# Analysis of the National Flood Insurance Program

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4/29/2014

**Abstract**

This paper talks about the National Flood Insurance Program (NFIP), which was created by the U.S. Congress in 1968 to help property owners protect themselves financially. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which works closely with private insurance companies to offer flood insurance to property owners and renters. It explains the problems faced by the NFIP and the effects of the 2012 Biggert-Waters Flood Insurance Reform Act (BW12), which was enacted to help eradicate these problems. This paper also talks about the shortcomings of the BW12 and how the Flood Insurance Rate Maps (FIRMs) play a role in the pricing of NFIP premiums. It also explains the actuarial rate formula and how it is used in pricing premiums.

**Introduction**

A flood is a general and temporary condition where two or more acres of normally dry land or two or more properties are inundated by water or mudflow [11]. There are several causes of flood such as dams, heavy rainfall, wildfire, tropical storms and hurricanes, spring thaw (snowmelt), outdated or clogged drainage systems [11]. Some of the primary effects of flooding are loss of life, damage to motor vehicles and structures such as buildings, roadways and bridges. There are also long-term effects of flooding such as economic hardship, rebuilding costs, food shortages leading to price increases, psychological damage due to deaths, injuries, and loss of properties. Since the effects of flooding are usually life-threatening, flood forecasting is very important. Flood forecasting is anticipating floods before they occur, which allows people to be prepared in advance for flooding conditions. There is a lot of risk associated with flooding and without flood insurance an individual could suffer devastating financial losses. Therefore, flood insurance should not only help individuals bounce back from flood related losses but also help reduce the damages caused by floods. Since standard homeowners insurance doesn't cover flooding, it's important for property owners and renters to have financial protection from floods that impact the country [11].

In 1968, the U.S. Congress created the National Flood Insurance Program (NFIP) as a result of the passage of the National Flood Insurance Act to help provide financial protection for property owners and reduce the impact of flooding through a combination of mitigation and floodplain management [6]. The NFIP offers flood insurance to property owners if their communities have agreed to participate. In order to participate in the NFIP, a community must agree to adopt and enforce floodplain management regulations and ordinances to reduce the risk of flooding [11]. The NFIP is controlled by the Federal Emergency Management Agency (FEMA), which works with nearly 90 private insurance companies to offer flood insurance to property owners and renters [11]. Flood insurance can be purchased through property and casualty insurance agents at fixed rates (rates do not differ between companies and agents).

In 1983, FEMA introduced the Write Your Own (WYO) program, which allows participating property and casualty insurance companies to write and service flood insurance in their own names [6].

The companies receive an expense allowance for policy writing and claims processing while the NFIP takes care of all the underwriting losses. An agent could either work with only WYO companies, both NFIP and WYO companies or directly with NFIP (NFIP direct business) [6]. Also, agents receive 15% commission from the NFIP [6]. Property-owners are required to make full year premium payments to enable them receive insurance coverage. Deductibles apply separately to building and contents policies and mortgage lenders can set a maximum amount for the deductible [11]. Typically, there is a 30-day waiting period from the date of the purchase before a policy goes into effect even though there are a number of exceptions [11]. The NFIP reimburses flood claims by the Replacement Cost Value (RCV) and Actual Cash Value (ACV). The RCV is the cost to replace damaged property for owners of single-family, primary residences insured to the maximum amount of insurance available under the program or no less than 80% of buildings replacement cost at the time of the loss. All other buildings and content coverage are valued at ACV. The ACV is the RCV at the time of loss minus physical depreciation [11].

Since the National Flood Insurance Act of 1968 was passed, there have been five reforms in 1973, 1994, 2004 and 2012, 2014 respectively. The Flood Disaster Protection Act of 1973 was passed to make the purchase of flood insurance a requirement for properties located in Special Flood Hazard Areas (SFHA) [6]. SFHA is another name for high-risk areas. The premiums charged to policyholders with pre-FIRM buildings were very subsidized and almost every community in high risk areas joined the NFIP. According to the NFIP, the subsidized premiums made it easier to convince communities to join the program since increasing community participation would allow the implementation of the sound floodplain management [9]. By 1986, the NFIP increased these subsidized policies with the intent of generating adequate premium to at least cover expenses and losses. The National Flood Insurance Reform Act of 1994 was passed to help make the NFIP more effective in achieving its goals of reducing the risk of flood damage to properties and reducing federal expenditures for uninsured properties that are damaged by floods [6]. Also, the National Flood Insurance Reform Act of 2004 was passed to reduce losses to properties for which repetitive flood insurance claim payments have been made, increase the funding and possibility of the Flood Mitigation Assistant (FMA) program [6]. The 2005 hurricanes

(Katrina, Rita, Wilma, Dennis) caused extraordinary losses for the NFIP, which caused them to borrow about $17.8 billion from the U.S. Treasury [9]. The Biggert-Waters Flood Insurance Reform Act of 2012 (BW12) was passed to ensure that premiums accurately reflected true flood risk associated with future flood damages, make the NFIP more financially stable, and change how Flood Insurance Rate Map (FIRM) updates impact policyholders [3]. The BW12 hasn't fully been enacted due to various reasons, which will be discussed later in the paper. In March of 2014, President Obama signed the Homeowner Flood Insurance Affordability Act of 2014 into law to help relieve policyholders who received rate increases under the BW12 [3].

FEMA's long-term goal is to eliminate subsidized rates from the NFIP and price full-risk premiums based on accepted actuarial principles. Subsidized rates are rates that do not take into consideration catastrophic loss levels [9]. There are both pre-FIRM and post-FIRM subsidized rates in high-risk flood areas. Pre-FIRM properties are properties that were built before a community's first Flood Rate Insurance Map (FIRM) whiles post-FIRM properties were built after the community's first FIRM [6]. FEMA conducts a Flood Insurance Study, which includes statistical data for river flow, storm tides, hydrologic analysis, rainfall and topographic surveys [11]. The statistical data is used to create the flood to create FIRMs for different communities. The FIRMs are then used to calculate rates for pricing subsidized premiums. The actuarial rates used for pricing post-FIRM premiums are calculated using hydrologic model, which estimate loss exposure (average loss cost per policyholder) and other relevant factors such as date and type of construction of property, building's location, deductible and level of flood risk and elevation relative to the Base Flood Elevation (BFE) [9]. The BFE is the elevation of a property where there is a 1 percent or greater annual chance of flooding. BFEs are approximations based on the best available data about major flood sources [6]. For the most part, premiums have increased yearly for the NFIP and as of year ending 2012; about 20 percent of policyholders pay subsidized rates. FEMA estimates that the subsidized premiums are about 40 to 45 percent of full-risk premiums [9].

**Analysis**

The FEMA website had NFIP's annual data on Loss Dollars Paid, Premiums Collected, Number of Losses Paid and Number of Policies Paid. Data on NFIP's operational expenses was also found on Exhibit B2 from the 2011 Actuarial Rate Review. We used the data to find the NFIP annual loss ratio (including the loss adjustment expense), annual difference between Premiums Collected and Loss Dollars Paid. The loss adjustment expense (LAE) is the cost incurred from paying losses (claims). From 1978-2012, the Total Losses Paid (including LAE) by NFIP was approximately $3 billion more than the Total Premiums Collected. In the early years of NFIP the losses outmatched the premiums since the NFIP charged subsidized premiums to convince communities to participate. Also, premiums increased annually while the losses dollars paid varied based on the severity of floods yearly.

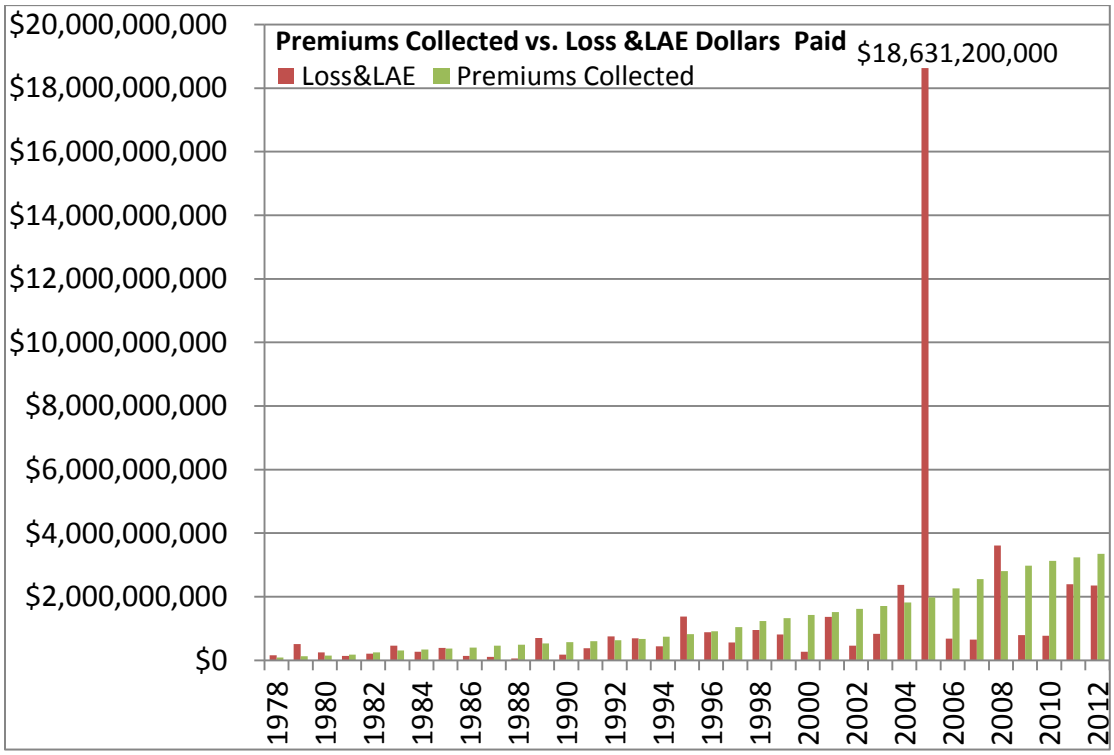


*Figure 1: Annual Premiums Collected Vs. Annual Losses Paid*

From 1978 to 2004, the NFIP collected a total surplus of approximately $4.6 billion even though there were years in which losses paid outmatched the premiums collected (including year 2004). The hurricanes (Charley, Frances, Ivan, Jeanne) caused the losses in 2004. In 2005, the NFIP suffered paid losses up to about $17.75 billion ($18.6 billion if LAE is included), mainly because of Hurricane Katrina.

The NFIP mostly pays losses and operating expenses out of collected premium. In times when the losses exceed the accumulated surplus, the NFIP has the authority to borrow from the U.S. Treasury [9]. In the early years, the NFIP had a $1 billion borrowing authority but the borrowing authority has increased over the past couple years [9]. Before the 2005 hurricanes, the NFIP had borrowed from the U.S. Treasury four times but were able to repay the borrowed amounts [9]. At the time Hurricane Katrina occurred, the NFIP had about $189 million and an outstanding borrowing of $225 million [9].

The accumulated surplus in 2004 was used to pay for the losses incurred from the 2004 hurricanes and operating expenses for that year. Aside the LAE, the NFIP has other expenses such as Direct and Bureau General Expense, WYO Operating Allowance, Direct Agent Commission. The U.S. Treasury increased the borrowing capacity to $20.7 billion after the 2005 hurricanes, which allowed the NFIP to borrow $17.75 billion to help pay for the losses [14]. Interest on the money borrowed started to accumulate and it became an expense for the NFIP in 2005.

| Expenses | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Interest on Borrowing | | | | | | $5232217 | $523,535,548 | $730,185,164 | $811,515,698 | $214,368,255 |
| Other Expenses | $322,587,415 | $320,981,003 | $339,883,060 | $363,734,043 | $366,330,151 | $395,019,539 | $450,216,093 | $489,269,088 | $495,063,569 | $533,363,749 |
| Total | $322,587,415 | $320,981,003 | $339,883,060 | $363,734,043 | $366,330,151 | $400,251,756 | $973,751,641 | $1,219,454,252 | $1,306,579,267 | $747,732,004 |

*Table 1: NFIP expenses from year 2000-2009*

The NFIP had decent surplus in the years following the 2005 hurricanes, which helped them pay a small part of the debt including interest on the debt As of year ending 2010, the NFIP had paid $2.4 billion in interest payments and $1.8 billion of the debt [12]. Unfortunately, the NFIP's ability to generate surplus to repay borrowed funds is impeded due to 20 percent of policyholders paying subsidized premiums.

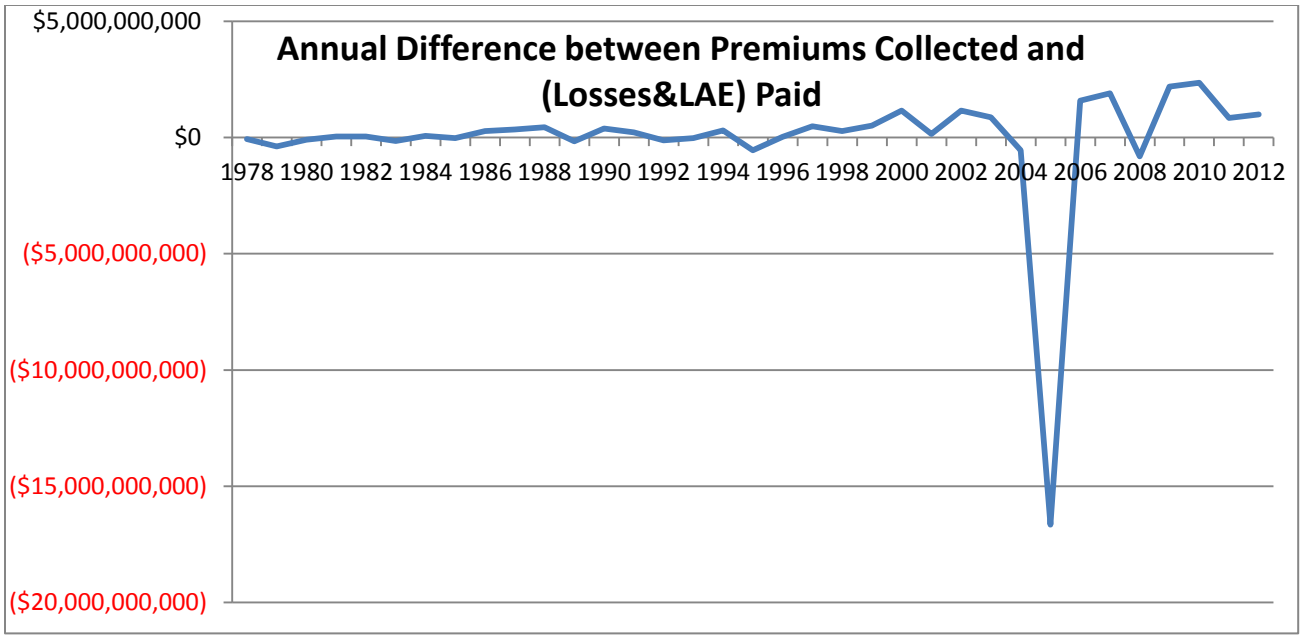


*Figure 2: Annual Difference between Premiums Collected and Losses Paid*

The loss ratio is the ratio of the Losses paid and Loss Adjustment Expenses to the Premiums collected. Loss ratio is a good indicator of the performance of the NFIP. A loss ratio less than 1 means the NFIP collected enough premiums to cover its losses paid in that particular year.

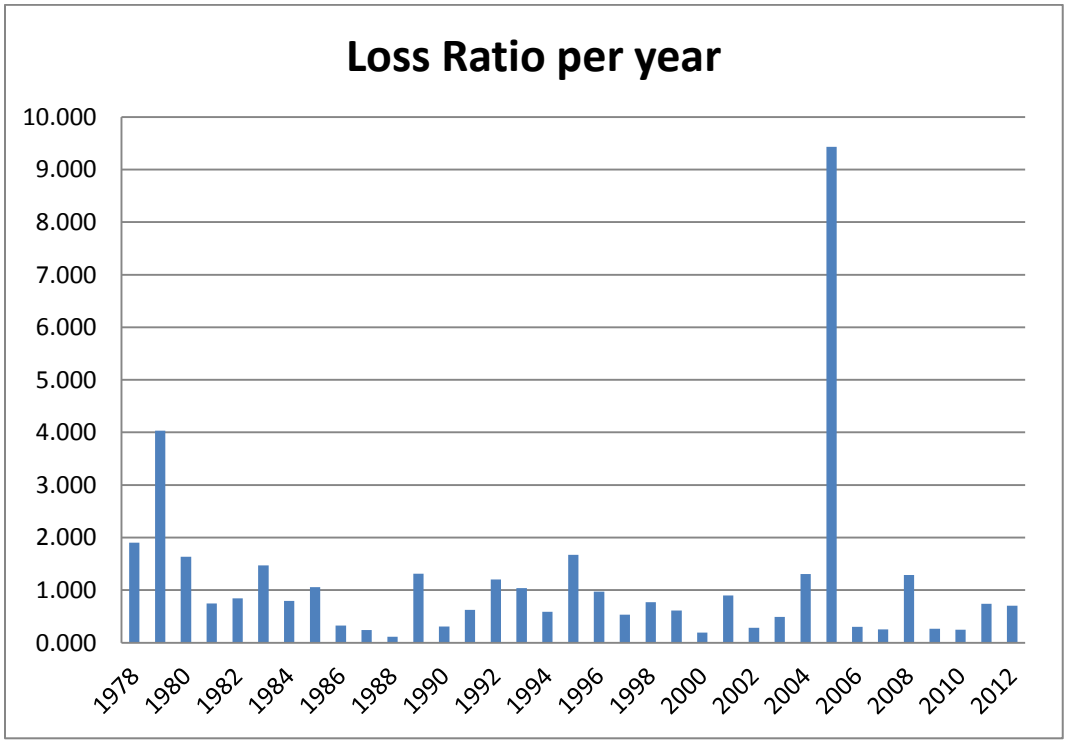


*Figure 3: Loss Ratio per Year*

The 2012 Hurricanes (Sandy, Isaac, Debby) caused NFIP about $8.2 billion in losses paid [2]. The U.S Treasury increased NFIP's borrowing authority by $9.7 billion to $30.4 billion, which helped them settle policyholder claims [14]. As of November 2012, FEMA's debt was about $20 billion and had not repaid any of the principal of the debt since 2010.

**Flood Insurance Rate Maps**

The NFIP measures flood risk using flood insurance rate maps (FIRMs). These maps do not only show different levels of risk for various communities but also help determine premiums. FIRMs categorize risk in different areas in 3 degrees namely; high-risk, moderate-to-low risk and undetermined-risk [11]. In high-risk areas (Special Flood Hazard Areas), FIRM indicates there is a 1% or greater annual chance of flooding. All property owners in SFHAs with mortgages from federally regulated or insured lenders are required to buy flood insurance. Also, a lender can require flood insurance, even if it is not federally required [11]. High-risk areas are labelled with the letters A or V on the flood maps. Moderate-to-low risk areas file nearly 25 percent of National Flood Insurance (NFIP) claims and receive one-third of flooding disaster assistance [11]. Property owners and renters in these areas are only recommended to purchase flood insurance. Moderate-to-low risk areas are labelled with the letters X (or a shaded X) on the flood maps [11]. Since 1985, all new FIRMs have shown at most ten zones, which are A, AE, V, VE, AH, AO, AR, A99, X, and D [9]. Zone AE includes all zones formerly designated as A1-A30, zone VE includes all zones formerly designated as V1-V30, and zone X represents areas formerly shown as Zones B or C [9]. No flood-hazard analysis has been conducted in undetermined risk areas, but a flood risk still exists. These areas are labeled with the letter D on the flood maps. Flood rates in Zone D reflect the uncertainty of the flood risk [11].

Because of the change in flood risk over time, FEMA is responsible for updating flood hazard maps for different communities. Digital Flood Insurance Rate Maps (DFIRMs) are new flood maps that show flood risk at a based on property type [11].

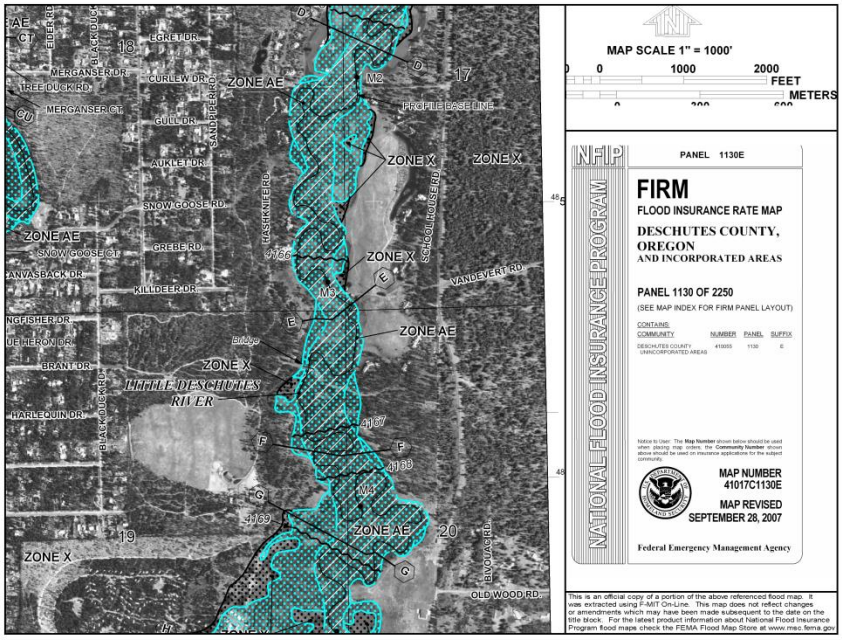


*Figure 4: Flood Insurance Rate Map for Deschutes County, Oregon*

A property owner whose property is mapped out of a high-risk area could experience a decrease in flood insurance costs whereas if a property is mapped into a high-risk area, the property owner will likely be required to purchase flood insurance if the mortgage is through a federally regulated or insured lender. If a map shows change from high flood risk to moderate-to-low risk, a policyholder could use the lower-cost Preferred Risk Policy, if the building qualifies [11]. Due to the cost associated with change in risk level, the NFIP has two options, the Preferred Risk Policy (PRP) Eligibility Extension and "Grandfathering". These two options allow property owners to pay subsidized premiums when their properties are newly mapped into high-risk flood zone.

**Preferred Risk Policy**

The Preferred Risk Policy (PRP) is a cost-saving option for property owners whose properties have been newly mapped into high-risk areas. A property owner is eligible to purchase or renew a PRP, if the property meets the loss history requirements and was newly mapped into a high-risk flood zone on or after October 1, 2008 [11].

**Grandfathering**

Grandfathering is another cost-saving option beyond the Preferred Risk Policy for properties that have been newly mapped into high risk areas. Properties that qualify for PRP can be renewed for two years. On the third renewal, the property owner can lock in standard rates associated with moderate-to-low risk zones instead of high-risk zones. Post-FIRM property owners can use the grandfather rule by showing proof of property compliance with the flood maps at the time of construction [11].

**Coverage**

Flood insurance policies cover physical damage to property and possessions. It provides coverage for both buildings and contents for owners and contents only for renters [11]. The policy does not cover the land occupied by the building, damage caused by moisture or mold, financial losses due to loss of insured property, and damage to motor vehicles [11]. Flood insurance is limited for basements and areas below the lowest elevated floor depending on the flood zone and date of construction [11]. The NFIP has two categories, namely; the Emergency Program and the Regular Program. The Emergency Program refers to the initial phase of a community's participation in the NFIP if no FIRM is available while the Regular Program refers to the final phase of a community's participation in the NFIP [6]. In the final phase, the Flood Insurance Rate Maps (FIRMs) are in effect and full limits of coverage are available [6]. The NFIP does not only offer flood insurance, it also supports local communities in their efforts to reduce the risk and consequences of flooding [11]. Most premiums include a Federal Policy fee and ICC premium and communities that participate in the CRS program pay discounted premium rates to reflect the reduced flood risk. The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements [6]. The Federal Policy Fee is a fee charged to policyholders to cover expenses of flood insurance studies, floodplain management and FEMA administrative costs [11]. The ICC premium is a premium charged for the compensation of policyholders when their significantly flood-damaged insured property is required to be in compliance with NFIP requirements [11]. Also, a probation surcharge is charged to communities on probation.

**Moderate-to-low risk areas (Zones B, C, X)**

For Moderate-to-low risk areas, homeowners, renters and condominium owners/renters have two policy options namely, Preferred Risk Policy (PRP) and Standard-Rated Policy. The PRP premiums are the lowest premiums available through the NFIP. The standard-rated policy is available for properties that are not eligible for the PRP [11].

| BUILDING & CONTENTS[1] | | | CONTENTS ONLY[1,4,7] | | |
|---|---|---|---|---|---|
| Coverage | Annual Premium[2,3] | | Coverage | Annual Premium[2] | |
| | Without Basement or Enclosure[6] | With Basement or Enclosure[5] | | Contents Above Ground[7] | All Other Locations[8] |
| $20,000/ $8,000 | $129 | $176 | $8,000 | $57 | $79 |
| $30,000/ $12,000 | $183 | $211 | $12,000 | $75 | $106 |
| $50,000/ $20,000 | $240 | $269 | $20,000 | $110 | $147 |
| $75,000/ $30,000 | $281 | $315 | $30,000 | $126 | $168 |
| $100,000/ $40,000 | $312 | $346 | $40,000 | $140 | $187 |
| $125,000/ $50,000 | $334 | $368 | $50,000 | $153 | $207 |
| $150,000/ $60,000 | $356 | $390 | $60,000 | $167 | $226 |
| $200,000/ $80,000 | $390 | $429 | $80,000 | $194 | $248 |
| $250,000/ $100,000 | $414 | $460 | $100,000 | $221 | $271 |

*Figure 5: Residential Preferred Risk Policy [11]*

| Building & Contents[1] | | | Contents Only[1,4,6] | | |
|---|---|---|---|---|---|
| Coverage | Annual Premium[2,3] | | Coverage | Annual Premium[2] | |
| | Without Basement or Enclosure[5] | With Basement or Enclosure[4] | | Contents Above Ground (more than one floor) | All Other Locations (basement only not eligible) |
| $50,000/$50,000 | $643 | $1,016 | $50,000 | $185 | $394 |
| $100,000/ $100,000 | $1,016 | $1,731 | $100,000 | $270 | $586 |
| $150,000/ $150,000 | $1,326 | $2,321 | $150,000 | $355 | $778 |
| $200,000/ $200,000 | $1,637 | $2,756 | $200,000 | $439 | $970 |
| $250,000/ $250,000 | $1,886 | $3,129 | $250,000 | $524 | $1,163 |
| $300,000/ $300,000 | $2,134 | $3,502 | $300,000 | $609 | $1,355 |
| $350,000/ $350,000 | $2,321 | $3,875 | $350,000 | $694 | $1,547 |
| $400,000/ $400,000 | $2,507 | $4,185 | $400,000 | $778 | $1,739 |
| $450,000/ $450,000 | $2,694 | $4,497 | $450,000 | $863 | $1,931 |
| $500,000/ $500,000 | $2,880 | $4,807 | $500,000 | $948 | $2,123 |

*Figure 6: Non-Residential Preferred Risk Policy [11]*

*KEY:*

1. *Add $50 probation surcharge, if applicable*
2. *Premiums include Federal Policy fee of $22.00*
3. *Premiums include ICC premium of $5.00.*
4. *Contents-only policy is not available for contents located in basement only*
8. *More than one floor.*

For high-risk areas, the Standard-Rated policy is the only option for both residential and commercial property owners [11]. The NFIP offers three Standard Flood Insurance policies namely the Dwelling Policy, General Property Policy and Residential Condominium Building Association Policy (RCBAP). The Dwelling Policy provides flood insurance to homeowners, residential renters and condominium unit-owners, owners of residential buildings containing one to four units [7]. The General Property Policy provides flood insurance to owners and lessees of non-residential building or units, residential condominium buildings that are not insurable under the RCBAP [7]. The Residential Condominium Building Association Policy (RCABP) provides flood insurance to condominium associations to insure eligible residential condominium buildings [7].

| | | REGULAR PROGRAM | | |
|---|---|---|---|---|
| BUILDING COVERAGE | EMERGENCY PROGRAM | Basic Insurance Limits | Additional Insurance Limits | Total Insurance Limits |
| Single-Family Dwelling | $ 35,000 * | $ 60,000 | $190,000 | $250,000 |
| 2–4 Family Dwelling | $ 35,000 * | $ 60,000 | $190,000 | $250,000 |
| Other Residential | $100,000 ** | $175,000 | $ 75,000 | $250,000 |
| Non-Residential | $100,000 ** | $175,000 | $325,000 | $500,000 |
| CONTENTS COVERAGE | | | | |
| Residential | $ 10,000 | $ 25,000 | $ 75,000 | $100,000 |
| Non-Residential | $100,000 | $150,000 | $350,000 | $500,000 |

* In Alaska, Guam, Hawaii, and U.S. Virgin Islands, the amount available is $50,000.
** In Alaska, Guam, Hawaii, and U.S. Virgin Islands, the amount available is $150,000.

*Figure 7: Coverage both the Emergency Program and Regular Program for high-risk areas [6].*

The Emegency Program offers less coverage as compared to the Regular Program; thus has less premiums for policyholders. The Regular Program offers coverage for both pre-FIRM and post-FIRM properties.

**Biggert-Waters Flood Insurance Reform Act of 2012 (BW12)**

In July 2012, the U.S. Congress passed the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12), which was signed into law by the President to extend the NFIP for five years and make significant changes to the way program operates [4]. Some of these changes have already been enacted while other changes will be phased in over time. The main goals of BW12 are phasing out subsidized rates and ensuring that rates more accurately reflect true flood risk associated with future flood damages, making the program more financially stable, and changing how Flood Insurance Rate Map (FIRM) updates impact policyholder premiums [3]. These changes will affect some but not all policyholders over time. After the NFIP was introduced, property owners in participating communities were not required to rebuild to high standards and many of them received subsidized rates that did not reflect their true risk. Over the years, cost and consequences of flooding have continued to increase. For the NFIP to remain sustainable, its premium structure must reflect the true risks and cost of flooding and catastrophic losses.

As of year ending 2012, approximately 80 percent of policyholders do not pay subsidized rates and the other 20 percent pay subsidized rates [4].5 percent of policyholders who pay subsidized rates for non-primary residences, businesses and severe repetitive loss properties will see a 25 percent annual increase immediately until their premiums are full-risk premiums [4]. 10 percent of policyholders who pay subsidized rates for primary residence will remain subsidized until the property is sold (full risk rate will be charged to new owner), the property suffers severe repetitive losses, there is a lapse in the policy, or a new policy is purchased [4]. The remaining 5 percent pay subsidized rates for condominiums and non-condominium multifamily structures [4]. In late 2014, other property owners, including non-subsidized policyholders affected by map changes will see a 20 percent annual increase until premiums are full-risk premiums [4]. Full risk rate means that the premium takes into account the full range of possible flood losses, including the rare but catastrophic floods as well [4].

Most policyholders will see a new charge on their premiums to cover the Reserve Fund assessment, which is mandated by BW-12. Initially, the Reserve Fund assessment will be 5 percent for all policies except PRPs [4]. Also, the BW12 allows installment payments for policyholders as compared to previous

requirements of full premium payments by the NFIP [5]. In addition, BW12 imposes minimum deductibles on flood claims. Minimum annual deductible for pre-FIRM property is $1500 if the property is insured for $100,000 or less, and $2000 if the property is insured for more than $100,000 [13]. The minimum annual deductible for post-FIRM properties is $1000 for properties insured for $100,000 or less, and $1,250 for properties insured for more than $100,000 [13].

Lastly, BW12 requires FEMA and U.S. Government Accountability Office (GAO) to assess options for privatizing and reinsurance of the NFIP [14]. Pre-FIRM properties, which have not been elevated and located in high-risk areas, would experience the greatest rate change. For high-risk zones, the elevation of the property in relation to the BFE helps determine the flood risk. Generally, the higher the elevation of the lowest floor of the property above the BFE, the lower the flood risk. Obtaining an elevation certificate is the best way to determine property risk and true-risk premiums. The Elevation Certificate is a form completed and signed by a licensed engineer or surveyor [6].

The Homeowner Flood Insurance Affordability Act (HFIAA) of 2014 was signed into law to help relieve non-subsidized policyholders who are affected by map changes and are required to see 20 percent annual increase until premiums are full-risk premiums as outlined in the BW12 [5]. The HFIAA also requires FEMA to issue refunds to new policyholders in high-risk areas who paid full-risk after BW12 was enacted and policyholders who renewed their policy after the HFIAA was enacted with premium increases exceeding 18 percent [5]. The refunds do not apply to subsidized policyholders who are paying the 25 percent annual increase and those these subsidized policyholders will continue to see up to 25 percent annual increases until their premiums are full-risk premiums [5]. For the other 15 percent of subsidized policyholders, HFIAA requires gradual rate increase to premiums by no less than 5 percent annually until premiums reflect full risk [15]. Also, HFIAA introduces a new surcharge, which will be added to all policies to offset the subsidized policies. A primary residence policy will include a $25 surcharge whiles all other policies will include a $250 surcharge until all subsidized rates are eliminated. This new surcharge will increase premiums for all policyholders and will prevent the policyholders paying the 25 percent increase from feeling discriminated.

**Actuarial Rate Formula**

The Actuarial rates used in pricing flood insurance for Post-FIRM properties are based on the consideration of risk involved and accepted actuarial principles. The rate calculated is per $100 of insurance coverage for a property. The actuarial rate formula used in developing premium rates:

$$RATE = \left[ \sum_{i=Min}^{Max} (PELV_i \times DELV_i) \right] \times \frac{LADJ \times DED \times UINS}{EXLOSS} \quad [9]$$

Where: *Min* = minimum lowest floor elevation at which flood damage occurs
*Max* = lowest floor elevation at which flood damage approaches a maximum
Lowest Floor Elevations are measured to the nearest foot

*PELV* is the probability that the flood water elevations will reach or exceed a given depth relative to BFE. There are unique *PELV* values assigned to the various flood zones.

*DELV* is the ratio of the flood damage to the value of the insurable property. *DELV* values can be obtained from water depth percent damage tables on the Actuarial Information System (AIS) database.

*LADJ* is the ratio of allocated loss adjustment to loss dollars paid. *LADJ* is based on the analysis of trended historical loss data.

*DED* is an estimate of the percentage of the damage that will not be covered by insurance because it is below the deductible. *DED* is based on damage amounts produced from insurance claim files.

*UINS* is the under-insurance factor designed to adjust for the amount policyholders have underinsured their property. *UINS* is the ratio of property value to amount of insurance.

*EXLOSS* is the expected loss ratio which serves to provide for operating (underwriting) expenses and unallocated loss adjustment expenses. *EXLOSS* is a factor used to offset premium discounts provided under the Community Rating System (CRS).

The value in the bracket in the Formula represents the expected average annual flood damage as a percentage of the value of the property irrespective of the type of property [9]. The second part of the formula converts the expected average annual damage to an insurance rate per $100 of coverage by applying the impact of deductibles, rate for handling losses and other operating expenses [9].

**Premium Calculation**

There are different steps for determining premium for both the NFIP Emergency Program and Regular Program. For the Emergency Program, the NFIP determines the occupancy (residential or non-residential), calculates the premium using the pre-determined rates based on the occupancy, applies appropriate deductible factor if applicable, applies Reserve Fund Assessment, and then adds Federal Policy Fee [6].

For the Regular Program, the NFIP determines whether the property is pre-FIRM or post-FIRM, determines zone, determines occupancy, determines building type, determines whether building has a basement (or enclosed area) and whether it is finished or unfinished, calculate premium using pre-determined rates based on the (building type, coverage, risk zone, elevation relative to BFE), adds the ICC Premium, applies Reserve Fund Assessment, adds or applies (deductible factor, CRS discount, probation surcharge) if applicable, and add Federal Policy Fee [6]. The NFIP has rate tables, which contains annual rates per $100 of coverage for both the Emergency and Regular Program.

Also, for the pre-FIRM properties, there are annual rates for primary, non-primary residence and severe repetitive loss properties. The NFIP has annual rates for post-FIRM properties in high-risk zones based on elevation of the lowest floor relative to the BFE. Post-FIRM properties in Zone A99, moderate-to-low areas, and undetermined areas are not based on elevation relative to BFE. In cases where lowest floor elevation is 2 or more below the BFE, the property is submitted for rating and it's classified as the Submit-for-Rate risk [9]. Properties that fall in this category have unusual higher risk of flood damage even in SFHAs. The Specific Rate Guidelines (SRG) is used by insurers to calculate premiums for special cases that have an untypical higher risk of flood damage [10]. The SRG has rates for buildings that have lowest floor elevation below the BFE.

**Conclusion**

Even though the NFIP accumulated surplus to pay part of the U.S. Treasury loan (both principal and interest) after the 2005 hurricanes, the 2012 hurricanes was a nail in the coffin. Before the 2012 hurricanes, the NFIP were making efforts in generating full-risk premiums to help pay the debt by passing the Biggert-Waters Flood Insurance Reform Act of 2012 (BW12). Unfortunately, the 2012 hurricanes increased their debt by $9.7 billion. In the years before and including 2009, the NFIP had an increase in total number of policies. The total number of policies in force has been on a decline since 2009 when the NFIP had the highest number of policies in force. The debt situation of the NFIP is causing the reduction in policyholders since no reforms were passed after the 2005 hurricanes until the BW12. In 2012, the NFIP had the lowest number of policies in force since 2007. If the BW12 is fully enacted, it will help eliminate cost-saving options such as the Preferred Risk Policy and Grandfathering. Also, the NFIP has to eliminate the Emergency Program, which also contributes to subsidized premium for policyholders.

One of the challenges preventing the BW12 from being fully enacted is that policyholders were not given enough time to adjust to the premium increases especially policyholders of non-primary residences, businesses and severe repetitive loss properties who are already paying the 25 percent annual increase. Since the NFIP would charge full-risk premiums under the BW12, the policyholder's installment plan will make premiums more affordable as compared to the one-time annual premium payment. The reserve fund is a really good idea by the NFIP but without the debt forgiveness from the U.S Treasury, it will take the NFIP a very long time to create reserve for expected future catastrophic losses. The HFIAA gives subsidized policyholders a better chance to adjust to the premium increases since it requires a 5 percent or less annual increase to premiums until premiums reflect full risk. If changes were made to the subsidized policyholders who are paying the 25 percent increase, it will slow down the NFIP's financial sustainability goals under BW12.

With the recent NFIP reforms and hopefully low future flood losses, the NFIP would not only achieve its financial sustainability goals but also would help the country become more resilient to future floods.

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