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# The Role of Actuarial Soundness in the National Flood Insurance Program

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Deloitte Consulting LLP

October 2006

Prepared under subcontract to the American Institutes for Research  
as part of the 2001–2006 Evaluation of the National Flood Insurance Program

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October 2006

## REPORTS IN THE EVALUATION OF THE NATIONAL FLOOD INSURANCE PROGRAM

This Evaluation consists of a series of reports assessing questions identified and prioritized by a steering committee about the National Flood Insurance Program. The reports of the Evaluation will be posted on the FEMA website as they are finalized. The website URL is

<http://www.fema.gov/business/nfip/nfipeval.shtm>. The reports in the Evaluation are:

*The Evaluation of the National Flood Insurance Program – Final Report*  
American Institutes for Research and NFIP Evaluation Working Group

*Assessing the Adequacy of the National Flood Insurance Program's 1 Percent Flood Standard.* Galloway, Baecher, Plasencia, Coulton, Louthain, and Bagha, Water Policy Collaborative, University of Maryland.

*Costs and Consequences of Flooding and the Impact of the National Flood Insurance Program.* Sarmiento and Miller, Pacific Institute of Research and Evaluation.

*Developmental and Environmental Impacts of the National Flood Insurance Program: A Review of Literature.* Rosenbaum, American Institutes for Research.

*The Developmental and Environmental Impact of the National Flood Insurance Program: A Summary Research Report.* Rosenbaum & Bouleware, American Institutes for Research.

*An Evaluation of Compliance with the National Flood Insurance Program Part A: Achieving Community Compliance.* Monday, Grill, Esformes, Eng, Kinney and Shapiro, American Institutes for Research.

*An Evaluation of Compliance with the National Flood Insurance Program Part B: Are Minimum Building Requirements Being Met?* Mathis and Nicholson, Dewberry.

*Evaluation of the National Flood Insurance Program's Building Standards.* Jones, Coulbourne, Marshall, and Rogers, Christopher Jones and Associates.

*Managing Future Development Conditions in the National Flood Insurance Program.* Blais, Nguyen, Tate, Dogan, Petrow, ABSG Consulting; and Mifflin and Jones.

*The National Flood Insurance Program's Mandatory Purchase Requirement: Policies, Processes and Stakeholders.* Tobin and Calfee, American Institutes for Research.

*The National Flood Insurance Program's Market Penetration Rate: Estimates and Policy Implications.* Dixon, Clancy, Seabury, and Overton, RAND Corporation.

*Performance Assessment and Evaluation Measures for Periodic Use by the National Flood Insurance Program.* Miller, Langston, and Nelkin, Pacific Institute of Research and Evaluation.

*The Role of the Actuarial Soundness in the National Flood Insurance Program.* Bingham, Charron, Kirschner, Messick and Sabade, Deloitte Consulting.

*State Roles and Responsibilities in the National Flood Insurance Program.* Mittler, Morgan, Shapiro, and Grill, American Institutes for Research.

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# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b>	<b>I</b>
Introduction	i
Methodology	iii
Findings	iii
Recommendations	ix
<b>1. INTRODUCTION AND PROJECT SCOPE</b>	<b>1</b>
1.1. Background on the Evaluation of the National Flood Insurance Program	1
1.2 Objective of the Study	1
<b>2. RELIANCE AND LIMITATIONS</b>	<b>3</b>
<b>3. NFIP BACKGROUND</b>	<b>5</b>
3.1 NFIP Overview	5
3.2 NFIP Historical Financial Results	7
<b>4. ACTUARIAL STANDARDS OF PRACTICE</b>	<b>22</b>
<b>5. ACTUARIAL SOUNDNESS AND INSURANCE INDUSTRY INDICATORS</b>	<b>24</b>
5.1 What is Actuarial Soundness ?	24
5.2 Insurance Industry Indicators	25
5.3 Insurance Industry Indicators and the NFIP	27
5.3.1 Incurred Loss Ratio	28
5.3.2 Loss Adjustment Expense Ratio	30
5.3.3 Combined Ratio	32
5.3.4 Operating Ratio	35
5.3.5 Surplus Driven Ratios (NLSR, NPSR, RBC, some NAIC IRIS Ratios)	37
5.3.6 Financial Strength Rating	38
5.4 Application of NFIP Indicators to the NFIP	38
<b>6. GOALS AND OTHER OBJECTIVES</b>	<b>41</b>
6.1 The NFIP's Actuarial Soundness Goals	41

<b>6.2 Other Objectives and the Effects on Actuarial Soundness Goals</b>	<b>42</b>
<b>7. PROGRESS</b>	<b>45</b>
7.1 NFIP Progress in Achieving Actuarial Soundness	45
7.2 NFIP Progress Based on Indicators	53
<b>8. COMPETING OBJECTIVES AND OVERCOMING OBSTACLES</b>	<b>55</b>
8.1 Competing Objectives to the NFIP's Actuarial Soundness	55
8.2 NFIP and Overcoming Obstacles to Actuarial Soundness	63
8.2.1 Pre-FIRM Subsidies	63
8.2.2 Rate of Growth in Grandfathered Properties	66
8.2.3 Competition from Federal Disaster Assistance	67
8.2.4 Addressing Repetitive Loss Properties	68
8.2.5 Policyholder Funding of Flood Insurance Studies and Mitigation Activities	69
8.2.6 Erosion	71
8.2.7 Flood Map Modernization	72
<b>9. RECOMMENDATIONS AND CONCLUSIONS</b>	<b>74</b>
<b>10. APPENDICES</b>	<b>81</b>
10.1 Appendix 1: NFIP Ratemaking Comparison to Industry	81
10.2 Appendix 2: Overall Rate Level Indication	82
10.2.1 Two basic methodologies to developing overall rate levels: Pure Premium and Loss Ratio	82
10.2.2 Experience losses versus Hydrologic model	83
10.2.3 Inclusion of Loss Adjustment Expense loading	85
10.2.4 Treatment of deductible offsets	85
10.2.5 Treatment of underinsurance	86
10.2.6 Treatment of fixed and variable expenses	86
10.2.7 Treatment of profit and contingency loading	87
10.3 Appendix 3: Catastrophe Loading	87
10.4 Appendix 4: Definitions	88
<b>11. ACRONYMS</b>	<b>93</b>
<b>12. REFERENCES</b>	<b>95</b>

# EXECUTIVE SUMMARY

## Introduction

Flooding is the most common source of catastrophic loss for individuals and businesses in the United States. However, standard homeowner policies do not include flood coverage: private insurers have historically found it unprofitable to insure low-frequency, high-severity disasters such as floods, because their future losses are difficult to measure. Until the establishment of the National Flood Insurance Program (NFIP) in 1968, the primary recourse for flood victims was federal government disaster assistance (FEMA 2002 p.1). Congress adopted the NFIP in response to the ongoing unavailability of private insurance and continued increases in federal disaster assistance.

The primary goals of the National Flood Insurance Program are to: decrease the risk of flood losses; reduce the costs and adverse consequences of flooding; and reduce the demands for and expectations of federal flood disaster assistance. While not listed specifically as a goal for the NFIP, protection and enhancement of the natural and beneficial functions of floodplains is an inherent part of the program, and has been interpreted as another goal of the NFIP over time.

Given these priorities, as well as concerns about equity, Congress chose not to mandate the universal purchase of flood insurance. Further, because localities generally retain the right to make land use decisions, and Congress did not want to deprive individuals of their right to use land at all, legislators focused on preventing development in highly dangerous areas, known as floodways, and to encourage higher standards for development in less risky but still flood-prone areas, or floodplains. Congress enticed communities to join the Program by offering affordable insurance rates to individual owners in exchange for adoption of stricter ordinances and building standards for future construction. Discounted flood insurance policies were needed to enroll and retain those residents whose homes or businesses had already, unknowingly, been constructed in floodplains.

The NFIP was thus faced with a situation in which most policyholders were originally provided with statutorily mandated discounts (often referred to as “subsidies”). As time progressed, it was expected that the beneficiaries of such policies, associated with pre-flood insurance rate maps (FIRMs) for special flood hazard areas (SFHAs), would gradually be replaced with non-subsidized (i.e. actuarially rated) policyholders of properties built to the higher NFIP standards. While this continues to occur to some extent, and the overall proportion of such policies had decreased over time, the replacement rate is low. In addition, the number of subsidized pre-FIRM policyholders has been augmented by a small number of administratively grandfathered policyholders, who pay the rates in effect when their properties were constructed, even as FIRM updated mapping processes place these properties in higher-risk zone designations or indicate higher elevations for expected floods.

In order for the overall Program to be truly actuarially sound, the NFIP’s total revenue from premiums needs to offset the expected value of all future costs associated with the sale of each flood insurance policy. Although most policyholders now do pay actuarial rates, those in older homes with subsidized rates do not and there are no other parties paying more than their actuarially fair share to make up the premium shortfall caused by subsidizing pre-FIRM and

grandfathered policyholders. As a result, the NFIP is unable to collect sufficient premiums to counterbalance all future estimated losses as indicated by actuarial rates, and is thereby prevented from achieving actuarial soundness as it is traditionally defined. Further, there has been no mechanism to assure that even if the NFIP had been accumulating sufficient additional revenues in the past that it would have been politically palatable for the program to continually collect surpluses during multiple-year cycles of lower than expected damage given predictions of higher damage at some point in the future.

Two other factors complicate the NFIP's ability to emulate privately run insurers, who do operate under a strict definition of actuarial soundness:

1. The number of grandfathered properties is unknown.

The private insurance industry predicates its ability to set actuarially sound premium rates on the availability and continuous updates of the information necessary to provide a full understanding of the risks involved in insuring, if not individual structures, each class of structure. There is concern about the NFIP's ability to both generate and update such data. For instance, the NFIP is unable to identify the number of properties grandfathered into rates that do not represent their true actuarial risk.

2. The existence of subsidized rates.

Actuarially sound premium rates are those set such that they offset the costs of all future estimated losses. However, Congress initially mandated setting total annual revenue from premiums far below the actuarially indicated level. Congress later agreed with FEMA in 1981 to move toward setting the NFIP's subsidized premium rates based on an objective standard, which was rates required to maintain total revenues equal to the "historical average loss year."<sup>1</sup> In other words, these premiums offset only the average annual cost of past losses, adjusted for inflation. FEMA increased premiums for subsidized properties until it reached that goal in 1986. These rates provided an objective measure that was politically palatable to important Congressional delegations while moving the program overall somewhat closer to actuarial soundness. During the NFIP's first 35 years of existence, however, the historical average loss year continued to be less than the expected true-long term average; thus its use actually resulted in occasional operating surpluses because few catastrophic flood disaster events occurred. For that reason, until 2004, premiums for subsidized policies did not move closer toward a level that would achieve actuarial soundness. This allowed for increased market penetration of flood insurance, achieving other goals of the NFIP, but undermining moving further toward actuarial soundness.

In 2000, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) contracted with the American Institutes for Research (AIR), Deloitte Consulting LLP (Deloitte Consulting), and Pacific Institutes for Research (PIRE) to perform a comprehensive evaluation of the NFIP. As part of the evaluation, Deloitte Consulting was

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<sup>1</sup> Implementing the historical average loss year avoided the controversy associated with a complex calculation of "actuarial soundness in the foreseeable future." The historical average loss year is easily computed, and could be put in place immediately and without additional expense.

charged with investigating the role of actuarial soundness in the NFIP. This report examines the following issues, laid out in Deloitte Consulting's scope of work.

- Q1:** a) What is actuarial soundness?  
 b) Should the NFIP strive to achieve this?  
 c) How do insurance companies and regulators assess financial solvency and actuarial soundness?
- Q2:** a) To what extent does the NFIP aim to become actuarially sound?  
 b) How do other NFIP objectives, such as social welfare and floodplain management, affect this goal?
- Q3:** According to insurance companies' and regulators' methods of assessing financial solvency and actuarial soundness, what progress has been made in achieving actuarial soundness for the NFIP?
- Q4:** What are the major competing objectives to the NFIP's actuarial soundness, and what is the NFIP doing to overcome these impediments?

Some of these questions are overlapping, and they are responded to in this executive summary together when appropriate.

In addition, this report recommends needed changes for the NFIP to achieve actuarial soundness. Although the NFIP's short-term ability to cover the costs of major disasters such as 2005's Hurricane Katrina is beyond the scope of this study, its long-term ability to pay for such disasters is addressed.

## Methodology

To assess the role of actuarial soundness in the NFIP, this study examines information from five types of sources:

- current actuarial practice standards;
- flood insurance research reports and reviews produced by FEMA, its subcontractors, and other federal agencies;
- NFIP-generated data;
- A.M. Best's aggregated insurance industry data; and
- publicly available information, such as news stories, testimony, presentations, etc.

This report also explains what additional data the NFIP must gather for a more accurate assessment of its ability to achieve actuarial soundness.

## Findings

Given the NFIP's multiple priorities, and Congress' decision not to mandate the universal purchase of flood insurance, actuarial soundness for the NFIP is contingent on a number of

factors. This report investigated this issue, and the answers to the questions laid out in its scope of work are provided below.

**Q1 a): What is actuarial soundness?**

An insurance program is considered actuarially sound when its premium rates offset the expected value of all future costs associated with the sale of each flood insurance policy. In particular, the rates account, as best as possible, for the contingency of losses from expected future catastrophes. The private insurance industry predicates its ability to set actuarially sound premium rates on the availability and continuous updates of the information necessary to provide a full understanding of the risks involved in insuring, if not individual units, each class of unit. Although the Program's non-subsidized policies are actuarially based, its subsidized premium rates, which are based on the historical average loss year, understated actuarial risks by not accounting for losses from future low-frequency but high-severity floods.

**Q1 b): Should the NFIP strive to achieve actuarial soundness?**

The NFIP needs to strive in the long-term to move toward actuarial soundness in order to be fiscally sound and attain self-sufficiency. However, as discussed later in greater detail, trying to achieve actuarial soundness in the short-term through pricing structures that simulate those expected in private markets will result in greatly increased premiums for older pre-FIRM homes and homeowners dropping policies, preventing the program from making progress towards at least one of its primary statutory objectives – reducing uncompensated losses. This effect would be somewhat comparable to the conditions confronting flood insurance before the existence of the NFIP, including adverse selection and higher federal disaster assistance expenditures or community bail-outs, which fostered the Program's creation in the first place. To the extent that higher rates decrease the incentive for communities to join or stay in the Program, actuarially-based rates on currently subsidized policies also could reduce the NFIP's ability to meet other important goals – reducing the risk and societal costs of flooding.

**Q1 c): How do insurance companies and regulators assess financial solvency and actuarial soundness?**

Insurance companies and regulators consider financial solvency and actuarial soundness to have been achieved when:

- annual premium rates include a contingency for future losses; and
- all data necessary for a full understanding of the risks involved in insuring, if not individual units, each class of unit, is factored into the rates and this data is continuously updated, and incorporated into the rate.

**Q2 a): To what extent does the NFIP aim to become actuarially sound?**

and

**Q3: According to insurance companies' and regulators' methods of assessing financial solvency and actuarial soundness, what progress has been made in achieving actuarial soundness for the NFIP?**

The NFIP aims to become actuarially sound for the historic average loss year to the extent possible, while also achieving its other statutorily-mandated floodplain management goals. In order to do so, the NFIP makes compromises where necessary. The 1968 Act that established that the NFIP require newer or renovated “post-FIRM” buildings be assessed full actuarially-based rates that reflect their complete flood risk. For reasons of equity and maximized market penetration, however, Congress mandated discounted policy rates for pre-FIRM policyholders in special flood hazard areas.

Initially, individual participation in the NFIP was voluntary, and hefty discounts were required to enroll and retain participants in existing pre-FIRM properties that were built below current standards. Even then, market penetration rates remained low until the Flood Disaster Protection Act of 1973 establishing a Mandatory Flood Insurance Purchase Requirement for properties financed by federally-backed mortgages or having received federal disaster assistance in Special Flood Hazard Areas. The 1973 Act also provided incentives for more flood-prone communities to join the NFIP. Discounted rates were intended to encourage NFIP participation among communities with many existing properties in floodplains in order to focus on achieving the Program’s goals of reducing future risk, costs, and consequences of flooding.

Legislators expected the subsidies to be eliminated gradually, perhaps over 30 to 40 years, as these pre-FIRM properties in now regulated floodplains, known as Special Flood Hazard Areas (SFHAs), were replaced or improved to meet post-FIRM standards. Although the percentage of such policies has declined substantially in the past 20 years from approximately 83 percent of policies in 1985 to approximately 26 percent in 2004 (FEMA 2003), the number of such policies remains large enough to prevent the Program from being actuarially sound. As of 2005, the beneficiaries of these subsidies received coverage at about 35 to 40 percent of the cost of the actuarial rate, preventing the NFIP from collecting total premiums sufficient to meet future estimated losses. Sources at the NFIP estimate it will take at least another 20 years for the program to approach long-term self-sufficiency, as this will only occur by either the phase-out of subsidies, cross subsidies (e.g., surcharge actuarial rated policies) or the replacement of subsidized properties with construction that meets current standards.

Given a predicted higher cycle of flooding activity in upcoming years, the subsidized premiums, which statutorily cannot be raised more than 10 percent per year, would not have been expected to compensate for the historical average loss year. However, given the now historical disastrous flood losses from the 2005 hurricane season, use of the historical average loss year might actually result in premiums for pre-FIRM buildings that are higher than expected future losses. This would change the rates for this class of policies to “subsidizing” rather than “subsidized” policies (that is, over-priced, rather than discounted rates) and would be expected to increase the program’s actuarial soundness but decrease market penetration rates and increase uncompensated losses among the people most likely to suffer those losses.

The NFIP has taken action to improve its actuarial soundness in the past, such as:

- Reducing the average subsidy;
- Increasing the number of deductible amounts and options available to policyholders;

- Adding Increased Cost of Compliance Coverage (ICC)<sup>2</sup>;
- Simplifying the insurance rating structure; and
- Clarifying NFIP policies.

To further improve its actuarial soundness, the NFIP's current strategy includes:

- Implementing a \$1 billion Map Modernization Program;
- Requesting that Congress authorize pre-disaster assistance, to reduce risks before flood disasters strike;
- Maintaining programs to mitigate properties suffering repetitive losses and petitioning for a change in the law regarding repetitive loss properties;
- Carrying out marketing campaigns such as FloodSmart to increase market penetration and counter the inaccurate perception that federal disaster assistance or homeowners' insurance will pay for flood losses, making flood insurance unnecessary and to maximize the number of both new and renewing flood insurance policyholders;
- Increasing rates for V Zone properties exposed to the rising risk of erosion; and
- Emphasizing the Community Rating System, which recognizes and encourages floodplain management practices at the local community level that go beyond NFIP minimum standards.

The NFIP's current strategy also includes reviewing past successes and monitoring issues such as policyholder retention, floodplain management and mitigation activity. For example, in May 2002, FEMA conducted a study that compared the level of flood insurance coverage in Virginia prior to September 1999's Hurricane Floyd with that in May 2002. The study found that the Hurricane Floyd experience convinced some Virginians, at least for a time, that flood insurance is not a luxury, but a necessity.

According to insurance companies' and regulators' methods of assessing financial solvency and actuarial soundness, the NFIP has made progress towards actuarial soundness despite the constraints imposed by its other objectives. For instance, the NFIP has mitigated severe repetitive loss properties, updated floodplain maps, and increased participation in the Community Rating System (CRS)<sup>3</sup>. NFIP rate calculations for post-FIRM properties are based on the pure premium method, a standard actuarial approach to developing rates. The NFIP's continuously updated "hydrologic" model incorporates the unique nature of the risks covered, as well as the Congressional limitations imposed on it.

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<sup>2</sup> The 1994 National Flood Insurance Reform Act (NFIRA) indemnifies policyholders who are required to bring their flood-damaged structures into compliance with local floodplain ordinances. Although the compensation program is actuarially sound, annual premiums are limited to \$75.00. In 1996, to comply with this decree, FEMA introduced Increased Cost of Compliance (ICC) coverage, which covers expenses up to \$15,000. This amount was raised to \$20,000 in 2000, and then to \$30,000 in 2003, based on analyses of the expected claim frequency. The Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 eases ICC restrictions by allowing policyholders, including those whose structures have not recently experienced flood losses, to apply ICC coverage to the non-federal cost-share requirement of FEMA-funded mitigation projects for individual structures.

<sup>3</sup> Increasing self-initiated and voluntary mitigation efforts that exceed standard NFIP participation requirements, particularly CRS activities that directly reduce flood damage, will help the NFIP achieve actuarial soundness. Measures that mitigate the severity of flooding events reduce the volatility of flood-related losses in CRS communities.

However, the lack of certain data necessary for a full understanding of the insurance risks involved hinders the NFIP's ability to move toward actuarial soundness in the foreseeable future. For instance, the NFIP's current residential application for flood insurance does not provide insurance agents with the ability to indicate if administrative grandfathering is the basis for a customer's rate. Therefore, the NFIP has no easy way to identify and track the shortfall from the increasing number of properties grandfathered into subsidized rates<sup>4</sup>. The NFIP needs to begin collecting this information on flood insurance applications. Further, the NFIP should maintain information for existing policies on the date of the most recent FIRM for the community and the date for the FIRM from which the individual property's rate is set in order to help track ongoing grandfathering. In addition, the NFIP needs to monitor the effects of erosion on properties. While doing so over the next 50 years would require a sizable investment of funds and effort, it is the only way the NFIP can account for erosion-related losses. The trade-off here is between the ability to achieve actuarial soundness through additional expensive data collection and larger administrative/mapping costs that would have to be paid for through higher premiums or separate funding.

There are further difficulties in achieving absolute actuarial soundness because floods, like other natural disasters, are unpredictable to model. In theory, major uncertainties about long-term global weather patterns and erosion should be modeled, although introducing such factors make rates more difficult to understand and justify. There also is a possibility that the statistical models used to model flooding probability may be severely understating actual risks. For instance, flooding damage such as that caused by 2005's Hurricane Katrina was determined to have a 1-in-1000 probability of taking place, but occurred during the NFIP's first 40 years of existence. Actuarially pricing such volatile, large-scale risks is a challenge that the private insurance industry has found increasingly unprofitable, as evidenced by private insurers withdrawing from wind damage coverage in Florida and increasingly declining to continue homeowners' coverage along the coasts.

**Q2 b): How do other NFIP objectives, such as social welfare and floodplain management, affect the goal of actuarial soundness?**

and

**Q4: What are the major competing objectives to the NFIP's actuarial soundness, and what is the NFIP doing to overcome these impediments?**

Several NFIP objectives conflict with actuarial soundness. The NFIP originally used subsidized flood insurance as a "carrot" to encourage communities to join the Program and foster sound floodplain management, including the adoption and enforcement of stricter ordinances and building standards for future construction. Congress recognized that providing insurance to some pre-existing buildings, constructed before a community's entry to the Program and sometimes not to current building standards, would be prohibitively expensive unless subsidized premiums were offered. Most of these flood-prone buildings were built by individuals who lacked a sufficient knowledge of flood hazards to make informed decisions.

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<sup>4</sup> The increased number of grandfathered properties will not affect the NFIP's overall premium shortfall as much as the declining number of pre-FIRM properties.

A strict approach to actuarial soundness would dramatically increase insurance premium rates among properties built below current standards and result in decreased market penetration due to the perceived low level of flood-risk by and voluntary participation of those not subject to the NFIP's mandatory purchase requirement. Property owners who dropped their flood insurance policies or newer owners who did not maintain coverage would create an increase in uncompensated losses, or flood losses that they would never recover<sup>5</sup>, increasing pressure for other forms of federal relief.<sup>6</sup>

Further, the NFIP reduces the demand for and expectation of federal flood disaster assistance to the extent that many of the pre-existing pre-FIRM structures (many of which do not carry federally-backed mortgages and thus are not required to hold flood insurance) are insured through the encouragement of offering heavily discounted rates. Although such subsidies are a major obstacle to actuarial soundness, the consequent increased market penetration rate has actually modestly *decreased* total federal costs and shifted some of the burden of flood losses from taxpayers to policyholders—one of the primary stated goals of the NFIP<sup>7</sup>.

During the creation of the Program, actuarial soundness was considered in conflict with another primary goal of the NFIP – reducing the costs of flooding when flooding does occur. As discussed earlier, discounted rates for some pre-FIRM structures were seen as necessary to encourage NFIP participation among communities with many such properties so that they would enact tougher ordinances and higher building standards that reduce future risk and costs of flooding. These tougher standards resulting from NFIP's floodplain management and mitigation programs are perhaps the most important legacy of the program and have saved the public over \$1 billion annually of flood damage (Sarmiento and Miller, 2006).

However, the Program has always charged actuarially sound premiums to all new construction in the SFHA. In this way it supports sound floodplain management in that the premium for any building built below BFE will be charged substantially higher premiums.

There is no data available to assess the extent to which communities might withdraw from the NFIP if subsidized premiums were discontinued. If communities leave, this would undercut the NFIP's goal of reducing costs of flooding. Most communities with many properties in the floodplains already participate in the NFIP, have adopted higher standards and stronger ordinances, and probably are unlikely to change their existing ordinances back to pre-NFIP standards for newly constructed buildings. A more likely scenario would be that some communities with newly mapped floodplains after Map Modification might be less inclined to

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<sup>5</sup> Given current estimates of a 50 percent market penetration rate, HAZUS modeling estimates from another report for the Evaluation of the NFIP indicates that the NFIP has reduced uncompensated losses by \$771 million. (Sarmiento and Miller 2006).

<sup>6</sup> At present, according to FEMA, every \$3 in flood insurance claim payments saves about \$1 in disaster assistance payments.

<sup>7</sup> Results from Sarmiento and Miller (2006) indicate that the NFIP has reduced the expected costs of flood-related government assistance to policyholders by an estimated \$526 million, a 70 percent reduction. Although reduced market penetration would decrease NFIP subsidies, total federal losses would likely increase. Sarmiento's and Miller's estimates predict that a 10 percent lower market penetration rate would increase net overall federal losses by \$43 million, after accounting for losses from NFIP subsidies, Small Business Administration loans, Federal Individual Assistance, and tax breaks.

join the Program if all rates are made actuarially based. This indicates some continuation of the conflict between the goal of reducing costs of flooding and actuarial soundness, although at a lesser level than the Program faced initially.

Some level of compromise with the objective of actuarial soundness appears necessary to the extent that the priority remains for the NFIP to achieve its primary objectives including decreasing flood risks and reducing the adverse costs and consequences of flooding through proper floodplain management<sup>8</sup>. Although the NFIP has been undertaking several initiatives, discussed under Q2a and Q3, to overcome these impediments toward the NFIP's other goals, to some extent, they cannot be overcome given the program's statutory requirements. Therefore, although achieving actuarial soundness should be a long-term goal for the NFIP, pursuing it as a short-term goal would clearly increase uncompensated losses, or flood losses that individuals never recover<sup>9</sup>, as well as pressure for other sources of federal relief. This decreases the ability of the NFIP to achieve two of its four primary goals outlined in the authorizing and subsequent legislation.

As long as the NFIP continues to attract and retain policyholders, encourage sound floodplain management, and mitigate repetitive loss properties, its net savings to its policyholders and U.S. taxpayers will transcend the benefit derived from strict actuarial soundness. For these reasons, this report recommends that the NFIP, in order to meet its primary goals, continue to use its current definition of actuarial soundness.

## **Recommendations**

To improve the NFIP's ability to assess progress toward and achieve actuarial soundness, FEMA needs to enable the NFIP to track the number of subsidized policies issued for administratively grandfathered properties, both for new and existing policies. The number of such policies is expected to grow as the map modernization program continues.

In light of the catastrophic losses of 2005 FEMA will need to review its use of historical average loss year as the mechanism to determine the level of its subsidized premium rates. Including the 2005 year at its full weight would result in the historical average loss year being larger than the expected long term average losses on an actuarial basis. Clearly, given the magnitude of the 2005 losses, FEMA would need to either appropriately modify the calculation or develop a different standard. Regarding the issue of subsidized rates, we recognize that, as mandated by Congress, a significant portion of the policies have always been issued with subsidies. Therefore, the NFIP has not been able to build the reserves needed to cover potential future catastrophes. Moreover, until such time as Congress directs that all policies be priced with actuarial rates, such reserves are not likely to accumulate in the National Flood Insurance Fund.

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<sup>8</sup> Section 6 discusses the NFIP's actuarial soundness goals; section 8 reviews NFIP objectives that obstruct actuarial soundness.

<sup>9</sup> Given current estimates of a 50 percent market penetration rate, modeling results indicate that the Program has reduced compensated flood losses for SFHA policyholders by \$1.5 billion, or 67 percent, and uncompensated losses by \$771 million. (Sarmiento and Miller 2006).

Regarding the actuarial premium rates, it is unclear to what extent FEMA's hydrologic model takes into account long-term global weather patterns and coastal erosion. FEMA should review the studies and literature about those factors and revise its model as appropriate.

The following recommendations are discussed in further detail in Section 7 through Section 9. The NFIP should:

- Keep using comprehensive marketing and advertising campaigns such as FloodSmart to educate consumers about the importance of buying flood insurance.
- Continue to mitigate the highest-cost repetitive loss properties.
- Proceed with its Map Modernization Program and monitor the subsequent increase in administratively grandfathered properties through changes in data collection.
- Ascertain how best to determine the erosion risk it faces over the next 50 years, for future analysis.
- Research the feasibility of phasing out subsidies for pre-FIRM properties. The research should review mandatory purchase requirements, study lender compliance, and examine changes to the NFIP's current coverage limits and options.
- Research whether some best practices modeling techniques from other property and casualty lines could be applied to the flood line, including, rate-making methods, probabilistic models, granularity, impact of geographic concentration and the impact of storm surge.
- Research whether NFIP coverages and coverage limits should be expanded, including would there be feasibility and a market from NFIP customers for additional living expenses and business interruption coverages, and increased and/or indexed coverage limits.

# **1. INTRODUCTION AND PROJECT SCOPE**

## **1.1. Background on the Evaluation of the National Flood Insurance Program**

Floods are the most costly and common natural disaster in the United States. They strike in all states and can happen at any time, as too many unfortunate victims have learned. Floods in the United States caused an average of about \$6 billion in damages per year between 1955 and 1999 (University of Colorado 2001). Floods kill about 100 people each year, and all states, save three, experienced flood-related deaths between 1989 and 1999.

Private insurers have historically been unable to provide flood insurance at affordable rates in the marketplace, and until the establishment of the National Flood Insurance Program (NFIP) in 1968, the primary recourse for flood victims was governmental disaster assistance.<sup>10</sup> Congress adopted the program in response to the ongoing unavailability of private insurance and continued increases in Federal disaster assistance to reduce the risk, loss, and expense associated with flooding. The program was created with the passage of the National Flood Insurance Act of 1968 and revised in 1973, 1977, 1994, and 2004. As of May 2006, over 20,000 communities participate in the program, with over 5 million policies in force representing in excess of \$900 billion of insurance in force. 69 percent of the current policies in force are for single family homes, 20 percent are for condominiums, and 11 percent are for other occupancy types such as 2 to 4 family units and non-residential exposures (The program's requirements are discussed in greater detail in Section 4.)

The Federal Emergency Management Agency (FEMA), which administers the NFIP and is part of the U.S. Department of Homeland Security, decided to conduct a major evaluation of the program's performance and goals.<sup>11</sup> In 2000, the Department of Homeland Security's Federal Emergency Management Agency (FEMA) contracted with the American Institutes for Research (AIR) to perform a comprehensive evaluation of the National Flood Insurance Program (NFIP). The evaluation is this first comprehensive review since the program's inception. The purpose of the overall evaluation is to develop data and information needed to formulate better policies for floodplain management, risk assessment, and insurance, and to support long-term planning and policymaking for the NFIP.

## **1.2 Objective of the Study**

Deloitte Consulting LLP (Deloitte Consulting) was subcontracted by the American Institutes for Research (AIR) to investigate the role of actuarial soundness in the National Flood Insurance Program (NFIP). Deloitte Consulting also reviewed the NFIP's current progress in

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<sup>10</sup>The catastrophic nature of flooding and private insurers' inability "to develop an actuarial rate structure that could adequately reflect the risk to which flood-prone properties were exposed" are given as the main reasons that the private sector could not provide insurance at a price that a substantial number of people were willing to pay (FEMA, 2002, p.1).

<sup>11</sup>FEMA assumed responsibility for the NFIP when the agency was established in 1979 (Browne and Hoyt, 2000, p. 298). The U.S. Department of Housing and Urban Development administered the NFIP prior to 1979.

moving towards actuarial soundness, possible impediments to achieving actuarial soundness, and whether actuarial soundness should be one of the NFIP's goals.

The evaluation study addresses the following questions related to the actuarial soundness of the NFIP, including both actuarially sound rates and subsidized (e.g., pre-Flood Insurance Rate Map (FIRM), grandfathered) properties:

1. What is actuarial soundness? Is actuarial soundness the appropriate standard for the NFIP? What indicators or measures do insurance companies and regulators of the insurance industry use to assess financial solvency and actuarial soundness?
2. What are the NFIP's goals with respect to achieving actuarial soundness? How do the social, floodplain management, or other objectives of the NFIP affect these goals?
3. What progress has there been in achieving the NFIP's goal of actuarial soundness? Using the measures identified above, is the NFIP approaching actuarial soundness? If not, why not?
4. What are the major competing objectives to the NFIP's actuarial soundness, and what is the NFIP doing to overcome these impediments?

The result of this assessment is a report that:

- a. Defines actuarial soundness and contrasts it with the NFIP's financial goals;
- b. Documents industry benchmarks for measuring actuarial soundness;
- c. Summarizes the historical context and discussion about the NFIP's actuarial soundness and the explicit assumptions associated with decisions to provide subsidized rates;
- d. Discusses whether the NFIP's current strategy makes sense in light of the NFIP's financial and policy goals;
- e. Considers the consequences of maintaining current subsidies as well as reducing or eliminating them, including repetitive loss properties, grandfathering, and the attrition of pre-FIRM properties;
- f. Discusses whether actuarial soundness is a reasonable and appropriate goal for the NFIP; and
- g. Discusses any possible constraints on the NFIP's current strategy for reaching and/or improving its actuarial soundness.

These recommendations will assist the Federal Emergency Management Agency (FEMA) in evaluating its strategy towards achieving actuarial soundness in light of the publicity regarding the subsidization of some policies, especially the highest-cost repetitive-loss properties.

## 2. RELIANCE AND LIMITATIONS

The conclusions in this report are based on information provided to us by representatives of AIR and the NFIP, documents from the NFIP website ([www.fema.gov/nfip](http://www.fema.gov/nfip)) and other publicly available information. Loss and exposure information is based on statistical summary reports and files provided by representatives of the NFIP or information from the NFIP website. A specific audit to verify the accuracy or completeness of this data is beyond the scope of this project, and we have relied without audit or verification on the data supplied. It is our explicit assumption that the data used are both accurate and complete.

This analysis relies on industry sources and our insurance knowledge to compare the NFIP's current approach to the ratemaking process (i.e., focus on historical average loss year, subsidization of certain policies, etc.) to best practices observed in the property and casualty insurance industry. Industry data also was relied on to calculate essential financial indicators (e.g., leverage ratios, solvency ratios, financial ratios, etc.) used by insurance companies and regulators to monitor and assess financial soundness.

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### 3. NFIP BACKGROUND

#### 3.1 NFIP Overview

The National Flood Insurance Act of 1968 (Title XII of the Housing and Urban Development Act of 1968 [PL 90-448]) created the National Flood Insurance Program (NFIP) and the Federal Insurance Administration (FIA) within the Department of Housing and Urban Development to provide flood insurance in communities that voluntarily adopted and enforced floodplain management ordinances by June 30, 1970, that met minimum NFIP requirements. The Federal Emergency Management Agency (FEMA) within the Department of Homeland Security (DHS) currently administers the NFIP.<sup>12</sup>

The purpose of the National Flood Insurance Act of 1968 was to

- Identify flood prone areas
- Require state and local communities to participate in the flood insurance program and to adopt adequate flood prone ordinances as a condition for the future financial assistance
- Encourage the purchase of flood insurance by property owners whose properties are located in areas having special flood hazards

The NFIP was created in recognition of the work performed by the Task Force on Federal Flood Control Policy chaired by Gilbert White. When the feasibility of providing flood insurance was first proposed, it became clear that private insurance companies could not profitably provide such coverage at an affordable price, primarily because of the catastrophic nature of flooding and the inability to develop an actuarial rate structure which could adequately reflect the risk to which flood-prone properties are exposed.

The Flood Insurance Act of 1968 was amended in 1973 with the Flood Disaster Protection Act of 1973, which created a number of essential provisions:<sup>13</sup>

- The Act requires the purchase of flood insurance for mortgages from Federally regulated lenders in special flood hazard areas (SFHA) in participating communities as a condition of receipt of Federal and Federally related financing for acquisition and construction purposed in identified SFHA.
- The Act requires Federal regulatory agencies to direct lenders, regulated by them, or whose deposits are insured by them to require flood insurance for any improved real property located in a SFHA when such property serves as security for any loan in a participating community.

<sup>12</sup> The Homeland Security Act of 2002 transferred FEMA's Federal Insurance and Mitigation Administration responsibility for managing the flood insurance program to the DHS. FEMA's responsibilities, including the flood insurance program, were placed in their entirety into DHS, effective March 1, 2003. Responsibility for the flood insurance program now resides in DHS's Emergency Preparedness and Response Directorate.

<sup>13</sup> Key provisions from Mr. Frank Reilly's November 17, 1997 memo to FEMA staff regarding the paper titled *The Evaluation of Erosion Hazards Study and Overview* and March 25, 2004 GAO report. We note that a number of the mandatory purchase provisions were amended in 1994.

- The Act requires that no Federal and Federally related financing for acquisition and construction purposes could be made available in a SFHA of a community not participating in the NFIP within one year after formal identification.
- The Act also prohibits further flood disaster assistance for any property where flood insurance was not maintained even though it was mandated as a condition for receiving prior disaster assistance.

Participation in the NFIP is based on an agreement between local communities and the Federal government. For communities that agree to implement and enforce measures to reduce future flood risks to new construction in SFHA, the Federal government makes flood insurance available within the community as financial protection against future flood losses. The building standards that the communities adopt enable the NFIP to actuarially rate Post-FIRM structures and reduce the risk for future construction. In addition, communities who join the NFIP's Community Rating System (CRS) can receive discounts ranging from five percent to 45 percent as a reward for community floodplain mitigation activity that is in excess of the measures required by the standard NFIP participation agreement.<sup>14</sup>

Flood insurance and floodplain management measures are strongly linked since flood insurance rates for building built after the issuance of the initial FIRM (Post-FIRM) for a community are based on the building's risk of flooding. Most rates are determined based on the elevation of the lowest floor of the building in relation to the Base Flood Elevation (BFE). Generally, buildings that comply with the community's floodplain management regulation and NFIP minimum requirements are charged the lowest rates, and those that do not comply may be charged much higher rates. Enforcement of floodplain management regulations by communities is critical to the NFIP to achieve its objectives of protecting lives and property and providing flood insurance in participating communities at actuarial rates.

The standard residential flood policy covers items such as:<sup>15</sup>

- Structural damage
- Furnace, water heater and air conditioner
- Clean-up of flood debris
- Floor surfaces such as carpeting and tile

In addition to the above coverage, NFIP policyholders can also buy a flood insurance policy to cover the contents of their home (e.g., furniture, clothing, jewelry, etc.). Greater detail about the NFIP coverage and many other special features are available in the current edition of the NFIP Flood Insurance Manual (2004).

<sup>14</sup> The CRS discounts range from 5 percent to 45 percent for Special Flood Hazard Areas (SFHA) and 5 percent for non-SFHAs. The CRS discount is also not applicable to Preferred Risk Policies because they already receive a lower premium than other policies. Other limitations may apply for certain zones in the SFHAs.

<sup>15</sup> From FloodSmart.Gov web site ([www.floodsmart.gov](http://www.floodsmart.gov)), "Insurance Center, Flood Insurance: What & Why"

Since the program's inception, existing buildings were provided a subsidy as an incentive for individuals to acquire insurance and as a measure of fairness when the program first was adopted (e.g., the NFIP offers pre-FIRM subsidies by reducing rates that are available for the first \$35,000 of coverage for a single-family to four-family dwelling and for the first \$100,000 of coverage for larger residential, nonresidential, or small-business buildings). To make the program more self-supporting, FEMA started to reduce subsidies in the 1980s, but they still remain (Kriesel and Landry, 2004, p. 417).

Additional information on the NFIP may be obtained in Title 44, Code of Federal Regulations (CFR) ([http://www.access.gpo.gov/nara/cfr/waisidx\\_02/44cfrv1\\_02.html](http://www.access.gpo.gov/nara/cfr/waisidx_02/44cfrv1_02.html)).

### **3.2 NFIP Historical Financial Results**

Between the program's inception in 1968 and 2004, the NFIP paid approximately \$15 billion in insurance claims to owners of flood-damaged properties. Based on NFIP estimates, claims due to Hurricane Katrina, Rita and Wilma could exceed \$23 billion, or about one-and-a-half times the \$15 billion the NFIP paid out in claims since the program's creation in 1968. These payments have been funded primarily by policyholders' premiums that otherwise would have been paid through taxpayer-funded disaster relief or borne by home and small business owners themselves (GAO 2004a). The information illustrates the magnitude and volatility loss payments by fiscal year.

Table 1 displays the NFIP's historical coverage information for fiscal years ending September 30, 1978 through 2004. Column 8 displays the fiscal year breakout of the NFIP's insurance claims through September 30, 2004. The table also illustrates the dramatic increase in policies in-force, premium in-force and coverage in-force since the program began.<sup>16</sup> In addition, the table also displays the volatility of the average loss payments and percentage of paid losses to premium in-force that would impact insurance company's willingness to write this line of business.

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<sup>16</sup> Policies in force: policies written and recorded on the books of the carrier which are unexpired as of a given date. Premium-in-force: premium dollars which have been written and are unexpired on the books of the insurance carrier. Coverage-in-force: insurance coverage which has been written and is unexpired on the books of the insurance carrier.

**TABLE 1: NFIP Coverage by Fiscal Year Ending September 30**

Fiscal Year-End	Policies In-force	Premium In-force (PIF)	Premium Per Policy	Coverage In-force	Coverage Per Policy	Paid Claims	Paid Losses	Avg. Paid Loss	Paid Losses To PIF	Average Paid Loss Per Policy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1978	1,130,100	87,031,252	77	38,826,340,000	34,357	29,890	144,042,315	4,819	166%	127
1979	1,788,126	136,869,083	77	70,114,213,000	39,211	71,652	493,008,836	6,881	360%	276
1980	2,058,601	155,271,780	75	93,962,605,000	45,644	39,354	219,449,804	5,576	141%	107
1981	1,952,098	231,675,571	119	102,034,298,000	52,269	24,399	127,170,169	5,212	55%	65
1982	1,840,514	313,118,975	170	103,436,159,000	56,200	26,806	148,618,700	5,544	47%	81
1983	1,961,547	387,913,852	198	115,601,117,000	58,934	57,432	484,549,022	8,437	125%	247
1984	1,912,426	412,106,533	215	121,444,094,000	63,503	27,542	242,600,803	8,808	59%	127
1985	1,949,827	432,032,431	222	133,887,985,000	68,667	26,742	206,230,003	7,712	48%	106
1986	2,077,717	490,867,108	236	150,942,534,000	72,648	24,471	280,737,349	11,472	57%	135
1987	2,089,667	551,794,235	264	161,453,248,000	77,263	16,141	130,395,375	8,079	24%	62
1988	2,120,097	568,630,635	268	171,867,209,000	81,066	8,666	61,227,903	7,065	11%	29
1989	2,245,430	620,458,816	276	256,291,966,000	114,139	31,626	608,856,645	19,252	98%	271
1990	2,415,883	655,460,565	271	210,005,287,000	86,927	16,707	186,325,676	11,153	28%	77
1991	2,501,638	707,955,730	283	219,587,003,000	87,777	19,574	217,262,529	11,100	31%	87
1992	2,577,728	777,031,608	301	231,386,220,000	89,764	30,850	527,342,903	17,094	68%	205
1993	2,757,472	857,257,174	311	258,457,750,000	93,730	61,049	1,004,520,991	16,454	117%	364
1994	2,871,451	948,831,361	330	281,179,730,000	97,923	13,024	170,870,229	13,120	18%	60
1995	3,369,447	1,090,531,519	324	332,165,045,000	98,581	59,022	1,104,388,088	18,711	101%	328
1996	3,586,768	1,215,102,981	339	385,300,750,000	107,423	52,844	1,091,014,440	20,646	90%	304
1997	3,889,598	1,399,297,049	360	428,762,579,000	110,233	41,766	683,804,615	16,372	49%	176
1998	4,182,868	1,615,105,025	386	491,028,843,000	117,390	53,094	690,969,079	13,014	43%	165
1999	4,253,567	1,681,636,532	395	519,429,732,000	122,116	38,337	829,503,159	21,637	49%	195
2000	4,377,150	1,727,177,333	395	562,202,936,000	128,440	21,227	221,767,121	10,447	13%	51
2001	4,455,446	1,739,193,579	390	603,099,237,000	135,362	51,655	1,417,864,498	27,449	82%	318
2002	4,495,105	1,776,867,832	395	643,587,759,000	143,175	19,283	301,662,103	15,644	17%	67
2003	4,541,125	1,868,787,757	412	681,047,822,000	149,973	39,862	838,424,003	21,033	45%	185
2004	4,618,075	1,999,509,737	433	743,605,918,000	161,021	30,667	889,954,194	29,020	45%	193
<b>Total</b>	<b>78,019,471</b>	<b>24,447,516,053</b>	<b>313</b>	<b>8,110,708,379,000</b>	<b>103,957</b>	<b>933,682</b>	<b>13,322,560,552</b>	<b>14,269</b>	<b>54%</b>	<b>171</b>

(1) Fiscal Year Ending September 30

(4) = (3) / (2)

(7) Total number of losses that have been paid

10) = (8) / (3)

(2) Policies In-Force on the Fiscal Year Ending "as of" date

(5) The coverage amount for policies in force

(8) Total number of paid losses

(11) = (8) / (2)

(3) The premium paid for policies in force

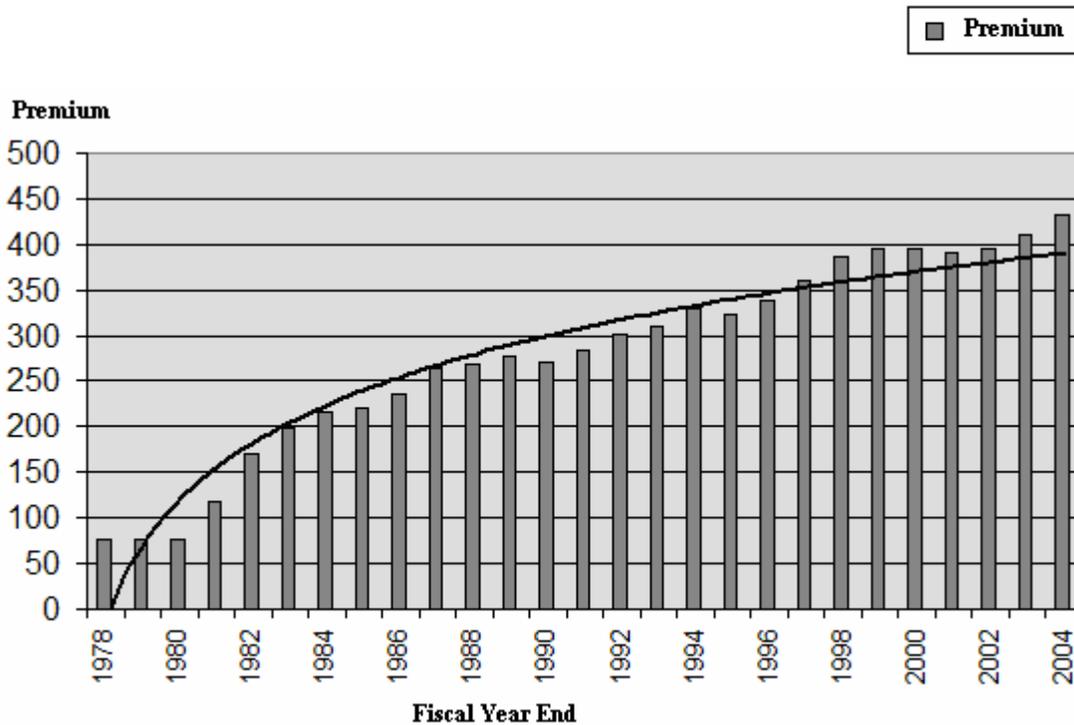
(6) = (5) / (2)

(9) = (8) / (7)

SOURCE: NFIP web site <http://www.fema.gov/business/nfip>. Please refer to the Flood Insurance Statistics section.

Figure 1 displays the trend in the NFIP's average premium in-force per policy (APIF) which is reflective of rising rates and increased exposure.

**FIGURE 1: NFIP's Average Premium in Force per Policy**

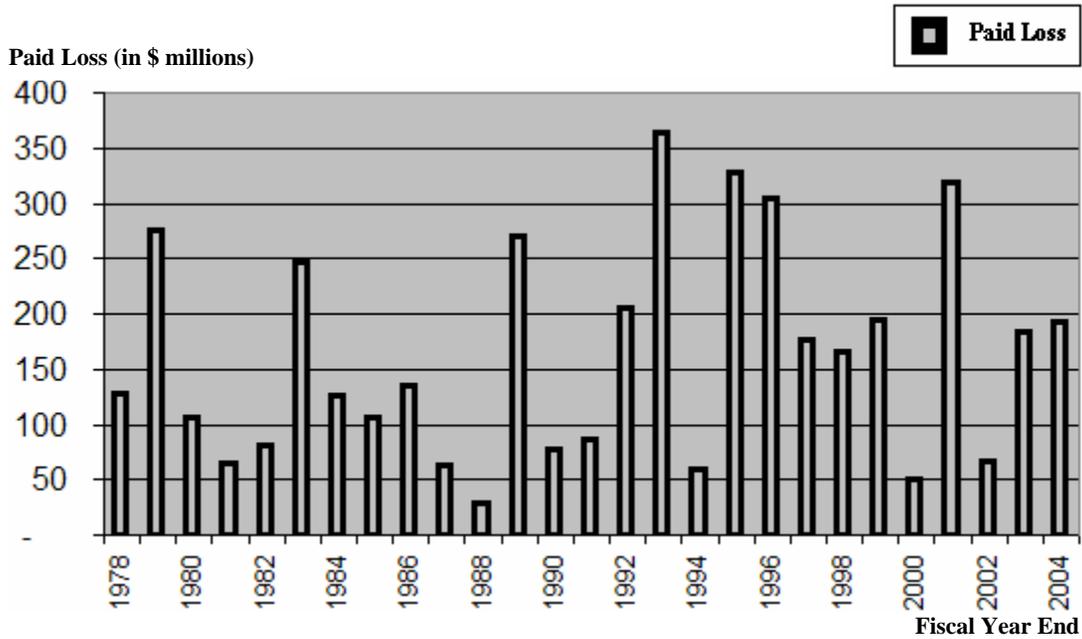


SOURCE: NFIP website <http://www.fema.gov/business/nfip/statistics/pcstat.shtm>

The Average Premium in Force has increased by an average annual rate of 6.9 percent since 1978. For the most recent 10 years, the APIF increased by an average annual rate of 2.7 percent. Since 1978, the program has seen only four years where the APIF increased in excess of 10 percent: 1981, 1982, 1983 and 1987. The APIF increased 5.2 percent in 2004. A decision to reduce or eliminate subsidies would have a direct impact on the APIF.

Figure 2 displays the untrended average paid loss per policy. Since 1978, the average paid loss per policy exceeded \$300 in four years: 1993, 1995, 1996 and 2001. For 2005, we would expect Hurricane Rita and Katrina to drive the average paid loss per policy closer to the \$4,000 level given the catastrophic damage to many policyholders.

FIGURE 2: Paid Loss per Policy



SOURCE: NFIP web site <http://www.fema.gov/business/nfip/statistics/pestat.shtm>

Table 2 displays the 25 largest NFIP events.<sup>17</sup> Table 2 helps to explain the large paid losses in fiscal years 2005, 2001, 1996, 1995 and 1993, which drive the historical volatility of the program.

<sup>17</sup> A significant event is one with 1,500 or more paid losses, or occasionally one added for other reasons as determined by the NFIP. Events have been named according to the most popular name at the time the events occurred, or if there is no apparent name, one has been created for the NFIP report. As noted by the NFIP, event naming is subjective; an event may begin as a hurricane, change to a tropical storm or be a heavy rain in some states. The NFIP attempts to use a single name and include counties in federally declared disaster areas.

**TABLE 2: Significant Flood Events  
Top 25 Events, 1978 – August 31, 2005**

Rank	Event	Year	Number of Paid Losses	Paid Losses (\$000)s
1	HURRICANE KATRINA	Aug-05	162,065	15,364,276
2	HURRICANE IVAN	Sep-04	28,310	1,493,214
3	TROPICAL STORM ALLISON – 2001	Jun-01	30,300	1,096,226
4	LOUISIANA FLOOD	May-95	31,264	584,140
5	HURRICANE ISABEL	Sep-03	19,646	469,199
6	HURRICANE FLOYD	Sep-99	18,612	439,100
7	HURRICANE RITA	Sep-05	8,817	404,654
8	OPAL	Oct-95	9,913	399,674
9	HUGO	Sep-89	12,795	375,738
10	NOR'EASTER – 1992	Dec-92	24,677	341,867
11	HURRICANE WILMA	Oct-05	8,943	324,682
12	MIDWEST FLOOD	Jun-93	10,257	271,326
13	TEXAS FLOOD OCTOBER 1994	Oct-94	6,152	216,633
14	FRAN	Sep-96	9,883	213,646
15	MARCH STORM	Mar-93	9,631	210,834
16	HURRICANE FRANCES	Sep-06	6,582	192,080
17	NORTHEAST FLOOD – JAN 1996	Jan-96	11,681	175,059
18	ANDREW	Aug-92	5,425	168,048
19	UPPER MIDWEST FLOOD	Apr-97	7,272	158,402
20	FLORIDA FLOOD OCTOBER 2000	Oct-00	9,232	157,663
21	HURRICANE GEORGES	Sep-98	8,832	149,385
22	TROPICAL STORM CLAUDETTE	Jul-79	9,623	146,772
23	HALLOWEEN	Oct-91	9,356	141,373
24	TEXAS FLOOD OCTOBER 1998	Oct-98	2,839	136,162
25	HURRICANE JEANNE	Sep-04	5,534	125,323
<b>TOTAL</b>			467,641	23,755,475

SOURCE: NFIP web site <http://www.fema.gov/business/nfip/statistics/sign1000.shtm> .

Table 3 displays the NFIP's historical coverage information by state as of April 30, 2006. Properties in Florida, Louisiana and Texas account for approximately 60 percent of the NFIP's policies in-force and insurance in-force.<sup>18</sup>

<sup>18</sup> Available from the NFIP web site <http://www.fema.gov/business/nfip>. Please refer to the Flood Insurance Statistics section.

**TABLE 3: NFIP Policy Statistics by state as of 04/30/2006**

<b>State</b>	<b>% of In-force</b>	<b>Insurance In-force</b>	<b>Written Premium (WP) In-force</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>
Alaska	0.1	475,834,700	1,569,709
Alabama	0.9	7,416,328,200	21,707,166
Arkansas	0.3	1,559,654,000	7,437,516
American Samoa	0.0	435,200	10,200
Arizona	0.6	6,152,411,200	15,379,777
California	5.3	56,493,724,700	151,596,703
Colorado	0.3	3,128,131,200	10,360,165
Connecticut	0.6	6,200,666,400	24,745,223
District Columbia	0.0	145,714,400	287,250
Delaware	0.4	3,858,803,300	10,354,875
<b>Florida</b>	<b>40.9</b>	<b>379,516,851,100</b>	<b>754,692,196</b>
Georgia	1.6	15,791,705,600	40,156,082
Guam	0.0	36,103,000	238,589
Hawaii	1.1	7,657,064,800	18,863,349
Iowa	0.2	1,159,540,100	6,273,461
Idaho	0.1	1,183,397,700	2,980,585
Illinois	0.9	6,115,837,800	27,115,707
Indiana	0.6	3,260,362,300	16,427,680
Kansas	0.2	1,159,078,500	5,553,780
Kentucky	0.4	2,240,034,300	11,386,869
<b>Louisiana</b>	<b>8.1</b>	<b>67,023,108,500</b>	<b>194,037,602</b>
Massachusetts	0.9	8,336,578,400	35,467,738
Maryland	1.2	9,929,171,300	24,492,799
Maine	0.1	1,246,822,300	4,902,347
Michigan	0.5	3,551,545,100	15,625,283
Minnesota	0.2	1,369,567,500	5,031,247
Missouri	0.5	2,863,777,600	14,125,043
Mississippi	1.1	8,893,816,600	23,433,201
Montana	0.1	452,043,300	1,660,550
North Carolina	2.4	23,034,615,600	60,005,352
North Dakota	0.1	754,821,500	2,755,799
Nebraska	0.3	1,648,619,600	7,306,091
New Hampshire	0.1	1,046,679,300	4,196,188
New Jersey	4.1	38,228,946,500	128,729,697
New Mexico	0.3	1,681,215,300	6,626,180
Nevada	0.3	3,488,464,000	7,364,823
New York	2.2	21,123,603,300	79,469,411
Ohio	0.7	4,493,389,700	22,135,757
Oklahoma	0.3	1,659,017,100	7,068,669
Oregon	0.6	5,337,856,200	15,182,958
Pennsylvania	1.2	9,071,598,900	39,469,316
Puerto Rico	1.2	4,783,767,000	24,919,599
Rhode Island	0.3	2,459,335,200	11,010,528
South Carolina	3.4	34,280,163,500	77,974,345
South Dakota	0.1	396,154,400	1,787,118
Tennessee	0.4	2,893,451,800	10,259,233
Trust Terr Of Pac	0.0	73,000	174
<b>Texas</b>	<b>10.5</b>	<b>104,622,803,700</b>	<b>210,932,799</b>
Utah	0.1	749,041,900	1,765,421
Virginia	1.8	17,226,607,400	44,981,156
Virgin Islands	0.1	327,246,600	1,709,185
Vermont	0.1	448,919,000	2,218,351
Washington	0.6	5,582,247,900	17,529,395
Wisconsin	0.3	1,709,382,200	7,538,421
West Virginia	0.4	1,985,488,900	12,074,901
Wyoming	0.0	379,044,300	1,301,879

Unknown	1.0	1,326,604,700	30,366,463
<b>Total</b>	100.0	897,957,267,600	2,282,591,901
<b>IIF Per Policy:</b>	<b>160.663</b>	<b>WP Per Policy:</b>	<b>433</b>

SOURCE: NFIP web site [http://bsa.nfipstat.com/reports/1011\\_200604.htm](http://bsa.nfipstat.com/reports/1011_200604.htm)

Table 4 displays the NFIP’s historical loss statistics by state as of April 30, 2006. Florida, Louisiana, and Texas represent almost 49 percent of the NFIP’s claims and approximately 67 percent of the loss payments made from January 1, 1978 through April 30, 2006. Louisiana leads the nation in flood-related insurance payments, with more than \$14.9 billion for losses from 1978 to 2006. Florida, with \$3.3 billion in losses, Texas, with almost \$2.8 billion, and Mississippi, with \$2.7 billion, round out the top four states, according to National Flood Insurance Program data. Only one other state, Alabama, had close to \$1 billion in losses with \$883 million in flood insurance losses.

TABLE 4: NFIP Loss Statistics from 1/1/1978 through 04/30/2006

State	Total Losses	Total Payments	% of Total Payments
(1)	(2)	(3)	(4)
ALABAMA	35,307	882,508,389	2.8
ALASKA	351	3,327,684	0.0
AMERICAN SAMOA	2	0	0.0
ARIZONA	3,541	25,937,236	0.1
ARKANSAS	4,286	34,799,390	0.1
CALIFORNIA	42,814	458,732,490	1.5
COLORADO	1,917	7,807,364	0.0
CONNECTICUT	13,994	104,858,022	0.3
DELAWARE	3,378	47,704,704	0.2
DISTRICT COLUMBIA	79	925,907	0.0
UNKNOWN	4,402	20,008	0.0
FLORIDA	220,164	3,335,138,396	10.5
GEORGIA	11,876	165,316,275	0.5
GUAM	145	1,573,941	0.0
HAWAII	3,742	59,279,138	0.2
IDAHO	530	4,258,299	0.0
ILLINOIS	31,753	212,099,000	0.7
INDIANA	9,958	74,368,604	0.2
IOWA	6,563	61,814,716	0.2
KANSAS	5,386	56,443,204	0.2
KENTUCKY	16,911	192,458,392	0.6
LOUISIANA	370,108	14,926,034,832	47.2
MAINE	3,524	27,076,363	0.1
MARYLAND	13,506	225,972,190	0.7
MASSACHUSETTS	24,550	232,252,271	0.7
MICHIGAN	8,795	38,748,039	0.1
MINNESOTA	9,135	105,724,874	0.3
MISSISSIPPI	51,684	2,708,931,169	8.6
MISSOURI	35,827	421,365,485	1.3
MONTANA	1,318	5,316,479	0.0
NEBRASKA	3,333	20,835,190	0.1
NEVADA	1,385	34,844,176	0.1
NEW HAMPSHIRE	2,127	14,473,548	0.0
NEW JERSEY	73,713	661,042,052	2.1
NEW MEXICO	665	2,688,910	0.0
NEW YORK	73,748	433,108,768	1.4
NORTH CAROLINA	59,504	725,338,634	2.3
NORTH DAKOTA	9,307	133,095,976	0.4
OHIO	18,319	156,631,939	0.5
OKLAHOMA	8,497	99,903,822	0.3
OREGON	3,983	54,949,209	0.2
PENNSYLVANIA	49,236	602,273,922	1.9
PUERTO RICO	21,597	105,922,574	0.3
RHODE ISLAND	3,106	29,396,157	0.1
SOUTH CAROLINA	26,896	425,723,503	1.3
SOUTH DAKOTA	1,617	13,767,289	0.0
TENNESSEE	6,699	60,301,794	0.2
TEXAS	172,282	2,781,548,200	8.8
UNKNOWN	421	3,142,039	0.0
UTAH	757	4,929,477	0.0

VERMONT	1,004	6,675,564	0.0
VIRGIN ISLANDS	2,743	40,754,925	0.1
VIRGINIA	28,256	398,157,423	1.3
WASHINGTON	8,068	103,564,024	0.3
WEST VIRGINIA	22,846	251,990,422	0.8
WISCONSIN	4,620	29,059,487	0.1
WYOMING	349	1,354,908	0.0
<b>TOTAL</b>	<b>1,540,624</b>	<b>31,616,266,793</b>	<b>100.0</b>

SOURCE: NFIP web site [http://bsa.nfipstat.com/reports/1040\\_200604.htm](http://bsa.nfipstat.com/reports/1040_200604.htm).

To the extent possible, the NFIP is expected to pay operating expenses and flood insurance claims with premiums collected on flood insurance policies rather than with tax dollars. However, the program, by design, is not actuarially sound because Congress authorized subsidized insurance rates to be made available for policies covering structures that were built prior to the community's entry into the NFIP (or 1978, whichever was later). The rationale for these subsidized premiums were threefold: lower premiums for existing construction made it easier to convince communities to join the NFIP; it was anticipated that very high premiums would cause great resistance to insurance purchase; and in the public policy discussions leading to the authorization of the NFIP, it was determined to be undesirable to potentially force, through high flood insurance premiums, the abandonment of otherwise economically viable structures.<sup>19</sup> As a result, the program does not collect sufficient premium income to build reserves to meet the long-term future expected flood losses. Table 5 displays the NFIP's historical underwriting profit/(deficit) per policy.

<sup>19</sup> Draft copy of 2006 NFIP Actuarial Rate Review by Thomas L. Hayes, Dan R. Spafford and J. Parker Boone.

**TABLE 5: NFIP Underwriting experience by calendar/accident year valuation as of November 30, 2005**

Year	Earned Exposures (Millions)	Average Amount of Insurance Per Policy	Earned Premium* (\$ Millions)	Loss & Loss Adjustment Expense (LAE) Expenses ** (\$ Millions)	Average Premium	Average Operating Expense incl. Agents Comm.	Average Loss & LAE	Underwriting Profit/ (Deficit) per Policy
2003	4.42	\$147,617	\$1,700.50	\$683.70	\$384.39	\$141.30	\$154.56	\$88.53
2002	4.37	\$140,771	\$1,611.40	\$441.60	\$368.94	\$132.74	\$101.09	\$135.11
2001	4.29	\$132,928	\$1,511.50	\$1,299.30	\$352.62	\$133.49	\$307.23	-\$88.10
2000	4.25	\$126,322	\$1,416.40	\$260.90	\$333.33	\$124.34	\$61.41	\$147.58
1999	4.17	\$119,569	\$1,319.40	\$789.20	\$316.39	\$120.91	\$189.24	\$6.24
1998	4.09	\$115,639	\$1,224.80	\$921.10	\$299.74	\$110.46	\$225.41	-\$36.14
1997	3.8	\$108,397	\$1,041.30	\$540.80	\$274.31	\$99.49	\$142.47	\$32.35
1996	3.52	\$102,309	\$904.90	\$858.20	\$256.73	\$97.75	\$243.47	-\$84.50
1995	3.2	\$99,023	\$819.40	\$1,332.10	\$256.14	\$100.48	\$416.38	-\$260.73
1994	2.85	\$96,712	\$734.60	\$423.50	\$258.20	\$93.32	\$148.85	\$16.04
1993	2.67	\$94,301	\$667.90	\$678.40	\$250.45	\$92.64	\$254.39	-\$96.58
1992	2.54	\$90,400	\$626.90	\$734.60	\$246.90	\$91.83	\$289.34	-\$134.26
1991	2.47	\$87,527	\$602.20	\$367.90	\$243.48	\$84.65	\$148.76	\$10.08
1990	2.33	\$85,005	\$570.40	\$174.20	\$244.40	\$82.40	\$74.63	\$87.37
1989	2.17	\$83,044	\$531.30	\$677.60	\$244.59	\$87.40	\$311.96	-\$154.77
1988	2.1	\$80,350	\$491.30	\$53.50	\$234.44	\$73.56	\$25.55	\$135.33
1987	2.07	\$76,700	\$462.10	\$110.20	\$222.74	\$70.14	\$53.09	\$99.50
1986	2.03	\$71,110	\$403.40	\$131.50	\$198.25	\$63.53	\$64.60	\$70.12
1985	1.92	\$66,888	\$364.80	\$382.40	\$189.95	\$55.49	\$199.08	-\$64.63
1984	1.92	\$61,862	\$334.90	\$265.80	\$174.68	\$48.10	\$138.67	-\$12.08
1983	1.92	\$58,105	\$313.00	\$460.80	\$163.24	\$42.07	\$240.31	-\$119.15
1982	1.89	\$55,168	\$247.70	\$209.40	\$130.90	\$38.76	\$110.68	-\$18.55
1981	1.97	\$50,883	\$181.00	\$134.90	\$92.00	\$31.60	\$68.57	-\$8.17
1980	1.95	\$45,101	\$149.20	\$244.00	\$76.38	\$29.51	\$124.92	-\$78.05
1979	1.62	\$37,650	\$125.50	\$505.80	\$77.26	\$23.80	\$311.40	-\$257.94
1978	1.06	\$33,150	\$81.80	\$155.60	\$77.20	\$26.85	\$146.87	-\$96.52

\* Earned Premium does not include the Federal Policy Fee, nor are the expenses covered by that fee included in this table.

\*\* Loss & LAE includes an allowance for open claims.

SOURCE: National Flood Insurance Program: November 2005 Actuarial Rate Revisions Study by Tom Hayes.

### 3.3 Actuarial Soundness and the NFIP

The NFIP is not intended, nor was it initially intended, to be actuarially sound, but this has not diminished concern about the statutorily mandated subsidies associated with pre-FIRM policies in SFHA.<sup>20,21</sup> When Congress created the NFIP, legislators assumed that subsidized policies would encourage participation among those who had already constructed their houses or businesses in flood plains without knowing that they had done so. Coupled with this assumption was an expectation that the subsidies gradually would be eliminated, perhaps over 30 to 40 years, as pre-FIRM properties in SFHA were replaced or improved to meet post-FIRM standards. The percentage of such policies has declined substantially in the past 20 years (from approximately 83 percent of policies in 1985 to approximately 25 percent in 2004), but the number of such policies remains high according to FEMA (FEMA 2003).<sup>22</sup> The beneficiaries of the subsidies receive coverage at about 35 to 40 percent of the cost of what the actuarial rate would be. Therefore, the NFIP is unable to collect sufficient premiums to meet future estimated losses.

After several years of repeated losses in the late 1970s and pressure by congress to cut subsidized premiums in half, the Federal Insurance Administration (FIA) announced in 1981 that it planned to raise subsidized premiums to a level that, in conjunction with the actuarial premiums charged to both newer construction and buildings outside the SFHA, would be sufficient to generate sufficient premiums to pay losses associated with the very favorable loss experience that the Program had experienced to date by fiscal year 1988.<sup>23</sup> The goal was achieved by 1986. The combination of the actuarially indicated premiums charged to the non-subsidized book and the subsidized premiums charged to the subsidized book currently equal 124.3 percent of the historical average loss year funding requirement.<sup>24</sup>

Elimination of the subsidy at first glance might be viewed as the quickest solution to achieving actuarial soundness for the program. Such action, however, is neither practical in terms of total governmental costs nor advisable due to other important, conflicting goals of the NFIP and given the voluntary nature of flood insurance outside of SFHAs and the difficulty in enforcing the mandatory purchase requirement within SFHAs.<sup>25</sup> Requiring actuarial rates for

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<sup>20</sup> A Flood Insurance Rate Map (FIRM) is an official map of a community on which FEMA has delineated both the SFHA and the risk premiums zones applicable to the community. "Pre-FIRM" pertains to a building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial FIRM, whichever is later.

<sup>21</sup> Please refer to both the original 1968 Act and the 1973 Reform Act for an understanding of the "initial intentions" of the program.

<sup>22</sup>Of the 27 percent of NFIP policies that are written at subsidized rates, 24 percent are Pre-FIRM and 2 percent are from other categories (e.g., Zone A99 with structural protection 50 percent completed, Zone AR decertified, grandfathered properties).

<sup>23</sup> It is important to note that the historical average loss year was selected to avoid the complexity and controversy involved in attempting to quantify what was needed to reach "actuarial soundness in the foreseeable future." The historical average loss year was chosen for its ease of calculation and ability to be implemented immediately without additional expenditures.

<sup>24</sup> The 124.3 percent would drop to approximately 115 percent if the 2004 storm activity was included in the historical average loss year calculation. Including 2005 storm activity and hurricane Katrina, the percentage would likely drop significantly, possibly below 80 percent based on discussions with the NFIP.

<sup>25</sup> See Tobin and Calfee's (2005) report, as part of the Evaluation of the NFIP, on the NFIP's Mandatory Purchase Requirement.

pre-FIRM structures, some of which do not meet any post-FIRM flood-related building standards and are thus likely to be those at highest risk, would cause premiums for these structures to rise dramatically.<sup>26,27</sup> It has been shown in the past that higher premiums would likely cause a number of property owners to drop their coverage and deter others from initiating coverage. The U.S. General Accounting Office (1983) estimated that if the NFIP had doubled the then existing average premiums (both subsidized and actuarial), about 40 percent of policy owners would cancel their policies.<sup>28</sup> Moreover, since disaster assistance and/or tax deductions for casualty losses typically are available to most property owners, including those without insurance, canceling pre-FIRM policies simply would transfer risk and financial obligation away from property owners to government. Thus, one of the NFIP's other primary goals, reducing the expectation of and reliance on Federal disaster assistance, would be compromised.

Higher premiums could also lead to adverse selection, whereby only policyholders with under priced policies and a high probability of flooding continuing to purchase coverage. If policyholders with favorable loss experience exited the program, the NFIP would be less able to benefit from the law of large numbers by spreading the risk of flooding over multiple policyholders, and premiums increase.<sup>29</sup> This is exactly the process that plagued the industry in the 1920s-50s.

The issue of actuarial soundness is further encumbered by the nature of the risk that flood insurance covers. With flood insurance, the NFIP assumes risks that the private sector historically has avoided because those in need of insurance do not offer the key conditions for ideal insurability. As the GAO (1997) explains:

Individual risks should be independent and of sufficient number to reasonably project losses and adequately pool risk to be insurable. In addition, the occurrence of losses should be accidental or unintentional in nature and capable of being measured. Without these insurable conditions, establishing an actuarially sound rate structure is difficult and the likelihood of adverse selection and moral hazard increases.<sup>30</sup>

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<sup>26</sup> Approximately half of the pre-FIRM structures currently insured by the NFIP have been documented through elevation certificates as being at or above the BFE. Buildings at or above the BFE have a considerably lower flood risk; so much so, that their full-risk premiums are less than the subsidized premiums. In these circumstances, these structures are allowed to use the lower post-FIRM rates

<sup>27</sup> See PriceWaterhouseCoopers (1999) report studying the economic effects of charging actuarially based premiums for pre-FIRM structures.

<sup>28</sup> If similar calculations were made today, it would be important to consider the mandatory-purchase requirement that obligates many homeowners to purchase and retain flood insurance during the life of their mortgage obtained from federally regulated lenders, sold on the secondary market to the Federal National Mortgage Corporation or the Federal Home Loan Mortgage Corporation.

<sup>29</sup> It is important to note that if every NFIP policy were actuarially priced (i.e., reflected the actual probability of flood damage), adverse selection would not be possible. However, the existence of subsidized policies and challenges of getting the "right price" for actuarially rated policies makes adverse selection a reality.

<sup>30</sup> Moral hazard arises when an individual (e.g., policyholder, claim handler, etc.), in possession of private information, takes action which adversely affects the probability of bad outcomes. For example, an auto policyholder may drive faster in a poor condition because he has insurance. A subsidized NFIP policyholder may build homes on floodplains or rebuild in harms way because he/she has flood insurance.

As we have observed with subsidized properties, policyholders who suffer minor to moderate flood damage (i.e., not impacted by the substantial improvement requirement), even repeatedly, simply repair the damage and remain exposed to similar flooding again in the future due to the availability of flood insurance (i.e., moral hazard).<sup>31</sup> Although the program is designed so that policyholders can rebuild in the floodplains using proper building standards, the presence of flood insurance and the availability of Federal disaster assistance allows policyholders in some of the riskiest floodplains, who have not been substantially damaged, to continue to re-build their properties. In addition, the private sector has also begun avoiding other lines of business facing catastrophic losses such as hurricanes, earthquakes and terrorism that are difficult to measure. For example, homeowner insurers along the east coast have been limiting their geographic hurricane exposure or exiting the market entirely. Insurance companies who used to offer earthquake endorsements have stopped writing new endorsements or have begun non-renewing policyholders across the country. Insurance companies are reducing their exposure to low frequency high severity exposures, not increasing their appetite for coverages like flood insurance where it is difficult to measure and estimate the size of future losses.

Despite the challenges associated with achieving actuarial soundness, staff involved with the NFIP have indicated interest in improving the program's soundness (e.g., PriceWaterhouseCoopers (1999) report, subsidy reduction proposal, budget initiatives, etc). In 2001, for example, a senior NFIP official noted the program's desire to reduce subsidies as a way to encourage mitigation for older properties. Howard Leikin (2001), FEMA's Deputy Administrator for Insurance, suggested the gradual elimination of subsidies for structures that are not primary residences. Others are more strident in their views, arguing that subsidies have outlived their original justification as a temporary measure to encourage participation (CBO 2003, 2006). In the view of these critics, reducing or eliminating subsidies would make policyholders pay their fair share commensurate with the risks to which they are exposed and create incentives for them to relocate or to take preventive measures.

The elimination or reduction of subsidies has also been discussed and debated by agents, adjusters, lenders, public officials, and condominium association members. The Association of State Floodplain Managers (ASFPM 2004) has proposed that owners of repetitive-loss, pre-FIRM properties that decline offers of mitigation be charged actuarial rates. In addition, J. Fletcher Willey testified on behalf of the Independent Insurance Agents and Brokers of America (IIABA) before the House Financial Services Housing Subcommittee (IIABA 2004) hearing examining the NFIP and various reform proposals. Willey outlined five principles that IIABA believes must be included to improve the NFIP:

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<sup>31</sup> The NFIP substantial improvement requirement and substantial damage requirement provides a mechanism to ensure that a significant increase in investment in existing Pre-FIRM buildings will receive needed protection from the risk of future flooding. If a community determines that the cost of improvements to a home or business equals or exceeds 50 percent of the market value of the building, the building is considered a "substantial improvement". If a community determines that the cost of restoring a home or business equals or exceeds 50 percent of the market value of the building before the damage from any origin occurred, the building is considered "substantially damaged". A substantially improved building or substantially damaged building must meet the minimum requirements of the NFIP.

1. Strengthen the NFIP's building requirements<sup>32</sup>;
2. Enforce the mandatory purchase requirement;
3. Provide additional mitigation resources;
4. Stop abuse through multiple claims; and
5. Require mandatory disclosures so that buyers can make an informed choice in their purchases and properly value their home.

On June 30, 2004, President George W. Bush signed into law the (FIRA04): “Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004.” FIRA04 established a pilot program for the mitigation of severe repetitive-loss properties and the funding of mitigation activities for individual repetitive-loss properties. For repetitive-loss property owners who refuse an offer to take action to mitigate their properties (e.g., through a buyout, elevation, relocation, flood-proofing, etc.), the act increases premium 50 percent as a consequence for that refusal, with the premium increasing another 50 percent for each subsequent loss until actuarial premiums are reached.

FIRA04 attempts to address the worst offenders by asking property owners to either mitigate their properties or pay a higher premium. The mitigation option reduces the structure's risk so significantly that the NFIP can collect full-risk premiums, while the higher premium rate option allows the NFIP to collect more adequate premiums for properties that are currently under priced. Both options help move the NFIP towards the goal of achieving actuarial soundness.

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<sup>32</sup> For further examination of the NFIP's building requirements, see another sub-study in the NFIP Evaluation, “The National Flood Insurance Program's Minimum Building Requirements” (Jones *et al.*, 2006).

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## 4. ACTUARIAL STANDARDS OF PRACTICE

Standards promulgated by the American Academy of Actuaries (AAA) will be relied upon to define actuarial soundness in the context of the NFIP as well as to assess whether it is an appropriate standard for the NFIP. Specifically, we focus on the four principles underlying Actuarial Standards of Practice (ASOP) No. 9.<sup>33</sup>

### **PRINCIPLES**

Ratemaking is prospective because the property and casualty insurance rate must be developed prior to the transfer of risk.

#### **Principle 1**

A rate is an estimate of the expected value of future costs. Ratemaking should provide for all costs so that the insurance system is financially sound.

#### **Principle 2**

A rate provides for all costs associated with the transfer of risk. Ratemaking should provide for the costs of an individual risk transfer so that equity among insured is maintained. When the experience of an individual risk does not provide a credible basis for estimating these costs, it is appropriate to consider the aggregate experience of similar risks. A rate estimated from such experience is an estimate of the costs of the risk transfer for each individual in the class.

#### **Principle 3**

A rate provides for the costs associated with an individual risk transfer. Ratemaking produces cost estimates that are actuarially sound if the estimation is based on Principles 1, 2, and 3. Such rates comply with four criteria commonly used by actuaries: reasonable, not excessive, not inadequate, and not unfairly discriminatory.

#### **Principle 4**

A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.

The AAA's definition of an actuarially sound estimate is widely accepted, but it is important to recognize that the NFIP has policy objectives that are not fully commensurate with actuarial soundness. For example, as the November 30, 2004 *NFIP Actuarial Rate Review* notes (FEMA 2004): "It is sound public policy to maximize the number of people who have flood insurance, so as to lessen the reliance on disaster assistance." Likewise, the document also observes that:

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<sup>33</sup> A PDF version of ASOP No. 9 is available from the AAA web-site [www.actuary.org](http://www.actuary.org) or by directly accessing [www.actuarialstandardsboard.org/asops.htm](http://www.actuarialstandardsboard.org/asops.htm).

Subsidized insurance for older construction, built to lower standards in regard to the flood risk for which full-risk premiums could be unreasonably high, was the quid pro quo for local community adoption of ordinances controlling new construction in the floodplain.

In other words, the NFIP seeks to advance multiple goals, including issues of public interest, rather than maintaining a narrower focus solely on actuarial soundness.

The *Actuarial Rate Review* notes the following regarding accepted actuarial principles and ratemaking:

Generally accepted actuarial principles require at a minimum that a rating system provide protection against the economic uncertainty associated with chance occurrences by exchanging the uncertainty for a predetermined price. This price for insuring the uncertain event must:

- Protect the insurance system's financial soundness;
- Be fair; and
- Permit economic incentives to operate and thus encourage widespread availability of coverage.

For the purpose of setting prices, the broad grouping of risks with similar characteristics is a fundamental precept of a financially sound and equitable system. Because each property at risk is different, a rate system that attempts to identify and reflect in prices every risk characteristic is unworkable and costly. The basic features that must be present in sound risk groupings in order to meet the above criteria are:

- The system should reflect cost and experience differences on the basis of relevant risk characteristics.
- The system should be applied objectively and consistently.
- The system should be practical, cost-effective, and responsive to change.
- The system should be minimizing anti-selection.
- The system should be acceptable to the public (FEMA 2004).

Appendix 1, *NFIP Ratemaking Comparison to Industry*, provides a detailed overview of the ratemaking process, derivation of the rate level indication, and a comparison of the NFIP's Hydrological Model to the ratemaking methods used by the insurance industry.

The NFIP's multiple goals of achieving an equitable system, versus a narrower focus on actuarial soundness, will be discussed throughout the remainder of this report.

## 5. ACTUARIAL SOUNDNESS AND INSURANCE INDUSTRY INDICATORS

### 5.1 What is Actuarial Soundness ?

The answer to this question is not as straightforward as one would think initially. In the March 21, 2001 GAO-02-671T Mortgage Financing testimony discussing the actuarial soundness of the Federal Housing Administration's Mutual Mortgage Insurance Fund, the GAO-02-671T testified that neither the legislation nor the actuarial profession defines actuarial soundness. Although the actuarial profession does not define actuarial soundness, ASOP No. 9 does address the concept of an "actuarially sound" estimate: a rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.

Not only does the NFIP legislation not define actuarial soundness, but the NFIP seeks to advance multiple goals, including issues of public interest and a net decrease in societal and federal losses extending outside the purview of the NFIP. The November 30, 2004 *NFIP Actuarial Rate Review* illustrates the importance of these goals in their ratemaking section. In the case of flood insurance authorized under Public Law 90-448 (National Flood Insurance Act), the system of insurance and pricing must further the purpose of the Act, which includes, among other items, to "(1) encourage state and local governments to make appropriate land use adjustments to constrict the development of land that is exposed to flood damage caused by floods, and (2) guide the development of proposed further construction, *where practical*, away from locations that are threatened by flood hazards (FEMA 2004a)" [emphasis added].

Given Congressional intent of multiple goals and a design that does not ensure universal mandatory purchase of flood insurance, actuarial soundness for the NFIP is contingent on other goals such as focusing on the reduction of flood risks and adverse costs and consequences of flooding through proper floodplain management. The NFIP would be actuarially sound contingent on these other goals if the rates charged to NFIP policyholders represent the expected value of all future costs associated with the sale of each flood insurance policy.

#### ACTUARIAL SOUNDNESS DEFINITION

**The NFIP would be actuarially sound if the rates charged to its policyholders represent the expected value of all future costs associated with the sale of each flood insurance policy.**

As discussed later, there are potential adverse consequences to the stated goals of the NFIP by following this definition if some future costs are not discounted slightly, as other goals at times conflict with achieving strict actuarial soundness.

The remainder of this report will discuss the NFIP's goals with respect to achieving actuarial soundness, challenges the NFIP faces in achieving actuarial soundness, possible solutions for moving the program towards actuarial soundness and whether actuarial soundness is an appropriate goal for the NFIP.

## 5.2 Insurance Industry Indicators

The following metrics represent indicators that insurance companies and regulators of the insurance industry use to assess financial solvency. An unfavorable result on a metric is frequently, but not always, a result of a slippage in the actuarial soundness of the company. In this section we review these metrics and consider their potential applicability to the NFIP as measures of actuarial soundness.

### Net Incurred Loss (IL) Ratio<sup>34</sup>

The IL ratio equals net incurred losses divided by net earned premium. Incurred losses, as used in the *Best Aggregates and Averages* report (A.M. Best 2004), means the cumulative amounts paid for all claims as of a particular point in time, plus outstanding unpaid amounts as estimated by claim adjusters, plus an estimate for the actuarially determined incurred but not reported (IBNR).<sup>35</sup> The IL ratio measures how much of a premium dollar is dedicated to paying the insurance claims of the company in a calendar year, excluding loss adjustment expenses (i.e., defense costs, court costs, investigative reports, etc.). An IL ratio of 70 percent implies the company pays 70 cents for every dollar of premium earned to indemnify its insured.

### Loss Adjustment Expense (LAE) Ratio

The LAE ratio equals net incurred LAE divided by net earned premium. LAE represents the cumulative payments made for the defense and cost containment (i.e., defense costs, court costs, investigative reports, etc.) and adjusting and other (i.e., fees/salaries for appraisers, expenses of adjusters and settling agents, etc.) for a claims as of a particular time, plus outstanding unpaid amounts as estimated by claims adjusters, plus an estimate for IBNR. The net IL and LAE ratio measure how much of a premium dollar is dedicated to paying the insurance claims and LAE costs of the company in a calendar year. An IL and LAE ratio of 100 percent implies the company pays 100 cents for every dollar of premium earned to defend and indemnify its insured.

### Combined Ratio (CR)

The CR equals the net IL and LAE ratio plus the expense ratio. The expense ratio equals the ratio of commission, brokerage, field supervision, collection expense, taxes, licenses, fees and general expense to net written premium.<sup>36</sup> The CR measures how much of a premium dollar

<sup>34</sup> Net implies after the impact of reinsurance.

<sup>35</sup> Actuarially determined IBNR can include the following items: 1) “pure” incurred but not reported (IBNR) – claims not yet known and not recorded in the loss system; 2) “pipeline” IBNR – claims known but not yet recorded in the loss system; 3) case development – future development on known, recorded claims; and 4) reopened claims – future reopened claims which are coded to the year in which the original claim occurred. For short tailed coverages like property and flood insurance, there tends to be minimal amounts of IBNR when compared to other long tail lines of business like workers compensation or medical malpractice.

<sup>36</sup> A.M. Best Company ([www.ambest.com](http://www.ambest.com)), *Best's Aggregates & Averages - Property/Casualty 2004 Edition*, “By Line Underwriting Experience” display the above expense categories as a ratio to net written premium. For

is dedicated to paying insurance costs in a calendar year. A CR of 125 percent implies the company lost 25 cents for every dollar of premium earned before considering investment income.

### Operating Ratio (OR)

The before-tax OR equals the CR ratio minus the net investment income and other income ratio to net earned premium (NII). The OR measures how much of a premium dollar is left after considering the impact of investment income earned on the CR. An OR of 110 percent implies the company lost 10 cents for every dollar of premium earned after consideration of investment income.

### Net Liability to Surplus Ratio (NLSR)

The NLSR equals the net loss and LAE reserves divided by surplus. The NLSR provides a measure of underwriting leverage, and thus risk. Surplus serves as a financial buffer to guard against adverse events and changes in financial condition, such as can result when reserve strengthening is required. A lower ratio signifies greater financial strength and a greater capacity to absorb adverse development in reserves.

### Net Premium to Surplus Ratio (NPSR)

The NPSR equals the net written premium divided by surplus. The NPSR measures the insurer's capacity to write additional business.

### Risk Based Capital (RBC) Ratios

The National Association of Insurance Commissioners (NAIC) RBC requirements calculate the amount of capital an insurer should hold as a function of the types of risks it has assumed in order to assess the solvency of each insurance company. The NAIC RBC formula reflects five different risk charges: fixed income securities, equity investments, credit risk, reserving risk and written premium risk. Insurers whose capital falls below pre-specified percentages of its authorized control level requirements are subject to various actions intended to mitigate insolvency, varying from company action level to mandatory control level where the company is placed under the control of the domiciliary regulator.

### NAIC Insurance Regulatory Information System (IRIS) Ratios

The NAIC IRIS ratios assist state regulators in monitoring the financial condition of insurance companies and identifying companies that may require special regulatory review or action (e.g., company fails four IRIS ratios). The NAIC calculates the following 12 IRIS Ratios: gross written premium to surplus (flag > 900 percent), net written premium to surplus (flag > 300 percent), change in net writings (flag > 33 percent, flag < -33 percent), surplus aid to surplus

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ratemaking purposes, general expenses and other acquisition, field supervision and collection expenses are often expressed as a percentage of earned premium. The NFIP statistics will be shown as a ratio to earned premium.

(flag > 15 percent), two-year overall operating ratio (flag > 100 percent), investment yield (flag > 10 percent, flag < 4.5 percent), change in surplus (flag > 50 percent, flag < -10 percent), liabilities to liquid assets (flag > 105 percent), gross agents' balances to surplus (flag > 40 percent), one-year reserve development to surplus (flag > 20 percent), two-year reserve development to surplus (flag > 20 percent), and estimated current reserve deficiency to surplus (flag > 25 percent).

### Rating Agency Financial Strength Rating

Rating agencies such as A.M. Best, Standard & Poors, Moody's Investor Services and Fitch/IBCA publish financial strength ratings that provide an opinion of each insurance company's financial strength and ability to meet the ongoing obligations to policyholders. For example, A.M. Best's rating scale<sup>37</sup> is comprised of 16 individual ratings grouped into 10 categories, consisting of three secure categories (Superior (A++, A+), Excellent (A, A-), Very Good (B++, B+), and seven Vulnerable categories.

## **5.3 Insurance Industry Indicators and the NFIP**

Insurance companies, rating agencies and regulators of the insurance industry rely upon the above metrics to assess the financial solvency of insurance companies. This section examines whether the same insurance industry indicators apply to the NFIP.

The NFIP's historical financial results have been compared to the financial results of five insurance industry property coverages. These coverages were chosen because of their focus on homeowners and commercial enterprises that best compare to the NFIP's policyholder base and FEMA's reliance on data from these coverages in their Financial Assistance/Subsidy Arrangement.<sup>38,39</sup>

1. **Fire** – Coverage protecting the insured against the loss to real or personal property from damage caused by the peril of fire or lightning, including business interruption, loss of rents, etc.
2. **Allied Lines** – Coverages that are generally written with property insurance, e.g., glass, tornado, windstorm and hail; sprinkler and water damage; explosion, riot, and civil commotion; growing crops; flood; rain; and damage from aircraft and vehicle, etc.

<sup>37</sup> For more detailed information on ratings, visit A.M. Best Company ([www.ambest.com](http://www.ambest.com)), "Rating Services, Rating Definition, Financial Strength."

<sup>38</sup> The five coverages were selected based upon the FEMA FIA Financial Assistance/Subsidy Arrangement (Appendix A – Part 62). Under Article III – Loss Costs, Expenses, Expense Reimbursement, and Premium Refunds, the arrangement states: "For this purpose, we (the Federal Insurance Administration) will use data for the property/casualty industry published, as of March 15 of the prior Arrangement year, in Part III of the Insurance Expense Exhibit in A.M. Best Company's Aggregates and Averages for the following five property coverages: Fire, Allied Lines, Farmowners Multiple Peril, Homeowners Multiple Peril, and Commercial Multiple Peril (non-liability portion)."

<sup>39</sup> Line of business definitions from Highline Data LLC's Insurance Analyst – Property & Casualty Web Analytics product ([www.highlinedata.com](http://www.highlinedata.com)).

3. **Commercial Multiple Peril (non-liability)** – A contract for a commercial enterprise that packages two or more insurance coverages protecting an enterprise from various property and liability risk exposures. Commercial Multiple Peril frequently includes fire, allied lines, various other coverages (e.g., difference in conditions) and liability coverage.
4. **Farmowners' Multiple Peril** – A package policy for farming and ranching risks, similar to a homeowners policy, that has been adopted for farms and ranches and includes both property and liability coverages for personal and business losses. Coverages include farm dwellings and their contents, barns, stables, other farm structures and farm inland marine (e.g., mobile equipment and livestock).
5. **Homeowners' Multiple Peril** – A package policy combining broad property coverage for the personal property and/or structure with broad personal liability coverage. Homeowner's multiple peril coverage is applicable to the dwelling, appurtenant structures, unscheduled personal property and additional living expenses.

### 5.3.1 Incurred Loss Ratio

Table 6 and Table 7 have been included to illustrate the size of the program in relation to the other five property coverages. Table 6 displays the calendar year earned premium for the NFIP (FEMA 2004a) and net earned premium for the five insurance coverages (A.M. Best 2004).

**TABLE 6: Earned Premium for the NFIP and Five Insurance Industry Property Coverages (in \$ billions)**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS	HOME OWNERS
1994	0.73	4.81	2.57	8.63	1.11	21.79
1995	0.82	5.09	2.80	9.31	1.19	23.16
1996	0.90	5.28	2.95	9.55	1.22	24.68
1997	1.04	4.94	3.00	9.52	1.33	26.06
1998	1.22	4.89	2.96	10.29	1.40	28.01
1999	1.32	4.74	2.77	10.31	1.44	29.80
2000	1.42	4.50	2.79	10.87	1.49	31.76
2001	1.51	4.54	3.25	12.13	1.60	33.76
2002	1.61	6.23	4.29	13.98	1.70	37.34
2003	1.70	8.16	5.98	15.69	1.88	42.74

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

Table 7 displays the NFIP's percentage of earned premium for comparison purposes.

**TABLE 7: Percentage of Earned Premium for the NFIP and Five Insurance Industry Property Coverages**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	2%	12%	6%	22%	3%	55%
1995	2%	12%	7%	22%	3%	55%
1996	2%	12%	7%	21%	3%	55%
1997	2%	11%	7%	21%	3%	57%
1998	3%	10%	6%	21%	3%	57%
1999	3%	9%	6%	20%	3%	59%
2000	3%	9%	5%	21%	3%	60%
2001	3%	8%	6%	21%	3%	59%
2002	2%	10%	7%	21%	3%	57%
2003						
<b>AVG</b>	2%	10%	6%	21%	3%	57%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

Table 6 and 7 reveal that the premium earned by the NFIP is relatively small in comparison to the premiums earned by the other insurance coverages. Over the nine year period, the premium earned by the NFIP has represented approximately 2 percent of the premiums earned for the NFIP and five insurance coverages combined.

Table 8 displays the incurred loss ratio for the NFIP and five property coverages.

**TABLE 8: Incurred Loss Ratio**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	55.9%	64.1%	71.0%	73.6%	67.9%	74.9%
1995	157.8%	64.0%	77.5%	60.7%	69.5%	69.6%
1996	91.4%	53.3%	75.2%	70.0%	81.2%	78.6%
1997	49.7%	53.3%	58.8%	65.7%	66.4%	57.3%
1998	71.1%	63.1%	74.5%	67.8%	72.2%	65.3%
1999	56.7%	60.3%	78.2%	74.8%	67.9%	64.9%
2000	17.2%	69.4%	70.7%	70.1%	67.3%	68.9%
2001	82.6%	74.9%	107.8%	73.9%	71.2%	79.4%
2002	24.6%	53.5%	46.9%	53.5%	66.6%	68.5%
2003	38.3%	49.8%	49.8%	47.5%	60.1%	59.0%
<b>AVG</b>	64.5%	60.6%	71.0%	65.8%	69.0%	68.6%
<b>StDev</b>	40.4%	8.1%	17.2%	9.2%	5.4%	7.5%
<b>MAX</b>	157.8%	74.9%	107.8%	74.8%	81.2%	79.4%
<b>MIN</b>	17.2%	49.8%	46.9%	47.5%	60.1%	57.3%
<b>SPREAD</b>	140.6%	25.1%	60.9%	27.3%	21.1%	22.1%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

The standard deviation, a statistical measure of spread, is provided for all insurance industry indicators because it illustrates the year-to-year variability of each measure for the program. The standard deviation of the NFIP's incurred loss ratio is higher than that of the other

lines of business.<sup>40</sup> For 1994 through 2003, the NFIP's incurred loss ratio ranged from a low of 17.2 percent to a high of 157.8 percent. For 1994 through 2003, the allied lines incurred loss ratio ranged from a low of 46.9 percent to a high of 107.8 percent. The NFIP's incurred loss ratio spread of 140.6 percent is more than double the spread for allied lines, the second most volatile property coverage for the insurance industry. The lower spread for the other lines of business is driven by the ability of insurance companies to actuarially price insurance policies (i.e., raise rates after significant events), purchase reinsurance to limit the severity of catastrophic events such as hurricanes, selectively spread of risks geographically in target markets (i.e., can choose not to cover certain communities facing higher risk) and avoid volatile single peril policies such as flood.

Prior to 1994, the NFIP's incurred loss ratios exceeded 100 percent in 1992, 1989, 1983 and the first three years of the program (e.g., almost 400 percent in 1979). As will be discussed later, the volatility of flood insurance results is the primary reason why the insurance industry is unwilling to write this coverage.<sup>41</sup>

### 5.3.2 Loss Adjustment Expense Ratio

Table 9 displays the incurred loss adjustment expense ratio for the NFIP and five insurance industry property coverages.

**TABLE 9: Incurred LAE Ratio**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	3.6%	5.7%	8.0%	9.3%	9.1%	12.2%
1995	9.9%	6.0%	8.4%	8.7%	9.6%	12.1%
1996	6.5%	5.3%	9.0%	10.2%	9.8%	12.8%
1997	3.8%	6.2%	8.7%	10.3%	9.5%	11.7%
1998	6.3%	6.2%	9.3%	10.0%	10.3%	12.5%
1999	4.9%	7.2%	10.1%	9.8%	10.4%	12.4%
2000	1.5%	6.5%	10.3%	9.5%	9.1%	11.4%
2001	6.1%	8.3%	11.8%	10.0%	9.4%	12.5%
2002	2.0%	5.9%	7.4%	8.9%	9.4%	11.9%
2003	3.1%	4.4%	6.8%	8.1%	8.1%	10.3%
<b>AVG</b>	4.8%	6.2%	9.0%	9.5%	9.5%	12.0%
<b>StDev</b>	2.5%	1.0%	1.5%	0.7%	0.7%	0.7%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

The NFIP has a lower average LAE ratio than the other lines of business. The standard deviation of the NFIP's incurred loss adjustment expense ratio is higher than the other lines of business. As would be expected, higher incurred loss adjustment expense ratios correlate with

<sup>40</sup> If more recent data was available at the time of analysis, we believe the impact of Hurricanes Charley, Frances, Jeanne, Ivan, Katrina, Wilma and Rita would further illustrate the volatility of the NFIP as compared to the property coverages which would be impacted to a lesser extent given flood exclusions.

<sup>41</sup> Although earthquake coverage is not displayed in the above tables, we note that earthquake related losses would exhibit high levels of volatility, versus the five coverages selected based on the Financial Assistance/Subsidy Arrangement.

higher incurred loss ratios, since increased claim activity equates to more time and money spent on the handling and settling claims.

Table 10 displays the incurred loss and loss adjustment expense ratio for the NFIP and five insurance coverages.

**TABLE 10: Incurred Loss and LAE Ratio**

<b>YEAR</b>	<b>NFIP</b>	<b>FIRE</b>	<b>ALLIED LINES</b>	<b>COMMERCIAL</b>	<b>FARM OWNERS'</b>	<b>HOME OWNERS'</b>
1994	59.5%	69.8%	79.0%	82.9%	77.0%	87.1%
1995	167.7%	70.0%	85.9%	69.4%	79.1%	81.7%
1996	97.8%	58.6%	84.2%	80.2%	91.0%	91.4%
1997	53.5%	59.5%	67.5%	76.0%	75.9%	69.0%
1998	77.5%	69.3%	83.8%	77.8%	82.5%	77.8%
1999	61.6%	67.5%	88.3%	84.6%	78.3%	77.3%
2000	18.8%	75.9%	81.0%	79.6%	76.4%	80.3%
2001	88.7%	83.2%	119.6%	83.9%	80.6%	91.9%
2002	26.7%	59.4%	54.3%	62.4%	76.0%	80.4%
2003	41.5%	54.2%	56.6%	55.6%	68.2%	69.3%
<b>AVG</b>	69.3%	66.7%	80.0%	75.2%	78.5%	80.6%
<b>StDev</b>	42.8%	8.9%	18.5%	9.8%	5.8%	8.0%
<b>MAX</b>	167.7%	83.2%	119.6%	84.6%	91.0%	91.9%
<b>MIN</b>	18.8%	54.2%	54.3%	55.6%	68.2%	69.0%
<b>SPREAD</b>	148.9%	29.0%	65.3%	29.0%	22.8%	22.9%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

The standard deviation of the NFIP's incurred loss and Loss Adjustment Expenses ratio is higher than for the other lines of business. For 1994 through 2003, the NFIP's incurred loss and LAE ratio ranged from a low of 18.8 percent to a high of 167.7 percent. For 1994 through 2003, the allied lines incurred loss ratio ranged from a low of 54.3 percent to a high of 119.6 percent. The NFIP's incurred loss and LAE ratio spread of 148.9 percent is more than double the spread for allied lines, the second most volatile property coverage for the insurance industry. The volatility of flood insurance incurred loss and LAE results illustrates why the insurance industry is unwilling to write flood insurance coverage. As was true in 1956 when the American Insurance Association performed a study that found flood insurance wasn't commercially feasible for insurance companies, the NFIP's volatility and catastrophic results from hurricane Katrina further continue to support this view.

Table 11 displays the expense ratio for the NFIP and five insurance coverages.

**TABLE 11: Expense Ratio**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	34.3%	36.5%	33.4%	37.3%	31.2%	30.8%
1995	34.0%	34.5%	33.6%	36.7%	30.9%	30.6%
1996	35.1%	35.4%	32.8%	36.6%	31.2%	29.8%
1997	34.6%	37.2%	36.0%	37.5%	31.3%	31.1%
1998	34.5%	38.0%	33.5%	37.3%	32.0%	30.8%
1999	36.3%	39.1%	35.4%	37.7%	33.2%	30.3%
2000	36.7%	37.7%	34.8%	35.3%	32.7%	30.6%
2001	35.1%	34.7%	32.2%	33.0%	32.7%	29.4%
2002	35.1%	27.8%	29.1%	33.0%	31.4%	28.5%
2003	35.5%	24.7%	22.9%	33.6%	30.9%	28.5%
<b>AVG</b>	35.1%	34.6%	32.4%	35.8%	31.8%	30.0%
<b>StDev</b>	0.9%	4.7%	3.8%	1.9%	0.8%	1.0%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

The NFIP's standard deviation is consistent with the homeowners and farmowners' coverages, but lower than the other coverages.

### 5.3.3 Combined Ratio

Table 12 displays the combined ratio for the NFIP and five insurance industry property coverages:

**TABLE 12: Combined Ratio**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	93.8%	106.3%	112.4%	120.2%	108.2%	117.9%
1995	201.7%	104.5%	119.5%	106.1%	110.0%	112.3%
1996	132.9%	94.0%	117.0%	116.8%	122.2%	121.2%
1997	88.2%	96.7%	103.5%	113.5%	107.2%	100.1%
1998	112.0%	107.3%	117.3%	115.1%	114.5%	108.6%
1999	97.9%	106.6%	123.7%	122.3%	111.5%	107.6%
2000	55.5%	113.6%	115.8%	114.9%	109.1%	110.9%
2001	123.8%	117.9%	151.8%	116.9%	113.3%	121.3%
2002	61.8%	87.2%	83.4%	95.4%	107.4%	108.9%
2003	77.0%	78.9%	79.5%	89.2%	99.1%	97.8%
<b>AVG</b>	104.5%	101.3%	112.4%	111.0%	110.3%	110.7%
<b>StDev</b>	42.3%	12.0%	20.5%	10.9%	6.0%	8.0%
<b>MAX</b>	201.7%	117.9%	151.8%	122.3%	122.2%	121.3%
<b>MIN</b>	55.5%	78.9%	79.5%	89.2%	99.1%	97.8%
<b>SPREAD</b>	146.2%	39.0%	72.3%	33.1%	23.1%	23.5%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition/National Flood Insurance Program: Actuarial Rate Review

The standard deviation of the NFIP's combined ratio is higher than the other lines of business. For 1994 through 2003, the NFIP's combined ratio ranged from a low of 55.5 percent to a high of 201.7 percent. For the 1994 through 2003 years, the allied lines' combined ratio ranged from a low of 79.5 percent to a high of 151.8 percent. The NFIP incurred combined ratio spread of 146.2 percent is more than double the spread for allied lines, the second most volatile property coverage for the insurance industry.

The Combined Ratio measures how much of a premium dollar is dedicated to paying insurance costs in a calendar year. For the NFIP, a CR of 201.7 percent in 1995 implies the NFIP lost 101.7 cents for every dollar of premium earned before considering investment income. Furthermore, a Combined Ratio standard deviation of 43.7 percent represents an extremely high level of uncertainty regarding the potential underwriting outcomes facing any insurance companies that would ever consider writing flood insurance coverage. The historical volatility of the NFIP's financial results combined with the potential for catastrophic losses helps to explain why the government and not the insurance industry writes flood insurance coverage.

In a speech at the May 2003 National Flood Conference in San Francisco, the NFIP's chief actuary (Hayes 2003) also discussed why the flood insurance program is a government program. Hayes defined the law of large numbers as the underlying truth that makes insurance feasible – that is, the outcome when insuring a large number of similar risks over time becomes predictable. Hayes also noted that the current number of residences insured by the NFIP is not large enough, and, more importantly, that not enough time has passed in order to develop a credible database for ratemaking purposes. With the changes in the NFIP's exposure to loss since the beginning of the program (e.g., impact of erosion, climate changes, location of development, etc.), the NFIP may have difficulty achieving the number of risks necessary to satisfy the law of large numbers. Even without these changing factors, the NFIP may never have enough policyholders to satisfy the law of large numbers in the traditional insurance sense.

When looking at the current state of the NFIP, it is easy to identify additional items that make achieving the law of large numbers more difficult for anyone other than the government:

1. Adverse selection – Adverse selection occurs only within a heterogeneous risk group when only property owners in that group subject to high risk of flooding buy flood insurance and there is limited participation from others. By reducing the pool of potential customers, the ability to reach the number of insured necessary to develop credible and predictable rates is significantly reduced.

Although the purchase of flood insurance is mandatory for homeowners in SFHAs with Federally-backed mortgages or loans regardless of the cost of flood insurance, the charging of actuarial rates to administratively grandfathered and pre-FIRM policyholders likely reduces the pool of potential flood insurance customers since more people might cancel “mandatory” policies that happens currently due to imperfect enforcement of this

requirement<sup>42</sup>. The decrease in flood insurance policies would negatively affect the number of insured necessary to develop credible, predictable and adequate rates (i.e., adverse selection).

2. Perceived competition from Federal disaster assistance and lack of flood insurance coverage awareness – It has been asserted by researchers and stakeholders (Lacy 2000, KRC 1996, Disasters Roundtable 2004) that property owners facing the risk of flooding may forgo the purchase of flood insurance protection or try to cancel that protection because they believe a Presidential disaster declaration will cover their flood related losses even though this is not true. This perception reduces the ability of insurance companies to reach the number of insured necessary to develop credible and predictable rates.
3. Allocation of investor capital – Unlike the NFIP, shareholders of publicly traded insurance companies demand a certain return on equity. When the returns are not commensurate with the risk exposure or the time period required to earn the desired rate of return, investor capital naturally flows to other lines of business (i.e., away from flood insurance).
4. Subsidized premiums – As is noted in the NFIP’s rate review and GAO reports, the premium for subsidized policies would have to increase substantially to be actuarially sound. For more insurance companies to be interested in writing flood insurance coverage, the rates would have to be actuarially sound and include a provision for profit.

The above points reveal why many insurance companies would find it challenging today to achieve the number of insured necessary to satisfy the law of large numbers in order to perform their own flood insurance ratemaking calculations. However, it is apparent that even if everybody in the US were required to purchase flood insurance, it could still take decades before a sufficient volume of insureds was built in order to reach fully credibility. Adverse selection, a problem that was originally identified in the 1956 report by the American Insurance Association focusing on the feasibility insurance companies covering flood risks, continues to be a major problem today.

Regarding the time period required to develop a credible ratemaking database, we note that investors have a much shorter time frame in mind than the NFIP or government when looking for a return on their investment. Given the number of alternative investments available in today’s capital markets and the volatility of NFIP losses (see Table 12), investors would likely require a large expected rate of return in order to compensate them for investing their money in flood insurance.<sup>43</sup>

<sup>42</sup> See (Tobin and Calfee, 2005). Note also the NFIP Evaluation report on the NFIP’s market penetration rate estimates that the compliance rate with the mandatory purchase requirement appears to be 75 to 80 percent (Dixon, 2005).

<sup>43</sup> One potential way to view the required rate of return is using the Capital Asset Pricing Model (CAPM) developed by Harry Markowitz in the early 1950s and later improved upon by others. The asset class’ expected rate of return (E(r)) in the CAPM formula is derived as:  $E(r) = R_f + \beta \times (R_p)$ ;  $R_p = E(m) - R_f$ . The market risk premium ( $R_p$ ) equals the expected market return (e.g., S&P 500) minus the risk free rate. Beta ( $\beta$ ) measures the asset class’ risk

It is important to note that the NFIP's expense ratio of approximately 35 percent (see Table 11) might not be considered by most in the insurance industry to be the true expense ratio. This cost does not include the Map Modernization Program. If Map Modernization was included as well, it could be argued that the actual expense ratio of the NFIP would be considerably higher than what has been published in the actuarial rate review.<sup>44</sup> Although the cost of the Map Modernization effort is not covered by the NFIP's federal policy fee<sup>45</sup>, and Deloitte Consulting does not know of any insurance company that is large enough to afford funding billion dollar efforts such as the Map Modernization Program in order to enhance the success of flood insurance in the United States. Even if the government continued to provide public good services such as map making, zoning, building codes, and mitigation assistance while private companies provided insurance, private insurance still would be faced with the four problems discussed above. Adverse selection could be dealt with only through additional laws tightening and perhaps expanding the mandatory coverage requirement to new potential policyholders.

### 5.3.4 Operating Ratio

Table 13 displays the investment income ratio (i.e., investment gain and other income) for the five insurance industry property coverages.

**TABLE 13: Investment Income Ratio**

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	N/A	3.8%	3.3%	5.2%	4.7%	4.8%
1995	N/A	4.5%	2.9%	4.6%	4.5%	5.3%
1996	N/A	4.3%	2.9%	4.1%	4.9%	4.9%
1997	N/A	4.8%	3.4%	4.3%	5.1%	4.5%
1998	N/A	6.1%	3.8%	4.4%	4.6%	4.6%
1999	N/A	2.4%	3.4%	5.2%	4.6%	4.5%
2000	N/A	5.8%	-8.8%	6.4%	4.4%	4.3%
2001	N/A	2.7%	-2.8%	3.5%	3.9%	3.3%
2002	N/A	2.2%	2.1%	2.7%	-2.4%	3.7%
2003	N/A	3.3%	1.8%	2.9%	3.1%	3.3%
<b>AVG</b>		4.0%	1.2%	4.3%	3.7%	4.3%
<b>StDev</b>		1.4%	4.0%	1.1%	2.2%	0.7%

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition

compared to the risk of the overall market. If one were to theoretically consider flood insurance using the CAPM formula, the implied  $\beta$  would likely be so large that the expected return would be a significant inhibitor in the calculation of rates. For example, assuming a risk free rate of return of 4 percent, a market risk premium of 8 percent and Beta of 2.0, the expected rate of return would be 20 percent.

<sup>44</sup> According to the March 25, 2004 GAO report NFIP – Actions to Address Repetitive Loss Properties, from October 1989 through July 2003, FEMA funded approximately 3,900 flood mitigation projects worth about \$2 billion through the flood insurance program and a variety of other grant programs.

<sup>45</sup> Since the inception of the FMA program, \$20 million annually has been transferred from the NFIP to mitigate flood damaged buildings. This cost is included in the calculation of the Federal Policy Fee.

Although displayed as N/A above, we note that the NFIP has generated investment income in years where premiums have exceeded losses and expenses. However, in periods of heavy loss activity, the NFIP has had to borrow significant funds which equate to negative investment income returns. Over the past 20 years (through fiscal year 2005), the program had net negative outlays in 11 years and net positive outlays in nine years (CBO 2006).

Table 14 displays the operating ratio for the five insurance industry property coverages.

**TABLE 14: Operating Ratio\***

YEAR	NFIP	FIRE	ALLIED LINES	COMMERCIAL	FARM OWNERS'	HOME OWNERS'
1994	N/A	102.8%	109.4%	115.2%	104.0%	113.5%
1995	N/A	100.3%	117.0%	101.6%	106.0%	107.4%
1996	N/A	89.8%	114.3%	112.7%	117.7%	116.8%
1997	N/A	92.3%	100.6%	109.3%	102.7%	96.4%
1998	N/A	101.6%	114.0%	110.9%	111.4%	104.8%
1999	N/A	104.4%	120.6%	117.2%	107.3%	103.7%
2000	N/A	107.9%	124.7%	108.6%	105.2%	107.0%
2001	N/A	115.3%	154.9%	113.4%	109.9%	118.4%
2002	N/A	85.2%	81.4%	94.6%	110.0%	105.6%
2003	N/A	75.8%	77.8%	87.6%	96.4%	94.9%
<b>AVG</b>		97.5%	111.5%	107.1%	107.1%	106.9%
<b>StDev</b>		11.7%	22.0%	9.6%	5.7%	7.8%

\*- Including Policyholder Dividends (PHD)

SOURCE: Best's Aggregates & Averages – Property Casualty 2004 Edition

Given the current structure of the NFIP and the impact of borrowing from the U.S. Treasury in heavy flood years, we do not believe the operating ratio represents a valid operational indicator for the NFIP. However, the NFIP's ability to borrow from the U.S. Treasury at risk free market rates does represent a significant advantage the NFIP has over the insurance industry. As seen in the past with other catastrophic events, insurance companies can have difficulty accessing the capital markets after an event occurs. For example, immediately after the tragic events of September 11, 2001, many insurance companies had difficulty securing reinsurance protection or raising additional capital from the capital markets. When access became available, the cost of the reinsurance increased significantly. The cost of investor capital also increased as rates of return demanded by investors rose. The lack of access to capital can also result in an availability crisis if insurance companies decide to stop providing insurance protection or some of the companies go out of business.

Examples of past insurance availability crises include the January 17, 1994 Northridge earthquake, which resulted in the creation of the California Earthquake Authority to replace the exit of insurance companies no longer willing to write earthquake coverage; Hurricane Andrew in 1992, which forced 11 insurance companies out of business, and resulted in the Florida Legislature passing a law that combined the Florida Residential Property and Casualty Joint Underwriting Association and the Florida Windstorm Underwriting Association into Citizens Property Insurance Corporation (Citizens) in order to provide insurance coverage to homeowners

unable to find coverage in the private insurance market; and the exit of insurance companies willing to write flood insurance coverage in the 1950s which eventually led to the formation of the NFIP. Even if insurers were able to replenish depleted surplus levels through the capital markets, the companies would have to pay significantly higher interest rates than what the NFIP could obtain from the U.S. Treasury, ultimately leading to higher costs for flood insurance policyholders.

### **5.3.5 Surplus Driven Ratios (NLSR, NPSR, RBC, some NAIC IRIS Ratios)**

Unlike insurance companies, which have capital and surplus requirements that are established and reviewed by state insurance departments (e.g., filing of Annual Statement, periodic insurance department Financial Examinations, etc.), the NFIP currently does not have any capital or surplus requirements. FEMA's Flood Insurance Rate Review (FEMA 2004a) notes that the NFIP has not been capitalized and pays losses and operating expenses out of policyholder premiums. The result is that during less-than-average-loss years the program generates surplus, while during higher loss years that accumulated surplus is used to pay the amount by which insured flood losses exceed that year's net premium revenue. The NFIP has borrowing authority with the U.S. Treasury to cover losses in the event that policyholder funds and investment income are inadequate. Initially, the NFIP was granted only \$1 billion in borrowing authority, but subsequent legislation has increased the NFIP's borrowing authority in order to provide a greater cushion against potential losses.

As a result of Hurricane Katrina, the National Flood Insurance Program Enhanced Borrowing Authority Act of 2005 (H.R. 3669) increased the NFIP's borrowing authority from \$1.5 billion to \$3.5 billion on September 20, 2005. The NFIP's borrowing authority was increased to \$18.5 billion on November 23, 2005 and subsequently increased on March 23, 2006 to \$20.775 billion. The CBO's September 14, 2005 cost estimate of H.R. 3669 indicated that the NFIP would likely be unable to repay funds borrowed under H.R. 3669 until after the year 2015, driven by the length of time it could take to pay off outstanding claims from Hurricane Katrina using annual policyholder premium income. It is important to remember that policyholder premium income has to cover current year losses and expenses. Only premiums in excess of these costs and interest payments can be used to repay any of the NFIP's past borrowings. In order to do this, the NFIP would have to benefit from lower storm activity for a number of years to come.

Policies on dwellings that were built before flood plain management regulations were established in their communities are subsidized and pay premiums of 35-40 percent of the true risk premium. In January 2006, FEMA estimated an annual shortfall in premium income of \$750 million for losses because of such policy subsidies. Some subsidized properties, called repetitive loss properties, also suffer repetitive flood losses, which accounted for about \$4.6 billion in claims payments from 1978 to March 2004. (GAO 2006). Given the current deficit position of the program and level of subsidization, the use of surplus driven ratios is not a valid operational indicator for the NFIP.

### 5.3.6 Financial Strength Rating

The implied backing of the U.S. government through the NFIP's borrowing authority would result in a favorable opinion by rating agencies of the NFIP's ability to meet its ongoing obligations to flood policyholders (e.g., United States Treasury Bill often referred to as risk free). Insurance companies owned by larger parents often receive higher financial strength ratings than they would on a stand-alone basis because of the parent company's ability to provide additional capital in times of crisis. One could easily argue that the U.S. government represents a financially sound parent for the NFIP.

## 5.4 Application of NFIP Indicators to the NFIP

Table 14 presents the findings from section 6.3.

**Table 14: Application of Insurance Industry Indicators to the NFIP**

<b>Insurance Industry Metric</b>	<b>Application to NFIP</b>
IL Ratio	Applies
LAE Ratio	Applies
Combined Ratio	Applies
Operating Ratio	Do Not Apply
Net Liability to Surplus Ratio	Do Not Apply
Net Premium to Surplus Ratio	Do Not Apply
RBC Ratios	Do Not Apply
NAIC IRIS Ratios	Do Not Apply
Financial Strength Rating	Unclear

Given the NFIP's current goal with respect to achieving actuarial soundness (see Section 6), the NFIP should monitor the program's combined ratio, which measures how much of a premium dollar is dedicated to paying insurance costs in a year. If the NFIP were operated like an insurance company (that is, if it charged actuarial rates to all policyholders, capitalized the program with adequate surplus, and did not have to compete with Federal disaster assistance), all of the above indicators should be appropriate for the NFIP. However, only the IL ratio, LAE ratio, combined ratio, and possibly the financial strength rating metrics apply to the NFIP given these qualifications.

As the NFIP continues to address repetitive loss properties, actively promote mitigation and proper floodplain management, and the pool of pre-FIRM policies continues to shrink, the program could see a lower combined ratio and possibly some reduction in the volatility of the combined ratio over time. However, floods by their very nature are unpredictable (e.g., Hurricane Katrina and Rita) and cannot be completely managed away.

The NFIP currently tracks financial data in its annual Actuarial Rate Review that is consistent with the monitoring of the combined ratio by insurance companies. The NFIP review displays the underwriting profit/(deficit) per policy by year from 1978-2003. If the NFIP could price policies using a crystal ball, the resulting underwriting profit would be zero, which equates to a combined ratio of 100 percent or an average underwriting profit/(deficit) per policy of 0. The NFIP underwriting profit/(deficit) per policy exhibit could easily be adjusted to include the

implied combined ratio by year. No matter which statistic is tracked, if the volatility of the combined ratio decreases, the volatility of the underwriting profit/(deficit) per policy will also decrease. The historical average loss year will be discussed in greater detail in Section 6 and Section 8.

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## 6. GOALS AND OTHER OBJECTIVES

### 6.1 The NFIP's Actuarial Soundness Goals

The NFIP's current goals with respect to actuarial soundness are twofold.

The first is to charge actuarial premiums to all construction built in a community after it joined the NFIP, as well as to charge actuarial premiums to all structures outside the SFHA, regardless when they were built. In this way, the insurance premium enters into a symbiotic arrangement with floodplain management. That is, insurance full-risk premium to any structure built out of compliance. These full-risk premiums can be quite large (sometimes amounting to tens of thousands of dollars) and act as a deterrent to unwise building. In turn, proper floodplain management assures that the flood risk to new structures is reduced to the level where full-risk premiums are affordable, helping the insurance company to collect sufficient premium

The second goal with respect to actuarial soundness concerns the proper level of premiums to be charged the remaining subsidized policyholders. The existence of subsidized premiums is mandated by statute. However, the NFIP does attempt to generate sufficient revenue through the combined premium from actuarial and subsidized policies to pay the average losses associated with all but the truly catastrophic loss year. The metric that the NFIP has developed to achieve this is "historical average loss year."<sup>46</sup> Under this concept, the target for NFIP premiums in total is not the actuarially indicated level, but rather a level that is at least sufficient to cover expenses and losses relative to the average of what has been paid in the past by the program, trended to a cost and coverage level commensurate with the loss exposure underlying the rate review. FEMA's Actuarial Rate Review states (FEMA 2004a): "In establishing a fiscally sound program, which was achieved in 1988, FEMA has stressed that, as opposed to the traditional insurance definition of fiscal solvency, the NFIP's intent is to generate premium at least sufficient to cover expenses and losses relative to what is called the 'historical average loss year'."

Prior to 2005, there were no truly catastrophic events in the history of the NFIP, and the historical average was less than the true long-term average. Unfortunately, as witnessed by the devastation caused by Hurricane Katrina, the historical average loss year understates the future loss potential of the NFIP because the program's loss history does not include a credible sample of possible future losses. In addition, historical losses incurred by the NFIP do not reflect changes in policyholder demographics which increase the probability of higher losses in the future (See Section 8.1 for a detailed discussion of the historical average loss year).

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<sup>46</sup> Approximately 27 percent of all policies issued by the NFIP are subsidized by congressional mandate. These policies pay on average 35-40 percent of their actuarial cost. There are no other parties paying more than their actuarially fair share to make up the premium shortfall caused by the subsidization of greater than one out of every four policies. The end result is that the NFIP is not able to collect enough premiums in total to match the amount indicated by the actuarial rates. NFIP's goals with respect to actuarial soundness is to support sound floodplain management through assessing all post-FIRM structures actuarial premiums. With regard to the subsidized policies, NFIP's goal has been to charge sufficient premium to these policies, so that the program is likely to be able to be self-sufficient except for truly catastrophic loss years. To address this issue, FEMA established the concept of the "historical average loss year" as an easily explained measure.

According to the November 2004 NFIP Actuarial Rate Review, the combination of the actuarially indicated premiums charged to the non-subsidized book and the subsidized premiums charged to the subsidized book will be equal to 124.3 percent of the historical average loss year funding requirement. The existence of the subsidized population and the significant amount of subsidization in their rates will make it very difficult for the NFIP to approach a premium level that is consistent with long-term costs for quite some time to come. Sources at the NFIP estimate it will take at least another twenty years for the program to approach long-term self-sufficiency, as this will only occur by either the phase-out of subsidies or the replacement of subsidized properties with construction that meets current standards and can afford to be included in the non-subsidized book.

When the NFIP was created, the U.S. Congress recognized that insurance for “existing buildings” constructed before a community joined the Program would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these flood-prone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. Under the NFIP, “existing buildings” are generally referred to as pre-FIRM (Flood Insurance Rate Map) buildings. These buildings were built before the flood risk was known and identified on the community’s FIRM.

The 1968 Act requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as post-FIRM buildings.

In addition to the information provided in the NFIP Actuarial Rate Review, we considered the responses to a six question survey of key NFIP stakeholders, which included the following question: “What do you believe is the NFIP’s current goal with respect to achieving actuarial soundness?”<sup>47</sup> One response yielded the following statement: “A fiscally sound NFIP for the average historical loss year combined with the furthering of floodplain management goals to the extent practical.” The importance of this response and the ramifications of using the historical average loss year will be discussed in greater detail in Section 8.

## **6.2 Other Objectives and the Effects on Actuarial Soundness Goals**

The NFIP has a number of other objectives in addition to the goal of achieving actuarial soundness (see Section 8.1 for a detailed discussion of Competing Objectives to the NFIP’s

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<sup>47</sup> Deloitte interviewed current and former NFIP staff to verify the current goal with respect to achieving actuarial soundness. As part of the interview process, some NFIP stakeholders responded to our email survey which asked the following six questions: 1) What is your “perfect world” vision of an optimal goal for the NFIP? 2) What do you believe is the NFIP’s current goal with respect to achieving actuarial soundness? 3) What do you believe are the top 5 to 10 impediments for the NFIP to reach actuarial soundness? 4) Do you anticipate any future revisions to the goal that will help achieve actuarial soundness? 5) Have any past revisions to the goal helped achieve actuarial soundness? 6) What revisions to the goal would you suggest to help achieve actuarial soundness?

actuarial soundness). Section 4001 of Title 42 (The Public Health and Welfare), Chapter 50 (National Flood Insurance) states the following in regards to the further purpose of this chapter:

1. Encourage State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses,
2. Guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards,
3. Encourage lending and credit institutions, as a matter of national policy, to assist in furthering the objectives of the flood insurance program
4. Assure that any Federal assistance provided under the program will be related closely to all flood-related programs and activities of the Federal Government, and
5. Authorize continuing studies of flood hazards in order to provide for a constant reappraisal of the flood insurance program and its effect on land use requirements.

As noted in further detail in Section 8.1, the NFIP currently aims to maximize the number of people who have flood insurance in order to lessen the reliance on disaster assistance. In order to maximize the number of NFIP policyholders, Congress has recognized that offering subsidized rates (e.g., pre-FIRM, grandfathering) increases participation. Section 4001 also states: “If such a program is initiated and carried out gradually, it can be expanded as knowledge is gained and experience is appraised, thus eventually making flood insurance coverage available on reasonable terms and conditions to persons who have need for such protection.” We note that coverage available on reasonable terms and conditions does not necessarily translate into the charging of actuarial rates. Reasonable terms and conditions, which may include the offering of subsidized rates, actually compete directly against the goal of achieving actuarial soundness.

Publicly available material reviewed by the sub-study team and produced by floodplain managers indicates support for prioritizing these other goals, especially proper floodplain management, over that of strict actuarial soundness and the charging of actuarial sound rates. The following list of items identified by Wisconsin’s Floodplain Planning Manager Gary Heinrichs is representative of the material reviewed from other NFIP regions in terms of program-wide goals<sup>48</sup>:

- Reduce loss of life and property caused by flooding,
- Reduce rising disaster relief costs caused by flooding, and
- Reduce the reliance on flood disaster relief dollars by providing an alternate means of protection for an individual’s home.

The above list, like most others, notably excludes reference to actuarial soundness.

In addition to goals for the overall program, the following approaches to accomplishing the NFIP goals discussed by various floodplain managers did not focus on the topic of actuarial soundness:

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<sup>48</sup> From the University of Wisconsin Center for Land Use Education web site ([www.uwsp.edu/cnr/landcenter/](http://www.uwsp.edu/cnr/landcenter/)).

- Require new construction and residences meeting the NFIP's substantial improvements clause to be flood resistant,
- Guide future development away from flood hazard areas,
- Transfer flood costs from taxpayers to floodplain property owners,
- Prohibit new development in designed floodplains that would increase flood heights,
- Publish maps to identify high flood-risk areas,
- Inform and educate public to make them aware of the flooding risk to their property, and
- Make affordable Federally backed insurance coverage available to property owners.

The key message observed in the material we reviewed consistently focused on making insurance coverage affordable, not making insurance coverage available at actuarially sound rates. A majority of the stakeholders focused their efforts on proper floodplain management, with insurance coverage being one of the many items of a successful flood insurance program. Given the NFIP's many objectives and the different focus of its many stakeholders, it is easy to see how other goals can compete directly with the program's ability to achieve actuarial soundness. The effects of these goals and the impediments they create in achieving the goal of actuarial soundness will be discussed in Section 8.

## 7. PROGRESS

### 7.1 NFIP Progress in Achieving Actuarial Soundness

This review indicates that the NFIP has made some progress, albeit limited, towards the goal of actuarial soundness in areas such as reducing the number of pre-firm properties, addressing repetitive loss properties, increase in the subsidized rates, restriction of contents coverage in the basements, excluding grandfathered properties and higher risk X-Zone structures from Preferred Risk Policy (PRP) eligibility requirements, introduction of wave heights in V-Zones for determining BFE, map modernization, focusing on customer retention, erosion and new product offerings. This section discusses the NFIP's progress. Section 7.2 then discusses the NFIP's progress in achieving actuarial soundness based solely on standard insurance industry benchmarks discussed in Section 6.3. In the next section of the report, section 8.2 discusses the obstacles the NFIP must overcome in order to achieve actuarial soundness.

#### Pre-FIRM Properties

As noted earlier, pre-FIRM properties, as a percentage of the total number of insured properties has declined substantially over the past 20 years from approximately 83 percent in 1985 to approximately 24 percent in 2004. This shift in the NFIP's distribution towards actuarially-rated policies, combined with increases to subsidized premiums that currently provide coverage at about 35 to 40 percent of the actuarial cost is slowly pushing pre-FIRM subsidized rates towards actuarial soundness. This shift in the NFIP business is the result of new properties in SFHA being built to meet Post-FIRM standards and the NFIP achieving greater penetration outside of SFHA, especially through the program's Preferred Risk Policy. Both of these are significant accomplishments of NFIP.

#### Repetitive Loss Properties

According to the GAO (2004a), repetitive loss properties represent a significant portion of annual flood insurance claims. About 1 percent of the 5 million properties currently insured by the program are considered to be repetitive loss properties – properties for which policyholders have made two or more \$1,000 flood claims. Historically, about 38 percent of all program claim costs have been the result of repetitive loss properties, at a cost of \$4.6 billion since 1978. FEMA officials estimate that these repetitive loss properties will account for about 20 percent to 25 percent of losses in future years. This is primarily due to the improvement in the distribution of business described in the previous paragraph. It is clear that there remains much potential for improvement with regard to repetitive loss properties.

The mitigation of repetitive loss properties is an important step in moving the NFIP towards the goal of achieving actuarial soundness. With the passage of the “Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004” (FIRA04), the NFIP has established a pilot program for the mitigation of severe repetitive loss properties and the funding of mitigation activities for individual repetitive loss properties. FIRA04 expands upon previous repetitive-loss property efforts of FEMA and will provide the incentive for even more repetitive-loss property owners to mitigate their properties through buyouts, elevation, relocation or flood-proofing.

Property owners who refuse to mitigate their property will be charged increased premiums. If the NFIP can focus its energy and efforts on a very small pool of properties driving a majority of the paid losses, the NFIP has a better chance of moving towards actuarial soundness.

### Flood Maps and Map Modernization

FEMA's Flood Map Modernization Program, although in its early stages, will lead to actuarial pricing that is based upon FIRMs that better reflect the current risk of flooding. As the GAO (2004b) noted:

Through its Map Modernization Program, FEMA intends to use advanced technologies to produce more accurate and accessible digital flood maps available on the Internet. These maps are expected to improve community efforts to reduce the impacts of floods, increase property owners' use of flood insurance, and improve community, state and Federal efforts to reduce risks of other natural and man-made hazards.

The map modernization effort will also have a positive impact on flood insurance participation from the lender community because the new maps will more accurately identify properties that are in a floodplain. In addition to property owners who would be required to purchase flood insurance for the first time, property owners who did not purchase or maintain flood insurance would be paying prices more reflective of the risk in the SFHA (i.e., not the preferred rate that they were benefiting from). Compared with existing paper maps, accessing the new maps through the Internet will make it easier for lenders to identify property owners who should have flood insurance.

The Map Modernization Program is an important step in moving the NFIP towards the goal of achieving actuarial soundness. With over 20,000 communities participating in the NFIP, electronic access to more accurate FIRMs will make it easier for Write-Your-Own (WYO) companies<sup>49</sup> and lenders to appropriately identify and price properties that should be purchasing flood insurance. For post-FIRM construction building and contents rates, accurately depicted Base Flood Elevation (BFE) information is the critical component for determining a flood policyholder's annual rate per \$100 of coverage. The elevation certificate and elevation of the lowest floor above or below BFE drives the final rate.

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<sup>49</sup> The [Write Your Own \(WYO\) Program](#), begun in 1983, is a cooperative undertaking of the insurance industry and FEMA. The WYO Program allows participating property and casualty insurance companies to write and service the Standard Flood Insurance Policy in their own names. The companies receive an expense allowance for policies written and claims processed while the Federal Government retains responsibility for underwriting losses. The WYO Program operates within the context of the NFIP, and is subject to its rules and regulations.

The goals of the WYO Program are:

1. Increase the NFIP policy base and the geographic distribution of policies;
2. Improve service to NFIP policyholders through the infusion of insurance industry knowledge; and
3. Provide the insurance industry with direct operating experience with flood insurance.

Currently, about 100 insurance companies write flood insurance with FEMA.

The Map Modernization Program does not solve all problems with maps. Setting precise BFE levels is difficult, however, as there are many factors involving hydraulics and hydrology, some of which may involve considerable uncertainty. Some of the factors involved in setting BFEs must be developed by use of probability distributions that represent statistical portraits of the frequency of given flows. BFEs are presented and discussed as only the central tendency point estimates – usually the mean estimated flood elevation. The true level at which the flood with a 1-percent annual chance probability would occur could be higher or lower, by inches or by feet. Thus, confidence intervals may be developed, but in practice only the one central value is used.<sup>50</sup> The point used does not represent the most conservative estimate of where that flood would be at the time that the estimate is made.

One important relevant issue beyond the Map Modernization Program that currently is not incorporated into this effort, but that can affect accuracy of providing actuarial rates, is that even this mapping effort soon will lead to inaccurate maps. Most maps are drawn and measurements made for BFEs based on the current state of development in an area. For areas that are developing rapidly, these maps do not reflect development that could be anticipated, which greatly affect the accuracy of BFEs, and thus the ability to set actuarial rates. Using mean estimates for the 1 percent flood level thus is particularly problematic for setting proper actuarial rates to cover all future costs, as required in the definition of actuarial soundness established earlier. For further discussion of the subject of mapping for future conditions, see *Managing Future Development Conditions in the National Flood Insurance Program* (Blais *et al.*, 2006).

#### Focus on New Customers and Renewal/Retention Ratios

The NFIP is actively targeting first time flood insurance customers outside of SFHAs while at the same time focusing on retaining a higher percentage of the program's current policyholders. Watermark (2004a) noted:

As part of FEMA's efforts to reach an annual NFIP net growth rate of 5 percent, the Mitigation Division's Office of Risk Communication is working on several fronts to determine (a) why so many NFIP policies are falling out of the program's database, and (b) what the Office of Risk Communication can do to keep these policies within the NFIP. If we can find ways to reduce the "attrition" of the NFIP flood policies, the program's annual net growth rate will undoubtedly rise.

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<sup>50</sup> One can indicate that the flow producing a 1 percent flood will lie somewhere between two flow values. If the confidence limits are low, the spread can be low; if the confidence limits are high the spread will be large. For example, it might be possible to compute that with 95 percent confidence that the 1 percent flow of a given river would fall between 150,000 cfs and 170,000 cfs. If you used the mean (160,000) as the measure of the 1% flood, you could indicate that the elevation of the 1percent flood would be at 30 feet but would know that it could be as low as 28 or as high as 32 feet, but there remains a 5 percent probability that the actual level lies outside that range. If you seek to have a high level of confidence, such as 99 percent, that you have bracketed the 1-percent flood, the flow values spread to 100,000 to 220,000 and the height above and below the mean of 160,000 could be 6 feet. Typically, in identifying the 1percent flood, the mean is used, yet this leaves the possibility that the actual 1 percent flood height (and thus proper level of protection) is 6 feet too low or 6 feet too high (Galloway *et al.*, 2006).

These efforts are important because retaining current policyholders reduces acquisition costs and increases ratemaking credibility. FEMA has implemented a new comprehensive marketing and advertising campaign, FloodSmart, which is designed to support Federal regulatory and lending agencies in meeting the mandatory flood insurance purchase requirements.

A visit to the FloodSmart website ([www.floodsmart.gov](http://www.floodsmart.gov)) illustrates the effort taken by FEMA to assist WYO companies and insurance associations with lead generation aimed at increasing the number of flood insurance policies sold. The web site provides educational material focusing on flood insurance basics, frequently asked questions, NFIP resources and other important facts. In addition, the website's insurance center describes important insurance policy considerations such as how to purchase flood insurance coverage, details on the NFIP's three standard policy forms, reasons to renew, and how to file a claim.

The NFIP's focus on policyholder growth and retention is an important step in moving the NFIP towards the goal of achieving actuarial soundness. With the current growth rate hovering around 1 percent, any shift towards the 5 percent goal would be a major improvement to the program's fiscal soundness. By increasing the number of new policies the NFIP brings in every year or by retaining a higher percentage of the current 5 million policyholders, the NFIP would accomplish the following:

- Increase premium revenue and the funding of future losses to the extent that new policies are actuarially priced;
- Reduce fixed costs as a percentage of premium revenue;
- Increase ratemaking credibility by increasing the number of insured (i.e., impact the Law of Large Numbers);
- Increase lender compliance by conducting information and education programs to inform lenders on how to reduce losses to property and assets that can be caused by natural disaster ; and
- Address the program's goal of floodplain management.

A challenge for FEMA is to expand the NFIP policyholder base by enforcing mandatory purchase requirements and encouraging voluntary purchase by homeowners who live in areas at lower risk of flooding. About 50-60 percent of single-family homes in SFHAs are subject to the mandatory purchase requirements, and compliance with it appears to be 75 to 80 percent.<sup>51</sup> There has been some congressional interest in the feasibility of expanding mandatory purchase requirements beyond the current special high-risk areas, however, there are a number of difficulties to assessing the impacts, effectiveness, and feasibility of such a change in the structure of the NFIP, as well as concerns related to enforcing and assessing compliance. For example, more precise flood mapping of areas outside the current high-risk areas would be required to accurately identify affected property owners. FEMA and its private insurance partners also have efforts underway to increase NFIP participation by marketing policies in areas where purchase is not mandatory.

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<sup>51</sup> Dixon et al., 2006, page ix

It is also important to note that expanding the mandatory purchase requirement beyond the current 100 year flood standard, which was proposed during 2005-06 Senate testimony, would increase ratemaking credibility and decrease somewhat adverse selection by increasing the number and spread of the NFIP's policyholders outside the SFHA. However, it would be important to note that the rates charged to the new policyholders should be actuarially determined in order to continue the program's progress toward actuarial soundness.

### Addressing Erosion

The NFIP has begun addressing the issue of erosion by adjusting the rates they charge V Zones (i.e., coastal high-velocity zones). FEMA (2004) notes the following with regard to V Zone experience: The increased risk of flooding brought about by erosion has been an area of concern for the NFIP. The 1994 NFIP reform legislation directed a study of a series of possible policy changes to address erosion hazards within Federal programs. The Heinz Center for Science, Economics and the Environment was contracted to perform this analysis, and the study was released in June 2000. The study results demonstrated that the risk of flooding in those areas of V Zones that are susceptible to erosion will increase dramatically (a two- to three-fold increase in the risk in various areas of the country) during the next 30 to 60 years.

The NFIP's ratemaking methodology for V Zones has not directly addressed this increased flood risk brought about by erosion. FEMA currently is investigating ways to do so in the flood maps and the flood rates. The Flood Insurance Rate Maps could be refined to delineate erosion zones. However, that will depend upon funding, development of mapping standards, and political acceptance of higher premiums targeted at those subject to the increased flood risk due to erosion. In May 2001, to partially address the hazard of erosion, the NFIP began a multiyear plan to increase rates for all V Zone policies. The fourth round of increases, which will be part of the May 1, 2004, rate changes, varies between 5 percent and 8 percent.

The reflection of higher rates for V Zones policies affected by erosion is a step in moving the program towards achieving actuarial soundness. Given the alarming findings in the Heinz Center study, it is likely that the NFIP will need to take significant future rate increases in order to address the rising impact of erosion on the NFIP over the next few decades and the effect of higher risk on the goal of actuarial soundness.

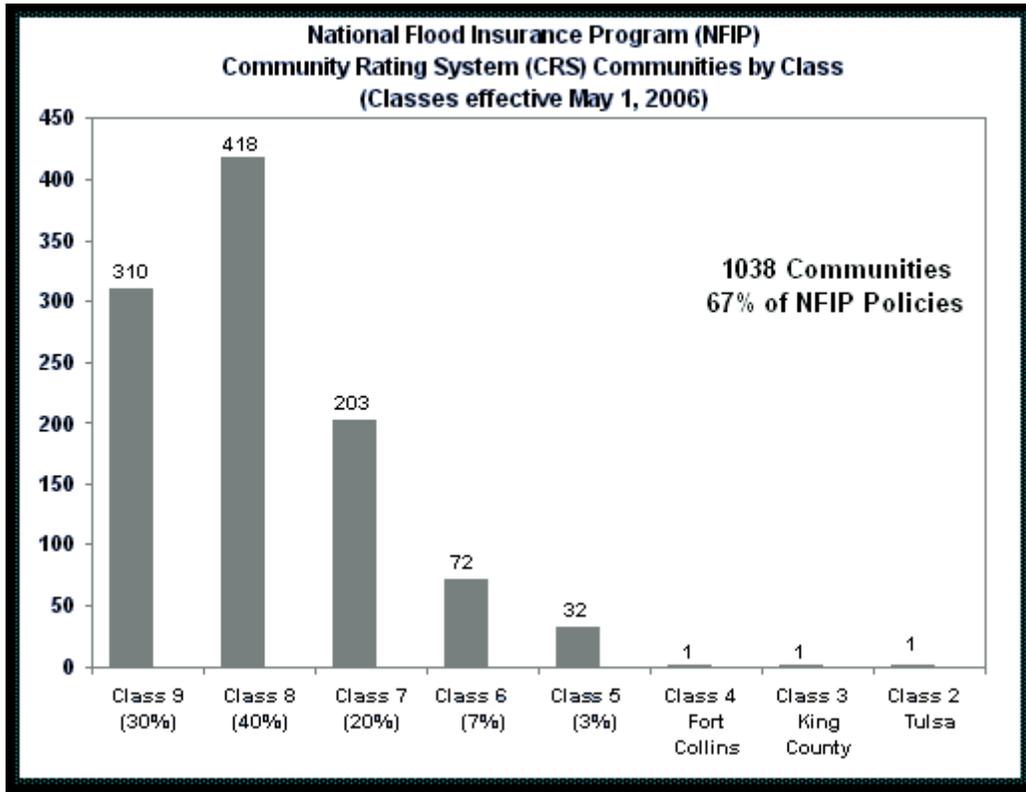
### Community Rating System (CRS)

As of October 1, 2005, the NFIP's CRS includes 1,028 communities that have community floodplain mitigation activities that go beyond the minimum measures required by the standard NFIP participation agreement. Each of these communities has earned a discount by addressing some or all of the 18 different activities identified in the CRS manual that fall into one of the following four categories:

1. Public Information
2. Mapping and Regulation
3. Flood Damage Reduction
4. Flood Preparedness

CRS communities receive discounts ranging from 5 percent (Class 9) to a maximum discount of 45 percent (Class 1). The graph below displays the current CRS class distribution and the percent discount received by policyholders.

FIGURE 3: CRS Communities by class



SOURCE: NFIP website <http://www.fema.gov/business/nfip/crs.shtm>

90 percent of CRS communities receive discounts ranging from 5 percent to 15 percent. Only one community has received a discount of 40 percent, NFIP's second highest rating (i.e., Class 2). Although the 1,038 CRS communities represent only 5 percent of the over 20,000 communities participating in the NFIP, they represent approximately 67 percent of the NFIP policies in force illustrating the value of the program. The NFIP publicizes communities that have benefited from proactive floodplain management.

CRS Communities by Class as of May 1, 2006

- Class 9 = 310 (30%) Discount = 5%
- Class 8 = 418 (40%) Discount = 10%
- Class 7 = 203 (20%) Discount = 15%
- Class 6 = 72 (7%) Discount = 20%
- Class 5 = 32 (3%) Discount = 25%
- Class 4 = 1 (Fort Collins, CO) Discount = 30%

- Class 3 = 1 (King County, WA) Discount = 35%
- Class 2 = 1 (Tulsa, OK) Discount = 40%
- Class 1 = 0 Discount = 45%<sup>52</sup>

In addition to the Watermark publications, post-disaster research done by the FEMA has been used to illustrate the positive impact on communities that have adopted stronger floodplain management (e.g., Hurricane Floyd study on six communities in the Virginia Tidewater area, success of buyouts in Austin, Minnesota, Flood Mitigation Assistance program success stories, etc.). For example, in Austin, Minnesota, a losses avoided analysis has demonstrated a 55 percent return on mitigation investment for two phases of property acquisitions resulting in 163 properties being removed from the flood plain before a major flood event in 2000 (Minnesota 2001). By calculating returns on mitigation investments and discussing success stories on acquisition, relocation, and retrofitting of flood prone properties, the NFIP illustrates how some CRS community activities have contributed to reduced flood damage<sup>53</sup>.

As a final note, Table 15 displays a comparison of CRS and non-CRS policy loss ratios using data evaluated as of 5/31/2004.<sup>54</sup> Although the NFIP does not rely on CRS/non-CRS data comparisons because of the number of control variables that would need to be accounted for in order to draw any meaningful conclusions over time, the information has been provided for informational purposes.

**TABLE 15: CRS / Non-CRS Policies**

POLICY YEAR	CRS POLICIES			NON-CRS POLICIES		
	WRITTEN PREMIUM (in \$ billions)	PAID LOSSES (in \$ billions)	LOSS RATIO	WRITTEN PREMIUM (in \$ billions)	PAID LOSSES (in \$ billions)	LOSS RATIO
1993	0.49	0.32	64.6%	0.24	0.34	140.5%
1994	0.54	0.18	33.3%	0.27	0.23	85.9%
1995	0.60	1.07	176.7%	0.29	0.23	78.0%
1996	0.67	0.33	49.4%	0.33	0.50	151.2%
1997	0.78	0.25	32.5%	0.42	0.27	63.3%
1998	0.86	0.41	47.4%	0.46	0.47	101.7%
1999	0.87	0.39	44.9%	0.48	0.36	74.5%
2000	0.93	0.17	18.5%	0.51	0.08	15.3%
2001	1.03	1.01	97.6%	0.56	0.25	45.1%
2002	1.10	0.22	19.9%	0.60	0.20	33.3%
2003	1.16	0.22	18.9%	0.64	0.35	54.9%
<b>TOTAL</b>	9.02	4.56	50.50%	4.80	3.27	68.10%

SOURCE: Information pulled from NFIP report SRRR9993C – “CRS & non-CRS policies”.

<sup>52</sup> In October 2006, policyholders in Roseville California became the first NFIP community to receive a Class 1 designation from the Federal Emergency Management Agency.

<sup>53</sup> Flood Mitigation Assistance (FMA) program guidance in 1999 encouraged states to target repetitive loss properties with four or more losses. CRS credits were increased for acquisition, relocation and retrofitting of floodprone properties with bonuses added for addressing repetitive loss buildings.

<sup>54</sup> Information pulled from NFIP report SRRR9993C – “CRS & non-CRS policies”.

Over the 11-year period, the loss ratio for CRS policies has exceeded the loss ratio for non-CRS policies in only three out of eleven years. Over the 11-year period, the CRS policy loss ratio is 25 percent lower than the non-CRS policy loss ratio. A large caveat regarding aggregate, uncontrolled data is that they do not distinguish when a policy converted to a CRS policy. CRS policies written during this time period were predominately in Florida. In discussions, NFIP's actuary emphasized that losses in Florida during this time period were very favorable, likely driving the 25 percent difference. This period of favorable losses appears to have ended with the 2004 and subsequent Florida hurricane activity which has adversely affected CRS community loss ratios.

Increasing self-initiated and voluntary mitigation activities that exceed the measures required by the standard NFIP participation agreement (especially CRS activities that have a direct effect on damage reduction) is a step in moving the NFIP towards the goal of achieving actuarial soundness. Mitigation activities, especially measures that help to reduce the severity of flooding events, helps to reduce the volatility of flood related losses in CRS communities.

### Preferred Risk Policy (PRP)

The PRP was introduced in January 1989 as a way for agents to sell easy-to-rate policies to properties located in lower-risk flood zones, where flood insurance is not mandatory, that meet eligibility requirements based on the property's flood loss history. The policy offers fixed combinations of buildings/contents coverage or contents-only coverage at modest, fixed premiums, and can be written on a one-page form with pre set limits and premium. According to the Watermark (Watermark 2004b) publication the PRP has been the NFIP's fastest growing insurance product, with studies showing 90 percent of PRP policies renewing.

The ability of the PRP to attract and retain NFIP policyholders is an important step in moving the NFIP towards the goal of achieving actuarial soundness. PRPs are available to structures that are outside of the Special Flood Hazard Area and have not flooded more than once. To assure that these conditions are met, the following two underwriting requirements were implemented in 1998:

- The insured property must be in the X Zone at the time of the policy inception and at each subsequent renewal; hence, no "grandfathering" is allowed.
- The insured property's flood history must meet additional requirements regarding paid insured losses and Federal Disaster Relief payments.

Since those underwriting rules were implemented, the PRP experience has substantially improved, except for 2001, when Tropical Storm Allison stalled over Harris County, Texas. While Allison also produced flooding in Louisiana, Mississippi, and Pennsylvania, most of the PRP losses were attributable to incorrectly mapped X Zones in Houston and the surrounding area. Flood maps have since been updated to more accurately reflect the true flood hazard in those areas. The PRP encourages new flood insurance customers to join the program while at the same time retaining a significant percentage of the current policyholders. As is well known in the insurance industry, it is more cost efficient to retain current policyholders than it is to write new business or attempt to reacquire past customers.

## Mortgage Portfolio Protection Program (MPPP)

The MPPP was introduced on January 1, 1991 as an additional tool to assist mortgage lending and service industries in bringing their mortgage portfolios into compliance with the Flood Disaster Protection Act of 1973. Since the lender or servicer issuing the MPPP policy does not have all of the underwriting variables required to write a standard NFIP policy, FEMA targets MPPP rates at levels that will compensate the program for the greater uncertainty in these risks. Effective May 1, 2003, MPPP rates were increased for the first time in several years. In a continuing effort to assure that these rates are in line with those charged to FEMA's non-MPPP policyholders, the rates were again increased effective May 1, 2004 and May 1, 2005. As is noted in the NFIP's Flood Insurance Manual FEMA (2004)<sup>55</sup>: It is intended that flood insurance policies be written under the MPPP only as a last resort, and only on mortgages whose mortgagors have failed to respond to the various notifications required by the MPPP. The MPPP's ability to increase lender compliance through the various notifications required by the MPPP is an important step; however, there is a significant risk of adverse selection. MPPP also does not provide contents coverage leaving the policyholders more exposed to flood risk.

Section 8 discusses the impediments the NFIP faces in furthering the work the program has done in these areas.

## **7.2 NFIP Progress Based on Indicators**

Due to the catastrophic nature of flooding and the challenges of actuarially pricing such volatile, large-scale risks, we believe it is difficult to state the progress the program has made based solely on standard insurance industry benchmarks.<sup>56</sup> However, according to insurance companies' and regulators' methods of assessing financial solvency and actuarial soundness, the NFIP has made progress towards actuarial soundness despite the constraints imposed by its other objectives. For instance, the NFIP has mitigated severe repetitive loss properties, updated floodplain maps, and increased participation in the Community Rating System (CRS).<sup>57</sup> NFIP rate calculations for post-FIRM properties are based on the pure premium method, a standard actuarial approach to developing rates. The NFIP's continuously updated "hydrologic" model incorporates the unique nature of the risks covered, as well as the Congressional limitations imposed on it.

However, we believe it is still important to monitor standard insurance industry benchmarks relative to other lines of business. As noted above, the standard deviation of the NFIP combined ratio is significantly higher than other lines of business<sup>58</sup> and the NFIP's

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<sup>55</sup> From Section I of the MPPP found in the NFIP Flood Insurance Manual.

<sup>56</sup> Similar to the private sector exiting the flood insurance market roughly 50 years ago, we are seeing a similar trend in lines of business such as hurricanes, earthquakes and terrorism that are difficult to actuarially price and measure.

<sup>57</sup> Increasing self-initiated and voluntary mitigation efforts that exceed standard NFIP participation requirements, particularly CRS activities that directly reduce flood damage, will help the NFIP achieve actuarial soundness. Measures that mitigate the severity of flooding events reduce the volatility of flood-related losses in CRS communities.

<sup>58</sup> We note that the single peril earthquake line of business would likely exhibit high levels of volatility, as compared to the five coverages selected based on the Financial Assistance/Subsidy Arrangement.

combined ratio spread is more than double the spread for allied lines, the second most volatile property coverage for the insurance industry coverages reviewed. Over time, the success of the NFIP's actions can be measured relative to other lines (e.g., spread decreases from double to 50 percent higher) in order to benchmark whether the program is successful in moving towards actuarial soundness.

## **8. COMPETING OBJECTIVES AND OVERCOMING OBSTACLES**

This section addresses competing objectives and impediments that may hinder progress towards achieving the goal of actuarial soundness.

To initiate the research process and identify key issues, the study teams asked six key NFIP stakeholders what they believe are the top five to ten impediments for the NFIP to reach actuarial soundness. The most frequent responses were:

- Pre-FIRM rate structure
- Repetitive loss properties
- Legislated maximum flood insurance coverage amounts
- Funding of flood insurance studies and mitigation activities with policyholder funds
- Lack of funding to keep flood insurance studies current
- The impact of erosion and mudslide legal definitions on studies and mapping these hazards

Although the number of respondents was limited, the survey respondents were chosen because of their in depth working knowledge of the program.

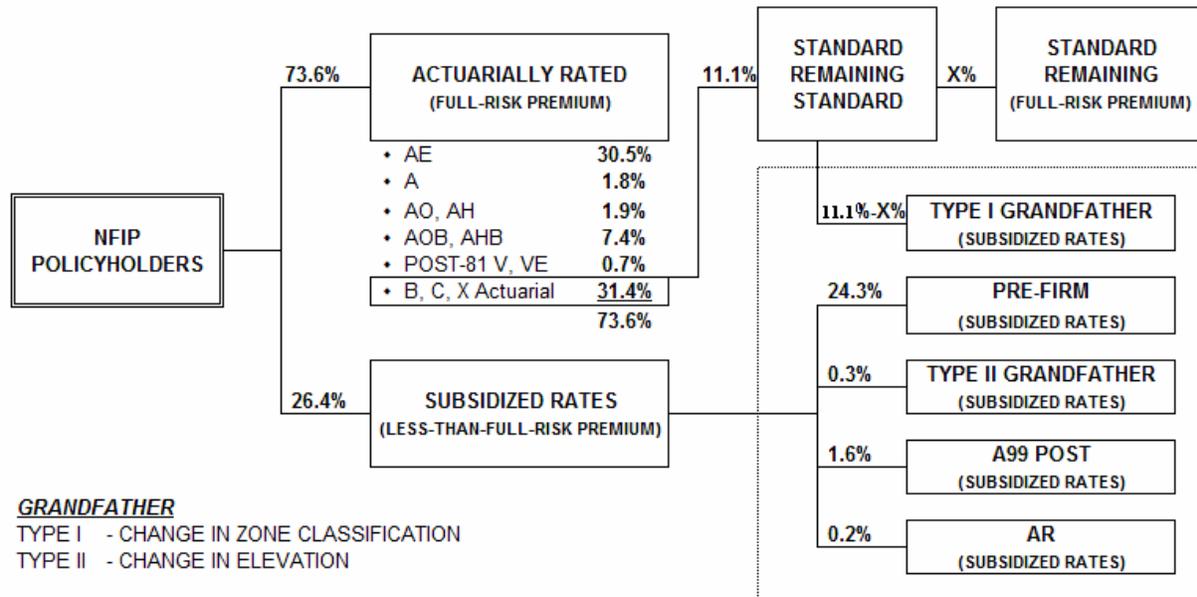
### **8.1 Competing Objectives to the NFIP's Actuarial Soundness**

This review indicates that the NFIP has competing objectives that will hinder the program's progress achieving actuarial soundness. These competing objectives include congressionally authorized subsidies, focus on the historical average loss year, floodplain management goals, community compliance and maximization of policyholders which are discussed in this section.

#### Congressionally Authorized Subsidies

Figure 4 displays the breakdown of the NFIP's current policyholder base, showing the percentage that are being charged subsidized rates.

FIGURE 4: Distribution of NFIP business



SOURCE: Developed from Exhibit A of November 2004, Actuarial Rate Review.

As one can see, less-than-full-risk premiums represent over 26 percent of the NFIP's current distribution of business. Approximately 24 percent of the subsidized rates are related to pre-FIRM property owners. The remaining 2 percent are related to the other three categories. Although the number of pre-FIRM properties will decline slowly over time, the potential growth that may occur in the other categories (e.g., Type II grandfathered properties that have had their prior elevation rating grandfathered at a more favorable BFE after a revision has been made to the FIRM) is an issue for the NFIP. The level of subsidy provided in the program has been the subject of much Congressional debate, and the 1994 NFIP reform legislation directed FEMA to study the economic effects of charging actuarially based premium rates for Pre-FIRM structures. PriceWaterhouseCoopers<sup>59</sup> was contracted to conduct this study, and FEMA released the results during fiscal year 2000. Several provisions of the Flood Insurance Reform Act of 2004 seek to reduce the adverse impact of repetitive loss properties on the National Flood Insurance Fund, which, when implemented, will help reduce the average overall subsidy level.

In addition to the specifically identified subsidized rates, there exists another block of subsidized rates under the B, C, X actuarial rated category. Although not specifically identified by the NFIP, a certain share of the 11.1 percent B, C, X actuarial category represent subsidized rates (i.e., Type I grandfathered properties that have had their original zone classification grandfathered at the X classification<sup>60</sup> instead of a higher rate classification after a revision has

<sup>59</sup> PriceWaterhouseCoopers May 14, 1999 report ([www.floods.org/PDF/pwc.pdf](http://www.floods.org/PDF/pwc.pdf)).

<sup>60</sup> Zones B, C, and X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding

been made to the FIRM). Although not currently readily identifiable according to the NFIP's actuary, Type I grandfathered properties likely represent somewhere in the range of 1 percent to 5 percent of the current distribution of business based on NFIP estimates.

Although Type I grandfathered properties are currently not an issue for the NFIP, the number of grandfathered properties will likely increase substantially as the map modernization effort is completed. Unfortunately, the NFIP's current application for flood insurance does not provide insurance agents with the ability to indicate that administrative grandfathering is the basis for the customer's rate. Therefore, the NFIP does not track grandfathering in its policy data and has no direct way to monitor Type I policy growth. In order to address this future shortfall driven by the map modernization effort, we would strongly recommend that the NFIP begin collecting this information on the current application for flood insurance. If the NFIP is unable to identify, monitor and analyze the financial impact of administratively grandfathered properties in the future, the program cannot expect to understand whether the program is continuing to achieve actuarial soundness.

### Historical Average Loss Year, Catastrophic Losses, and Levees

In 1981 FEMA established the goal to generate premium at least self sufficient to cover expenses and losses relative to what is called the historical average loss year. FEMA (2004) notes: Qualifying the target as the historical average loss year as opposed to the long-term expected annual losses is an important distinction. Actuarially rated policies are charged premiums that consider the probabilities of the full range of possible losses, including catastrophic levels. Thus, these premiums are targeted at the true long-term average. Written premiums for actuarial policies will generally be greater than those that would be based on the historical average loss year. This is consistent with the expectation that the long-term average annual losses will be higher than the historical experience to date because of the influence of relatively infrequent but catastrophic losses. Because NFIP experience since 1978 does not include loss years of catastrophic levels for the program, the historical average is significantly less than that which can be expected over the long term where the influence of extremely large loss years would be felt (e.g., future catastrophes similar in magnitude to Hurricane Katrina reflecting the possibility of levee breaks). The importance of targeting the historical average loss year should not be discounted in the difficulty in reaching actuarial soundness, however. It is the level around which the great preponderance of loss years will concentrate and allows for the accumulation of reserves in years where losses are less than that level to help fund losses in years where they exceed that level.

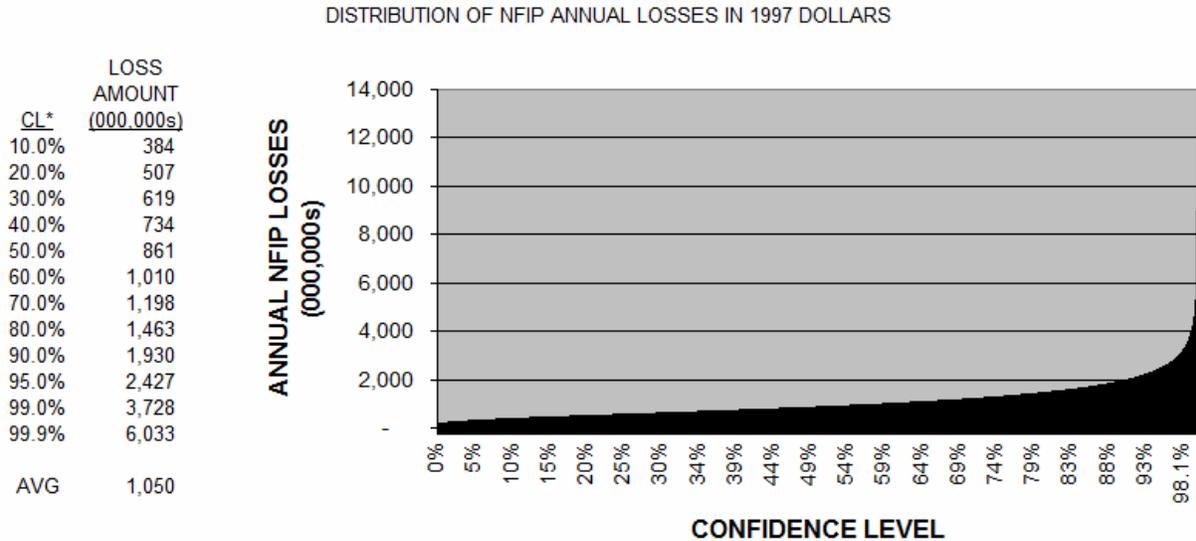
Research regarding the potential level of catastrophic losses facing the NFIP has produced some interesting historical estimates. For example, GAO (GAO 2001b) indicated that Administration officials reported that a catastrophic year at that time was defined as a year resulting in \$5.5 billion to \$6.0 billion in claims losses. The officials gave this level of damage only a 1 in 1,000 chance of occurring. Collecting premiums to meet the historical average loss year does not realize the collections necessary to build reserves for potential catastrophic years in the future.

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where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Deloitte & Touche LLP's (Deloitte & Touche LLP 1999) report investigating alternative financing options for the NFIP modeled the following distribution of annual losses:

**FIGURE 5: Distribution of NFIP Annual Losses in 1997 Dollars**



\* - CL = Confidence Level

= A CL of 40% implies that there is a 40% chance that losses will be less than or equal to \$734 million.

The above distribution indicates that it was estimated there was a 1 in 100 chance that annual NFIP losses could exceed \$3.7 billion (1997 dollars). At the catastrophic level defined by the NFIP, there was a 1 in a 1000 chance that annual NFIP losses could exceed \$6.0 billion in 1997 dollars. Based on discussions with the NFIP's chief actuary, the NFIP believes this catastrophic loss level could be as high as \$9.0 billion after adjusting for inflationary costs and changes in the NFIP's current exposures.

It is important to note that the catastrophic loss levels estimated in the past did not consider the possibility of levee failures. The levee break near the New Orleans's 17th Street Canal and Lake Pontchartrain's flooding of the city through a two-block-long break after Hurricanes Katrina and Rita illustrate the cost ramifications of excluding levee breaks from flood modeling exercises. Although FEMA has not provided public estimates of the flood insurance losses due to the levee failures during Hurricane Katrina, reasonable estimates can be deduced from their loss estimates. If the current \$23 billion dollar Hurricane Katrina, Rita and Wilma estimate was adjusted to remove losses related to the two levee breaks, the estimate would likely decrease significantly. For example, the estimated building and contents claims payments for Orleans and St. Bernard parishes, where flooding was primarily due to levee breaks, is \$11 billion. When ICC claims and loss adjustment expenses the estimate for those two parishes could be as much as \$13 billion.<sup>61</sup> The adjusted loss estimate excluding levee breaks, therefore, still

<sup>61</sup> It is difficult to adjust the overall storm costs for the impact of the levee breaks. For example, flooding claims in Jefferson Parish may have occurred even if the levee did not break.

would produce what would be categorized as a catastrophic loss (i.e., 1 in 1000 event) using the \$9 billion benchmark.

New Orleans is not the only area of the country at risk of floods and for which levee strength is a concern. For instance, there are more than 10,000 miles of levees in California (Galloway *et al.*, 2006, citing Pineda 2006).

Since the Federal government was not always able to provide timely flood protection or because the benefits from proposed local projects did not exceed their costs, in many cases, local groups assumed responsibility for building their own levees to protect farm lands, small communities, developments or even individual homes. In 1941 Congress authorized the US Army Corps of Engineers (USACE) (PL 77-228) to conduct emergency repair or rehabilitation of flood control works damaged by floods, and subsequently permitted similar work for restoration of Federally authorized coastal protection structures damaged by extraordinary wind, wave, or water action (PL 84-99).

There are five fundamental problems with levees. They must be built well, be maintained well, and be modified when changes occur to the predicted river flows they must pass during a flood event. In addition, levees can fail or overtop when their design level of protection is exceeded and, since levees keep flood waters out of a protected area, this same protection can reduce drainage of areas behind the levee and create internal flooding.

Early in the development of the NFIP, HUD determined that when local flood protection works provided protection at or above the 1 percent level, the areas so protected would be removed from the SFHA, and insurance would not be required of those who lived in those areas. Thus, it became advantageous for communities in the NFIP and large areas in the floodplain, to have levees with at least 1 percent protection (National Research Council 1982). As far back as 1980, FEMA had evidence that “the use of a 100 year standard was encouraging construction of levees to the 100 year design level for the sole purpose of removing an area from the special flood hazard designation” (Jimenez 1980). When the standard used in design of the levee is the 1 percent flood, a failure to provide this required level of protection will remove the levee from the NFIP and those behind must acquire flood insurance.

Under current FEMA regulations, 44 CFR 65.10, when an area is protected by a levee that has been designed to pass the 1 percent flood flows or higher and meets certain structural conditions and provisions have been made to handle internal drainage, the levee is shown on the FIRM as protecting that area and the area is mapped as out of the 1 percent zone. As previously indicated, people who live in the certified leveed area are not required to obtain insurance.

To be recognized as providing protection from the 1 percent annual chance flood on NFIP maps, a levee system must meet, and continue to meet, minimum design, operation, and maintenance standards. The height of the levee must meet or exceed the elevation of the 1% flood and, normally, in addition, provide three feet of freeboard if it is a riverine levee system or, in the coastal environment, one foot above a 1 percent wave or maximum wave run-up associated with the 1 percent stillwater surge (whichever is greater). Freeboard has been used to

provide a margin of safety to compensate for those conditions and situations that can not rationally be quantified in the design of the levee system.

In addition, levee systems must meet engineering standards governing embankment protection, embankment and foundation stability, and potential settlement. The levee owners, government or private, must also ensure the safe operation of the system, provide for maintenance of the levee and for interior drainage behind the levee. All structural aspects of the levee design must be certified by a professional engineer or by an appropriate Federal agency.

In 1994, FEMA began a five year \$1 billion flood map modernization program. The program is designed to establish a map production environment that would provide communities maps that are frequently updated with the best available information and are available in digital form. Under this program, as an existing map comes up for review and modernization and a levee is shown on the map as providing protection to a community, the mapping contractor must follow a procedure that requires the owner of the levee (government or private) to produce the original certification of the levees compliance with 44 CFR 65.10 and to indicate that the levee remains certifiable. If the owner is unable to do this, the levee is not mapped as providing protection and those previously exempt from the mandatory insurance provisions of the NFIP must obtain insurance.

The treatment of levees in the NFIP has been debated, studied and staffed for over 30 years. Levees were recognized as part of the NFIP because it seemed to make sense that if levees provided protection that created protection parity with elevated homes or other flood damage reduction works, those protected by levees should be treated, for insurance purposes, in the same manner as those receiving the other types of protection. The consequences of a levee failure or overtopping are far more critical than the slow rising inundation of a home near river.

For over 30 years, governments and practitioners at all levels have pointed to the underfunding of levee maintenance, the absence of thorough inspections and even the lack of information about where levees are located.

Several internal and external studies have recommended that levees protecting urban areas should be built with a higher level of protection. The experience of other countries as well as our own United States experience bears this out. Yet, little is done to move in this direction. If the Federal government does not move to a higher standard, it, in effect is creating a hazard in that it is aware that the public does not understand lesser levels of protection and sees government approval of the lesser level as government endorsement of the safety of these structures.

The historical average loss year also does not reflect occasional lack of congruence between actual and specified risks. Examples include when maps are outdated and when mapping based on current conditions is quickly outstripped by development that affects flooding<sup>62</sup> or after failure of levees that protect areas mapped as out of flood zones<sup>63</sup>.

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<sup>62</sup> See Blais, *et. al*'s (2006) report as part of the Evaluation of the NFIP *Flood Insurance Rate Maps that Reflect Anticipated Development*.

For post-FIRM policies which are charged full risk premiums that consider the probabilities of the full range of possible losses including catastrophic levels, it is important to question whether the actuarially determined rates accurately reflect the catastrophic exposures to levee failures in the tail of the distribution. As illustrated above, the losses from Hurricane Katrina alone will exceed the \$9 billion in annual flood losses the NFIP believed would represent a 1 in 1000 chance of exceeding. Stated another way, Hurricane Katrina represents the 1 in 1000 year storm that happened in the first 40 years of the program. Although statistical experts would not suggest that a 1 in 1000 probability could not happen in the first 40 years, the fact that it has occurred so soon suggests the statistical models used are severely understating actual risks.

Recommendation: Given the above, FEMA might want to research whether some best practices modeling techniques from other property and casualty lines could be applied to the flood line, including, rate-making methods, probabilistic models, granularity, impact of geographic concentration and the impact of storm surge.

### Floodplain Management Goals

As was noted above, the NFIP wasn't originally intended to be actuarially sound. To encourage participation in the program, Congress made the conscious decision to offer subsidized policies to further floodplain management goals and the program's growth. One of the major floodplain management goals is to encourage state and local governments to make appropriate land use adjustments to constrict the development of land that is exposed to flood damage caused by floods. Another major floodplain management goal is to guide the development of proposed construction, where practical, away from locations that are threatened by flood hazards. Charging actuarially sound rates may be in direct conflict with a community's ability to foster ongoing floodplain management goals.

### Community Compliance With NFIP

Community compliance with the NFIP can affect the program's ability to be actuarially sound. The NFIP Evaluation study on community compliance with the NFIP's minimum building requirements (Mathis and Nicholson, 2006), attempts to measure actual compliance of structures with NFIP regulations among NFIP communities. Although the results are not generalizable to all NFIP communities, the sub-study indicates that 37.2 percent of the buildings in the clusters of communities surveyed were not fully compliant with all NFIP requirements. Although that figure appears large, most of the violations involved would likely result in little or no increase in flood damage under the assumption of a flood no greater than the 1-percent annual chance flood and so have only minor influence on the NFIP's financial position. The study also observes that the levels of compliance are higher for more recent construction than for the older buildings that were surveyed, a potential indication of some on-going improvement, which would suggest decreasing influence on the NFIP's financial position.

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<sup>63</sup> See Galloway, *et. al's*, (2006) report as part of the Evaluation of the NFIP *The 1 Percent Annual Chance Flood Standard*.

AIR (2005a), as part of the NFIP Evaluation, addresses the processes and organizations that support and enforce community compliance with NFIP regulations. While overall community compliance is fairly good, many problems with compliance exist and even more problems with the overall process of assuring compliance. The sub-study finds that many communities currently participate in the CRS without having demonstrated their compliance through Community Assistance Visits (CAVs). Twelve percent of communities in the CRS, which are supposed to be model communities in which policyholders are receiving discounts ranging from 5 percent to 40 percent, have had “serious” program deficiencies noted during CAVs conducted since they entered the CRS; 37 percent of those CAVs remained “open,” or officially unresolved as of September 2004. Many of those communities were upgraded to a higher CRS grade within one year of a CAV in which a serious program deficiency was identified.

Compliance of communities with the NFIP generally is important in terms of actuarial soundness. Compliance may be especially important for CRS communities. If these communities have deficiencies that result in policyholders getting unwarranted premium discounts, the financial results of the program will be adversely effected hindering the program’s progress towards achieving actuarial soundness.

#### Maximization of Flood Insurance Policyholders

Charging actuarial rates would conflict with the NFIP’s efforts to maximize the number of NFIP policyholders. As is noted in GAO studies on the NFIP and the charging of actuarially subsidized rates, the elimination of the subsidy would likely cause a number of pre-FIRM properties (especially those not subject to mandatory purchase requirements and some percentage of those that are supposed to have mandatory coverage) to cancel their policies. The charging of actuarially sound rates for grandfathered properties would also have a negative impact on current policyholder retention and the program’s ability to attract new flood insurance policyholders as the map modernization effort revises FIRMs across the country.

Another study that speaks to this question is PriceWaterhouseCoopers’ (1999) study on charging actuarially sound rates. The study covered economic effects such as changing premium amounts by geographic area, numbers and types of properties affected, cancellations, and the impact on property values. The study estimated that if the subsidy was eliminated immediately, the participation rate for pre-FIRM structures in the SFHA would likely decrease from 26 to 20 percent in a year and would be 9 percent lower than it otherwise would have been 14 years later, for a total decrease of 280,000 flood insurance policy contracts. The study noted, however, that if the subsidy was phased out over time, the decrease in participation would not be as large.

Achieving actuarial soundness would require that the goal of maximizing policyholders participation to be a consideration, but not necessarily a primary focus of the program. Increasing participation helps to spread risk and increase premium revenue, but the cost and consequences of subsidizing the increased participation produces adverse results that may compound over time. Another approach to maximizing the number of flood insurance policyholders might include expanding the NFIP coverages and coverage limits.

Recommendation: FEMA might want to research whether NFIP coverages and coverage limits should be expanded, including would there be feasibility and a market from NFIP customers for additional living expenses and business interruption coverages, and increased and/or indexed coverage limits.

## 8.2 NFIP and Overcoming Obstacles to Actuarial Soundness

The NFIP has some impediments that may hinder the program's progress towards achieving the goal of actuarial soundness:

### 8.2.1 Pre-FIRM Subsidies

The immediate elimination of the pre-FIRM subsidies (i.e., reduced rates that are available for the first \$35,000 of coverage for a single-family to four-family dwelling and for the first \$100,000 of coverage for larger residential, nonresidential, or small-business buildings) would be a faster approach to moving towards actuarial soundness, but such action is not practical in the short term. First, requiring actuarial rates for pre-FIRM structures in SFHAs, few of which meet any post-FIRM flood-related building standards and are thus those at highest risk, would cause premiums for these structures to rise dramatically. The higher premiums would likely cause a number of property owners to drop their coverage (including some subject to the mandatory purchase requirement due to imperfect enforcement mechanisms<sup>64</sup>) and deter others from initiating coverage. This would work counter to the goal of reducing uncompensated losses, and unexpected legal changes can affect the value of property rights without time for gradual adjustment that may be considered fair.

Second, since disaster assistance is typically available to most property owners, including those with insurance, canceling pre-FIRM policies would likely transfer a portion of the risk and financial obligation away from property owners to government, offsetting the goal of reducing Federal expenditures. Modeling results for the NFIP Evaluation suggest that increasing the market penetration rate of flood insurance through moderate subsidization of NFIP policyholders may have actually *decreased* total Federal costs and shifted some of the burden of flood losses from taxpayers to policyholders – one of the primary stated goals of the NFIP<sup>65</sup>;

Third, charging actuarial rates is not as easy as turning on a light switch. Unlike post-FIRM properties, where elevation certificates are required in the Submit for Rate insurance application process, elevation certificates would have to be gathered for pre-FIRM properties in order to actuarially rate the properties. In many cases, the resources required to complete the

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<sup>64</sup> See Tobin and Calfee, (2005).

<sup>65</sup> According to HAZUS modeling results in another report for the Evaluation of the NFIP, although NFIP subsidies would decrease with lower market penetration, total Federal losses are likely to increase. According to Sarmiento and Miller's (2006) modeling results, after accounting for NFIP losses from subsidies, Small Business Administration loan losses, Federal Individual Assistance, and tax breaks, a 10 percent lower market penetration rate would result in higher overall federal costs of \$43 million.

information gathering for pre-FIRM properties would take some time, effort, and cost.<sup>66</sup> In addition, the NFIP could face adverse selection on properties where the current average rate understates their risk of flooding (e.g., two pre-FIRM properties may have the same rating variables but one homeowner may live in the mountains versus another in a flood plain).

Flood insurance is mandatory only for properties in special flood hazard areas that carry mortgages from Federally insured lenders, and compliance with the requirement is far from complete.<sup>67</sup> The topic of phasing out the pre-FIRM subsidy has been discussed by NFIP staff, PriceWaterhouseCoopers (1999), and in witness testimony to the U.S. Senate Committee on Banking, Housing, and Urban Affairs on October 18, 2005. The options discussed include eliminating all pre-FIRM properties, a stair-step approach to eliminating all pre-FIRM properties (e.g., 20 percent a year for five years), phasing out the pre-FIRM subsidy on all insured structures other than primary residences (e.g., second vacation homes, rental properties, etc.) and reducing subsidies each time a property is sold. For example, the Congressional Budget Office (CBO 2003) noted that “(p)hasing out the subsidy... would yield additional receipts of \$25 million in 2004 and \$588 million over the 2004-2008 period.” Those estimates take into account the likelihood that some current policyholders will drop their coverage. Accordingly, CBO expects that the option would somewhat reduce the participation of both voluntary purchasers and property owners for whom the insurance is mandatory.

The same CBO report also notes the following observations of advocates and opponents of subsidies: Advocates of phasing out the subsidy argue that it has outlived its original justification as a temporary measure to encourage participation among property owners who were not previously aware of the magnitude of the flood risks they face. Phasing out the subsidies would make policyholders pay more of their fair share for insurance protection and would give them incentives to relocate or take preventive measures. Advocates for phasing out subsidies on secondary residences argue that this change focuses on structures whose owners would face relatively little hardship in paying actuarial rates.

Opponents of phasing out subsidies for pre-FIRM properties state that it would be unfair to charge full actuarial rates to owners of properties built before FEMA documented the extent of local flood hazards. Reduced rates of participation in the program would lead to increased spending on disaster grants and loans. As noted earlier, this argument is supported, albeit modestly, by the modeling results of Sarmiento and Miller and the 2006 CBO testimony (CBO 2006) which states that 10 percent of policyholders would drop out of the program if the rates of all subsidized policies were raised 150 percent. Opponents of phasing out subsidies on secondary residences object primarily to its effect on lower-income people, because owners may be able to pass on the increased cost to renters in some markets.

Table 16 displays the difference between pre-FIRM and post-FIRM loss<sup>68</sup>:

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<sup>66</sup> Required activities would include review of public records for elevation certificate information, obtaining an elevation certificate from a registered land surveyor, submitting the elevation certificate to an insurance agent for the rate quote, NFIP processing, etc.

<sup>67</sup> See *Ibid.* Note also that the compliance rate with the mandatory purchase requirement was most recently estimated to be 75 to 80 percent (Dixon, 2005).

<sup>68</sup> From NFIP report SRRR9993B – “Pre-FIRM & Post-FIRM policies”.

TABLE 16: Difference between Pre-FIRM &amp; Post-FIRM Policies

POLICY YEAR	PRE-FIRM			POST-FIRM		
	WRITTEN PREMIUM in \$ (billions)	PAID LOSSES in \$ (billions)	LOSS RATIO	WRITTEN PREMIUM in \$ (billions)	PAID LOSSES in \$ (billions)	LOSS RATIO
1978	0.108	0.148	136.4%	0.003	0.000	0.8%
1979	0.137	0.465	340.4%	0.005	0.018	370.5%
1980	0.152	0.224	147.9%	0.007	0.006	83.5%
1981	0.239	0.124	52.2%	0.018	0.003	14.5%
1982	0.260	0.193	74.2%	0.035	0.005	15.0%
1983	0.259	0.414	160.1%	0.042	0.026	61.3%
1984	0.325	0.246	75.7%	0.056	0.008	15.2%
1985	0.319	0.336	105.4%	0.068	0.032	47.1%
1986	0.351	0.121	34.6%	0.085	0.005	5.7%
1987	0.396	0.100	25.3%	0.103	0.005	5.2%
1988	0.398	0.044	11.0%	0.116	0.007	5.9%
1989	0.426	0.535	125.6%	0.133	0.125	94.3%
1990	0.457	0.158	34.6%	0.153	0.009	6.1%
1991	0.466	0.314	67.3%	0.164	0.039	24.0%
1992	0.479	0.623	130.1%	0.178	0.086	48.6%
1993	0.529	0.601	113.7%	0.205	0.057	27.7%
1994	0.571	0.349	61.2%	0.241	0.061	25.5%
1995	0.616	0.949	154.0%	0.278	0.345	123.8%
1996	0.683	0.724	106.0%	0.314	0.103	32.9%
1997	0.820	0.449	54.8%	0.377	0.070	18.5%
1998	0.890	0.679	76.3%	0.432	0.200	46.4%
1999	0.901	0.568	63.1%	0.449	0.181	40.2%
2000	0.938	0.170	18.2%	0.498	0.079	15.8%
2001	1.012	0.943	93.2%	0.579	0.315	54.4%
2002	1.058	0.311	29.4%	0.640	0.107	16.7%
2003	1.102	0.464	42.1%	0.690	0.104	15.1%
<b>Total</b>	13.981	10.254	73.8%	5.869	1.998	34.0%

SOURCE: Information pulled from NFIP report SRRR9993B – “Pre-FIRM & Post-FIRM policies”, data evaluated as of May 31, 2004

As shown in this table, over the history of the program, the post-FIRM loss ratio has exceeded the pre-FIRM loss ratio in only one year (1978), the program's second. Over the entire period, we also see that the pre-FIRM loss ratio is more than double the post-FIRM loss ratio. These statistics further illustrate why the existence of pre-FIRM rates will continue to hinder the program's progress towards achieving the goal of actuarial soundness. For actuarially rated post-FIRM policies, the table shows the significant progress that has been made by the NFIP.

To move towards actuarial soundness of the program itself, over time the NFIP should move toward actuarially-based rates on all properties if it can do so along with changes that improve the enforcement of the mandatory purchase requirement or other methods of increasing market penetration outside the current SFHA boundaries. This moves the program closer to original legislative intent. Doing so in conjunction with changes in enforcement of the mandatory purchase requirement would reduce the extent to which market penetration would drop and thus result in lower increases in other federal costs. Section 9 of this study presents alternative approaches to be considered in terms of timing of phase out of pre-FIRM subsidies.

Recommendation: We recommend that the NFIP monitor the growth in administratively grandfathered properties due to the map modernization. Further research topics could include the review of mandatory purchase requirements, focus on lender compliance, and other changes aimed at NFIP coverage limits and options.

### **8.2.2 Rate of Growth in Grandfathered Properties**

There is considerable concern regarding the potential growth that may occur in Type I and Type II "grandfathered" properties. As FIRMs are updated during FEMA's Map Modernization Program, post-FIRM construction in the V Zones built between 1975 and 1981 will be "grandfathered" at less than full-risk premium rates (Type II).<sup>69</sup> As FEMA (2004) noted: buildings during this period were constructed using NFIP standards that accounted for stillwater flood elevations but not the associated wave heights, which were not determinable by the engineering state-of-the-art of the time. There is also significant growth in grandfathered properties due to a shift in the properties' zone classification after a FIRM is revised (Type I). In this situation, property owners who are remapped to a more costly zone classification are allowed to benefit from the rating of the former flood zone through grandfathering. Although Type I properties are growing significantly based on discussions with the NFIP's chief actuary, we have no direct way of analyzing the actual growth rate because the NFIP does not track grandfathering in their policy data.

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<sup>69</sup> FEMA administratively created grandfather rules that permit property owners who are remapped to benefit from the rating for the former flood zone (or to use the rating in the new zone if it is more favorable) in two circumstances. First, despite the map changes that identify higher risks, existing policyholders can renew their policies based on the former zone as long as they retain continuous coverage and the building has not been altered in a way that places the building's lowest floor below the base flood elevation (BFE) on the applicable FIRM. Second, property owners who built in compliance with the FIRM or BFE in effect at the time of construction can use the rates applicable at the date of construction and obtain coverage for the first time before the map change is effective as long as the building has not been substantially improved or altered in a way that places the building's lowest floor below the BFE on the applicable FIRM.

The “grandfathered” less than full-risk premium rates are lower than what would be indicated by the updated FIRMs that have been developed using current state-of-the-art engineering. As FEMA’s Map Modernization Program impacts additional communities, the number of grandfathered properties will continue to grow as more properties are placed in SFHAs. Since the NFIP currently lacks the ability to identify grandfathered properties in its NFIP flood insurance applications, the program’s ability to monitor and track the growth in grandfathered properties is impaired. Without accurate premium and loss information, it may be difficult for the NFIP to understand the extent of the grandfathering problem until significant losses occur. In addition to monitoring loss ratios, some grandfathered properties may not have been accurately recorded on the policy application (e.g., incorrectly inputted as grandfathered). These uncertainties further hinder the program’s progress towards achieving the goal of actuarial soundness.

Recommendation: FEMA must focus its short term efforts on refining the NFIP’s data collection process in order to ensure that the program captures all the necessary information in order to properly evaluate the program’s actuarial soundness. Any efforts focusing on the issue of subsidies should also address administratively grandfathered properties since the NFIP lacks the ability to track the expected growth in these policies as the map modernization effort continues. It would be better to address the subsidy now rather than wait for the number of grandfathered policyholders to increase before the next Hurricane Katrina hits.

### **8.2.3 Competition from Federal Disaster Assistance**

Many of the people who forgo purchasing flood insurance believe that a flood will never affect their property, and if flooding does occur, Federal disaster assistance will pay for their losses (KRC Research & Consulting. (1999)).<sup>70</sup> As noted by Gerald E. Galloway (Disasters Roundtable (2004)):

Generous government post-disaster relief and short-sighted floodplain management in many areas have created a sense that building in the floodplain is acceptable because the government will come to the rescue if flood damage occurs.

The subject was also discussed at the October 18, 2005 U.S. Senate Committee on Banking, Housing, and Urban Affairs discussing the future of the NFIP. A witness from the University of Wisconsin-Madison discussed the NFIP’s exposure to “charity hazard”, whereby an individual at risk does not purchase insurance as a result of reliance on expected charity from sources that include government emergency programs.

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<sup>70</sup> A Presidential disaster declaration enables FEMA and other federal agencies to team with state and local disaster workers to help residents and business owners in affected counties recover. Disaster assistance in the form of a low-interest disaster loans from the U.S. Small Business Administration is the main source of federal recovery aid for disaster victims. Aid can also include grants for temporary housing and money for emergency repairs to make a home livable.

Unfortunately, this perception leads to Federal disaster assistance competing with the NFIP. The end result is a reduction in the number of flood insurance policies that could have been sold if more people understood the true risk of flooding, the form of disaster assistance, and the probability of receiving disaster assistance. It is also important to note that a majority of disaster declarations do involve flooding. As the GAO (GAO 2004a) has observed: Nearly 9 out of every 10 Presidential disaster declarations result from natural phenomena in which flooding was a major component.

Given the significant correlation of flooding with disaster declarations, it is easy to see how the general public could associate Federal disaster assistance with flooding. FEMA (2003) noted:

Some people resist buying flood insurance in the faulty belief that if flooding occurs, the government will bail them out. Federal disaster assistance is available only if a flood (or other disaster) is so large and widespread it warrants a major disaster declaration from the President. Most disasters are not Presidentially declared. In the majority of floods, victims are on their own – unless they have flood insurance. And even for floods that are declared major disasters, the aid available is limited. Most assistance is in the form of loans. Although the NFIP continues to educate flood insurance customers on the importance of buying flood insurance versus relying on disaster assistance, we believe this issue will continue to hinder the program’s progress towards achieving the goal of actuarial soundness.

Recommendation: The NFIP should continue to educate flood insurance consumers on the importance of buying flood insurance using comprehensive marketing and advertising campaign such as FloodSmart.

### **8.2.4 Addressing Repetitive Loss Properties**

Although the passage of the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 addresses the issue of repetitive loss properties, there is considerable additional work that still remains in mitigating these properties. As the GAO (GAO 2004a) observed: About 1 percent of the 5 million properties currently insured by the program are considered to be repetitive loss properties – properties for which policyholders have made two or more \$1,000 flood claims. However, about 38 percent of all program costs have been the result of repetitive loss properties, at a cost of about \$4.6 billion since 1978. For example, a 1998 study by the National Wildlife Federation noted that nearly 1 out of every 10 repetitive loss homes has had a cumulative loss that exceeded the value of the home.

At an estimated cost of roughly \$200 million annually, repetitive loss properties represent a major area of concern for the NFIP. Even with FIRA04 and the 50 percent rate increase applied to property owners who refuse FEMA’s offers to mitigate, a 50 percent rate increase may not be enough to cover future losses. This sub-study reviewed the GAO (2004a) data on repetitive loss properties for the period January 1, 1978 through November 30, 2003. Repetitive loss properties (especially in states such as Louisiana, Florida and Texas where half the

payments have historically been made) will continue to hinder the program's progress towards achieving the goal of actuarial soundness. Recent Federal actions to reduce program claims related to repetitive loss properties include FEMA's strategy to target the most frequent and costly repetitive loss properties for mitigation and congressional proposals to phase out coverage or begin charging full and actuarially based rates for repetitive loss property owners who refuse to accept FEMA's offer to purchase or mitigate the affected buildings. These actions have the potential to reduce future program losses and improve the financial condition of the program.

Recommendation: FEMA should continue to aggressively address repetitive loss properties (e.g., FIRA04) by addressing the program's worst offenders.

### **8.2.5 Policyholder Funding of Flood Insurance Studies and Mitigation Activities**

The Association of State Floodplain Managers noted in a 2004 report (ASFPM (2004)): The main focus of FIRA04 was to augment the existing Flood Mitigation Assistance Program, which provides grants to states and communities to help implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. Additional funding and mechanisms will focus mitigation efforts on "severe" repetitive loss structures that result in a disproportionate proportion of claims to the National Flood Insurance Program. Importantly, the funds are all derived from the NFIP, which clearly recognizes that the NFIP and policyholders, rather than taxpayers as a whole, are the primary beneficiaries of the added mitigation elements.

Although taxpayers are not being asked to fund these activities, it is important to note that studies and mitigation activities do benefit society as a whole and not just NFIP policyholders. Every dollar spent on mitigation saves society an average of four dollars, according to a new study released by the Multihazard Mitigation Council of the National Institute of Building Sciences. The study examined hazard mitigation grants over a 10-year period (1993 - 2003) that were aimed at reducing future losses from earthquakes, floods and high wind. It found that these efforts were successful and cost-effective.

According to the study, mitigation results "in significant net benefits to society as a whole -- to individuals, to States and to communities -- in terms of future reduced resource losses and significant savings to the Federal treasury in terms of future increased tax revenues and future reduced hazard-related expenditures." The study was mandated by Congress and conducted independently by the Council. It involved two interrelated components, (1) a benefit-cost analysis of a broad sample of FEMA mitigation grants and (2) additional empirical research on FEMA-funded mitigation activities carried out in eight selected communities. The community studies examined all FEMA mitigation grants received by the selected communities between the years of 1988-2003. Key findings include:

- On the average, a dollar spent on mitigation saves society \$4.
- In addition to savings to society, the Federal treasury can redirect an average of \$3.65 for each dollar spent on mitigation as a result of disaster relief costs and tax losses avoided.

- In each of the eight communities studied in depth, FEMA mitigation grants were a significant part of the community's mitigation history and often led to additional loss reduction activities.
- Mitigation is sufficiently cost-effective to warrant Federal funding on an ongoing basis both before disasters and during post-disaster recovery.

Recommendation: FEMA should continue mitigation efforts.

### 8.2.6 Erosion

The Heinz study (Heinz 2000) notes: Over the next 60 years, erosion may claim one out of four houses within 500 feet of the U.S. shoreline. To the homeowners living within this narrow strip, the risk posed by erosion is comparable to the risk from flooding, especially in beach areas. The National Flood Insurance Program, however, does not map erosion hazard areas to inform homeowners of the risk they face, nor does it directly incorporate erosion risk into its insurance ratemaking procedures. Other facts noted in the study:

- At current enrollment levels, the National Flood Insurance Program will pay \$80 million per year for erosion-related damage, about 5 percent of today's premiums.
- Although certain types of erosion damage are not eligible under the National Flood Insurance Program rules, most erosion-related losses sustained by policyholders are reimbursed by the program. Erosion damage is not fully reflected in flood insurance rates, however; current rates are primarily based on flood risk alone. Thus erosion losses will be subsidized by policyholders in non-eroding areas or by general taxpayers.
- To fully reflect erosion-related risk, insurance rates in the highest coastal areas must be, on average, twice today's rates.

Erosion is not well addressed by the current NFIP. Although certain types of erosion-related damage are not reimbursable under program rules, the NFIP appears to pay for most erosion-related damage claims in low-lying areas. A survey of insurance agents by The Heinz Center found no case where policyholders failed to submit a claim, or the program denied a claim, because of erosion. However, current insurance rates do not reflect the magnitude of the erosion risk faced by any individual policyholder. Thus, future claims by homeowners in erosion-prone areas will have to be subsidized by others. Moreover, because current flood maps do not incorporate erosion risk, they are not only incomplete but also misleading to users.

Given the estimated shortfall in coastal flood insurance rates and the Heinz Center's estimates of payments for erosion-related damage to structures and contents (especially along the Atlantic Coast and Gulf of Mexico), the growing impact of erosion over time will only increase the number of subsidized NFIP policyholders.

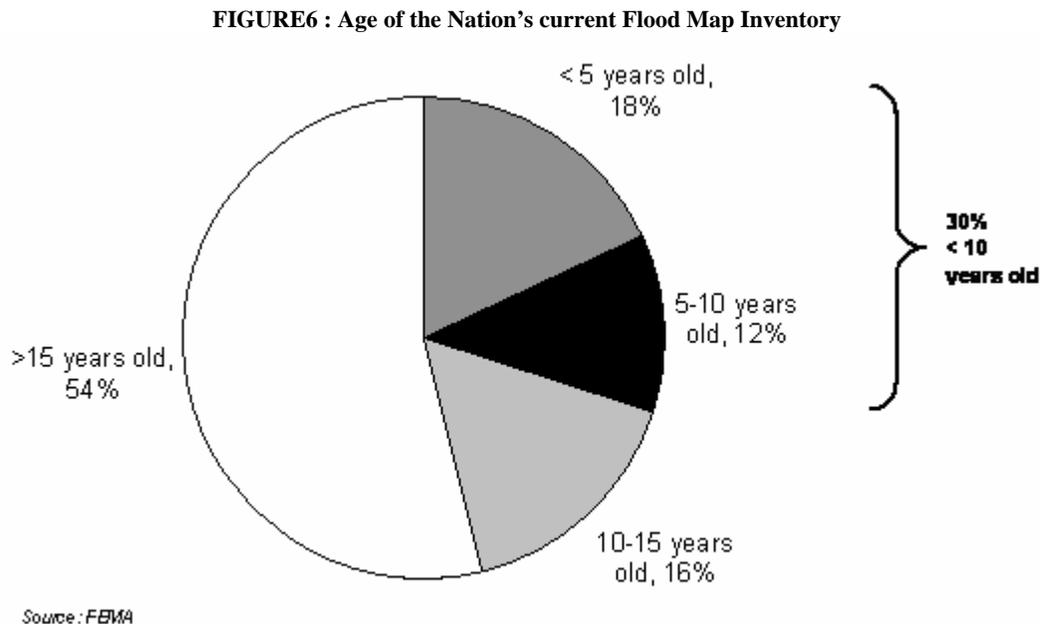
It is important to note that the NFIP currently does not map erosion and was unable to provide us with data in order to estimate the shortfall in coastal rates or amount of impact erosion may have over time. According to the NFIP's chief actuary, FEMA believes that it needs direction from Congress before it could utilize erosion information to set premiums.

Recommendation: The NFIP should investigate what would be involved in collecting this information for future analysis. This might be an area where Congress could consider funding a major effort to understand the erosion risk faced by the NFIP over the next 50 years.

## 8.2.7 Flood Map Modernization

Although the map modernization effort is a significant step in moving the NFIP towards actuarial soundness, the costs associated with keeping FIRMs up-to-date is a potential impediment to the future success of the program.

The need for map modernization is clear. GAO (GAO 2004b) notes: According to FEMA, nearly 70 percent of the nation's approximately 92,222 flood maps are more than 10 years old, and many of these maps no longer reflect current flood hazard risks because of such changes as erosion and development that can alter drainage patterns and thus the areas at highest risk of flooding. Figure 6 based on FEMA data and taken from the GAO report displays the age of the nation's current flood map inventory:



The large number of flood maps has required the NFIP to prioritize the nation's communities in order of highest risk of flooding to the lowest risk of flooding. As a result, the FIRMs updated in the first year of the five-year effort will be five years old by the end of the \$1 billion effort. Assuming the map modernization can effectively update a majority of the higher-risk counties, will the next map modernization effort cost as much or be complete before once again 70 percent of the nation's flood maps are 10 years or more out of date? As a result of the Map Modernization Program,<sup>71</sup> FEMA expects that the current map production cycle time of five years or more will decrease to less than three years.

In addition to the significant task of updating the nation's FIRMs, the impact of the new FIRMs will depend largely upon the involvement of the principal stakeholders (e.g., state and local floodplain managers, community planners, insurance companies and agents writing flood

<sup>71</sup> The decrease in map production time can be associated with the Mapping Information Portal (MIP) and the enforcement of data credibility by removing impediments to data entry, having a single sign-on, focusing on data collection as case moves through the system, reduced processing time and costs for map updates, etc.

insurance policies, lenders, developers, etc.) who currently rely upon the FIRMs. Both the GAO report and FEMA discuss the importance of partnering with the principal stakeholders and the development of programs such as Cooperating Technical Partners (CTP)<sup>72</sup> who play an active role in ensuring the success of the new FIRMs. It will take some time to tell if the cost and effort spent building these partnerships will lead to significant cost savings (e.g., more accurate policy rating, higher lender compliance, more effective floodplain management, etc.) for the NFIP.

Recommendation: The NFIP should continue to monitor the success of the map modernization effort and its impact on NFIP policyholders.

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<sup>72</sup> With over 20,000 communities in the National Flood Insurance Program (NFIP), it is a significant challenge to keep flood maps up to date. The Cooperating Technical Partners (CTP) Program is an innovative approach to creating partnerships between FEMA and participating NFIP communities, regional agencies, and State agencies that have the interest and capability to become more active participants in the FEMA Flood Hazard Mapping Program. FEMA is seeking qualified CTPs to collaborate in maintaining up-to-date flood maps and other flood hazard information

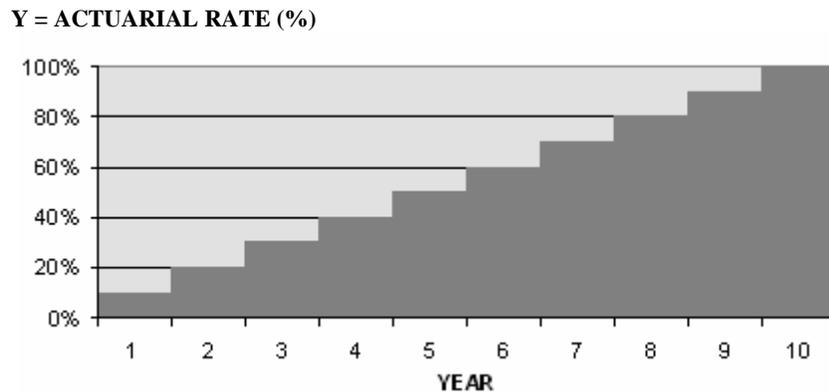
## 9. RECOMMENDATIONS AND CONCLUSIONS

We believe the NFIP has several options available for moving the program towards actuarial soundness. A number of NFIP these options were discussed on October 18, 2005, in front of the U.S Senate Committee on Banking, Housing, and Urban Affairs hearing focused on the future of the NFIP. Eight witnesses shared their testimony and ideas for addressing issues facing the NFIP. The topics included addressing repetitive loss properties, expanding purchase of coverage beyond SFHAs (e.g., 1-in-250 or 1-in-500 flood plains), participation rates, “charity” hazard, increasing lender compliance, expansion of compliance to non-Federally regulated lenders, map quality and digital standards, FEMA staffing and resources, tougher building standards, Increased Cost of Compliance, oversight of WYO companies, reduction or elimination of all subsidies, elimination of specific subsidies (e.g., vacation homes, rental properties, etc.), research specific to manufactured homes, elimination or modification of LOMR-F, and better funding of map modernization.

Although not specifically addressed in the testimony, subsidies on Pre-FIRM properties and grandfathered properties could be addressed using some of the following phase out strategies:

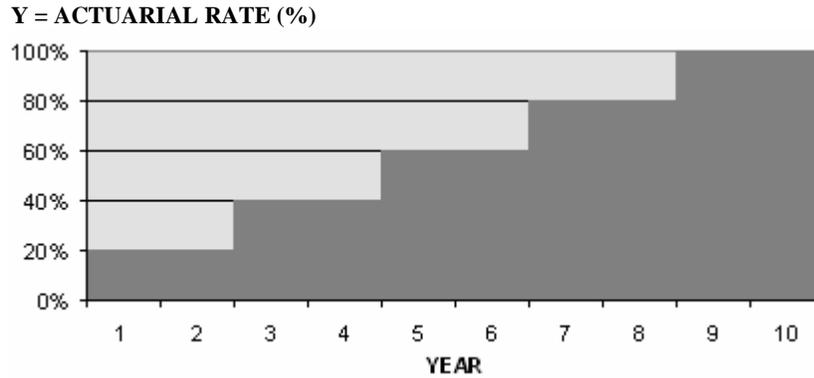
- Uniform stair-step phase out (e.g., 5-year, 10-year, etc.)  
10-year (i.e., 10 percent of the way to the actuarial rate in year 1, 10 percent in year 2, etc.)

**FIGURE 7: Percentage of the current subsidized premium shortfall eliminated  
10-Year Stair Step Phase Out**



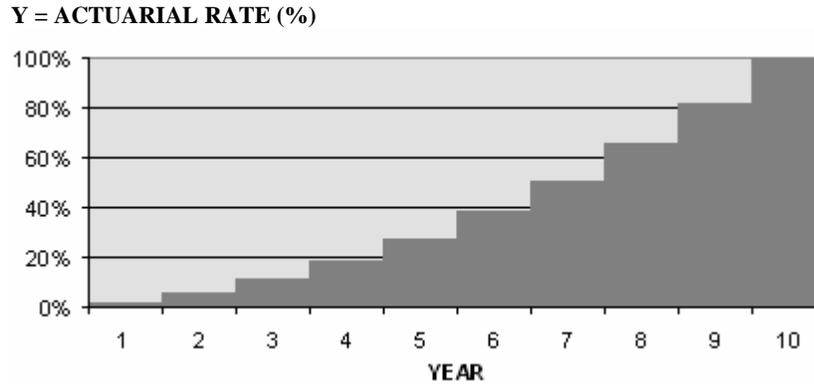
- Staggered stair-step phase out (e.g., 5-year, 10-year, etc.)  
10-year odd (i.e., 20 percent in year 1, 20 percent in year 3, etc.)

**FIGURE 8: Percentage of Actuarial Rate achieved 10-year staggered stair step phase out**



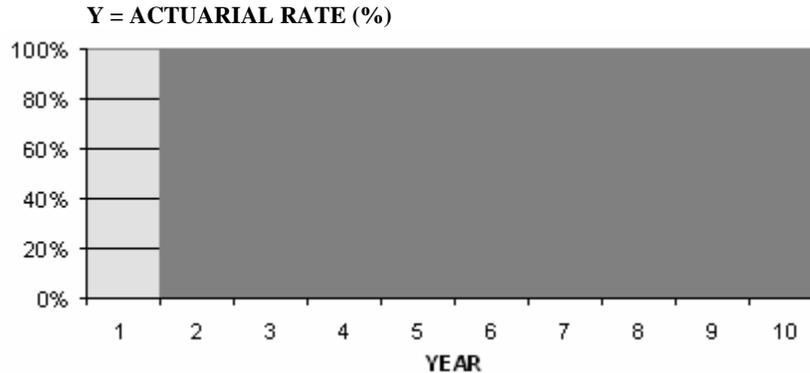
- Ramped phase out (e.g., 5-year, 10-year, etc.)  
10-year (e.g., 1/55 in year 1, 2/55 in year 2, etc. where 55=1+2+...+10))

**FIGURE 9: Percentage of Actuarial Rate achieved 10-year ramped stair step phase out**



- Immediate phase out

**FIGURE 10: Percentage of Actuarial Rate achieved 10-year immediate phase out (1 year delay)**



No matter which strategy is used, the above options for addressing subsidized rates have advantages and disadvantages. For example, the NFIP could immediately phase out all pre-FIRM properties to actuarially sound rates. The advantage of this approach would be the ease of

administration, simple explanation of approach to policyholders (i.e., no phase-in over multiple years), ease of communication to agents, and immediate achievement of actuarially sound rates. The disadvantages of this approach would be the potential exodus of policyholders unwilling or unable to pay actuarially sound rates, negative reaction of policyholders, impact on pre-FIRM property values, effort required to obtain elevation certificates for actuarial rating and immediate economic impact on states and local communities.

The NFIP could also convert all pre-FIRM properties to actuarially sound rates over a multi-year period (e.g., 5, 10, 15, 20, etc.) using the uniform, staggered or ramped phase-in methods. The main advantage of these approaches would be in allowing pre-FIRM policyholders time to adjust their annual budgets to the rising cost of flood insurance. Another advantage of these approaches would be the achievement of actuarially sound rates at a rate faster than natural attrition. The disadvantage of these approaches would be the administrative challenges of phasing out pre-FIRM rates (e.g., systems, policy forms, agent training), communication of phase-in methods, potential exit of policyholders unwilling or unable to pay actuarially sound rates, impact on pre-FIRM property values and long term economic impact on states and local communities.

The NFIP could also maintain the status quo and wait for the natural attrition of pre-FIRM properties. The advantages of this approach would be continuing “business as usual” and minimal disruption to NFIP stakeholders. The disadvantage of this approach would be the slow rate of progress towards achieving actuarial soundness for pre-FIRM properties.

The important difference between pre-FIRM and administratively grandfathered properties is the fact that the number of administratively grandfathered properties will continue to grow as FIRMs are revised. This difference allows the NFIP to address the problem for current grandfathered properties only, for future grandfathered properties only, or for both current and future grandfathered properties. As the map modernization effort completes, the importance of addressing grandfathered properties will increase significantly.

The NFIP has been addressing repetitive loss properties for some time. With the passage of FIRA04, it might be prudent to observe how the mitigation efforts of severe repetitive loss properties progress over the next few years before considering any alternative repetitive loss property options.

Regarding the NFIP’s current pricing approach, which charges actuarial rates to post-FIRM policies and uses the historical average loss year as a benchmark for determining the subsidy level for subsidized Pre-FIRM policies, it is important to note that the program eventually could approach the long-term expected annual losses. However, waiting for pre-FIRM properties to decline and for the program’s historical loss history to reflect enough catastrophic losses like hurricane Katrina is a slow process. Without the elimination of the current subsidies, it would be hard for the program to approach the long-term expected annual loss level without charging post-FIRM policyholders higher than actuarially indicated rates.

Given the contradictory effects of actuarial soundness on the NFIP’s primary legislated goals, actuarial soundness cannot simultaneously be a primary overriding goal of the NFIP. Given

this contradiction, the fact that implementing rate increases cannot address all of the NFIP's challenges, and the realization that some higher risk properties may never reach true actuarial pricing, FEMA should continue to follow a policy of pursuing actuarial soundness as best as possible contingent on the not undermining other primary goals included in the NFIP's legislation. Actuarial soundness should remain a long-term focus of the program, and the recommendations provided here can move the program closer to that goal. However, it appears that given the NFIP's current financial position since Hurricane Katrina and given the volatility of flood-related losses, pursuing actuarial soundness as a primary goal could undermine other goals and increase net costs to society. As long as the program continues to attract new policyholders, encourage floodplain management and mitigate repetitive loss properties, the service that the NFIP provides to its policyholders and U.S. taxpayers outweighs strict adherence to the goal of actuarial soundness.

Our primary recommendation would be for FEMA to focus its short-term efforts on refining the NFIP's data collection process to ensure that the program captures all the necessary information in order to properly evaluate the program's actuarial soundness. Any efforts focusing on the issue of subsidies should also address administratively grandfathered properties since the NFIP lacks the ability to track the expected growth in these policies as the map modernization effort continues. It would be better to address the subsidy now rather than wait for the number of grandfathered policyholders to increase before the next major flood disaster occurs.

In light of the catastrophic losses of 2005 FEMA will need to review its use of historical average loss year as the mechanism to determine the level of its subsidized premium rates. Including the 2005 year at its full weight would result in the historical average loss year being larger than the expected long term average losses on an actuarial basis. Clearly, given the magnitude of the 2005 losses, FEMA would need to either appropriately modify the calculation or develop a different standard. Regarding the issue of subsidized rates, we recognize that, as mandated by Congress, a significant portion of the policies have always been issued with subsidies. Therefore, the NFIP has not been able to build the reserves needed to cover potential future catastrophes. Moreover, until such time as Congress directs that all policies be priced with actuarial rates, such reserves are not likely to accumulate in the National Flood Insurance Fund.

Regarding the actuarial premium rates, it is unclear to what extent FEMA's hydrologic model takes into account long-term global weather patterns and coastal erosion. FEMA should review the studies and literature about those factors and revise its model as appropriate.

The following recommendations were discussed in Section 7 through Section 9 of this report.

- We recommend that the NFIP continue to educate flood insurance consumers on the importance of buying flood insurance using comprehensive marketing and advertising campaign such as FloodSmart.
- We recommend that the NFIP continue to aggressively address repetitive loss properties (e.g., FIRA04) by addressing the program's worst offenders.

- We recommend that the NFIP continue to monitor the success of the map modernization effort.
- We recommend that the NFIP investigate what would be involved in collecting erosion information for future analysis. This might be an area where Congress could consider funding a major effort to understand the erosion risk faced by the NFIP over the next 50 years.
- We recommend that FEMA study the growing influence of subsidies on administratively grandfathered properties. Further research topics could include the review of mandatory purchase requirements, focus on lender compliance, and other changes aimed at NFIP coverage limits and options.
- We recommend that FEMA research whether some best practices modeling techniques from other property and casualty lines could be applied to the flood line, including, rate-making methods, probabilistic models, granularity, impact of geographic concentration and the impact of storm surge.
- We recommend that FEMA research whether NFIP coverages and coverage limits should be expanded, including would there be feasibility and a market from NFIP customers for additional living expenses and business interruption coverages, and increased and/or indexed coverage limits.



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## 10. APPENDICES

### 10.1 Appendix 1: NFIP Ratemaking Comparison to Industry

#### Ratemaking Overview

The following guidelines explain the traditional actuarial ratemaking process:

1. Historical loss<sup>73</sup> experience is collected in coverage year detail for the last several years. This will usually include paid losses, incurred losses<sup>74</sup> and claim count information. The data is reviewed for reasonableness and consistency, and estimates of the ultimate value of the coverage-year loss are developed using actuarial techniques<sup>75</sup>.
2. Ultimate losses<sup>76</sup> are adjusted to the prospective level (i.e., the period for which rates are being made). This process involves an appropriate adjustment for changes in average costs and claim frequencies (called trend). Adjustments also would be made for any changes in circumstances that can affect costs (e.g., if a coverage provision has been altered).
3. Adjusted ultimate losses are compared to premium (or some other appropriate exposure base) to determine a loss ratio (or loss cost per exposure) for the prospective period.
4. Expenses associated with the business must be included. These are underwriting and general expenses (review of application, policy issuance, accounting, agent commission, premium tax, etc.) Other items to consider are the profit and contingency provision, reinsurance impact, and Federal income tax.
5. The final major components of the ratemaking process are a factor to reflect investment income, a contingency load and a profit load.

These five steps, applied in a detailed manner and supplemented by experienced judgment, are the standard roadmap followed in developing indicated rates. There are a number of other issues to address in establishing the final rates to charge. These include recognizing differences among territories within a state, limits of coverage, differences in building types and construction, and

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<sup>73</sup> Since flood losses are highly volatile they lack credibility in setting overall premium.

<sup>74</sup> Incurred losses = Paid losses + Case reserves. Paid losses represent the cumulative loss amount paid for NFIP claims as of a particular point in time. Case reserves represent an estimate of the unpaid amount of an accident year's loss experience as of a particular point in time as provided by the claim adjusters.

<sup>75</sup> Ultimate losses can be developed using multiple actuarial techniques. For example, the loss development method (LDF) can be used with either incurred or paid losses to develop ultimate losses. The LDF method is a multiplicative method in which incurred losses/paid losses are projected to an ultimate level based on prior historical development patterns. An analysis of the historical changes in accident incurred/paid losses between various valuation points provides a basis for estimating future changes. Assuming that reporting patterns, reserving practices, and payment patterns have remained reasonably stable, loss development methods can provide reasonable estimates of ultimate losses.

<sup>76</sup> Ultimate losses = Incurred losses + Incurred But Not Reported (IBNR) = Paid losses + Case Reserves + IBNR.

others. The final rates will reflect supplemental studies of these various other aspects of the rate structure.

## 10.2 Appendix 2: Overall Rate Level Indication

### 10.2.1 Two basic methodologies to developing overall rate levels: Pure Premium and Loss Ratio

As described in Charles McClenahan's chapter on ratemaking in *Foundations of Casualty Actuarial Science* (CAS 2001)<sup>77</sup>, there are two basic methodologies that casualty actuaries follow when deriving actuarially sound rates for an insurance product. These are the **pure premium method** and the **loss ratio method**.

The **pure premium method** uses the formula  $R = \frac{P + F}{1 - V - Q}$ , where

R = rate per unit of exposure

P = pure premium = L / E

L = experience losses

E = experience period earned exposures

F = fixed expense per exposure

V = variable expense factor

Q = profit and contingencies factor

While the pure premium method directly derives indicated rates, the loss ratio method calculates an indicated rate change which must then be combined with the current rates to develop indicated rates.

The **loss ratio method** uses the formula  $R = AR_0$ , where

R = indicated rate

R<sub>0</sub> = current rate

A = adjustment factor = W / T

W = experience loss ratio = L / ER<sub>0</sub>

L = experience losses

E = experience period earned exposure

T = target loss ratio =  $\frac{(1 - V - Q)}{1 + G}$

V = premium related expense factor

Q = profit and contingencies factor

G = ratio of non-premium related expenses to losses

<sup>77</sup> CAS 2001, Chapter 3, pp. 75 – 148.

Combining all of these elements, the formula for R becomes  $R = \frac{L * (1 + G)}{E * (1 - V - Q)}$ .

It can be mathematically proven that the two equations are equivalent.

McClenahan lists the following table as “practical differences” between the two methods:

<b>Pure Premium Method</b>	<b>Loss Ratio Method</b>
Based on exposure	Based on premium
Does not require existing rates	Requires existing rates
Does not use on-level premium	Uses on-level premium
Produces indicated rates	Produces indicated rate changes

The NFIP utilizes a variation on the pure premium approach to developing rates. The variation reflects the unique nature of the risks being covered by the NFIP and the congressional rules surrounding the issuance of flood insurance. The specific NFIP rate formula is based on the “Hydrologic” Model, as follows:

$$\text{RATE} = \left[ \sum_{i=\text{Min}}^{\text{Max}} (\text{PELV}_i \times \text{DELV}_i) \right] \times \frac{\text{LADJ} \times \text{DED} \times \text{UINS}}{\text{EXLOSS}}$$

PELV = probability that flood waters reach a certain depth (i.e. frequency)  
 DELV = ratio of flood damage to value of insurable properties (i.e. severity)  
 LADJ = loss adjustment expense factor  
 DED = deductible offset factor  
 UINS = underinsurance factor  
 EXLOSS = loading for expenses and contingencies

It can be seen, then, that traditional actuarial ratemaking techniques develop a rate as a function of (a) experience losses, (b) fixed expenses, (c) variable expenses, and (d) profit and contingencies factors. The NFIP’s hydrologic model develops a rate as a function of (a) flood loss frequency, (b) flood loss severity, (c) flood loss to insured loss conversion factor, (d) underinsurance factor and (e) expenses and contingency loading. Experience losses in traditional actuarial ratemaking are equivalent to the product of flood loss frequency, flood loss severity and flood loss to insured loss conversion. Fixed and variable expenses and a profit and contingencies factor are combined in the NFIP model into one expenses and contingency loading. The underinsurance factor in the NFIP model is equivalent to an “insurance to value” adjustment in homeowners ratemaking. The following paragraphs will examine each of the components of the traditional actuarial technique in more detail to see how closely they align with the equivalent NFIP components.

### 10.2.2 Experience losses versus Hydrologic model

In traditional actuarial ratemaking (CAS 2001), experience losses are also described as “trended, projected ultimate losses”.<sup>78</sup> This is the process of by which claims, valued as of date X, are first developed to their ultimate loss value and are then adjusted so the average date of loss matches the average date of loss for the policies that will be written at the new rate level. This insures that the claims being contemplated in the rates used to price future policies are consistent with the costs that will be incurred when those policies are actually sold.

The hydrologic model develops an estimate of claim costs that enter the ratemaking calculation through the equation  $\left[ \sum_{i=Min}^{Max} (PELV_i \times DELV_i) \right]$ . Both the frequency (PELV) and severity

(DELV) components originate with Army Corps of Engineers studies done in the 1960s. As described in the Actuarial Rate Formula on page A-3 of the November 30, 2004 NFIP Actuarial Rate Review, the loss frequency is “the probability of a particular water surface elevation relative to the 100 year Base Flood Elevation”. The summation across all values of  $i$  captures the range of water levels at which flood damage is expected to occur. The DELV values begin with the Army Corps of Engineers studies that quantify the percentage of structural damage that can be anticipated to occur at different PELV levels. These values are credibility weighted with actual claims experience to derive the final DELV values for each PELV level. The credibility factor used for each DELV value is a function of the severity variability observed in the actual claims experience. If there is a large amount of variability (as defined by the standard deviation of observed claims severities), the average actual claims experience will be given less weight in the DELV calculation than if there is a smaller amount of variability in the average actual claims experience.

The most significant difference between the traditional actuarial approach to developing experience rates and the NFIP approach stems from the lack of actual flood claim costs. While there have been significant costs over the life of the NFIP in terms of claims paid, the volume of claims history is not particularly large from the standpoint of actuarially credible data. On the claims frequency side, the NFIP rate review notes “it has been projected that complete reliance on the traditional flood frequency tables in the calculation of insurance rates would produce only about one-half the insurance premium required to meet the insured risk”. On the claims severity side, while there are types of claims whose historical severities are able to be wholly relied upon for future severity estimates, most claim types do not have much historical data with which to supplement the Army Corps of Engineers studies.

A second area of difference lies in the nature of the experience rates that are calculated. In traditional actuarial analyses, a future dollar cost is developed that can be compared to an exposure base to produce a cost per exposure. This allows for a direct incorporation of future claims costs in the rates being developed. In the NFIP analysis the claims cost is developed as a percentage of the replacement value of the insurable property. The methodology used assumes that the claims cost remains a constant percentage of the replacement value over time. If the relationship between claims costs and the value of the insurable property changes in the future or

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<sup>78</sup>CAS 2001, Chapter 3, p.112.

was different in the past, the claims cost contemplated in the final NFIP rates will not be an accurate reflection of the NFIP's actual claims exposure.

### 10.2.3 Inclusion of Loss Adjustment Expense loading

It is appropriate and necessary to include the cost of both allocated and unallocated loss adjustment expenses in the final rates charged to a policyholder. In his “*Ratemaking*” chapter (CAS 2001), Charles McClanahan notes “The actuary must determine whether to make projections on a pure loss basis, or whether to include allocated loss adjustment expenses with losses. Unallocated loss adjustment data are rarely available in sufficient detail for inclusion with losses and allocated loss adjustment expenses, and are generally treated as part of the expense provision—frequently as a ratio to loss and allocated loss adjustment expenses.”<sup>79</sup> Additionally, in his article, “*Homeowners Insurance Pricing*”, Mark Homan (CAS Paper Program, 1990) describes the following procedure for including allocated and unallocated loss adjustment expenses in rates: “The losses used in the indication have no provision for loss adjustment expense (LAE). Typically, the allocated loss adjustment expense portion of LAE is very small for Homeowners; the unallocated portion comprises the bulk of the LAE. Therefore, it is simpler to treat all LAE as if it were unallocated and load it in as a percentage of losses. The LAE load can be calculated by using the ratio of LAE to losses from the Insurance Expense Exhibit (IEE). A three year average is typical.”<sup>80</sup>

The NFIP approach incorporates a 4.2 percent loading in the projected rates to provide funds for the payments of loss adjusters' fees and special claims investigation costs. These are typically considered allocated loss adjustment expenses (ALAE) as opposed to unallocated loss adjustment expenses (ULAE), which consist of items such as salaries of claims processing personnel and the overhead associated with the processing of claims. The 4.2 percent load was calculated from the May 1, 1997 adjuster fee schedule. The loading is comparable to the ratio of ALAE to loss for Homeowners, based on AM Best consolidated industry data as of December 31, 2002. The AM Best five year average ratio is 3.7 percent and the three year average ratio is 3.9 percent.

### 10.2.4 Treatment of deductible offsets

Deductibles are incorporated into rates by examining the average amount of loss that is eliminated by the deductible. This value is converted into a percentage of experience losses so that the product of the experience losses and the deductible offset results in the trended, ultimate losses in excess of the deductible. This process is consistent with what is done during the NFIP rate review.

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<sup>79</sup> CAS 2001, Chapter 3, p. 98.

<sup>80</sup> CAS Paper Program, 1990, p. 733.

### **10.2.5 Treatment of underinsurance**

One element of Homeowners rate reviews that is also incorporated into the NFIP analysis is the existence of something called “insurance to value”, or underinsurance. When a policyholder purchases Homeowners or Flood insurance, they must tell the insurance underwriter the estimated replacement value of the insured property. The price charged for the insurance is a function of that value. Typical Homeowners rates assume that policyholders will declare a value for their property that is at least 80 percent of its replacement cost value. If the policyholder declares a value that is less than 80 percent of replacement cost and a claim occurs, the policyholder’s reimbursement will be reduced by the difference between the declared value and 80 percent of replacement cost. The NFIP coverage operates in a similar manner. To the extent that policyholders insure their dwellings for less than 80 percent of their replacement value, the recoveries they will get from their flood policy are reduced by the percentage underinsured. A key difference between Homeowners insurance and Flood insurance is that policyholders insuring to 100 percent of value can purchase guaranteed replacement cost coverage which will cover the cost of replacing a lost dwelling, even if the replacement cost is greater than the face amount of the policy. The Flood policy will only reimburse policyholders up to the policy face amount.

This is a significant difference between Homeowners and Flood policies. Underinsurance exists when an individual purchases insurance coverage that is less than the value of the property insured. When that scenario is contrasted with an individual who purchases full coverage, it is evident that the programs receive less premium, but it is also true that the expected payout is reduced by a much smaller amount. This results in a mismatch between revenue and expected claims payments. Most private insurers avoid this situation by requiring insureds to purchase full coverage. Since the NFIP cannot require their policyholders to fully insure their homes and businesses, it monitors the amount of underinsurance and adds a loading to the indicated rates to compensate for that. The UINS factor is used to prevent this from happening by regular monitoring of the relationship of Flood policy face values to insured properties.

### **10.2.6 Treatment of fixed and variable expenses**

The rates charged for a particular coverage must include an allowance for the expenses associated with writing business and maintaining the insurance company infrastructure to support the writing of that business. There is no hard and fast rule for how these costs are separated into fixed versus variable components. Some companies treat them all as variable; others treat only a portion as variable. The NFIP formula treats all the costs associated with insurance agent commissions and other acquisition expenses as variable. Therefore, from the NFIP perspective, these costs are wholly passed through to the purchaser of flood policies. The only difference between the NFIP process and that of traditional insurance companies is the exclusion of a premium tax provision in NFIP rates – this is because flood insurance premiums are exempt from state premium taxes.

### 10.2.7 Treatment of profit and contingency loading

The proper way to incorporate profit and contingencies in insurance product pricing is constantly evolving. Insurance rates through the mid-1960's typically had a five percent loading built in. As interest rates soared in the early 1980's and insurance companies began making most of their profits from investment income, profit and contingency loads became negative on an undiscounted basis. More recently, simulation methods have been used to determine appropriate loadings for profit and contingency. Charles McClanahan describes this process as follows (CAS 2001): "This method involves the development of a probabilistic model of the insurance operation and then, generally through Monte Carlo simulation, determining the probability of ruin (insolvency) over a fixed period of time. A maximum acceptable probability of ruin is then determined and the rate level assumption underlying the model is adjusted to the minimum rate level producing a ruin probability less than or equal to the acceptable level. The difference between the resultant adjusted rate level assumption and the rate level assumption with no risk margin is then used as the profit and contingencies provision."<sup>81</sup> A variation on this approach assumes that company surplus will be used to make up the difference between the expected level of losses contemplated in the rates and the loss amount associated with the maximum acceptable probability of ruin. The appropriate profit load, then, is that amount which generates a rate of return on the allocated surplus that is commensurate with the rate of return that would be demanded by an external entity for loaning money to cover a similarly risky venture. The NFIP model has no profit loading, as FEMA is not trying to make a profit on flood insurance. There is a 5 percent contingency loading in the rates for non-coastal policies to account for variability in potential flood experience. For those zones that are subject to wave action, the contingency loading is 10 percent. Based on discussions with FEMA actuaries, it was learned that these loadings were introduced early in the program to mimic the loadings that were used in homeowners insurance at the time. The contingency loading was increased to 10% in the coastal V-Zones in light of the greater flood risk in those areas. However, it is clear that the current contingency loadings are not a function of the volatility in flood losses. It is much too small for that.

## 10.3 Appendix 3: Catastrophe Loading

In order to insure the long-term profitability of certain types of insurance coverages, these coverages must incorporate a loading for infrequent but very costly events, i.e. catastrophes. Prior to the development and marketplace acceptance of catastrophe models, such a loading was made to homeowners business via the "ISO excess wind methodology". Examples of this methodology can be found in the 1990 paper "*Homeowners Insurance Pricing*" by Mark Homan and in the 1990 paper "*Homeowners Ratemaking*" by Stacy Weinman (CAS Paper program, 1990).<sup>82</sup> With hurricane models in common usage in property ratemaking, the procedure has evolved to one in which statewide rate indications are built up from two subsections – a non-hurricane loss cost and a hurricane loss cost. The 1996 paper "*Incorporating a Hurricane Model into Property Ratemaking*" by Burger, Fitzgerald, White and Woods (CAS

<sup>81</sup> CAS 2001, Chapter 3, p. 117.

<sup>82</sup> CAS Paper Program, 1990, pp. 781-808.

Forum, 1996) provides a step by step example of this process as applied to both homeowners and commercial property ratemaking.<sup>83</sup>

If one considers why flood insurance exists, it is really there for no other reason than catastrophic events. This is evident when one considers that the Base Flood Elevation underlying flood insurance rates is the 1-percent-annual-chance flood. Since there are no “non-catastrophic” flood losses, the only risk that the flood rates must capture is the catastrophe risk.

This is done through the  $\left[ \sum_{i=Min}^{Max} (PELV_i \times DELV_i) \right]$  equation. As further support of this, in the

November 30, 2004 document “NFIP Actuarial Rate Review”, it is noted that “actuarially rated policies are charged premiums that consider the probabilities of the full range of possible losses, including catastrophic levels.”<sup>84</sup> At the same time, this document observes that “it is generally accepted that the uncertainties involved in calculating the 500 year flood level are significant”<sup>85</sup> Taking these statements together, it appears that the NFIP methodology attempts to conform as much as possible to the current state of the art in catastrophe ratemaking for more traditional lines of business but the lack of data makes it very difficult to accurately estimate the cost of truly catastrophic flood events.

## 10.4 Appendix 4: Definitions

**Base Flood Elevation (BFE)** – The elevation shown on the FIRM for applicable zones that indicates the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year.

**Community Rating System (CRS)** – A program developed by FEMA to provide incentives for those communities in the Regular Program<sup>86</sup> that have gone beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding.

**Direct Costs of Flood Damage** – Direct costs of flood damage reflect immediate losses and repair costs as well as short-term costs such as flood fighting, temporary housing, and administrative assistance.

**Erosion** – The collapse, undermining, or subsidence of land along the shore of a lake or other body of water. Erosion is a covered peril if it is caused by waves or currents of water exceeding their cyclical levels which result in flooding.

**Flood** – A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties (at least one of which is the

<sup>83</sup> CAS Forum, 1996, pp. 129-190.

<sup>84</sup> NFIP Actuarial Rate Review, November 30, 2004, p. 11.

<sup>85</sup> NFIP Actuarial Rate Review, November 30, 2004, p. A-4.

<sup>86</sup> A description the Regular Program and the limits for building coverage and contents can be found on the NFIP web site <http://www.fema.gov/business/nfip/how.shtm>.

policyholders property) from: overflow of inland or tidal waters; or unusual and rapid accumulation or runoff of surface waters from any source; or mudflow; or collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

**Flood Insurance Rate Map (FIRM)** – Official map of a community on which FEMA has delineated both the special hazard areas and the risk premium zones applicable to the community. FIRMs are the risk assessment tools used to identify flood prone areas, establish flood zones and reveal base flood elevations, and set the cost of flood insurance. For example, FIRMs are used for: state and community floodplain management regulations, calculating flood insurance premiums, determining whether property owners are required by law to obtain flood insurance as a condition of obtaining mortgage loans or other Federal or Federally related financial assistance, planning for land use and water resources management and planning for emergency response and mitigation.

**Floodplain Management** – The operation of an overall program of corrective and preventative measures for reducing flood damage, including but not limited to, emergency preparedness plans, flood control works, and floodplain management regulations.

**Grandfathering** – An exemption based on circumstances previously existing<sup>87</sup>. Under the NFIP, buildings located in Emergency Program<sup>88</sup> communities and pre-FIRM buildings in the Regular Program are eligible for subsidized flood insurance rates. Post-FIRM buildings in the Regular Program built in compliance with the floodplain management regulations in effect at the start of construction will continue to have favorable rate treatment even though higher BFEs or more restrictive, greater risk zone designations result from FIRM revisions.

**Indirect Costs of Flood Damage** – Indirect costs of flood damage reflect costs incurred in an extended time period following a flood and include loss of business and personal income (including permanent loss of employment), reduction in property values, increased insurance costs, loss of tax revenue, psychological trauma, and disturbance to ecosystems.

**Mitigation** – Sustained action that reduces or eliminates long-term risk to people and property from hazards and their effects.

**Mortgage Portfolio Protection Program (MPPP)** – A program designed to help lending institutions to maintain compliance with the Flood Disaster Protection Act of 1973, as amended<sup>89</sup>. Policies written under the MPPP can be placed only through a WYO Company.

**Post-FIRM Building** – A building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of an initial FIRM, whichever is later.

<sup>87</sup> Detailed documentation can be found in the Rating section of the NFIP Flood Insurance Manual, page RATE 21, XIV., C. Map “Grandfather” Rules—Effect of Map Revisions on Flood Insurance Rates.

<sup>88</sup> A description of the Emergency Program and the reduced limits for building coverage and contents can be found on the NFIP web site <http://www.fema.gov/business/nfip/how.shtm>.

<sup>89</sup> Detailed documentation can be found in the MPPP section of the NFIP Flood Insurance Manual.

**Pre-FIRM Building** – A building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial FIRM.

**Preferred Risk Policy (PRP)** – A policy that offers fixed combinations of buildings/contents coverage or contents-only coverage at modest, fixed premiums<sup>90</sup>. The PRP is available for property located in B, C, and X zones in Regular Program communities that meet eligibility requirements based on the property’s flood loss history.

**Repetitive Loss Structure** – Means a structure covered by a contract for flood insurance under Title 42, Chapter 50 that has incurred flood-related damage on 2 occasions during a 10-year period ending on the date of the event for which a second claim is made, in which the cost of repair, on the average, equaled or exceeded 25 percent of the value of the structure at the time of each such flood event (definition from Title 42, Chapter 50, Section 4121).

**1 percent Chance Flood** – A flood that has a one-percent chance of being equal or exceeded in any given year<sup>91</sup>.

**Zones** V Zones – Coastal high-velocity zones  
 A Zones – Non-velocity primarily riverine zones  
 B, C, and X Zones – Outside of SFHAs

#### **Zone A**

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

#### **Zone AE and A1-A30**

Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

#### **Zone AH**

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. The BFEs derived from the detailed

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<sup>90</sup> Detailed documentation can be found in the PRP section of the NFIP Flood Insurance Manual.

<sup>91</sup> As is noted on the NFIP web site, the term “100-year flood” is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time.

hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

### **Zone AO**

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross section and then along the direction of flow to determine the extent of the zone. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the FIRM. Mandatory flood insurance purchase requirements apply.

### **Zone AR**

Zone AR is the flood insurance rate zone used to depict areas protected from flood hazards by flood control structures, such as a levee, that are being restored. FEMA will consider using the Zone AR designation for a community if the flood protection system has been deemed restorable by a Federal agency in consultation with a local project sponsor; a minimum level of flood protection is still provided to the community by the system; and restoration of the flood protection system is scheduled to begin within a designated time period and in accordance with a progress plan negotiated between the community and FEMA. Mandatory purchase requirements for flood insurance will apply in Zone AR, but the rate will not exceed the rate for unnumbered A zones if the structure is built in compliance with Zone AR floodplain management regulations.

For floodplain management in Zone AR areas, elevation is not required for improvements to existing structures. However, for new construction, the structure must be elevated (or flood proofed for non-residential structures) such that the lowest floor, including basement, is a maximum of 3 feet above the highest adjacent existing grade if the depth of the BFE does not exceed 5 feet at the proposed development site. For infill sites, rehabilitation of existing structures, or redevelopment of previously developed areas, there is a 3-foot elevation requirement regardless of the depth of the BFE at the project site.

The Zone AR designation will be removed and the restored flood control system shown as providing protection from the 1 percent annual chance flood on the NFIP map upon completion of the restoration project and submittal of all the necessary data to FEMA.

### **Zone A99**

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplains that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

### **Zone D**

The Zone D designation on NFIP maps is used for areas where there are possible but undetermined flood hazards. In areas designated as Zone D, no analysis of flood hazards

has been conducted. Mandatory flood insurance purchase requirements do not apply, but coverage is available. The flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

**Zone V**

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone. Mandatory flood insurance purchase requirements apply.

**Zone VE**

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

**Zones B, C, and X**

Zones B, C, and X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

## 11. ACRONYMS

AAA	American Academy of Actuaries
AIR	American Institute for Research
ALAE	Allocated Loss Adjustment Expense
AO	Adjusting and Other
APIF	Average Premium In-Force
ASFPM	The Association of State Floodplain Managers
ASOP	Actuarial Standard of Practice
BFE	Base Flood Elevation
CAPM	Capital Asset Pricing Model
CAS	Casualty Actuarial Society
CAV	Community Assistance Visits
CBO	Congressional Budget Office
CFR	Code of Federal Regulations
CR	Combined Ratio
CRS	Community Rating System
DCC	Defense and Cost Containment
DHS	U.S. Department of Homeland Security
FEMA	Federal Emergency Management Agency
FIA	Federal Insurance Administration
FIRA04	Flood Insurance Reform Act
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FPF	Federal Policy Fee
GAO	United States General Accountability Office
HUD	U.S. Department of Housing and Urban Development
IBNR	Incurred But Not Reported
IL	Incurred Loss
ICC	Increased Cost of Compliance
IRIS	Insurance Regulatory Information System
LAE	Loss Adjustment Expense (ALAE + ULAE or DCC + AO)
MPPP	Mortgage Portfolio Protection Program
NAIC	National Association of Insurance Commissioner
NII	Net Investment Income
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NLSR	Net Liability to Surplus Ratio
NPSR	Net Premium to Surplus Ratio
OR	Operating Ratio
PIF	Policies In-Force
PRP	Preferred Risk Policy
RBC	Risk Based Capital
SFHA	Special Flood Hazard Areas
ULAE	Unallocated Loss Adjustment Expense
WYO	Write-Your-Own Program

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