	—	—	—	—	—					
	Sandbags or Equivalent 2 Feet	—	—	—	—	—					
	Sandbags or Equivalent 3 Feet	—	—	—	—	—					
FLOOD PROOFING	Wet										
	Dry	—	—	—	—	—					
MITIGATION MEASURES IN COMBINATION		MEAN DAMAGE RATIO									
		WOOD FRAME STRUCTURE					MASONRY STRUCTURE				
		FLOOD DEPTH (FT) ABOVE GROUND					FLOOD DEPTH (FT) ABOVE GROUND				
		7	9	11	13	15	1	2	3	4	5
STRUCTURE	Mitigated Structure Utility Equipment Elevated 2 Feet Above Floor, Bracing and Wet Flood Proofing						—	—	—	—	
	Mitigated Structure Utility Equipment Elevated 2 Feet Above Floor, and Sandbags	—	—	—	—	—					

**Form VF-4: Flood Mitigation Measures
Mean Flood Damage Ratios and Flood Loss Costs
(Trade Secret Item)**

Part B

INDIVIDUAL MITIGATION MEASURES		COASTAL LOSS COSTS		INLAND LOSS COSTS	
		WOOD FRAME STRUCTURE	MASONRY STRUCTURE	WOOD FRAME STRUCTURE	MASONRY STRUCTURE
		ACROSS ALL FLOOD DEPTHS		ACROSS ALL FLOOD DEPTHS	
	REFERENCE STRUCTURE	—	—	—	—
FIRST FLOOR HEIGHT	Elevate Floor 1 Foot		—		—
	Elevate Floor 2 Feet		—		—
	Elevate Floor 3 Feet		—		—
FLOOD PROOFED UTILITY EQUIPMENT	Elevate or Protect 1 Foot				
	Elevate or Protect 2 Feet				
	Elevate or Protect 3 Feet				
STRENGTHEN FOUNDATION	Bracing of Timber Pile Foundation		—		—
TEMPORARY PROTECTION	Sandbags or Equivalent 1 Foot	—		—	
	Sandbags or Equivalent 2 Feet	—		—	
	Sandbags or Equivalent 3 Feet	—		—	
FLOOD PROOFING	Wet				
	Dry	—		—	
MITIGATION MEASURES IN COMBINATION		COASTAL LOSS COSTS		INLAND LOSS COSTS	
		WOOD FRAME STRUCTURE	MASONRY STRUCTURE	WOOD FRAME STRUCTURE	MASONRY STRUCTURE
		ACROSS ALL FLOOD DEPTHS		ACROSS ALL FLOOD DEPTHS	
STRUCTURE	Mitigated Structure Utility Equipment Elevated 2 Feet Above Floor, Bracing and Wet Flood Proofing		—		—
	Mitigated Structure Utility Equipment Elevated 2 Feet Above Floor, and Sandbags	—		—	