

# Florida Public Flood Loss Model

V1.0

## ACTUARIAL STANDARDS



## Standard AF-1

### Flood Model Input Data and Output Reports

- A. Adjustments, edits, inclusions, or deletions to insurance company or other input data used by the modeling organization shall be based upon generally accepted actuarial, underwriting, and statistical procedures.**

Input data received from insurance companies are reviewed via a combination of editing programs and human intervention. The editing programs search for missing or invalid entries and inconsistencies among attributes (e.g. zip code and county mismatch). Edits identified are reviewed by the model operator.

Records missing key information such as location, FFE and insured value are dropped.

Number of stories for a single family residence, if not provided, is populated based on county statistics.

Ground elevation is extracted from the DEM.

These adjustments to the inputs are consistent with generally accepted actuarial, underwriting and statistical procedures.



## Standard AF-1

### Flood Model Input Data and Output Reports

- B. All modifications, adjustments, assumptions, inputs and input file identification, and defaults necessary to use the flood model shall be actuarially sound and shall be included with the flood model output report. Treatment of missing values for user inputs required to run the flood model shall be actuarially sound and described with the flood model output report.**

The flood model output report identifies and summarizes the input file that was used. Any changes to the original input file, including the treatment of missing values are included in the output report as well.

**The model satisfies Standard AF-1.**



## Standard AF-2

### Flood Events Resulting in Modeled Flood Losses

**A. Modeled flood loss costs and flood probable maximum loss levels shall reflect insured flood related damages from both coastal and inland flood events impacting Florida.**

Modeled flood loss costs and PML levels include damages from:

- Storm surge and inland flooding modeled by a stochastic set of tropical events, and
- Historical non-tropical rainfall events.



## Standard AF-2

### Flood Events Resulting in Modeled Flood Losses

- B. The modeling organization shall have a documented procedure for distinguishing flood-related flood losses from other peril losses.**

*A document titled “Florida Public Flood Loss Model (FPFLM) Procedure to distinguish flood losses from other peril losses” details the procedure employed to meet this requirement.*

**The model satisfies Standard AF-2.**



## Standard AF-3 Flood Coverages

### **A. The methods used in the calculation of personal residential structure flood loss costs, including the effect of law and ordinance coverage, shall be actuarially sound.**

The model estimates personal residential structure damages for tropical events using a set of matrices that vary by construction, FFE, number of stories and other exposure characteristics. Within a matrix, the damage depends on the hydrological state and the flooding depth for the event.

Resulting damages are adjusted for policy limits, deductibles, and demand surge and aggregated across all events to determine loss costs.

An allowance for average annual losses from non-tropical flooding is added to the event-based estimate.

The model includes Increased Cost of Compliance (ICC) as an optional coverage and adds \$30,000 to the modeled structure loss whenever the coverage is elected and damage exceeds 50% of the insured value.



## Standard AF-3 Flood Coverages

- B. The methods used in the calculation of personal residential appurtenant structure flood loss costs shall be actuarially sound.**

Appurtenance structures are modeled as separate structures as described on the previous slide.



## Standard AF-3 Flood Coverages

- C. The methods used in the calculation of personal residential contents flood loss costs shall be actuarially sound.

There are separate damage matrices for contents, but otherwise the loss costs are modeled using the same approach described for structures.





## Standard AF-3 Flood Coverages

- D. The methods used in the calculation of personal residential time element flood loss costs shall be actuarially sound.**

There are separate damage matrices for time element, but otherwise the loss costs are modeled using the same approach described for structures.

**The model satisfies Standard AF-3.**



## Standard AF-4

### Modeled Flood Loss Cost and Flood Probable Maximum Loss Level Considerations

- A. Flood loss cost projections and flood probable maximum loss levels shall not include expenses, risk load, investment income, premium reserves, taxes, assessments, or profit margin.**

The items listed (i.e., expenses, risk load, profit margin, etc.) are not included in loss costs or PMLs.

- B. Flood loss cost projections and flood probable maximum loss levels shall not make a prospective provision for economic inflation.**

There is no prospective provision for economic inflation in loss costs or PMLs.



## Standard AF-4

### Modeled Flood Loss Cost and Flood Probable Maximum Loss Level Considerations

- C. Flood loss cost projections and flood probable maximum loss levels shall not include any explicit provision for wind losses.**

There is no explicit provision for wind losses in loss costs or PMLs.

- D. Damage caused from inland and coastal flooding shall be included in the calculation of flood loss costs and flood probable maximum loss levels.**

Coastal and inland flooding from tropical events and inland flooding from non-tropical events are included in calculation of flood loss costs and flood PML's.

- E. Flood loss cost projections and flood probable maximum loss levels shall be capable of being calculated from exposures at a geocode (latitude-longitude) level of resolution including the consideration of flood extent and depth.**

The model requires exposures at the geocode level . Coastal flooding depths and wave heights are interpolated to determine the damage for a specific location. Inland flooding depths are determined at a high resolution and do not require interpolation.



## Standard AF-4

### Modeled Flood Loss Cost and Flood Probable Maximum Loss Level Considerations

- F. Demand surge shall be included in the flood model's calculation of flood loss costs and flood probable maximum loss levels using relevant data and actuarially sound methods and assumptions.**

Demand surge factors are applied to the losses from each event in the stochastic set before calculating loss costs and PML levels.

Model assumes demand surge is a function of:

- Coverage
- Region
- An event's statewide damages (before DS)

*(continued on next slide)*



## Standard AF-4

### Modeled Flood Loss Cost and Flood Probable Maximum Loss Level Considerations

**F. Demand surge shall be included in the flood model's calculation of flood loss costs and flood probable maximum loss levels using relevant data and actuarially sound methods and assumptions.**

**Data used in the development of demand surge functions:**

- Marshall Swift construction cost indices for FL zip codes
- Miami-Ft. Lauderdale Consumer Price Index for Household Furnishings & Operations.

**General approach:**

- Method used to estimate DS involves examining the gap between forecasted and actual post-storm indices.

**The model satisfies Standard AF-4.**

## Standard AF-5 Flood Policy Conditions

- A. The methods used in the development of mathematical distributions to reflect the effects of deductibles and policy limits shall be actuarially sound.**

The modeled loss for an exposure is calculated net of deductible and policy limits for each tropical event in the stochastic set. The AAL for historical non-tropical events is stated net of deductible and policy limits for each exposure.



## Standard AF-5 Flood Policy Conditions

### **B. The relationship among the modeled deductible flood loss costs shall be reasonable.**

Modeled loss costs decrease as the deductible increases, all other factors held constant. See Form AF-6.

### **C. Deductible flood loss costs shall be calculated in accordance with s. 627.715, F.S.**

The model calculates deductible flood loss costs in accordance with the Standard Flood Insurance requirement of this statute.

## The model satisfies Standard AF-5.



## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

**A. The methods, data, and assumptions used in the estimation of flood loss costs and flood probable maximum loss levels shall be actuarially sound.**

Loss costs are the sum tropical and non-tropical average annual losses per \$1,000 of exposure.

PML's for various return periods are calculated as quantiles of the ordered set of losses.

The methods, data and assumptions underlying these estimates are actuarially sound.

**B. Flood loss costs shall not exhibit an illogical relation to risk, nor shall flood loss costs exhibit a significant change when the underlying risk does not change significantly.**

Loss costs produced by the model exhibit a logical relation to risk and do not change significantly when the underlying risk is unchanged. See Form AF-6. In the Year-Built Test, for example, construction years judged to be equally strong by the engineers have the same loss cost.





## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

**C. Flood loss costs cannot increase as the structure flood damage resistance increases, all other factors held constant.**

Loss costs do not increase as the structure flood damage resistance increases, all other factors held constant. This can be seen in the Construction Test in Form AF-6.

**D. Flood loss costs cannot increase as flood hazard mitigation measures incorporated in the structure increase, all other factors held constant.**

Loss costs do not increase as flood hazard mitigation measures incorporated in the structure increase, all other factors held constant. For example, loss costs do not increase as the FFE increases as shown in the Lowest Floor Elevation Test in Form AF-6.

**E. Flood loss costs shall be consistent with the effects of major flood control measures, all other factors held constant.**

The existence of major flood control measures is taken into consideration in determining the flood depth above ground level. This effect can be seen in the Brevard location in Form AF-6 which did not flood despite its location on the immediate coast because it is located behind a sea wall and berm.



## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

**F. Flood loss costs cannot increase as the flood resistant design provisions increase, all other factors held constant.**

The model's loss costs do not increase in the presence of flood resistant design provisions, all other factors held constant. The vulnerability matrices allow for floodproofing, break-away walls, elevated utilities and manufactured home tie-down. See the Foundation Type test in Form AF-6.

**G. Flood loss costs cannot increase as building code enforcement increases, all other factors held constant.**

Loss costs vary appropriately with building code enforcement, all other factors held constant. See the Year-Built Test in Form AF-6.

**H. Flood loss costs shall decrease as deductibles increase, all other factors held constant.**

Loss costs vary appropriately by size of deductible. See the Deductible Test in Form AF-6.



## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

- I. **The relationship of flood loss costs for individual coverages (e.g., personal residential structure, appurtenant structure, contents, and time element) shall be consistent with the coverages provided.**

The Coverage Test in Form AF-6 demonstrates the appropriate loss cost relationships among coverages.

- J. **Flood output ranges shall be logical for the type of risk being modeled and apparent deviations shall be justified.**

The output ranges are not a reasonable test of the logical relationship to risk. Variations in ground elevation within a county and FFE among exposures distort the expected relationships among construction types. For example, an assumed 3 ft FFE for Manufactured Home exposures produces lower loss costs relative to Frame and Masonry Owners which, on average, have a lower FFE.

Form AF-6, however, shows that the model produces the appropriate relationships since comparisons are made at fixed locations (and hence ground elevation) with FFE held constant.

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## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

- K. All other factors held constant, flood output ranges produced by the flood model shall in general reflect lower flood loss costs for personal residential structures that have a higher elevation versus those that have a lower elevation.**

The design of the vulnerability matrices takes into account both the ground elevation at a location and the FFE of the individual exposure to determine the percent damage to each coverage in a flooding event.



## Standard AF-6

### Flood Loss Outputs and Logical Relationships to Risk

- L. For flood loss cost and flood probable maximum loss level estimates derived from and validated with historical insured flood losses or other input data and information, the assumptions in the derivations concerning (1) construction characteristics, (2) policy provisions, and (3) contractual provisions shall be appropriate based on the type of risk being modeled.**

The loss costs and PML estimates derived by the model reflect the characteristics of the exposure being modeled primarily through the vulnerability component. The insured loss is determined by adjusting the damage estimates to allow for the specific provisions of the policy.

## The model satisfies Standard AF-6.

