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THE NATIONAL FLOOD INSURANCE PROGRAM: CHALLENGES AND SOLUTIONS

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Flood Insurance Work Group

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Section 1: Executive Summary

The National Flood Insurance Program (NFIP) is the primary provider of flood insurance in the United States, in partnership with private insurers and servicing contractors. The program was formed to address a lack of coverage being offered in the private insurance market, reflecting limited tools to assess risk and the problem of adverse selection from consumers who usually knew far more about local properties' exposure to flooding than did prospective insurers.

Since its inception in 1968, the NFIP has been charged with sometimes conflicting mandates:

- To establish a comprehensive floodplain and coastal flood management framework;
- To make available affordable flood insurance coverage;
- To reduce the public's reliance on post-event disaster assistance
- To encourage widespread participation; and
- To limit the U.S. Treasury's exposure to the need for lending to cover deficits.

Although premiums were set at a level that was generally sufficient to cover losses in the program's early decades, they proved unable to fund catastrophic losses from storms like Hurricane Katrina and Superstorm Sandy. Large deficits required significant borrowing from the Treasury, fueling calls for reform of the program.

In recent years, improved data availability and computing power have significantly improved the understanding of flood risk and the ability of private insurers to underwrite it. Powerful models have been developed to provide a highly refined view of the peril, and have helped to overcome the reluctance of many insurers to offer flood coverage. In the United States, private insurers are beginning to offer flood coverage, something common in other parts of the world. Global reinsurers are using models to price and make available reinsurance capacity. These developments offer an opportunity to reconsider the NFIP's mission.

The NFIP affects many constituencies, including property owners, local governments, builders, realtors, mortgage lenders, insurers, and taxpayers. The program differs from traditional private insurance in several fundamental ways. Changing it without causing market disruption or triggering unintended consequences may be difficult. The program's current authorization expires in September 2017 and Congress will need to consider many complex and highly technical issues as it debates reauthorization.

The American Academy of Actuaries Flood Insurance Work Group[1] developed this monograph to assist Congress and other stakeholders in understanding the key issues surrounding the NFIP and its role in flood management and recovery after catastrophic events.

The monograph is comprised of 13 sections followed by two appendices. Following this executive summary, Section 2 covers the monograph's purpose and scope. Section 3 reviews the evolution of the program, identifying key principles underlying its mission. Section 4 describes the program's mission, while Section 5 identifies ways in which the program interacts with others in the federal government. Section 6 discusses the importance of funding and capital to the program, particularly in the context of how it pays claims following catastrophic events. Section 7 reviews the importance of flood modeling and how recent advances in technology and data can enable private markets to offer coverage. Section 8 discusses the benefits of taking a long-term view of the program's finances, using the prospect of rising sea levels to illustrate its exposure to changing conditions over time. Section 9 covers actuarial standards and principles and how they can be used in NFIP ratemaking. Section 10 discusses issues surrounding privatization and Section 11 provides an example of how state experience in tackling property insurance problems can aid in identifying policy ideas for the NFIP. Section 12 summarizes a survey the work group undertook of ideas for reform from various stakeholders. Section 13 presents conclusions.

1 The Flood Insurance Work Group was formed by the Academy's Casualty Practice Council to provide actuarial support, advice, and communications on topics that involve flood insurance. Specifically, it is focused on the National Flood Insurance Program and proposed changes to its enabling legislation. It will also be considering the private flood insurance market and relevant reinsurance and catastrophe bond issues.

Several issues are highlighted in this monograph:

- The NFIP's mission has evolved over time. Changes in the law have led to some conflicting mandates, particularly between reducing Treasury's exposure to the need for lending to cover program deficits while encouraging widespread participation by keeping premiums affordable and offering subsidies to certain classes of policyholders.
- The NFIP is much more than an insurance program. It disseminates important flood exposure information through maps, works with communities to develop land use management strategies, influences building code standards, protects lending institutions against mortgage defaults due to uninsured losses, and reduces the need for post-event disaster aid, among other things. It is important to consider these other activities when evaluating the public benefit of the program.
- As a government program, the NFIP's funding and capital structure is fundamentally different from that of private insurers. While private insurers must prefund potential losses up to well established solvency thresholds, the NFIP can operate without capital or reinsurance and post-fund losses through borrowing from the Treasury. The potential limit of that borrowing is unclear, as Congress can change it at will. This funding uncertainty creates questions about how much revenue should be raised in premiums as opposed to post-event surcharges, and about how the Treasury's exposure to the need for lending should be provided for in program rates.
- Recent advances in data and modeling have increased the supply of reinsurance for flood risk and are likely to improve the willingness of private insurers to underwrite coverage.
- The program's exposure to loss will change over time, particularly due to the likelihood of rising sea levels and continued development in coastal areas. The NFIP has a large inventory of coastal policies that are highly exposed to ocean storm surge. Congress routinely considers the financial solidity of social insurance programs such as Social Security and Medicare over multi-decadal time horizons; a similar view would be prudent regarding the NFIP.
- Actuarial principles can provide important guidance to the NFIP in establishing rates that yield sufficient revenue to cover program claims in a way that reflects each policy's risk. However, actuarial standards promulgated to guide ratemaking for private entities may not be sufficient for public programs such as the NFIP. In particular, two issues arise: mandates for subsidies or rate capping (which either undermine rate adequacy or require cross-subsidies), and the required cost of capital (due to the NFIP's access to post-event borrowing from Treasury).

- Currently, the NFIP only insures about 5 million homes in the United States, and most of the remaining homes have no insurance to protect them from flood risk that can financially devastate individual families and entire communities, despite evidence this risk is not trivial outside high-risk areas. It is important to encourage and promote insurance coverage of the flood peril to expand protection for homeowners.
- While recent advances in modeling will enable greater private sector participation in underwriting flood risk, the potential interaction of the NFIP and private markets is complex. If cross-subsidies are to be maintained and/or affordability is a concern, it is likely that the NFIP will continue to insure a substantial number of policies regardless of private participation. Further, because private insurers will seek out insureds offering the greatest likelihood of profit, the NFIP is likely to experience adverse selection in coming years, potentially increasing its deficits.
- Any significant increase in private insurer writing that "depopulates" the NFIP will undermine the NFIP's ability to generate revenue from surcharges to repay past borrowing from Treasury.
- Private insurers are regulated at the state level while the NFIP is not. To evaluate the viability of privatization, it is essential to keep in mind that state-level regulation can have significant implications for pricing, coverage requirements, and participation in residual market pools. States will take a state-level view of rate adequacy, something the NFIP has not done to date.
- Many states have long experience with challenges in property insurance markets arising from catastrophic losses from perils like hurricanes and earthquakes. Congress can look to states as a laboratory for finding successful reform ideas.
- Various stakeholders interviewed by the work group offered several clear directions for potential changes to the NFIP. One area strongly supported involved finding ways to increase flood coverage in areas perceived to be "low risk." Doing so would address problems of uninsured losses arising from events like the recent flooding in Louisiana, while potentially improving the system's overall financial position by increasing revenue and spread of risk.

While the Academy does not advocate any particular set of policies, we do suggest that Congress carefully consider a number of specific items, which are outlined in Section 13.

Section 2:
Purpose and Scope

The National Flood Insurance Program (NFIP) is the primary source of flood insurance coverage for homeowners and small businesses throughout the United States. It is administered under authority of a federal law that is subject to a requirement for periodic reauthorization. The current authority is due to expire on September 30, 2017. Consequently, in the coming months, Congress is expected to be reviewing the current law and contemplating various changes.

This monograph is presented to inform the taxpaying public, federal and state policymakers and regulators, actuaries, agents, and other insurance professionals about the NFIP so that they may contribute to the public dialogue with a comprehensive, financial frame of reference. It contains discussion of the background and intent of the program, an outline of federal legislative and regulatory actions that have affected flood insurance in the United States, and an examination of how the program has evolved over time. Perhaps most significantly, this monograph also identifies key differences between the NFIP and conventional, privately offered insurance found in the marketplace.

In addition, this document contains an examination of some of the important issues that underlie recent discussions, with explanation of the background and specific considerations of each issue and a description of how it would affect the financial condition of the NFIP. The monograph discusses how rising sea levels, regardless of the cause, could place severe strain on the program's financial viability in the medium to long term.

This monograph is not intended to be a comprehensive examination of the actuarial soundness of the ratemaking and financial structure of the NFIP. Nor is it intended to address all possible ways in which the current program may be changed during the reauthorization process that will occur in 2017. Rather, this paper is intended primarily to provide an educational foundation upon which to discuss the key issues affecting the NFIP. While an in-depth analysis of the ratemaking and financial structure of the NFIP from an actuarial standpoint would be a valuable study, it is beyond the scope of this monograph and would require additional information not currently available in the public domain. Also beyond the scope of this monograph is a comprehensive analysis of the wide range of ideas for transforming the program. The Academy will offer additional comments on specific proposals to as legislation unfolds during 2017.

The topic of this monograph requires frequent use of technical terms. To aid readers in following the discussion, a glossary is included as Appendix 2.

Section 3: Background—Key Aspects of the Evolution of the Program

Introduction

Critical to the exercise of reassessing and reshaping the financial structure of any government program is an understanding of the following questions:

1. What dynamics led to the creation of the program?
2. What was the program's original purpose?
3. Have the program's goals evolved over time; if so, how and why?
4. Has the program achieved its goals to date, and is it positioned to do so going forward?

This section of the monograph will address these questions.

Creation of NFIP

In the early 1900s, two significant flood events occurred in the United States, and by 1929 private insurers had discontinued offering coverage. Concurrent with these developments, legislation was passed that transferred the lead role in flood risk management to the federal government and appropriated funding to invest in a broader range of solutions. In the 1930s, in response to various types of natural disasters, the federal government began to provide funding through loans and aid to assist communities in recovery. In 1950, this process became more formalized via passage of the 1950 Disaster Relief Act. This act allowed the federal government to provide financial assistance to state and local governments to support recovery of communities that fell victim to natural disasters.

Despite the existence of preventive and protective measures to manage flood risk after enactment of the Disaster Relief Act, private sector insurance was largely unavailable on terms consumers were willing to accept. One key problem was that detailed information about flood risk was largely unavailable to insurers, meaning the consumer knew far more about the risk than a potential insurer, leading to adverse selection. Another problem was that consumers were sometimes reluctant to pay rates sufficient to attract adequate private insurer capacity.

Federal disaster relief was the primary source of funding for disaster recovery of victims, exposing the federal treasury to significant expenditures. With this concern in mind, over the next two decades efforts were made to design an insurance program that would support flood disaster recovery and reduce exposure to flood risk. The program was envisioned as a public-private partnership providing insurance at reasonable rates.

This process culminated with the National Flood Insurance Act of 1968, which included the creation of the National Flood Insurance Program (NFIP). The goals for the NFIP were multifaceted and included both managing flood risk and providing financial protection to support disaster recovery.

Original Purpose of Program

The NFIP's mission at inception was fourfold, as follows:

Create a unified foundation for floodplain management	Encourage effective land use; reduce exposure to flooding	Facilitate prefunding and sharing the challenges of disaster recovery	Deliver coverage at affordable and reasonable rates while meeting solvency goals

Communities participating in the NFIP were required to adopt a floodplain management strategy that discouraged development in high-risk areas and encouraged preventive and protective measures. The legislation included some core principles and expectations:

- The NFIP was to measure flood risk and monitor floodplain management.
- The cost of protection should be shared by those at risk and the general public.
- The program should strive for widespread participation to facilitate pooling and prefunding disaster recovery.
- The NFIP was to develop actuarially sound rates that included funding for losses and administration.
- Its rates should be reasonable, so subsidies were offered to pre-FIRM (Flood Insurance Rate Map) structures to improve participation.
- The program should be designed to maximize attractiveness to participation by the private sector.

It was from these core values that the current system has evolved. The following graphic illustrates a view of the NFIP's key areas of focus:

Building Analytics	• Flood mapping • Risk projection and modeling • Financial tracking • Community compliance tracking
Reducing Exposure	• Land use—discourage development in high-risk areas • Mitigation—reduce vulnerability to flood damage • Benefit design—raising cost sharing and limits over time • Claims management—controls on rebuilding, effective processing
Spreading Risk and Pooling	• Community incentives • Keeping rates reasonable (pre-FIRM subsidies, grandfathering) • Mandatory purchase requirements • Expanding distribution and marketing (e.g., FloodSmart) • Expanding the private sector role (e.g., "Write Your Own")
Managing Solvency	• Annual rate review and rating refinement (e.g., Community Rating System) • Fees and surcharges (e.g., mapping fee) • State/local funding balance • Reducing subsidies

Evolution of the Program

A detailed history of the program's early years is available from numerous sources, including the Academy's 2011 monograph.[2] Several highlights from the period before 2005 are relevant to the NFIP's current status. Significantly, the program covered both riverine (inland) flooding, generally caused by rivers overflowing their banks, and coastal flooding, generally caused by coastal storm surge triggered by tropical cyclones.

The focus during the first 10 years of the program was identifying the at-risk communities, developing and adopting standards for floodplain management, and building the insurance pool. Several studies focusing on managing exposure in flood prone areas were conducted, supporting the development of floodplain management goals for local communities.

Initial participation and partnership with communities was slow to build. Significantly, the key focus in the early years was on increasing the number of communities participating in the program and the number of policies. Rates were reduced three times from 1972 to 1974, with the intent of driving growth of the insurance pool. Within three years of these rate reductions, the number of communities participating grew from 2,850 to 15,000 and policyholders increased from just over 300,000 to over 1 million.

The law was amended in 1973 in an effort to inform communities of their risk and drive participation (and thus floodplain management). A mandatory purchase mechanism was developed whereby lending institutions were to require flood insurance be in place. In addition, communities that were remapped into a higher risk region could retain their current pre-FIRM rates—they were "grandfathered," and could not be required to comply with existing construction requirements.

Over this initial period, the General Accounting Office (GAO; now known as the Government Accountability Office) issued several reports expressing concerns about the effectiveness of the process to identify and map floodplains as well as with monitoring the compliance of local communities with the floodplain management policies.

2 *The National Flood Insurance Program: Past, Present … and Future?;* The American Academy of Actuaries; July 2011.

1979 to 2005

By 1979, enrollment in the program approached 2 million policies, and over 16,000 communities were participating. Having achieved considerable growth in both community participation and policies enrolled, the focus moved toward solvency and improving the adequacy of subsidized rates. With the goal of eliminating subsidized rates, for the first time since the start of the program a significant rate increase (19 percent) was implemented. This increase was followed by a 45 percent increase. Over the course of seven years starting with 1981, rates went up by 120 percent. In 1988, for the first time NFIP achieved the goal of being self-supporting as measured by taking in revenue sufficient to fund the historical average annual program loss plus expense.

As rate increases were implemented, participation in the program began to decline. From 1980 to 1982, the size of the pool had declined by 10 percent. Efforts to manage solvency began to focus instead on adjustments to coverage levels and the scope of coverage to reduce exposure in lieu of increasing premium. In 1983, in an effort to drive additional growth, the private sector's role in marketing and administering policies was expanded considerably with the introduction of the "Write-Your-Own" (WYO) program. The intent was to expand distribution channels to better inform property owners of their risk and increase the insurance pool. With the WYO program in place, the pool began to grow again; by 1988 it had rebounded to the level before the rate increases were implemented. Thereafter the NFIP grew steadily and by 2005, nearly 5 million policies were in effect.

This period ended with a year of unprecedented losses. In 2005, several major hurricanes—Katrina being by far the largest—hit the U.S. coast. Prior to 2005, NFIP's experience did not reflect the impact of such a plausible catastrophic loss year, creating a false sense of its financial solidity.

Since 2005

With the emergence of a catastrophic loss year for the first time since the NFIP was formed, the program experienced a debt approaching $20 billion, which was funded by borrowing from the U.S. Treasury. Over the next three years, some progress was made toward reducing that debt; however, Hurricane Ike hit in 2008, driving the debt back to near $20 billion. With debt at unprecedented levels, the focus began to move heavily toward solvency. In 2012, the Biggert Waters Flood Insurance Reform Act ("Biggert-Waters") was passed to improve the NFIP's financial condition.

A core foundational provision of Biggart-Waters was to add language around the goals for solvency. This provision clarified the standard for rate adequacy as being based on funding the average historical loss year obligation including catastrophic loss years. By focusing on historical catastrophic years, rather than the range of plausible catastrophic events based on a probability standard, long-term rate adequacy (in the way the term is understood in private markets) was unlikely to be achieved. Worth noting is that, while the language that the premiums be adequate to support catastrophic losses was added, the language regarding rates being reasonable to achieve widespread participation was preserved. In addition, no revisions were made to core goals of the original legislation, and thus the premise of sharing the burden of flood disaster recovery between communities at risk and the general public remained in place.

Biggert-Waters eliminated premium subsidies for certain pre-FIRM properties, including policies with severe repetitive losses, as well as the use of grandfathering. Pre-FIRM properties were built prior to the existence of floodplain management standards, and the original law provided for subsidies for such properties. Grandfathering allowed policyholders to be rated on the risk classification in place at the time the insurance was purchased rather than using a later updated risk classification.

To temper the financial impact of these changes on policyholders, the law included provisions for phasing in premium increases for those most impacted. Annual rate increase caps moved from 10 percent to 20 percent, and policyholders were given the option to pay premiums in installments. As a complement to the enhanced clarity around solvency measurement, the law put in place formal requirements for building a catastrophic loss reserve, and required a plan for paying down the debt. It also included higher minimum deductibles and larger mandatory purchasing penalties. When properties were sold or policies were reissued after lapsing, the new policies would be issued at full actuarial rates based on the current risk profile.

In addition to the solvency initiatives, some key studies were required in order to inform future legislative changes. Among these were a study by the National Academy of Sciences on affordability, a study on privatization, and a study on expanding coverage to include protection against business interruption and living displacement. There was also a requirement for the review of expense data from WYO companies. The inclusion of the affordability study is a sign that while many provisions of Biggert-Waters were focused on addressing solvency, the challenge of affordability was still a concern and the new provisions that eliminated subsidies would present challenges as the law was implemented.

Unsurprisingly, affected stakeholders expressed concerns soon after the law took effect. Though many of the premium increases were transitioned in, some policyholders saw immediate increases. This included non-primary residences and new homeowners, which saw significant rate increases.

In 2012, Superstorm Sandy resulted in over $9 billion in losses to NFIP, further increasing the debt. With a second catastrophic loss year less than 10 years after Katrina, the NFIP became increasingly unable to meet conflicting mandates to set premiums that funded catastrophic loss years, achieved high participation in the program, and delivered prices deemed to be reasonable and affordable.

In 2014, the Homeowners Flood Insurance Affordability Act (HFIAA) was passed. It moderated some of the provisions of Biggert-Waters and required refunds for any rate increases associated with these provisions. This moderation included re-establishing grandfathering and allowing properties to retain subsidized rates at sale or upon reinstatement. The requirement to phase out pre-FIRM subsidies on non-primary residences and severe loss properties using a 25 percent cap on annual increases remained in place. While maximum annual increases were reduced from 20 percent to 18 percent, a minimum increase to pre-FIRM properties of 5 percent was implemented so that all subsidized rates would now be on a path to full risk rates.

An annual surcharge of $25 on primary residences and $250 on other properties was imposed across all policies to offset the subsidies that would remain in place. While the surcharge supports the goal of improved solvency, an April 2014 GAO study found it was not adequate to bridge the gap that emerged as grandfathering was reinstated and the required increases under Biggert-Waters were moderated. The 2014 law also included

additional provisions focused on affordability, including a requirement to offer higher deductible levels, and a goal to minimize premiums that exceed 1 percent of the coverage level. The general approach taken toward affordability in both Biggert-Waters and HFIAA suggest the program's goals should be to remove subsidies, offer premiums reflective of true risk, and target any moderation of premiums to insureds based on their need. The law requires the Federal Emergency Management Agency (FEMA) to deliver an affordability framework that considers assistance based on ability to pay, community actions to reduce risk, impact of rate increases on participation, and the impact of mapping updates on affordability, among other items.

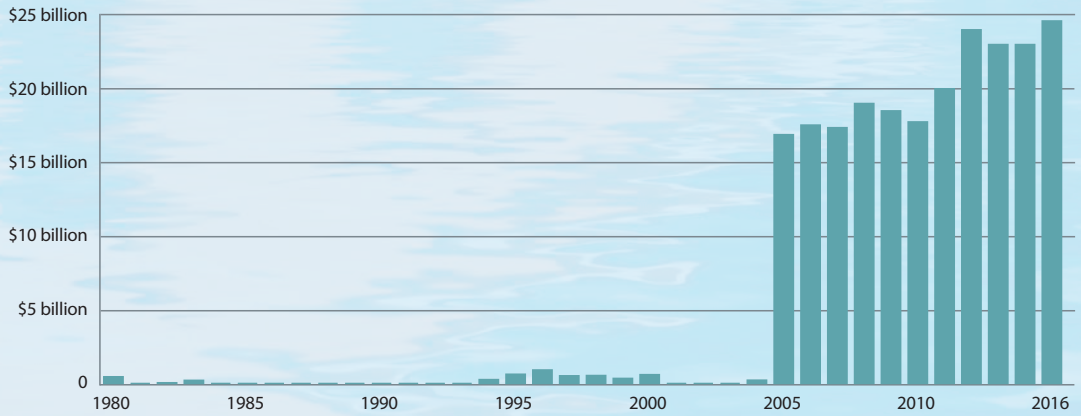
In 2016 there were two significant flood events. The inland floods in Louisiana are noteworthy because they were largely outside the high risk 100-year floodplain and were caused by heavy rain from a tropical system. Over 100,000 homes were impacted, but many were uninsured. After the Louisiana event, it was clear that many affected homeowners had believed erroneously that they were not at risk of a flood since their homes were outside the zones subject to mandatory purchase of flood insurance for federally insured mortgages. Many others believed that their homeowners policies would cover them, despite most private home insurance policies excluding coverage for the peril of flood. In addition, in early October Hurricane Matthew hit along the east coast of the US, causing storm surge and inland flooding. Claims against the NFIP are currently being processed, but estimates indicate that these events may total $3 billion in losses for the NFIP.

Results to Date

In 2015, the NFIP had 5,206,241 policies in force generating $3,449,784,005 of earned premium. Since its inception, it has taken in $53,088,686,549 of earned premium and paid $53,895,595,294 of claims and allocated loss adjustment expenses. Cumulative expense figures are not available, but underwriting expenses generally run about 35 percent of premium. Its debt stood at $23 billion during most of 2016, but increased to $24.6 billion after recently borrowing an additional $1.6 billion, largely to cover claims from the Louisiana event and Hurricane Matthew.

FIGURE 1

NFIP Debt Over Time[3]



The program's debt, including additional debt taken on in 2016, will be a focus during the 2017 reauthorization process.

3 Data through 2011 are drawn from *The National Flood Insurance Program: Status and Remaining Issues for Congress*; Congressional Research Service (CRS); February 6, 2013. Data for 2012 and 2014 are drawn from *High-Risk Series: An Update*; CRS; February 2015. Data for 2013 are drawn from *Overview of GAO's Past Work on the National Flood Insurance Program*; Government Accountability Office; April 9, 2014. Data for 2015 are drawn from *Introduction to FEMA's National Flood Insurance Program (NFIP)*; CRS; August 16, 2016. Data for 2016 are drawn from "Written testimony of FEMA Federal Insurance & Mitigation Administration Deputy Associate Administrator Roy Wright for a House Committee on Financial Services, Subcommittee on Housing, and Insurance hearing titled 'Flood Insurance Reform: FEMA's Perspective'"; Department of Homeland Security; March 9, 2017.

Section 3 Conclusions

The NFIP was created to address several significant problems that arose due to a combination of poorly understood exposure, suboptimal land use management, inadequate building codes, and a lack of available and affordable insurance coverage in the private market. It was designed to improve post-event disaster recovery, reduce the government's exposure to unbudgeted disaster relief payments, and improve mitigation. Over the years its charge has evolved to focus more on financial solidity, though its mandate still includes addressing affordability and offering subsidized policies in some cases. Recent efforts to address rate level deficiencies have triggered opposition, forcing Congress to moderate some provisions enacted in prior legislation. The program's debt, including additional debt taken on in 2016, will be a focus during the 2017 reauthorization process.

Section 4: Structure of the National Flood Insurance Program

The NFIP is a large federal program with more than 5 million policies in force and annual written premiums of approximately $3.6 billion as of August 2016.[4] It has an especially large impact on specific communities, businesses, and individuals in the United States, particularly on those communities and individuals that are located within the floodplains, known as special flood hazard areas (SFHAs). As a result, many different constituencies are invested in the work of the NFIP. Those constituencies include policyholders/homeowners, policyholders/business owners, community officials, community and state floodplain professionals and managers, insurance agents, insurance industry professionals, banking and mortgage officials, real estate agents, state and federal regulators, the executive branch, and, of course, Congress.

The structure and administration of the NFIP is complicated. The NFIP is directed by the Federal Insurance and Mitigation Administration of FEMA. The insurance operations of the NFIP are carried out mostly by participating property and casualty insurers (the "Write-Your-Own" [WYO] companies), which operate under a business arrangement with FEMA governed by statute and regulation.[5] The NFIP is administered, in large part, by 71 property and casualty insurers. The number of WYO insurers has declined in recent years.[6] A separate direct flood insurance vendor administers policies written on behalf of the government.

Congress has an extensive oversight responsibility for the NFIP, primarily through the Senate Banking, Housing, and Urban Affairs Committee and the House Financial Services Committee. Those committees and their predecessors were the authors of the original NFIP legislation and all NFIP-altering legislation promulgated since then. Major changes to the NFIP are accomplished by legislation originating from those two committees. Less

4 "The Write Your Own Program Company Arrangements"; FEMA website; accessed on April 4, 2017; and "WYO Company Financial Assistance/Subsidy Arrangement"; FEMA website; accessed on April 4, 2017.
5 "Write Your Own Flood Insurance Company List"; FEMA website; accessed on April 4, 2017.
6 "Flood Insurance Requirement"; FEMA website; accessed on April 4, 2017.

significant reforms can be made through regulatory modifications promulgated by FEMA. Such regulatory modifications must go through the federal rulemaking process. That process, including public comment periods, generally takes one to two years. FEMA is part of the executive branch of the federal government. It is housed within the Department of Homeland Security (DHS). Oversight of the NFIP, therefore, also comes from DHS and the Office of Management and the Budget, which is an executive office of the president.

Congress often assigns studies of the NFIP and its operations to the GAO, the Congressional Research Service (CRS), and the Congressional Budget Office (CBO). The inspector general of DHS and FEMA's Office of the Chief Financial Officer also periodically review various aspects of the NFIP's operations. In addition, the DHS inspector general conducts an annual financial audit of the NFIP.

The program affects many constituencies nationwide. In its role as the manager of the NFIP, FEMA identifies and maps areas of flood risk, promotes the appropriate management of the floodplains, and provides insurance for properties covered by the NFIP. These services are intended to reduce disaster aid payouts by requiring flood-exposed property owners to contribute to the reduction of the cost of their potential future losses through the purchase of insurance.

The NFIP offers flood insurance coverage only in communities that adopt and enforce floodplain management regulations through an ordinance that meets or exceeds NFIP criteria.

Flood insurance coverage is promoted by a law mandating that federally regulated or insured lenders require borrowers to purchase flood insurance in high-risk areas.[7] Recent reforms have adjusted NFIP premiums to more adequate rate levels; however, the program continues to include subsidized rates.[8] Two additional features of the NFIP, both of which have operational impacts, are the existence of its sunset provision and its periodic need to borrow money from the U.S. Treasury to pay claims.

7 National Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973, Section 1319; FEMA; 1968.
8 "National Flood Insurance Program Reform - Frequently Asked Questions"; FEMA website; accessed on April 4, 2017.

Sunset Provision

The NFIP sunset provision, or expiration date, has been extended several times by Congress, generally for five-year periods, but sometimes on a more temporary, stopgap basis. The stopgap extensions generally have been adopted when Congress was in the midst of a more comprehensive NFIP review of reauthorization, with the intention of drafting reform legislation that would extend the program for longer periods of time. The sunset provision has the potential to cause concern to NFIP stakeholders as the sunset date approaches, primarily because of the possibility of a lapse in the NFIP.

The last extension was part of Biggert-Waters, which extended NFIP's authority through September 30, 2017.[9] Long-term reauthorization is valued by some parties, but many others perceive that reauthorization is the only way to force Congress to review the program. A survey of stakeholders (discussed in Section 11) revealed significant support for a mechanism to compel Congress to review the program without the threat of a lapse.

NFIP Borrowing Authority

The National Flood Insurance Act of 1968 contained a specific cap on the NFIP's borrowing authority. The cap originally was $1 billion. In 1996, Congress raised it to $1.5 billion.[10] After the catastrophic claims from the 2005 hurricanes, Congress raised the borrowing authority several times. In 2013, it was increased from $20.725 billion to $30.425 billion[11] in response to claims from Superstorm Sandy. The amount that NFIP borrows from the U.S. Treasury cannot exceed the existing cap. When NFIP borrowing approaches the existing cap, the NFIP warns the WYO companies and the NFIP servicing agent to be prepared to stop processing claims and other payments related to their flood programs. As of March 2016, FEMA owed the Treasury $23 billion.[12] Recently, there have been legislative proposals to forgive the $23 billion debt, which would return the focus to using current revenues to fund payment of future losses.[13]

9 "National Flood Insurance Program: Reauthorization Guidance"; FEMA website; accessed on April 4, 2017.
10 "U.S. Code—Title 42. The Public Health and Welfare. Chapter 50, Subchapter I, Section 4016, Amendments, 1996 – Subsection (a)(2)"; FindLaw website; accessed on April 4, 2017.
11 H.R.41—To temporarily increase the borrowing authority of the Federal Emergency Management Agency for carrying out the National *Flood Insurance Program*; 113th United States Congress; January 6, 2013.
12 *Review of FEMA Study and Report on Community-Based Options*; U.S. Government Accountability Office; August 2016.
13 "Waters Introduces Legislation to Forgive $23 Billion Flood Insurance Program Debt"; U.S. House Committee on Financial Services Democrats; September 8, 2016.

The sunset provision and the borrowing authority are perceived by some stakeholders at times as critical weaknesses of the NFIP. Congress can delay, and has delayed, extending the NFIP or increasing the borrowing authority cap. If Congress were to postpone in the future such decisions during critical times, like after major flooding events, unfortunate dislocations could occur, such as delays in payments to claimants and discontinuation of claims-handling activities. The uncertainties and disruptions or lapses arising from the reauthorization process have had consequences, both in terms of the level of participation and cost of administration.

NFIP Rate Structure

The objective of the NFIP's premium structure is to promote the program's financial soundness, support floodplain management, and encourage the widespread purchase of flood insurance. The premium structure of the NFIP consists of two distinct approaches, the application of which depends on whether buildings have been constructed after the issuance of a FIRM delineating a community's flood risk, or before the issuance of a FIRM.[14] Sections 4014 and 4015, respectively, of Title 42 of the U.S. Code provide the legislative basis for those two general premium classifications.[15]

The congressional goals for the NFIP of high take-up rates and reasonable premiums were counterbalanced by reforms in Biggert-Waters that were intended to move the NFIP more toward actuarially sound rates, though some of this movement was softened by HFIAA.[16]

NFIP Reporting

FEMA's actuarial staff has historically published an *NFIP Actuarial Rate Review* memorandum (though the latest one on the FEMA website is from 2011).[17] This memorandum describes the NFIP's premium-rate determination methodology and provides explanations for rate changes, along with updated statistics. For example, the memo published in support of the October 1, 2011, rate changes included Exhibits A and D, providing NFIP policy distribution data and other information about premiums.

14 *Actuarial Rate Review*; FEMA; 2011.
15 "U.S. Code—Unannotated Title 42. The Public Health and Welfare"; FindLaw website; accessed on April 4, 2017.
16 *Affordability of National Flood Insurance Program Premiums: Report 1*; National Research Council; 2015
17 *Actuarial Rate Review*; FEMA; 2011.

NFIP Rates, Subsidies, and Surcharges

Approximately 78.5 percent of NFIP policyholders receive full-risk rates. Full-risk rates are determined in one of two ways. For properties inside a SFHA,[18] a rate is determined using a hydrological/financial model originally developed by the U.S. Army Corps of Engineers. For policies outside an SFHA, where there is not enough detailed information to use the hydrological/financial model, actuarial and engineering judgments and underwriting experience are used. The NFIP actuarial staff periodically conducts analyses of claims, trends of inforce growth, and expenses by class of business to update the model. To determine rate classifications, structures are categorized by flood zone according to their location on a FIRM, their elevation relative to the base flood elevation (BFE), and by occupancy type (e.g., by residential versus nonresidential), along with other specific determinants of risk.

Remaining policyholders, by statute, receive subsidized rates, though only on the $60,000 basic limit of insurance. Most of the subsidized policies are issued on properties in SFHAs built before FEMA mapped flood risk in the community. It is worth noting that while the average subsidy is about 50-55 percent of full-risk premium, average rate for a subsidized policy is almost three times the average price of the full-risk rated policies. This occurs because subsidized properties generally have a much more severe risk profile than unsubsidized properties.

In addition to premium charges on NFIP policies, there are three non-premium fees on all NFIP flood policies. Biggert-Waters had a provision that NFIP build a reserve fund equal to 1 percent of insured values. The result is a reserve fund assessment of 15 percent of premium. Additionally, HFIAA introduced a $50 Federal Policy Fee to fund some mapping and community mitigation efforts and an HFIAA policy fee of $25 for primary residential policies and $250 for other policies to bolster the reserve fund.

18 SFHAs are areas mapped to have a 1% annual probability of flood, or about a 1 in 4 chance of flooding over the 30-year term of a mortgage. "Special Flood Hazard Area"; FEMA website; accessed on April 4, 2017.

The rationale for allowing subsidized classes of business was to permit the large inventory of structures (known as pre-FIRM structures) that were built in SFHAs prior to the general implementation (in approximately 1974) of FIRMs and flood-related building codes to be covered by flood insurance at reasonable rates. Also, a goal of the NFIP always has been one of encouraging participation, even if that meant that some property owners would pay actuarially inadequate premiums. Those subsidized property owners prefund at least part of the cost of their flood losses. This provides additional NFIP resources to fund losses as well as lessening the public burden of providing disaster assistance. In addition, widespread participation in the NFIP engenders public awareness of flood dangers and encourages local officials to take the floodplain management actions necessary to make their communities safer. The NFIP indicates that approximately one-fifth of current policyholders are paying subsidized rates.[19]

An area of controversy involves NFIP coverage of properties that have suffered multiple flood losses. Repeated losses suggest such properties have higher-than-average risk. These properties, known as severe repetitive loss (SRL) properties, have been defined in various ways. SRL properties currently are defined as NFIP-insured structures that have had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978. In its 2004 report on the subject, the GAO looked at all locations that had two or more claims over the past 10 years.[20] These properties had accounted for about 38 percent of all claim dollars since 1978. But about half of them were still insured, amounting to only about 1 percent of the then-insured properties.

SRL properties comprise the most heavily discounted class under NFIP. The NFIP currently cannot refuse to cover an eligible property, and ineligible properties are few. While there have been proposals in the past to impose a surcharge on multiple-loss properties, Congress has not chosen to approve any surcharges except those in the 2004 NFIP Reform Act, which dealt with the disproportionate cost of insuring SRL properties in a limited way. Properties identified as severe repetitive loss properties are handled by the NFIP Special Direct Facility, rather than a WYO company. Under Biggert-Waters, FEMA is required to increase rates for SRL properties until they reach full-risk rate levels.

19 *National Flood Insurance Program: Actions to Address Repetitive Loss Properties*; U.S. Government Accountability Office; March 25, 2004.
20 *National Flood Insurance Program: Continued Progress Needed to Fully Address Prior GAO Recommendations on Rate-Setting Methods*; U.S. Government Accountability Office; March 17, 2016.

Types of Flooding

The NFIP covers two very different types of flooding: inland flooding (riverine and flash flooding) and coastal flooding. Properties at greatest risk of flooding are those located near rivers or coasts. Many other types of properties are at risk of flash flooding. Several issues arise because of the differences between properties near coasts and properties in other areas.

- **Inland flooding** occurs when rivers and streams overflow their banks, breach levees or dams, and flood adjacent land. Flash floods occur when very heavy rainfall overwhelms storm drainage systems, causing localized but very heavy storm flooding. Flash floods inundate buildings with water, typically causing damage to first floors and below-ground floors. Floods in narrow valleys occasionally can carry enough force to destroy entire buildings, but such areas are typically small, with relatively few buildings at risk.

- **Coastal storm surge** accompanies intense ocean storms and damages buildings within the run-up of the surge. Storm surge destroys buildings on coasts by the combined force of the rising water and damaging waves while undermining the ground beneath buildings. With the dense concentration of high-valued structures along most hurricane-exposed coasts, high claims payouts are a virtual certainty.

A question arises whether properties that are subject to different types of flooding should be treated differently. Coastal flooding is driven more by storm surge, with a lower frequency but higher severity than comparable inland riverine flooding. Given the relatively larger scale of impact due to coastal flooding, this exposes the NFIP to more significant catastrophic losses. The two events that contributed the most to the NFIP's current debt were Hurricane Katrina and Superstorm Sandy, both of which had significant coastal effects.

Market penetration between areas with riverine flooding exposure and those on the coast is very different. Recent NFIP statistics show that 69 percent of policies are in the 10 hurricane-exposed coastal states from Texas to Virginia (Florida alone has 35 percent of the policies). Those policies account for 60 percent of the inforce premium for the NFIP as of August 2016. Another 13 percent of the policies come from the nine Northeast coastal states between Maryland and Maine. The rest of the country, therefore, accounts for only 18 percent of the policies.[21]

21 *National Flood Insurance Program: Continued Progress Needed to Fully Address Prior GAO Recommendations on Rate-Setting Methods*; U.S. Government Accountability Office; March 17, 2016.

In the private insurance market, the lower frequency/higher severity coastal exposures will require higher prices to reflect their higher volatility. The different nature of loss volatility for inland and coastal areas should be considered when discussing possible privatization reforms/strategies.

Section 4 Conclusions

The NFIP is a large federal program housed within FEMA under the Department of Homeland Security. Insurance operations are mostly carried out by nongovernment "Write-Your-Own" insurers under contract. Congress has significant oversight authority, often requesting studies of the NFIP by the GAO, CRS, or CBO. The program is subject to a sunset provision, requiring Congress to periodically reauthorize it.

The program generates revenue from premiums and surcharges, which it uses for claim payments, flood mapping, administration, operations, and other activities. The program has run a cumulative deficit since its inception and requires borrowing from the U.S. Treasury to cover obligations. It charges premiums designed to be actuarially sound for most of its policies, though some classes are subsidized.

It covers two distinct types of flooding, riverine and coastal. These types have different patterns of loss, with coastal flooding more prone to severe catastrophic loss from tropical cyclones.

Section 5: Interaction With Other Federal Programs, Building Codes, and Land Use Planning

The NFIP engages in many "non-insurance" activities such as promulgating flood maps and encouraging community land use planning. When evaluating the program's value to the general public and the potential effects of proposed efforts at privatization, it is important to note such activities. Arguably, financial deficits generated by the program should be viewed in the context of other value the program generates.

Reducing Post-Event Disaster Relief

It has been a policy in the United States since at least 1803 to give disaster relief to local areas for large catastrophic events. From that time until 1950,[22] a specific law would need to be passed in regards to the amount of disaster relief provided for each given specific event.[23] In 1950, the Federal Disaster Relief Act was passed, which authorized the president to provide federal assistance in response to a disaster if requested by a state governor. The Stafford Disaster and Emergency Assistance Act in 1998 brought more order to the process. For the federal government to assist after an event, a disaster must be declared by the state governor along with a request for assistance.

A founding goal of the NFIP was to reduce the amount of disaster aid required to recover from floods. This was to be accomplished by improved floodplain management, better building standards, land use planning, and prefunding of losses through insurance. Today, the NFIP generates significant value to taxpayers from activities not directly reflected in profits and losses in the insurance program.

22 *Overview of Federal Disaster Assistance*; FEMA; October 1999.
23 "On Call Disaster Reserve Workforce News"; FEMA website; accessed on April 4, 2017; and "Disaster Response in the United States of American: An Analysis of the Bureaucratic and Political History of a Failing System"; *College Undergraduate Research Electronic Journal*; May 10, 2007.

An additional goal of the NFIP is to create a unified program on floodplain management. For example, to better ensure that those at risk of flood are buying insurance, federally regulated or insured lenders are mandated to require flood insurance on properties that are in areas at high risk of flooding. Similarly, to encourage decisions that reduce the potential for future flood losses, the federal government only provides flood insurance in those communities that adopt and enforce floodplain management regulations that meet NFIP requirements. According to the NFIP Actuarial Rate Review, the NFIP's standards for new construction are now saving an estimated $1.2 billion annually in flood damage avoided.[24]

Communities incorporate NFIP requirements into their zoning codes and subdivision ordinances, and adopt special purpose floodplain management ordinances. The NFIP requirements apply to areas mapped as SFHAs on Flood Insurance Rate Maps issued by FEMA. The NFIP requirements include elevation of new and substantially improved residential structures above the base flood level, prohibition of development in floodways, and additional requirements to protect buildings in coastal areas from the impacts of waves, high water velocity, and storm surge. These requirements are the most cost-effective way to reduce the flood risk to new buildings and infrastructure.

In addition to protecting new buildings, the NFIP's substantial improvement and substantial damage requirement ensure that flood protection measures are integrated in structures built before FIRMs were established. A building is considered "substantially improved" or "substantially damaged" when the cost of improving or repairing the building equals or exceeds 50 percent of the market value of the building. When this occurs, the community, which makes the determination, must ensure that the NFIP requirements are applied to these buildings so that they are protected from future flood damages.

In addition, damaged homes can be "bought out" by FEMA, allowing the homeowner(s) to then build outside of a high-risk flood zone and thereby reduce future flood potential for that home. Per the *NFIP Actuarial Rate Review* report, an estimated additional $1.6 billion is saved annually from mitigation activities around elevation and buyouts.[25]

24 *Actuarial Rate Review*; FEMA; 2011.
25 *Ibid.*

Communities are also able to obtain discounted flood insurance premiums by participating in the Community Rating System. Under the Community Rating System, flood insurance premium rates are discounted to reward community actions that meet the three goals of the system, which are: (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management.[26] There are 19 public information and floodplain management activities that apply. The categories include activities such as: disclosures and protection information made available to citizens, open space preservation, storm water management, drainage system management, and additional flood mapping.[27] The highest rated community—Rosedale, California—averages an $850 discount off NFIP premiums for its community members in Special Flood Hazard Areas.

The insurance available through the NFIP is not as extensive as coverage often available for loss perils purchased through private insurance property policies. For example, there are limitations on the maximum limit of coverage for the building property and personal property in addition to a lack of additional living expense coverage. After flooding events, disaster relief is still made available, whether for property owners that did not have flood policies or those with flood policies that had losses not covered by the flood policy. The relief can come in the form of grants that do not have to be paid back or in the form of loans.

Federal disaster assistance is usually in low amounts, such as $10,000 per residence, which is insufficient to rebuild communities. Only insurance with much higher limits of coverage can promote robust community resilience after disasters.

Section 5 Conclusions

The NFIP performs functions not normally done in the private insurance sector such as requiring land use and building code standards for local communities. It also generates detailed maps used by many stakeholders to assess flood risk. Its activities affect government expenditures for disaster relief and infrastructure investment, and contributes to community resilience by providing a mechanism to fund rebuilding.

26 "Fact Sheet"; FEMA website; accessed on April 4, 2017.
27 *National Flood Insurance Program Community Rating System A Local Official's Guide to Saving Lives Preventing Property Damage Reducing the Cost of Flood Insurance*; FEMA; May 2015.

Section 6: Funding and Capital

Private insurance companies hold capital and/or buy reinsurance to absorb and prefund extraordinary levels of catastrophic event losses that may exceed premium income (sometimes by multiples) in a given period. The capital held by an insurance company must provide an adequate return to its provider. Thus, the premiums charged by a private insurer to policyholders must include a margin large enough to absorb retained catastrophic loss levels, maintain sufficient capital to back its policies, fund reinsurance, and provide an adequate return on capital over time.

As a government entity, the NFIP does not operate with owner or investor capital as do private insurance companies. Instead, a line of credit is provided by the U.S. Treasury from which the NFIP can draw when its cumulative revenue falls short of losses and expenses. Any excess of NFIP revenue over losses and expenses is added to reserve funds that pay future losses when revenue falls short of losses and expenses, or to service debt. The NFIP does not need to generate a return on these reserve funds similar to the return on capital for private insurers. However, for the NFIP to be self-sufficient, the premiums charged to policyholders would require a volatility loading large enough to service and eventually repay any debt generated by catastrophic losses over a multi-decadal time horizon. Thus, occasional NFIP debt following catastrophic events would not be problematic for the NFIP if annual revenues were sufficient to permanently repay the debt within a foreseeable time frame.

Neither private insurers nor government entities can fully absorb any level of catastrophic loss and continue to operate.[28] Extreme catastrophic losses can render private insurers insolvent, often requiring activation of state guarantee funds that pay a portion of policyholder claims. For a government entity, extreme catastrophic losses can generate the need for taxpayer assistance and/or engender debt levels that cannot be repaid with limited revenue, given the program's lack of underwriting flexibility and inability to promote risk diversification.

28 *Disaster Risk Financing and Contingent Credit: A Dynamic Analysis*; Daniel Clarke and Olivier Mahul; The World Bank; June 2011.

The capitalization and business model of private insurers is evaluated by nationally recognized statistical rating organizations, which publish ratings used widely in regulatory activity and private contracts. Secure ratings indicate extremely low probabilities of insolvency that are attractive to customers, regulators, and business partners. In theory, insurers holding more capital need to charge higher premiums to consumers, who may value the additional claims-paying security. There is no comparable rating of federal insurance programs. While NFIP borrowing authority establishes a formal "debt ceiling," there are no clear limitations, other than congressional approval, to further extend the "debt ceiling" whenever it is exhausted by catastrophic events. However, there is also no automatic adjustment to NFIP revenue and/or underwriting flexibility to ensure that it is able to repay any amount of debt issued.

In this section, the current state of NFIP funding and the U.S. flood insurance market will be discussed first, followed by an exploration of potential variations in its funding structure, financing mechanisms, and market position.

Current NFIP Dominance of the U.S. Flood Insurance Market: Status Quo Financing

NFIP funds to pay claims come from three sources: revenue from policyholders, reinsurance, and loans from taxpayers. Total NFIP revenue is now comprised of premium, policy fees, assessments, and surcharges. The assessments and surcharges introduced in 2015 as additional charges to all policies generated a significant increase in annual revenue. Nevertheless, total NFIP revenue remains inadequate for two fundamental reasons:

- Subsidized rates below the "full risk" level are granted to many policies, primarily pre-FIRM.
- The implicit volatility loading in the premium is too low to provide for NFIP self-sufficiency when catastrophic events occur.

The loss component of the rates for subsidized policies falls below their expected losses, making the revenue from subsidized policies inadequate. For unsubsidized policies, the loss component of the rates is targeted to their expected losses. However, even the revenue from unsubsidized policies is inadequate because the implicit volatility loading is too low to allow the NFIP to operate without a significant likelihood of borrowing that may not be repaid

from premiums, assessments, and surcharges over a reasonable time horizon. The rapid advances in flood modeling capabilities in recent years also suggest that NFIP ratemaking methodologies employed to date have often underestimated expected losses. If so, this would contribute to inadequacy.

Grandfathering is often discussed in conjunction with subsidized rates, but the estimated rate inadequacy for grandfathered policies is cross-subsidized by the rates for others. If the NFIP remains a near monopoly for residential U.S. flood insurance, grandfathering should not result in adverse selection and does not contribute further to the overall inadequacy.

In contrast to grandfathering, the "subsidies" in the premium for subsidized NFIP policies are not cross-subsidized by other policyholders, nor are they directly funded by taxpayers. When the NFIP is forced to borrow from the Treasury, a portion of that debt is generated by these "subsidies," but the NFIP is expected to repay the debt, so the "subsidies" have yet to be incurred by taxpayers. Although Treasury loans are extended to the NFIP to fund catastrophic losses when needed and there is no reason to expect that Congress would deny future such loans, the NFIP is expected to repay the loans regardless of the size of the catastrophic losses incurred. Although the interest rate charged by the Treasury is modest, debt service has nevertheless become an additional burden following Hurricane Katrina.

The distribution of catastrophe losses is such that it is typical for actual annual loss amounts to fall below annual expected losses. Thus, reserve funds can accumulate for several years even with some degree of revenue inadequacy as measured using actuarial principles. This happened historically with the NFIP prior to Katrina, and the problem was exacerbated by rapid exposure growth where reserve funds accumulated from smaller revenue levels not commensurate with inforce exposure at the time.

In partial recognition of NFIP funding deficiency, the Biggert-Waters legislation authorized the NFIP to phase in larger rate increases for subsidized policies over time to eventually bring their premiums to "full risk" levels. The HFIAA legislation forestalled some planned rate increases but imposed the new assessments and surcharges on all policies to increase NFIP revenue. However, neither legislative act provided any debt forgiveness to the NFIP despite the extraordinary amount of losses incurred from Hurricane Katrina. NFIP revenue is insufficient to fully repay debt of the current magnitude in the foreseeable future.

Current NFIP Dominance of the U.S. Flood Insurance Market: Structured Financing Alternatives

Prospectively addressing this financial situation first requires recognition that there is a maximum amount of short-term loss that can be fully funded by NFIP revenue. One approach would be to establish a "sufficiency standard" for the loss level that NFIP revenue should be expected to fully fund. For example, the sufficiency standard could be stated as a maximum loss amount per catastrophic event, determined on the basis of an acceptable annual probability, or a maximum aggregate amount of annual loss. Any losses exceeding the defined sufficiency standard incurred by the NFIP could be agreed to be publicly funded by taxpayers. Private insurers are held to an analogous standard, after which state guarantee funds reimburse policyholders for claims from insolvent private insurers using funds from assessments paid by solvent insurers.

The average volatility loading in the NFIP rate level must be calibrated to support the defined sufficiency standard. The trade-off between more affordable flood rates and stronger sufficiency standards is a key public policy choice. The initial approach would most likely estimate the sufficiency standard supported by the existing rate level given limited short-term rate and underwriting flexibility. Because NFIP revenue would be adequate to fund losses up to this sufficiency standard and a public guarantee would fund losses above this level, NFIP revenue would then be sufficient to repay any debt incurred by the NFIP over time, although the cost of loan interest would also need to be reflected in rates. The average duration of time for any debt repayment could be established as another factor in NFIP revenue, but this could also impact rate level. Because past NFIP revenue could never have funded losses above the sufficiency standards at the time those events occurred, it would be reasonable to forgive the amount of the outstanding debt, including interest, on the portion generated by losses exceeding the sufficiency standard supported by rates in existence at the time of the events.

Probabilistic modeling is required to evaluate the trade-offs and feasibility of alternative sufficiency standard and rate level combinations, but with imperfect multiyear assumptions and within ranges of outcomes. Rating agencies also use such modeling to evaluate capitalization standards for private insurers. The natural catastrophe portion of rating agency modeling generally focuses on the percentage of capital consumed by catastrophic events that reflect a given probability of a loss of a given size.

Until recently, U.S. flood modeling capabilities were inadequate for reasonable evaluation of sufficiency and rate level trade-offs for the NFIP. During the past couple of years, the first U.S. inland flood models were released by modeling firms, addressing inland flood peril, which had not previously been modeled to commercial standards. While the available models and NFIP exposure data are imperfect and somewhat incomplete, they are now sufficient in conjunction with historical data analysis to provide reasonable estimates of NFIP loss distributions. Annual loss distributions are standard output for these models, but they need to be extended to multiyear models using other models to evaluate rate adequacy and sufficiency over time. Such NFIP models were built for the Flood Insurance Risk Studies (FIRS) mandated by Biggert-Waters.

The FIRS stochastic NFIP flood models support the statements made in this section regarding the inadequacy of NFIP revenue. As U.S. flood models and NFIP exposure data improve, future models will be able to more accurately and completely evaluate NFIP loss potential and funding. However, difficulties with the multiyear modeling projections exist, such as with unexpected exposure changes in regions most vulnerable to flood.

Risk Transfer Options

An alternative or complement to borrowing from the Treasury is to transfer risk through reinsurance or alternative capital market instruments.[29] Private insurers routinely use excess of loss reinsurance contracts to provide stability and protection against lower-frequency catastrophic events that generate losses above specified attachment points. The cost of a fixed limit of reinsurance drops as the attachment point increases, so a sufficiently high attachment point can leverage the annual cost into a coverage limit of many multiples of that cost. The trade-offs for this advantage are that:

- there will be no reinsurance loss recoveries for most years with a low-frequency attachment point; and
- the reinsurance premium includes a margin for expense and profit in addition to expected losses.

29 *A Methodology for Calculating the Opportunity Cost of Layered Sovereign DRFI Strategies*; U.K. Department for International Development, The World Bank, and the Global Facility for Disaster Reduction and Recovery; 2013.

A partly offsetting advantage to these additional reinsurer costs is that reinsurers are far more diversified than the NFIP in geographical regions, other natural catastrophe perils, and other lines of business. This diversification reduces the profit margin in the reinsurance premium to the extent flood risk contributes to a total diversified risk profile. Nevertheless, reinsurance business expenses would also need to be reflected in the NFIP rate level. Another option would be for taxpayers to directly subsidize reinsurance renewals as part of the annual budget, if a predictable annual budget amount is deemed to be preferable to the more volatile alternative funding needs following significant events.

Alternative capital market instruments (such as catastrophe bonds) provide risk transfer options that generally function in a similar manner, but are offered by financial organizations that are not traditional reinsurers.

To maximize the leverage effect of risk transfer options and limit their cost, they would generally attach above the amount that the NFIP would borrow, with a limit consistent with the sufficiency standard. Instead of requiring congressional approval to extend borrowing authority when it is exhausted, borrowing authority could automatically be granted for loans needed to fund losses up to the amount of the reinsurance attachment less available reserve funds. This would require some advance agreement about the reinsurance attachment points to be expected. Thus, the logical order of funding for catastrophic event losses that exceed annual NFIP revenues would be:

1. available reserve funds;
2. short-term loans from the Treasury up to the amount of borrowing authority that can be repaid from surcharges; and
3. reinsurance (or alternative risk transfer) consistent with the defined sufficiency standard.

These amounts would sum to a level consistent with the sufficiency standard. Any losses above this standard could be funded by taxpayers, perhaps with debt forgiveness.

Since receiving the authority to secure private market reinsurance through Biggert-Waters and HFIAA, FEMA has been exploring a potential reinsurance purchase to transfer NFIP risk. Following a very small initial placement in September 2016, FEMA significantly expanded this reinsurance program by entering into agreements with 25 reinsurers for a placement effective January 1, 2017.[30] Under this agreement, the reinsurers will cover 26 percent of NFIP losses between $4 billion and $8 billion arising from a single flooding event in exchange for a reinsurance premium of $150 million. Thus, the transaction transfers a total of $1.042 billion in flood risk to the private sector.

In describing the 2017 NFIP reinsurance program, FEMA explains that it will diversify its financial management tools, "lay the cornerstone for a multi-year program" and "promote private sector participation in flood risk management." This could indicate that FEMA may pursue broader improvement in its financial management, further expand the reinsurance program as a future part of that process, and incent the private sector to invest more toward improving its capabilities in the modeling and analysis of U.S. flood risk.

The World Bank and Global Facility for Disaster Reduction and Recovery (GFDRR) have sponsored research to improve strategies for government financing of natural disasters. Some other available publications from these organizations provide more analytical insight into effective strategies and layering of the various types of financing discussed.

Shift to Private Industry Participation in the Flood Insurance Market

The issue of privatization of parts of the NFIP is addressed in a subsequent section of this monograph. There are two concepts that directly involve funding and capital considerations.

First, there is a fundamental difference in how private and public systems prefund losses. Private insurers must hold capital and/or reinsurance sufficient to cover the gap between losses that can be paid from current period premiums and the solvency standards required by regulators and rating agencies. The cost associated with holding capital or purchasing reinsurance must be reflected in current premiums. Public insurers, on the other hand,

30 "National Flood Insurance Program's (NFIP) Reinsurance Program for 2017"; FEMA website; accessed on April 4, 2017.

can hold lower reserves and buy less reinsurance because most have an implicit or explicit source of revenue outside the policyholder premium base. Further, public insurers can run a "negative surplus" by borrowing funds to pay losses with a promise of future repayment. Accounting rules preclude private insurers from doing this. In simple terms, public insurers can spread losses across both time and space, while private insurers can only spread them across space in the current period. This means that prices charged in private and public insurance programs may be significantly different even if assumptions about expected losses and expenses are the same.

Second, because private insurers must hold sufficient capital/reinsurance to fund large losses, areas of highly concentrated exposures will carry higher loadings than sparse ones. While the reasons for this effect are beyond the scope of this monograph, the consequence is that areas of high exposure concentration that also have high exposure to flooding will be more difficult to privatize at a given rate level. If the NFIP's rates fail to reflect this concentration charge in specific geographic areas, it should be expected that prices for private coverage and the NFIP will diverge. All else being equal, this effect may result in less voluntary privatization occurring in such areas and a corresponding shift in the NFIP's book to these areas. The result of this effect will be to increase the volatility of NFIP experience and erode the overall adequacy of its rate levels.

As noted previously, policies in coastal areas subject to large tropical storms generally would experience less frequent but more severe losses. To the degree this is the case, such areas would require a higher risk load in the private market. The NFIP would also find reinsurers requiring a higher risk load to accept risk.

One other effect of increased private sector participation in the flood insurance market should be noted regarding NFIP borrowing. To the extent that privatization initiatives reduce the policy and premium base of the NFIP, less revenue will be generated from surcharges on NFIP policies to pay off past borrowing, reducing the amount of borrowing that can be repaid, and/or extending the time required to repay it. One way to conceptualize this is to recognize that a reduced policy count and premium base should result in a lower threshold for debt forgiveness at a given sufficiency standard, meaning privatization initiatives could result in a need for greater forgiveness of past debt unless some mechanism were developed to require privatized policies to contribute to the retirement of past NFIP debt.

Section 6 Conclusions

Any entity that underwrites insurance must have access to funding to pay claims and expenses that exceed current period premium volume.

Private insurers must prefund losses up to a sufficiency standard, holding capital or buying reinsurance for this purpose, and are subject to well-tested regulatory and rating agency standards for solvency. Mechanisms exist to address issues arising from insolvencies triggered by extreme losses exceeding an insurer's capacity to pay. Government insurers are not subject to the same accounting and regulatory standards that private insurers are, which allows them to incur deficits that can be funded by borrowing from Treasury or issuing post-event bonds.

The NFIP offers coverage for some properties at subsidized or grandfathered rates that do not reflect risk, meaning it is expected to run deficits and that private sector insurers are unlikely to offer coverage on similar terms. Further, the program may not be adequately funding catastrophic loss potential.

The NFIP currently does not have clear guidance on what level of loss its rates should anticipate, known as a sufficiency standard. Developing one would help clarify the level of loss that should be funded by various sources, such as short-term borrowing, reinsurance, or debt forgiveness.

When considering potential privatization initiatives, differences in how public and private insurers fund losses are important. Also, a shift of policyholders from the NFIP to private insurers will degrade the NFIP's ability to repay past borrowing.

Section 7: Technical Tools—Maps and Modeling

The ability to reasonably estimate the loss potential of a portfolio of properties is fundamental to any insurance mechanism's ability to underwrite it. The insurer needs to know the likely frequency, size, and timing of potential losses, either routine or catastrophic, to determine needed amounts of capital and reinsurance to assure claim payment. Such information is also needed to determine the revenue required from premiums, both at a portfolio aggregate level and at an individual policy level.

In lines where losses are dominated by reasonably predictable and frequent random events, actuaries can utilize recent historical loss experience, adjusted for inflation and known changes (such as in law or coverage), to estimate future losses. In lines where losses are subject to infrequent catastrophic events, such as flood, the available historical record may not be sufficient to understand future loss potential. This can be due to either a lack of large events or an insufficient experience period. Data may require trending or adjusting for inflation, law, changes in policy conditions, or current construction practices. Such adjustments are extremely difficult to accomplish accurately. This problem with catastrophe loss estimation has led to the development of sophisticated loss simulation models for perils such as hurricane, earthquake, and flood.

The NFIP has firsthand experience with the limitations of using historical data to price its policies. Prices determined from historical experience failed to anticipate extreme catastrophic losses from events like Katrina and Sandy.

Flood also poses a challenge due to significant differences in expected loss from a property's specific characteristics, such as elevation, proximity to rivers or the ocean, or whether the building sits on the ground or is on stilts. With coastal storm surge, it is also important to understand the bathymetry, or contour of the ocean floor or near-coastal waters, in order to compute the likelihood and extent of surge from a coastal storm. These issues ha led to extensive efforts to develop maps of local communities and to understand the hydrology of rivers and coasts.

The difficulty of developing comprehensive estimates of loss at a granular level was at the core of the historical problem of private insurers not being able to offer coverage for flood. It is also a major factor in the NFIP having difficulty determining adequate aggregate price levels and needed contributions from individual policies.

In recent years there has been a revolution in tools available to measure catastrophic risk in general and flood risk in particular. This revolution was triggered by rapid improvements in computer technology that allowed extremely sophisticated simulation models to be built. Concurrently, there has also been an explosion in available data on both property and hazard characteristics. The latter is colloquially illustrated by tools like Google Earth street view. The combination of powerful computers and "Big Data" has transformed understanding of hazards such as flood. This new understanding opens up new opportunities to insure and reinsure flood risk in the private market. It also offers the NFIP new ways to align premium with risk, reducing cross-subsidies and encouraging mitigation by sending appropriate price signals to consumers.

Understanding these changes in modeling technology is critically important to evaluating policy options on how the NFIP can be funded and how it interacts with private markets. While a comprehensive review of modeling tools and techniques is beyond the scope of this monograph and would require a long paper of its own, in this section a summary of key concepts is presented. In the following discussion, the term "insurer" is used in a broad sense that includes both private companies and government programs such as the NFIP.

Catastrophe Models

Similar to hurricane simulation models—used by the insurance industry for over two decades—flood models are complex, as they consider rainfall, wind speed, land use/land cover, surface roughness, effect of geology and soil type, elevation, flood defense, flood control measures, construction, policy conditions, and more to calculate potential insured flood losses. Like other models, they analyze whatever current exposures are introduced to the model, so they avoid the pitfalls in adjusting historical experience to reflect changes in the number and type of structures exposed to the hazard. The models can also account for changes in building practices or elevation requirements.

Catastrophe Module Components Specific to Flood

- **Hazard—event generation module:** Contains flood event information generated by the model, including annual probability of occurrence.
- **Hazard—local Intensity module:** This module calculates inundation depth at each geographic location based on soil type, rainfall, river discharge, wind field, tide, and the impact of flood defense such as private levees and those managed by the U.S. Army Corps of Engineers.
- **Engineering module:** The structure characteristics are specific to flood damage, although some (such as the age of a building) are likely to be applicable to many perils.

Flood simulation models estimate losses from coastal and inland flooding based on a portfolio's actual exposure. Coastal flooding includes storm surge from hurricanes and tropical storms. Inland flooding includes river, lake, and surface water flooding. Importantly, the differentiation is based on the cause of the event and the direction it moves, not the geographic location of the damage. As can be seen in Figure 2, precipitation (not wind) damage from tropical storm cyclones can be considered either type of flood. Surge begins at the coast and moves inland. Riverine flooding, for example, starts upriver and flows to the coast. Coastal properties can be damaged by inland flooding.

Potential Uses of Flood Models

The major output of a flood model is an "event loss table,"[31] which contains the probability of each event happening, the expected cost of the event, and measures related to the uncertainty of the expected costs. These are used to build various probability distributions, which then allow for calculation of useful statistical measures. Some examples of the uses and related measures are:

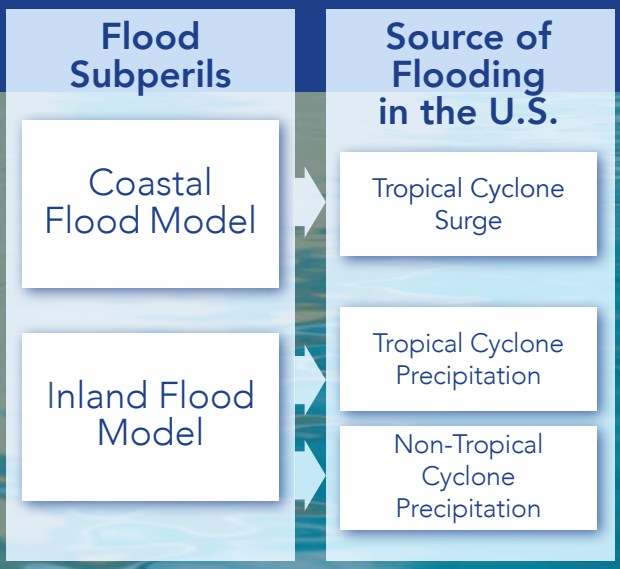
- **Ratemaking**—Although hurricane (and flood) events are not frequent occurrences, policy terms are usually for a year. Therefore, the annual cost of these events needs to be determined. A model generates Average Annual Loss (AAL) for each insured property, which can be used to determine premium needed to pay for those losses. AAL and derivative metrics can be used to evaluate the actuarial and business impacts of various deductibles, limits, territorial definitions, and classifications of risk.

31 This term is commonly used by a leading modeling vendor. Other vendors have different terminology, such as "year ID, event ID." For consistency, we have chosen to use terms from that vendor in this document.

FIGURE 2

Source of Flooding

Flood Models

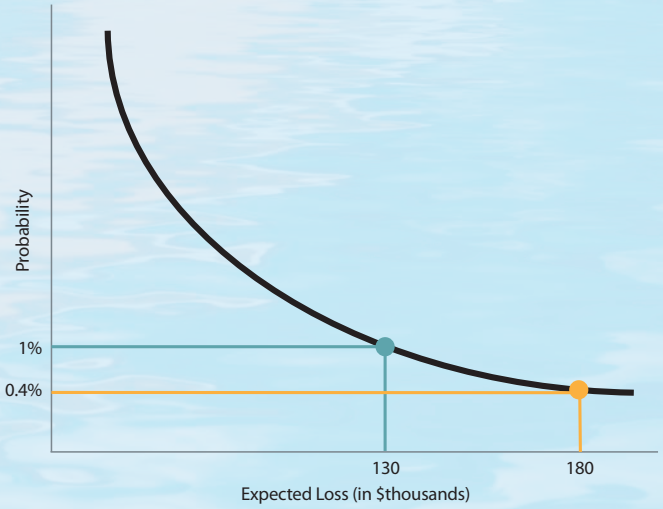


Flood simulation models estimate losses from coastal and inland flooding based on a portfolio's actual exposure. Coastal flooding includes storm surge from hurricanes and tropical storms. Inland flooding includes riverine, lacustrine, and surface water flooding. Importantly, the differentiation is based on the cause of the event and the direction it moves, not the geographic location of the damage.

- **Loss mitigation activities, impact, and strategy**—AALs and other measures can be calculated with and without various characteristics (such as elevation or location of electrical systems) to see how much expected loss may differ.
- **Underwriting risk selection**—Nearly any property can be insured if an appropriate rate can be calculated and charged. However, the impact of adding a given property to what an insurer already has on its books depends not only on the individual property, but also on how its potential for loss interacts with existing policies. Therefore, measures such as Probable Maximum Losses (PML) are considered. A PML or Return Period Loss is an amount that is expected to be exceeded by an event with a given annual probability.
- **Portfolio management**—Insurers have goals and plans that reflect their own philosophy of the risk/return trade-off. In addition, long-term sustainability (and where appropriate, profitability) are considered. For example, a company may decide that it would like to be able to pay for an event that has a 1 percent probability of occurring, but transfer any more severe losses to a reinsurer. Figure 3 demonstrates how model metrics help visualize this type of information. The graph is a Probable Maximum Loss curve.
- **Reinsurance**—Reinsurers evaluate contract retentions, limits, and pricing as well as their aggregation of risk and diversification benefits among primary insurers they work with. Because model output is a common language for evaluating the expected loss, potential transactions are efficient to administer, standardize, and customize.
- **Enterprise Risk Management (ERM)**—Specific catastrophic event scenarios can be used for stress testing the financial soundness of an insurer. Modeled expected losses can be combined with non-catastrophic and non-modeled perils in a robust ERM analysis.
- **Financial and capital adequacy analyses**—Specific model output measures are key inputs into rating agencies' tests and evaluations.

FIGURE 3

Probable Maximum Loss Curve



The blue circle shows the 1.0 percent PML along with its associated expected loss, and the yellow circle shows a 0.4 percent PML.

Public Evaluation of Flood Models

The Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) is in the process of developing standards for evaluation of flood models.[32] The FCHLPM was established in 1995 and is widely regarded as having the most complete set of requirements for the development and use of hurricane models in the United States. Flood standards and review of commercial flood models will follow much of the structure and process that has been successful in dealing with the hurricane peril. Standards are grouped in six categories: General, Meteorological/Hydrological, Statistical, Vulnerability, Actuarial, and Computer/Information. Models are reviewed in depth by a "Professional Team," comprising experts in each of these areas. Members of the Professional Team are not state employees, and can enter into confidentiality agreements that facilitate the review of proprietary intellectual property and trade secret information. Standards must be reviewed and may be revised every other year. While the information and standards are Florida-focused, many of them have applicability in other geographic areas, and the Florida process often is mentioned as the gold standard when other states develop their own regulations.

Maps

Maps are used within models and on their own. With maps, insurers can view aggregation of risk to aid in underwriting, loss adjustment, capital management, and transfer of risk. Maps can also be used by communities and governments for planning and regulation. Just before, during, and after a catastrophe, they are invaluable in providing information related to adjuster deployment, potential evacuation situations, disaster relief, and detection of potential fraudulent claims.

Approximately 60 percent of the U.S. land mass and 92 percent of the population is covered by current FEMA flood maps. The original use was for mortgage issuance, which requires flood zone determination. The current maps are used by the NFIP, commercial flood insurers, and modelers. Flood maps are being continually updated and improved. However, some areas' maps are quite old and much of the land covered lacks detail that could be useful. Fortunately, new technologies and products are available that can be helpful in collecting and updating maps. Maps (and the data contained in them) are most useful when they are current and detailed (regarding both geography and richness of data).

32 "Flood Standards Development"; Florida Commission on Hurricane Loss Projection Methodology website; accessed on April 4, 2017.

Data

Detailed, current data are of the utmost importance in the development and validation of models and maps.

Data can be usefully separated into information on events and information on structures. Event data are used in models to develop and validate the hazard information shown in Figure 2 in an earlier section of this monograph (event generation and local intensity), while structure information provides information on the damage estimation of insured property.

Historical event data can provide valuable insights into what has happened and can help identify properties that have been or are likely to be prone to repeated flooding, as well as the severity and extent of the events. Each type of event (such as hurricane, flash floods from heavy rain, and snow runoff) requires specific data[33] on the meteorology of the event and the hydrological characteristics of the land over which the event occurred. Raw data on events usually reside in government agencies such as the National Oceanic and Atmospheric Administration and the United States Geological Survey.

Of course, more current information is far more useful than older information. Old information must be transformed to reflect current conditions, an imperfect exercise at best that becomes more difficult with time. Further, more recent events usually provide more detailed event information due to improvements in data collection. Information from decades ago is still valuable, but substantially less so.

Elevation information related to the property a building occupies is a key predictor of damage for flood, as well as the location of items (such as electrical panels) in relation to elevation. Elevation is one of the most significant rating factors that differentiates NFIP premiums according to geography within the SFHA zones, but the NFIP does not use elevation information to set premiums for properties outside the SFHA. This means that there is virtually no geographical rate differentiation among the lower-risk areas, generally inland areas away from rivers, which comprise the majority of the property in the United States.

33 For more detail on event and land data: "National Oceanic and Atmospheric Administration Homepage"; National Oceanic and Atmospheric Administration website; U.S. Department of Commerce; accessed on April 4, 2017. "United States Geological Survey"; United States Geological Survey website; accessed on April 4, 2017.

Structure information helps to quantify damage severity and can give insight into potential mitigation features. Data on individual structures usually resides in private insurers' records or in real estate transactions. Acquiring, organizing, and storing this data is a significant and expensive task. The relative costs and benefits of gathering, checking, and storing information need to be considered. Characteristics that have not been routinely gathered should be added to the information that already is collected. The potential impact of new features needs to be determined and quantified to guide cost-benefit decisions.

Many characteristics are interdependent. When reporting of individual property or structure characteristics is optional, bias is likely—features that lower or are perceived to lower insurance costs are far more likely to be reported than those that could raise costs, which is likely to exacerbate the adverse selection impact mentioned in Section 10.

Some data is applicable on a community basis, which presents its own challenges, such as: Who is responsible for updating and maintaining that information? If one neighborhood builds a wall to retain water, could the water then divert to a neighboring area?

Information germane to flood must be extremely detailed geographically. Many areas show variations in elevation, for example, across a relatively short distance. In addition, because more current information is far more useful than older information, even if a structure has not changed, changes in surrounding land use may impact the original building's exposure to flood, meaning voluminous data must also be kept fresh.

Transparency and availability of detailed data is an important ingredient in helping all parties understand and mitigate flood risk.

Section 7 Conclusions

Catastrophe models can enhance pricing accuracy and risk management for the NFIP and for the private market. Flood models assess coastal flood risk, inland flood risk, or both. In general, the data, maps, and models for coastal events are more developed than those for inland events. There has been tremendous improvement in the sophistication of flood models in recent years, opening new opportunities for both the NFIP and private insurers to underwrite policies and charge premiums reflective of risk, if data collection and management can ensure both granularity and continuing relevance.

Section 8: Future Issue—Rising Sea Levels

Given the NFIP's significant exposure to coastal flooding (due to the location profile of its policyholders) and public policymakers' interest in promoting the program's long-term financial soundness, it is important to consider how changes in coastal storm surge potential may affect the program. While an exhaustive review of possible future conditions is beyond the scope of this monograph, the likelihood of rising sea levels necessitates more study in this area.

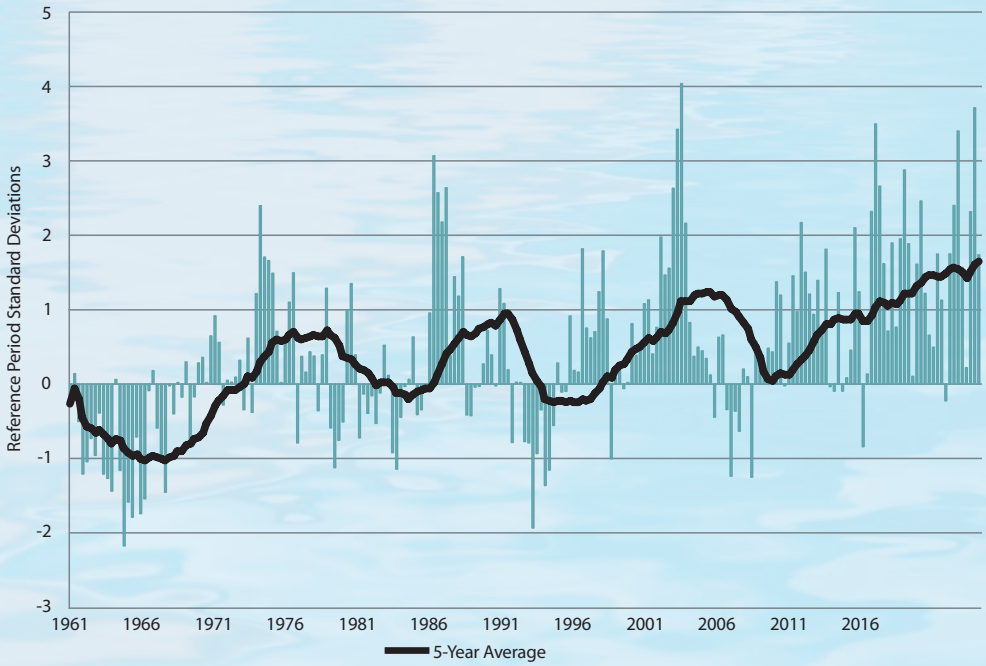
Science

Of all the changes that may or may not be occurring in the global climate, the prospect of rising sea levels is the one that is the hardest to overlook. Both ground and satellite observations clearly show an empirically significant decline in ice contained in glaciers and high-latitude ice caps in recent decades. Observed temperatures have increased significantly in the Arctic and Antarctic. Even if high-latitude temperatures stabilize at current levels, significant amounts of ice will melt in coming decades. Given what is known about how the ocean expands and how ice sheets and glaciers are adding water to the seas, scientists have stated that at least 3 feet of sea level rise, and probably more, is likely to occur.[34] The American Association for the Advancement of Science (AAAS) concludes: "Sea level rise projections over the next century vary considerably, with the high-end scenarios yielding a rise of up to 6 or 7 feet by 2100."[35]

34 "NASA Zeroes in on Ocean Rise: How Much? How Soon?" NASA; August 26, 2015.
35 "What we know: The Reality, Risks, and Response to Climate Change"; AAAS Climate Change Panel; accessed on April 4, 2017.

FIGURE 4

Sea Level Index[36]



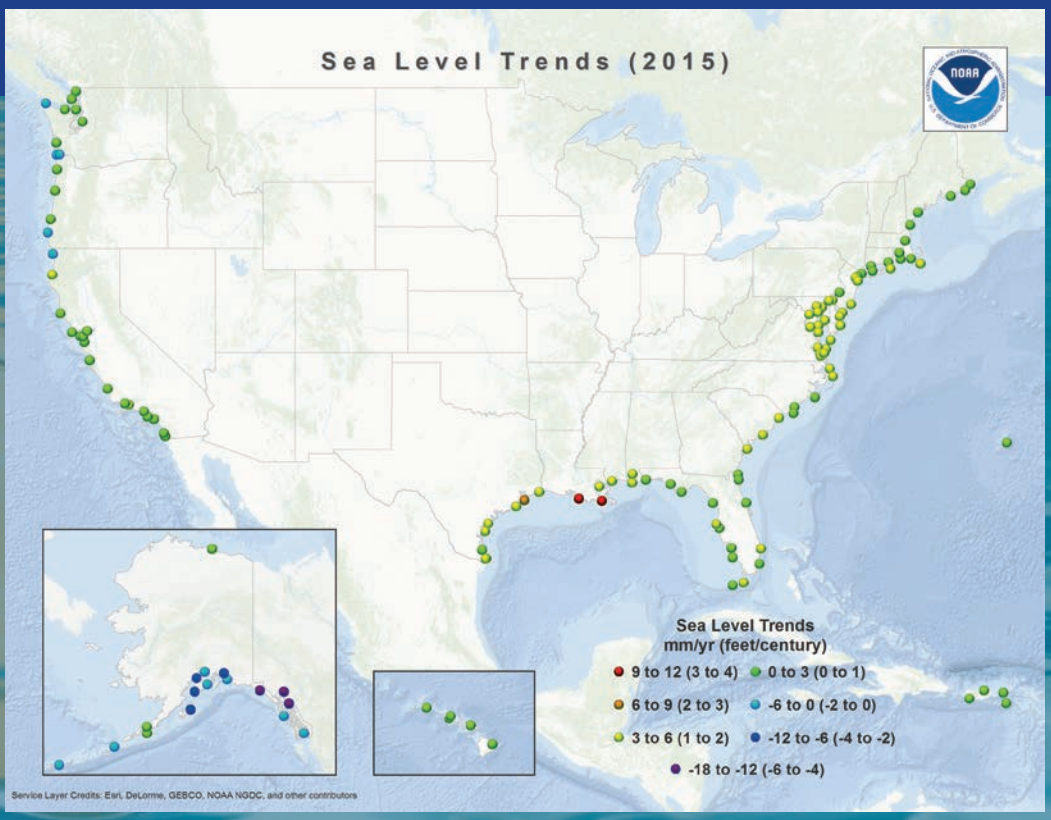
The Sea Level Index for the U.S. and Canada from the Actuaries Climate Index highlights the recent trend of sea level rise.

Figure 4 shows the Sea Level Index for the United States and Canada from the Actuaries Climate Index; Figure 5 shows sea level trends from the National Oceanic and Atmospheric Administration. Both clearly indicate the trend, if sustained, of sea level rise.

36 Actuaries Climate Index; accessed on April 4, 2017.

FIGURE 5

Sea Level Trends (NOAA)[37]



The relative increase in sea level will leave many U.S. cities facing increasing exposure to losses due to flooding, investment in very expensive flood control systems, or both.

Many coastal areas of the United States are also undergoing significant land subsidence, generally caused by continual building on soft soil. The relative increase in sea level (absolute sea level rise plus land subsidence) will leave many cities facing increasing exposure to losses due to flooding, investment in very expensive flood control systems, or both.

37 "Sea Level Trends"; NOAA website; accessed on April 4, 2017.

Effects of Sea Level Rise

Many studies have developed measures of future vulnerability to coastal flooding. One is summarized in *Nature Climate Change* (September 2013), in an article titled "Future flood losses in major coastal cities." Supported by the Organisation for Economic Co-operation and Development and the World Bank, the study developed a method to quantify future flood losses in major coastal cities.

The study concluded that flood exposure is increasing in coastal cities due to a combination of "growing population and assets, the changing climate, and subsidence." Present and future flood losses for 136 of the world's largest coastal cities were estimated under a range of socioeconomic, climate, and adaptation scenarios. Currently, due to their high wealth, three American cities (Miami, New York, and New Orleans) account for 31 percent of global aggregate losses, indicating the United States is "particularly vulnerable."

This and other studies show that the United States faces the potential for significant costs from coastal flooding in coming decades through direct losses, required investments in mitigation and resilience, or both. Models, as described in the previous section, can be used to estimate the effect of higher sea levels under a range of future scenarios.

The NFIP and Sea Level Rise

What will be the impact on the NFIP as sea levels rise? Increased flooding due to higher sea levels can only increase the amount of loss from storms absent expensive investment in coastal defenses. In the face of rising sea levels and increased losses, it will be impossible to maintain current premiums, coverage, and eligibility without severe limits on building, strong mitigation requirements, or exposure to enormous program losses and additional U.S. debt.

In addition to insurance, the NFIP has authority for promulgating standards for land use and building codes that communities must adopt in order to be eligible for the NFIP program. The question arises whether NFIP resources should be used to estimate increasing flood exposure in coming decades to inform those standards. Current codes specify minimum building elevations in flood zones. These are based on current conditions and historical water flood levels. Questions have been raised about whether these elevation standards will be adequate to protect building stock throughout the design life of the buildings if sea levels rise.[38]

Building Codes

Current building code development compounds the problem with respect to a change in hazard due to rising sea levels, because the assumed resistance to loss may not work as intended. Buildings may be built to expected 100-year return period flood (e.g., by requiring a certain elevation), but if changing conditions mean the 100-year flood is now a 25-year flood, not only will losses exceed expectations due to more frequent inundation, but also the effect of mitigation will be less than planned when severe events exceeding design standards occur.

If future conditions regarding rising sea levels are not factored into planning for the NFIP, two problems are likely to arise:

- Building elevation standards will not yield the expected reduction in losses.
- Losses to the NFIP are likely to increase from higher hazard and the effect of past construction failing to maintain its planned level of flood resistance over the design lifetime of the structure.

It is also important to note that rising sea levels will likely affect other areas of government spending, such as post-event disaster relief or investment in flood defenses that the U.S. Army Corps of Engineers might be called upon to build.

Most buildings have a design life of 50 years or even 100 years. Building codes and land use policies logically should contemplate foreseeable conditions over the design horizon. The high likelihood of rising sea levels in coming decades is a clear example of something that will change a building's exposure to loss in a foreseeable manner, and thus should be factored into setting standards.

38 "Rising Tides"; Rade Musulin; *Contingencies*; November/December 2015.

Policy Implications

The federal government considers certain long-term projections in developing policy on social insurance programs such as Social Security and Medicare. A similar consideration should be required for the NFIP if solvency is to be assured over time. This implies that the NFIP should adopt a long-range plan to address rising sea levels both in terms of its pricing and in community planning for land use and building codes. Such a plan can be informed by flood models, which can be adjusted to simulate a range of future conditions, including rising sea levels.

Section 8 Conclusions

There is abundant, readily observable evidence of melting ice in glaciers and high-latitude ice sheets indicating an extremely high likelihood that sea levels will rise in coming decades. Focus on the financial solidity of the NFIP combined with its high exposure to coastal flooding requires consideration of the potential effects of rising sea levels. This is one example among many of how a change in conditions can affect the program. Other factors include growth in coastal population and mitigation measures.

Buildings are being constructed in coastal areas today with design lifetimes of up to a century. The NFIP influences local land use policies and building codes, which consider things like the elevation required to withstand a certain return period of flooding. It is important for local communities to consider design horizons in order to mitigate future losses and maintain the affordability of flood insurance.

Section 9: Actuarial Standards, Principles, Soundness, and the NFIP

Terms such as "actuarial rates" and "actuarially sound" have been used in many ways with regard to the NFIP. Biggert-Waters, for example, placed a requirement in statute that NFIP rates reflect "all costs, as prescribed by principles and standards of practice in ratemaking adopted by the American Academy of Actuaries and the Casualty Actuarial Society."[39] FEMA often refers to "actuarial" rates in describing some types of rates charged by the NFIP.[40] These terms have meaning in actuarial lexicon, but their application to the specific circumstances of the NFIP can lead to confusion, as various stakeholders do not always agree about how to apply them.

There are many differences between the NFIP and private-sector insurance programs that affect the application of actuarial concepts. Key differences include the NFIP's statutory requirements regarding rate levels in certain classes, its rate classification system, and how it funds catastrophe losses (its cost of capital).

Actuarial Standards of Practice and Statements of Principles

There are many ASOPs promulgated by the Actuarial Standards Board (ASB),[41] which is housed within and established by the bylaws of the American Academy of Actuaries. The ASB's goal is to set standards for appropriate practice for the United States. The ASOPs identify what the actuary should consider, document, and disclose when performing an actuarial assignment. The following ASOPs are particularly relevant to defining appropriate actuarial practice in this area:

- ASOP No. 30, *Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking*
- ASOP No. 12, *Risk Classification (for all Practice Areas)*
- ASOP No. 41, *Actuarial Communications*
- ASOP No. 38, *Using Models Outside the Actuary's Area of Expertise (Property and Casualty)*

39 Public Law 112-141; U.S. Government Publishing Office; July 6, 2012.
40 "Actuarial Rates in the Context of Actuarial Rates in the Context of National Flood Insurance Program (NFIP) Hazard-Mapping"; American Academy of Actuaries; July 17, 2011.
41 "Actuarial Standards Board"; Actuarial Standards Board website; accessed on April 4, 2017.

In addition, the board of directors of the Casualty Actuarial Society (CAS)[42] adopted the *Statement of Principles Regarding Property and Casualty Ratemaking* in May 1988 (before the ASB was established). This document featured four fundamental "principles of ratemaking" and discussed other considerations.

The ASOPs and the CAS Statement of Principles (SOPs) together constitute the body of currently accepted actuarial principles for property insurance ratemaking and risk classification.[43] Much of that guidance is applied similarly by NFIP actuaries and by those in the private sector. The public nature of the program and FEMA's public policy goals can sometimes conflict with the goal of achieving "actuarial" rates.

A detailed discussion of the concepts of actuarial soundness is beyond the scope of this monograph. In 2012, the Academy issued a public policy special report titled *Actuarial Soundness* that provides a detailed background discussion of the topic.[44] Of particular interest to the NFIP is a section entitled "Catastrophe Insurance Programs" (beginning on page 20), which discusses specific considerations with government pools subject to catastrophes, including the NFIP.

As detailed below, the NFIP's actuarial methodology differs from private-sector actuarial practice in several areas: rate adequacy, risk classification, cost of capital, and actuarial soundness.

Rate Adequacy

The NFIP's enabling legislation specifically provided for two distinct classes of business, which were differentiated by two types of premium rates:

- Risk premium rates, more commonly known as full-risk or actuarial rates, which are "based on consideration of the risk involved and accepted actuarial principles," among other considerations. These "would be required in order to make such insurance available on an actuarial basis for any types and classes of properties for which coverage is available" under the section 4012 of the statute;[45] and

42 The CAS's purposes "are to advance the body of knowledge of actuarial science applied to property, casualty and similar risk exposures, to expand the application of actuarial science to enterprise risks and systemic risks, to establish and maintain standards of qualification for membership, to promote and maintain high standards of conduct and competence for the members, and to increase the awareness of actuarial science." "About Us"; Casualty Actuarial Society website; accessed on April 4, 2017.
43 According to the ASB, the CAS requested that the ASB develop an actuarial standard of practice in the area of property/casualty ratemaking. In its request, the CAS noted that the *Statement of Principles* contained considerations that might be expanded to become the basis of an ASOP. In 2016, the ASB approve an exposure draft of a proposed ASOP titled *Estimating Future Costs for Prospective Property/Casualty Risk Transfer and Risk Funding*, with a comment deadline of April 30, 2017.
44 *Actuarial Soundness*; American Academy of Actuaries; May 2012.
45 "U.S. Code—Unannotated Title 42. The Public Health and Welfare. Chapter 50, Subchapter III, Section 4104(a)(1)(A)"; FindLaw website; accessed on April 4, 2017.

- Other than risk premium rates, more commonly known as subsidized rates: "the rates, if less than [the risk premium rates described above], which would be reasonable, would encourage prospective insureds to purchase flood insurance and would be consistent with the purposes of" the legislation.[46]

Under the provisions of the governing laws and regulations, the NFIP would not be actuarially sound in the aggregate, because the premiums for the policies that receive subsidized rates are not expected to match their full long-term costs. In fact, even some classes of policies subject to full-risk rates may not be considered actuarially sound (that is, the rate does not reflect the expected value of the future cost associated with the transfer of risk)[47] because of statutory requirements to provide premium rates that ignore specific known risks for specific groups of policyholders.[48] Those known inadequacies, however, can theoretically be compensated for in the aggregate by increasing the overall level of rates.

Because the NFIP's overall premiums are inadequate by design, the program should be expected to produce deficits that will not be made up over time.

In accordance with relevant actuarial principles, the basis for the NFIP's full-risk rates is the expected value of annual losses, including those due to catastrophic events, differentiated by rating class. Also, net premiums incorporate the expected values of all expenses of the NFIP, including the annual expenses of maintaining the FIRMs. Investment income is not considered in the rates; it is assumed to be immaterial.

Risk Classification

The NFIP also diverges from private sector actuarial practices, as defined by the ASOPs and the CAS SOPs, in the area of classification of risks. The largest variation in practice is evidenced in the subsidized rates discussed above. Additional departures from typical private sector programs regarding risk classification include:

46 "U.S. Code—Unannotated Title 42. The Public Health and Welfare. Chapter 50, Subchapter III, Section 4104(b)"; FindLaw website; accessed on April 4, 2017.
47 See the *Statement of Principles Regarding Property and Casualty Insurance Ratemaking.*
48 42 USC § 4104(e) and (f), provide that, under certain specific conditions, if a community is making "adequate progress on the construction or reconstruction of a flood protection system," or if the community is actively in the process of adequately restoring such a flood protection system (primarily referring to dams or levees), the buildings so protected are eligible for flood insurance rates as if the protection system was already accredited to meet FEMA's standards of protection.

- Encouragement of sound floodplain management practices and the rapid adoption of FIRMs by local communities have led to the practice of permanently grandfathering, on a less than full-rate basis, buildings that were built in compliance with an existing FIRM at the time but are now no longer compliant, based on a subsequent FIRM. FEMA, however, compensates for the grandfathered buildings by raising rates in the B, C, and X zones, such that overall rates for those zones are actuarially adequate.
- The NFIP is subject to a statutory cap on annual premium increases of 15 percent for risk classes and 18 percent for individual premiums.[49] That restriction may have, at times, led to inadequate premiums for certain risk classes.
- Due to market forces and the need to mitigate against adverse selection, private sector insurance programs tend to have a large number of relatively homogeneous risk classes. As a public program, the NFIP is not subject to the same market forces as the private sector. To facilitate the operations of the program, and because of its unique public policy goals, NFIP risk classes are very broad.[50] There are five major risk classes nationally with separately differentiated rates:
    - AE zone, which describes "areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods."[51] Rates are differentiated by elevation relative to base flood elevation (BFE).
    - VE zone, which describes "areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action."[52] Rates are differentiated by elevation relative to BFE.
    - X zone, which are moderate to minimal flood hazard areas labeled B, C or X, and are the areas between the limits of the 100-year flood and the 0.2-percent-annual-chance (or 500-year) flood and areas higher than the elevation of the 500-year flood. That is, this describes standard risks outside of special flood hazard areas (SFHAs).[53]
    - Preferred risk policies (PRPs), for preferred risks, located in B, C, and X zones.
    - Subsidized, for pre-FIRM buildings located in SFHAs.

49 "April 1, 2015 Program Changes Fact Sheet"; FEMA website; accessed on April 4, 2017.
50 When the NFIP was first created, rating distinctions were much finer. For example, the AE and VE zones each were divided into separate subzones based on topographies and were refined further based on community-specific rating factors. In the late 1970s, the rating scheme was simplified to its current state.
51 "Zone AE and A1-30"; FEMA website; accessed on April 4, 2017.
52 "Zone VE and V1-30"; FEMA website; accessed on April 4, 2017.
53 "Flood Zones"; FEMA website; accessed on April 4, 2017.

For example, an AE-zone building located in a West Virginia river valley at a specific elevation would be charged the same premium as a similar AE-zone building with the same coverage details and elevation rating that was in a flat South Carolina floodplain—regardless of whether the two buildings had significantly different flood-loss histories and assuming both had the same community rating system status.

In general, the NFIP public policy goals of maintaining affordability and maximizing participation can be at odds with a detailed risk classification system. As a risk classification system becomes more refined, the variation in premium rates becomes wider. The riskiest properties at one end of the spectrum may have rates that are so high that affordability and participation are reduced. On the other end, the NFIP's broad classifications and explicit subsidies result in rates for the least risky properties that have been deliberately set above their expected loss (or cost) level. For these policies, even though the NFIP premiums may be relatively low, property owners may perceive them as excessive and be unwilling to opt in to the program.

Cost of Capital

A third major difference between private sector insurance and the NFIP involves the cost of capital. Private sector insurance companies must maintain capital as a solvency cushion, thus prefunding potential adverse outcomes. Typically, a blend of provisions in current premiums, retained capital, and capital "rented" via a reinsurance contract risking the reinsurer's capital is used to fund disaster events. To secure the required amounts of capital for solvency protection, private sector insurance companies must earn a profit to pay for the use of this capital. Otherwise, there would be no incentive to put this investment at risk and solvency funding would be in short supply. Thus, private sector insurers are required to include a provision for the cost of capital in their rates.

In contrast, the NFIP is not required to secure capital pre-event as a solvency margin. The federal government could, theoretically at least, provide unlimited liquidity and credit to the program. Consequently, in a departure from actuarial principles as recommended by ASOP No. 30,[54] there historically has not been an explicit cost of capital included the NFIP ratemaking process. There is a reserve fund assessment and a reserve fund surcharge

54 ASOP No. 30, *Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking*; Actuarial Standards Board; July 1997. Section 3.1 provides: "Property/casualty insurance rates should provide for all expected costs, including an appropriate **cost of capital** associated with the specific risk transfer."

intended to pay interest and principal on the debt and build a loss reserve fund. It is argued that the federal government provides the capital backing of the NFIP in the form of its guarantee that all legitimate claims will be paid so that the NFIP should not be expected to earn any return on capital. The NFIP does have contingency loadings in its gross premium rates.[55]

However, the cost of capital for the NFIP is not zero. To the extent the NFIP has accessed post-event funding in the form of loans from the Treasury, the cost of capital is explicit in the interest paid on the debt. Further, to the extent there is an explicit provision in NFIP premiums for interest and principal repayment on post-event funding, the rate structure would shift the cost of risk capital from the original policyholders to current and future policyholders.

As a government program, the NFIP accesses funding in several forms: post-event funding in the form of loans from the U.S. Treasury, assessments levied on NFIP policyholders to service existing debt and build a loss reserve fund, and a nascent reinsurance program. In the future, the NFIP could continue to rely primarily on post-event funding from the U.S. Treasury. Alternatively, it could expand its use of assessments to build and maintain a solvency reserve, expand the use of private reinsurance, or increase its access to capital markets through catastrophe bonds or other insurance-linked securities.

How risk capital is accessed by the NFIP and how the cost of capital is provided for in the ratemaking process are issues to be addressed with congressional reauthorization of the program. With clarity on this aspect of ratemaking, the application of actuarial principles and the determination of actuarially sound rates would become less problematic.

Actuarially Sound Rates

Generally, the principles for determining actuarially sound rates ensure insurance will be financially sustainable and fair. That is, the full cost of risk transfer is fairly reflected in the program rates. The Casualty Actuarial Society's SOPs set forth the following four principles:

55 The current loadings are 20 percent of net premiums for the riskiest buildings, considered to be those located in the V-zones (buildings exposed to the water velocities due to wave motion), and 10 percent for all other risks. Those loadings are primarily designed as a cushion to mitigate the extreme volatility in losses from flood events, but they also serve to compensate for possible underestimations of catastrophic losses and other assumptions that may turn out to be non-conservative in the long run.

- *Principle 1:* A rate is an estimate of the expected value of future costs.
- *Principle 2:* A rate provides for all costs associated with the transfer of risk.
- *Principle 3:* A rate provides for the costs associated with an individual risk transfer.
- *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.

For policies that are subject to full-risk rates, the NFIP's ratemaking process can be said to follow Principle 1 above. The lack of a cost-of-capital provision in the NFIP rates could be viewed as falling short of Principle 2. On the other hand, the NFIP's unique position as an insurance program backed by the federal government enables other sources of funding for which the reserve fund surcharge is intended to account.

The prevalence of grandfathering and the NFIP's wide rate classes could be regarded as counter to Principle 3 because there are cross-subsidies within rating classes. On the other hand, in administering any insurance system, managers balance the cost of estimating an individual risk transfer and the expense of maintaining a system of extensive rate classifications. Private sector insurers tend to collect substantially more detailed data and use it to develop more refined rate structures. Even then, most private sector insurers probably could be found to contain some cross-subsidies within their rate classifications. To make the NFIP rating scheme more specific, it would have to collect and use more refined data.

The extent to which Principle 4 may be violated depends on conclusions reached about whether the NFIP's structure violates principles 1-3.

The administration of the NFIP includes valid and unique considerations that differ from private sector insurance programs. Thus, the application of the ASOPs and the CAS SOPs requires recognition of these differences including the public funding mechanism and the public policy goals of the NFIP. And importantly, all actuarial standards of practice require the actuary to develop rates in accordance with the law or regulation.[56]

56 ASOP No. 1, *Introductory Actuarial Standard of Practice*; Section 3.1.5; Actuarial Standards Board; March 2013.

Section 9 Conclusions

While much of the actuarial standards and ratemaking principles that have been promulgated for actuaries in developing rates for insurance programs is applicable to the NFIP, there are important differences between NFIP and private sector insurance that must be considered. The most important of these are mandates that the NFIP subsidizes certain policies, caps on premium increases, considerations of affordability, and differences in funding sources for losses exceeding current period premium income.

Section 10: Private Sector Insurance and the NFIP

The NFIP is a public insurance program. This section summarizes the significant differences between the NFIP and private sector property and casualty insurance. It also examines considerations regarding increased private coverage of the flood insurance peril, from the perspective of both private insurers and the NFIP.

Goals

The goals of the NFIP are very different from the goals of private sector insurance companies. As stated previously, the purposes of the NFIP are: 1) identifying flood risk, 2) regulating floodplain management, and 3) providing flood insurance. A fourth, longer-term goal of the NFIP has been to reduce federal expenditures on disaster assistance after floods.[57] The NFIP also has the authority to require coverage in some cases and to require certain floodplain management practices for communities to participate in the NFIP.[58]

By contrast, a primary motivation for private sector insurance companies is to earn a profit by providing for the needs of their customers through appropriate insurance coverages. Unlike the NFIP, private sector insurance companies have no power to require that their customers buy coverage or to compel communities to adopt land use policies and/or stricter building codes. Also, unlike the NFIP, private insurers are not statutorily required to serve some clients at unprofitable rates.

57 *National Flood Insurance Program Description*; FEMA; August 1, 2002.
58 *Ibid.*

Policy Contract

NFIP flood policy contract language is provided by federal statute and/or regulation.[59] The insured cannot assert that he or she did not know or understand the policy in coverage disputes. The NFIP requires that coverage disputes arising under the program be litigated in federal courts.[60]

The types of coverages and insurance limits provided by the NFIP are set by statute and regulation, and they differ from coverage provided under a typical property policy in the private sector. Federal regulations require that private insurance coverage must be at least as much as that offered by the NFIP to satisfy federal loan requirements for flood insurance on properties in a standard flood hazard area.

As of the time of publication, the NFIP had a maximum coverage limit ($250,000 building/$100,000 personal property on dwelling policies, $500,000 building/$500,000 personal property on nonresidential buildings).[61] Conversely, the building and personal property limits available in the private sector insurance market are typically limited only by the value of the insured property and the insurer's underwriting preferences.

The personal property coverage in the NFIP is actual-cash-value coverage.[62] In the private market, on the other hand, replacement-cost-value coverage typically is available, at least as an option.

Additional living expenses are not covered by the NFIP, and business interruption coverage is not presently covered by NFIP commercial policies.[63] On the other hand, most private property insurance policies offer some coverage for such expenses at an additional cost.

59 "*Guidance Documents & Other Published Resources*"; FEMA website; accessed on April 4, 2017.
60 "*The National Flood Insurance Program: A 'Flood' of Controversy*"; *The Florida Bar Journal*; April 2008.
61 *National Flood Insurance Program Description*; FEMA; August 1, 2002
62 Standard Flood Insurance Policy; FEMA; May 2005.
63 Ibid.

Rates

NFIP policy rates are developed differently than those in the private sector.

- The NFIP's flood policy rates do not include a profit provision that includes the cost of capital.[64] Private sector insurance policies include a profit provision sufficient to cover all expected costs of risk transfer. A private sector insurance company must maintain and build capital to preserve its solvency. In addition, because investors will consider the riskiness of their investment, private sector insurers will often include a risk provision. The NFIP can use a lower standard partly because it can operate with a deficit by borrowing from the U.S. Treasury when necessary.
- NFIP's flood program rate changes do not need approval by state regulatory authorities. Conversely, in the private sector, rates are closely monitored by state regulators and are subject to filing and approval requirements that vary by state.
- Flood insurance rates for pre-FIRM properties are set by regulation at below actuarially sound levels.[65] In the private sector, insurers typically charge actuarially sound rates, though in some cases insurers and regulators disagree about what constitutes an actuarially sound rate.
- Properties that were built in compliance with the hazard map in effect at the time of construction are "grandfathered" with a lower rate if a new map is published that moves them to a higher risk zone. These lower rates are recouped by higher rates for other properties in the entire zone. Private sector insurance companies would rate policies based on the risk they now present, and would generally avoid such explicit cross-subsidization.[66]
- There are no regulatory capital requirements in the NFIP. Flood insurance is backed by the full faith and credit of the United States.[67] Private sector insurance companies, on the other hand, are monitored by state regulators for solvency and must meet various capital requirements designed to maintain their standing with rating agencies.

64 *National Flood Insurance Program Description*; FEMA; August 1, 2002.
65 *Ibid.*
66 *Pricing Flood Insurance: How and Why the NFIP Differs from a Private Insurance Company*; Resources for the Future; October 2014.
67 *Ibid.*

Pace of Change

As noted above, significant changes to NFIP's coverage, policy administration, and operations are accomplished largely by procedures established by federal statute and/or regulation. The implementation of changes to the NFIP often takes a significant amount of time. In private sector insurance, however, individual companies regularly and rapidly respond to market conditions.

Oversight

Congress provides oversight of the NFIP. The congressional committees with NFIP oversight authority are the House Committee on Financial Services and the Senate Committee on Banking, Housing, and Urban Affairs. The NFIP is also overseen by the executive branch via FEMA and the Department of Homeland Security. Private sector companies are overseen by their boards of directors and owners as well as state regulators.

Underwriting

The NFIP is not allowed to refuse to cover an "eligible" property, regardless of the property's loss history. Ineligible structures are few and are proscribed by the federal program. The private sector insurance industry, on the other hand, can accept or reject applications for policies based on the underwriting guidelines of each individual company (subject to the constraints of applicable state statutes or regulations).

Time Horizon

The NFIP is not authorized to operate indefinitely. The continuation of the NFIP depends upon congressional action prior to each established sunset date. Should Congress fail to reauthorize the NFIP, it is possible that all existing flood insurance policies would cease to be enforceable, expiring policies would not be renewed, and new policies would not go into effect until the NFIP is reauthorized. Unlike the NFIP, private companies may operate indefinitely, so long as they are financially solvent.

Privatization of Flood Insurance—Considerations for Private Insurers

While flood was once deemed uninsurable, advances in scientific modeling, technology, data, and capital markets make it possible for the private market to become more involved. There is now a growing market for primary flood insurance, including one major reinsurer that is marketing inland flood endorsements for mutual insurers and another major reinsurer that has developed its own proprietary flood map.[68]

Many of the newest entries in the private flood insurance market have been in Florida, subsequent to the passage of Senate Bill 542 in 2014 (found at Chapter 2014-80). The law encourages private insurers to offer new flood products by allowing a limited period of flexibility with respect to ratemaking, underwriting, and catastrophe modeling, but included consumer safeguards as well.

There are several benefits to private insurers offering flood insurance:

- Many of their customers who have not purchased coverage from the NFIP believe they have protection as part of their homeowners policies, so the companies lose policyholder goodwill and trust when they must deny uninsured claims. Many states have moved to strengthen notices to policyholders to address this, but the problem persists.
- Even when a customer has purchased flood insurance coverage through the NFIP, in the case of hurricane wind and water losses, there may be a conflict between a homeowner's insurer and the NFIP in allocating the claim cost. This uncertainty has led to significant legal costs and reputational risk for the insurance industry in the past.
- NFIP coverage is limited relative to that of private insurers, leaving uninsured gaps.
- Many argue that the U.S. property insurance market and the global reinsurance markets are overcapitalized. To the extent this is true, flood insurance provides an application for capital to back a distinct new risk that diversifies risk profiles.

68 "Munich Re Launches Inland Flood Insurance Product for U.S. Homeowners"; *Insurance Journal*; August 6, 2015; and "Private Insurers Start to Offer Flood Coverage"; *Wall Street Journal;* February 25, 2014.

However, there are several significant uncertainties that make private insurers wary of entering this market:

- Combining the flood insurance peril with other perils would in many cases increase the probability of catastrophic losses. The greater the exposure a company takes on, the more important it is to understand how that exposure affects the company's future solvency and required capital.
- Robust flood insurance models have only recently become available and are therefore relatively untested in the United States. Because most companies have little or no access to granular data on historical flood insurance exposures and claims, it is difficult for them to assess the validity of these models. The NFIP has historically provided data only at a very high level that is insufficient for this purpose.
- Unless flood insurance becomes mandatory for all mortgage holders or all property owners, the people most likely to buy are those at risk of flooding. Therefore, especially for the early adopters, companies offering flood insurance are likely to be subject to adverse selection.
- Policies must be priced at a level that covers the underlying cost and risk, which is not always easily done in highly regulated states. Some insurers may be wary of how rate regulation will impact their ability to develop and maintain rates at a level that they believe is actuarially sound. A similar consideration applies to flexibility in adapting rules and coverage terms to new experience or discoveries in a market; forms and rules are often regulated even more tightly than rates.
- Regulators may face intense political pressure to impose moratoria on nonrenewals or other exit restrictions after large disasters, and private insurers must account for such unmeasurable but historically real risk in business planning.
- At the federal level, the presence of the NFIP as a competitor and the rules on acceptance of private insurance in lieu of NFIP insurance have a significant impact on the market potential for private insurers. Uncertainty about future federal legislative action compounds the uncertainty regarding state regulation. Conversely, federal legislation could be used to provide options that would stimulate private market involvement. For example, the federal government could encourage pilot programs such as a private flood insurance pool that gives insurers a chance to test the market or offer limits on the risk borne by the private market in the case of a mega-event. (Various laws provide for access to Treasury Department funds in the event of massive insurance losses caused by terrorism, nuclear power plant problems, or commercial space launch failures.)

Privatization of Flood Insurance—Considerations for NFIP

There are possible consequences to NFIP due to competition from the private sector. With its relatively coarse rating plan, the NFIP could be significantly exposed to adverse selection. Spread of (adequately priced) risk is important to stability of any insurance program. Should the NFIP lose significant numbers of both diversifying inland polices and adequately priced coastal flood policies, it would take longer for annual premiums to fund catastrophic events, translating into a greater reliance on borrowing from the Treasury. Further, any "depopulation" of the NFIP will reduce its ability to repay the Treasury from policy surcharges designed for that purpose, requiring either a write-off of such debt or the development of some mechanism to collect that revenue from policies that moved to the private market.

More specifically, cross-subsidization, while socially valuable, will be challenged under competition, adding pressure to overall rate adequacy and stability for the NFIP. When a flood map update that expands the SFHA is announced, polices purchased before the implementation date (and after the announcement) are purchased at the "pre-SFHA" rate and, given continuous coverage, will have that rate grandfathered. This rate generally caps out at $499. With a mean annual premium for Zone A and Zone V at $1,432 and $4,759,[69] respectively, grandfathering associated with updated maps creates substantial subsidies.

To the extent that the discount in grandfathered policies is offset by higher rates on other policyholders in the same zone,[70] it is likely that the NFIP would be left with a growing share of subsidized policies. Such subsidies are likely to become less viable in a competitive market, as competition will bid down the price of policies paying the subsidy, leaving no funding to allow for discounts while maintaining an overall adequate rate level.

Until 2016, the NFIP had not purchased reinsurance. When the NFIP does purchase reinsurance, coarse allocation of reinsurance costs could again create the possibility of adverse selection. Insurers generally charge higher risk loads (embedded in premiums) in areas likely to suffer catastrophic loss, as these areas require more allocated capital. To the extent NFIP does not consider notional capital allocation, there is a possibility of under-allocating costs in high-risk areas and over-allocating costs elsewhere, further concentrating the NFIP book of business.

69 *Financing Flood Losses: A Discussion of the National Flood Insurance Program*; Carolyn Kousky; Resources for the Future; February 2017.
70 *Ibid.*

Over the longer term, there are public policy issues to address regarding building codes and land use policies associated with both current flood risk and long-term risk in the face of rising sea levels.[71] The NFIP has partnered with local communities on these efforts. A transition to privatization of flood insurance should be managed with an eye toward continued effective flood management/mitigation. Minimum regulations around flood management may need to be enforced regardless of NFIP partnership status. Additionally, as one views the likelihood of rising sea levels, thoughts about building codes and land use policy should take into account changing conditions over the building's expected lifetime. If NFIP involvement in flood insurance is reduced, effective public policy may need to be maintained in other ways.

Flood Coverage Outside of High-Risk Areas

One final consideration in discussing private market involvement in flood involves properties located outside areas where the NFIP has traditionally operated. Large parts of the country are in locations perceived to be at minimal or no risk of flood. The combination of insurance industry limitations on flood coverage in standard policies and a consumer perception that there is no flood risk in areas outside of NFIP high-risk zones has led to the potential for a significant coverage gap.

In theory, the existence of such a gap would lead private insurers or the NFIP itself to aggressively market coverage to such potential insureds. In practice, either due to the perceived difficulty of offering such coverage or consumer resistance to paying for it, large segments of the homeowners market have no flood protection. The adverse consequences of this for consumers were clearly demonstrated in the 2016 flood in central Louisiana. Other stakeholders, such as financial institutions underwriting mortgages or local governments facing property tax shortfalls, can also be adversely affected.

There have been numerous suggestions for encouraging "all-risk" (including flood) coverage in homeowners and small business policies. Such coverage is routinely offered in many other countries across the world. Improving the adoption of flood coverage in "low-risk" segments of the property insurance market is beyond the scope of this monograph, but an important public policy issue.

71 "Rising Tides"; Rade Musulin; *Contingencies*; November/December 2015.

Section 10 Conclusions

The NFIP differs from private insurers in several aspects, including the goals of the program; its mandate to address "non-insurance" functions like community land use planning; and its statutorily defined coverage levels, oversight, subsidization of certain classes of policies, and funding sources. These factors require public policy planners to carefully consider how the NFIP interacts with private insurers when discussing possible privatization.

One important issue is the potential for adverse selection if private insurers focus on low-risk segments of the NFIP policy population, which could leave the NFIP with larger losses on a smaller premium base. Depopulation could also erode the base upon which surcharges are applied, potentially making it impossible for the NFIP to repay borrowing.

A related issue is the significant number of properties that do not carry any flood coverage from either the NFIP or private insurers. The consequences of this were evident in the high number of uninsured losses in the 2016 floods in Louisiana.

Section 11: An Example of How Property Risk Pools Have Been Addressed at the State Level

The federal structure of the United States government engenders many approaches to solving public policy problems at national, state, and local levels. This is a great strength of the American approach to governance, allowing for a range of testable solutions.

Many states have formed risk pools to address problems in property insurance markets. Congress could benefit from reviewing various state mechanisms for catastrophe-exposed property insurance, their challenges, and their responses. While a comprehensive review of these entities is beyond the scope of this monograph, an example from Florida is offered here to illustrate a state-level solution that parallels the challenges and opportunities for the NFIP.

Florida is exposed to extreme property damage from hurricanes. This reflects both the severity of the natural hazard and the large (and growing) inventory of structures in high-risk locations. In 1992, Hurricane Andrew caused about $17 billion of damage (in 1992 dollars) and triggered a meltdown of the state's property insurance market. Over the next two decades Florida's government put in place two entities to help fund the cost of hurricanes in a way that sought to balance the needs of various stakeholders. So doing involved various trade-offs and compromises, such as those between:

- Consumers and private insurers;
- Private insurers and government pools;
- Today's consumers and tomorrow's;
- Building and development interests and insurance consumers; and
- Residents of high-risk coastal areas and those in inland areas.

Florida had to address many difficult challenges, including:

- A severe shortage of private market capacity for high-risk properties;
- Very large and underfunded government pools that exposed the state to huge deficits;
- Inadequate and poorly resolved direct insurance pricing in the pools;
- Poor mitigation incentives for consumers; and
- Public skepticism over modern catastrophe models and the difficult economic messages they sent.

Florida has made significant progress in solving these problems by taking a series of actions over many years. These included:

- Creating a reinsurance facility, the Florida Hurricane Catastrophe Fund (FHCF), to provide a stable source of low-cost reinsurance to both insurers and other property market pools. Key features of the FHCF include:
    - Availability to both private market and government pools on similar terms;
    - Price for coverage is based on catastrophe models and actuarial principles (albeit with muted risk loads);
    - Coverage structure aligning benefit (amount of coverage) with underlying risk, providing incentives for private insurers to offer coverage in high-risk areas;
    - Funding sources involving assessments on most insurance policies in Florida, subject to a defined limit; and
    - Some of its limited capacity being reserved for subsequent events and successive years.
- Creating a consolidated direct insurer, Citizens Property Insurance Corporation (Citizens), to address availability and affordability issues for consumers. Key features of Citizens include:
    - An annual limit on individual policy rate changes (referred to as a "glide path") to remedy historically inadequate rates and achieve rate adequacy over time;
    - Computation of full-risk rates, even if capped to promote affordability, to signal true cost of coverage;
    - Depopulation programs to facilitate transfer of blocks of policies to private insurers mid-term;
    - Data exchange and transparency between Citizens and private insurers;
    - Clear processes to fund pool deficits through assessments on Florida policyholders and bonding; and
    - Increasing use of reinsurance and capital market products to transfer risk based on a multiyear goal of reducing likelihood and amounts of assessments.

- Creating an expert panel, the Florida Commission on Hurricane Loss Projection Methodology, to improve the science of catastrophe modeling and public acceptance of its messages.
- Setting up assessment mechanisms in a way that minimized distortions on private insurer financial statements due to accounting rules and that included policies in both Citizens and the private carriers to assure a steady revenue stream regardless of fluctuating market shares between the two.

Citizens has significantly reduced its exposure to large unfunded losses in recent years. Along with the luck of storm-free seasons that allowed increased accumulation of surplus, it has pursued rate adequacy, depopulation, and reinsurance strategies that reduced potential 100-year storm assessments from $11.6 billion in 2011 to zero in 2015.

A more detailed description of Citizens can be found in Appendix 1.

Section 11 Conclusions

Florida's innovative approach to its hurricane problem illustrates how public policy can be tailored to address many of the problems the NFIP is currently facing, including how to put limits on public exposure to deficits, how to depopulate a pool with private sector "take outs," how to evaluate complex catastrophe models, and how to use reinsurance in a public entity. Important lessons can be learned by studying state-level solutions to such problems. The Academy stands ready to assist Congress with exploring this issue.

Section 12: Potential Congressional Reforms

In the course of drafting this monograph, the Flood Insurance Work Group surveyed key stakeholders in the NFIP reauthorization process to get a better understanding of their respective concerns and viewpoints, and to identify areas that would be most useful for the Academy to address. The work group interviewed representatives from over a dozen organizations spanning the areas of insurance and reinsurance, real estate, consumer advocacy, environmental advocacy, policymaking, and regulation. (Note: While the groups and individuals who were surveyed represented a broad cross-section of the various NFIP stakeholders, this was not a true scientific sample, nor does it represent any effort to form a consensus.)

In each interview we asked respondents about the future of the NFIP and what specific reforms should be considered by Congress as part of the 2017 reauthorization. This section contains a high-level summary of the interview responses.

The reforms addressed by the responses can be grouped into the following policy goals:

- Address interaction of the public and private flood insurance markets;
- Expand protection/increase flood insurance take-up rates;
- Address issues of fairness and subsidization;
- Promote risk reduction/mitigation;
- Improve risk measurement;
- Promote risk spreading;
- Increase education and transparency;
- Protect the solvency of the program;
- Improve rate adequacy;
- Promote planning and stability; and
- Address affordability.

Many of these goals have conflicting or cascading impacts, so that movement toward one goal may threaten others. For example, actions taken to make NFIP rates more adequate may enhance transparency, improve fairness, incentivize risk reduction, and protect the program's solvency. They may also result in an increased level of interest in the private market to provide flood insurance and expanded protection for consumers as a whole. However, to the extent that these actions make NFIP rates less affordable, they may result in reduced take-up rates and a lower spread of risk within the NFIP, and ultimately may have the effect of making the NFIP less solvent.

Figure 6 shows the reform alternatives mentioned by our interview respondents, listed in order of the number of times suggested. We have indicated which policy goals are most directly addressed by each reform. The following are some high-level observations regarding the reforms suggested by our respondents:

- Almost half of the reforms dealt in some way with the interaction between the NFIP and private insurance or reinsurance. Most responders accept that the NFIP cannot solve the flood insurance problem on its own, and that the private market is likely to become more significant over the medium term. Many participants emphasized that the NFIP or some type of residual market must be preserved and/or protected, because some properties will not be able to find affordable coverage in the private market. There was also a comment that voluntary flood writers should help pay for flood mapping, building code development, and consumer education efforts conducted by the NFIP.
- Many of the reforms identified are intended to increase policyholder take-up rates and expand protection beyond the approximately 5 million homes currently insured for flood in the United States. There was significant agreement that the current market penetration is insufficient to provide adequate financial protection against the risk of flood. Several participants mentioned that the ideal solution would be for private homeowners insurance policies to include coverage for flood, although they did not believe that this is feasible in the short term, and no one suggested this as a mandatory reform.

- One of the most-cited issues is the mandatory purchase requirement for federally backed mortgages on properties within SFHAs. The use of a 1 percent exceedance standard to define the SFHAs, and the fact that properties falling outside this threshold are not required to purchase flood insurance, has misinformed consumers that they face little or no flood risk if their home is outside an SFHA.
- A related comment is that the NFIP needs to improve its mapping process to be more transparent and better reflect risk. Participants expressed encouragement that Congress and the NFIP help consumers better measure and manage flood risk. Some participants emphasized that the NFIP's mapping process should be expanded to consider risk over the longer term, so that significant potential changes in risk such as those from sea level rise can be understood by consumers considering purchasing a property.
- Many participants encouraged passage of the proposed Flood Insurance Market Parity and Modernization Act[72] that would clarify requirements for private flood insurance to meet the mandatory purchase requirement. This clarification would enhance the ability of private insurers to enter the flood market and of state regulators to regulate private flood insurance.
- Many participants expressed support for a long-term reauthorization of the NFIP to avoid short-term extensions and program lapses that would create uncertainty in the insurance, housing, and commercial lending markets.
- Many participants felt that NFIP rates should be more differentiated, more risk-based, and more actuarially sound. Anticipating that this would result in affordability issues, several of them suggested that means-based subsidies should be implemented, separate from the premiums so that the policyholders better understand the underlying flood risk.
- Several participants focused on the need to reduce flood risk through the use of natural resources (such as wetlands), funding pre-event mitigation, addressing severe repetitive loss properties, and the use of risk-based pricing to better incent consumers and communities to invest in mitigation.

72 "Flood Insurance bill reintroduced in Congress"; *Business Insurance;* March 8, 2017. Introduced by Representatives Dennis Ross and Patrick Murphy in the 114th Congress, the legislation was passed in the House but was not taken up in the Senate.

FIGURE 6

Flood Reform Alternatives

Reform	Private vs. Public	Increase Takeup Rates & Protection	Fairness/ Subsidization	Mitigation/Risk Reduction	Risk Measurement	Risk Spreading	Education/ Transparency	Solvency	Rate Adequacy	Planning/Stability	Affordability
Communicate understandable risk of cat events to consumers beyond 1-100		x			x		x				
Pass Ross-Murphy bill (HR 2901): Flood Insurance Market Parity and Modernization Act	x	x									
Create more consistent mapping process that better reflects risk			x		x						
Implement long-term reauthorization										x	
Create road map to move more risks to private market over time	x										
Fund pre-event mitigation especially on repetitive loss properties				x							
Implement a broad multi-peril policy, effectively a national cat program across US		x	x			x					
Implement risk-based pricing within NFIP			x				x		x		
Address affordability through need-based subsidies			x								x
Eliminate noncompete for WYO companies	x	x									
Promote mitigation, improving coverages, underwriting in general				x							
Provide access to non-confidential FEMA data for regulators, cat modelers, industry organizations	x										
Account for future flood risk / sea level rise in flood maps				x	x			x		x	
Make NFIP premiums more differentiated for risks with different exposures			x				x		x		
Purchase reinsurance to protect NFIP	x					x		x			
Review training requirements for producers, ensure it is complete with respect to private flood	x	x					x				
Make NFIP policy terms more like private insurance	x	x									
Emphasize enforcement of provisions at every level		x		x							
Encourage pilot of flood insurance pool of private insurers	x					x					
Expand mandatory purchase area		x				x					
Require private insurers writing voluntary flood to take a certain percentage of residual risks	x		x								
Reinstate rules allowing mid-term NFIP policy cancellation/refund if private flood purchased	x	x									
Keep NFIP in place in addition to private market	x										
Require flood purchase if you've received federal disaster assistance					x						
Use natural resources (wetlands, etc.) to reduce risk				x							
Increase takeup rates through consumer education, better compliance with mandatory purchase		x									

Given the complexity of these reforms and their inherent trade-offs, a number of our interview participants expressed the need for objective, thorough analysis of different policy positions that might be considered by Congress. Many specifically mentioned the need to include consideration of data that may be hard to obtain, including:

- Comparison of NFIP premiums to the full-risk rates;
- Data on self-insurable nuisance claims vs. true catastrophe claims;
- Locations and typical profile of NFIP policyholders;
- Household data on affordability;
- Solvency information, estimating the losses the NFIP may take on vs. premium levels;
- A definition of what level of losses the NFIP is expected to handle vs. what should be passed on to the Treasury and taxpayers; and
- Consideration of issues related to the NFIP debt.

Section 12 Conclusions

The work group's survey identified a number of possible policy goals for Congress to consider during the reauthorization process. Some goals may be conflicting, but understanding them can help clarify priorities. One specific issue that generated significant agreement was the need to explore ways to increase the take-up of flood coverage.

Section 13: Summary and Conclusions

The insurance industry once considered flood an uninsurable risk because flood is a low-frequency, high-severity event in which past experience is a poor predictor of loss potential. Further, a distance of a few hundred feet can make a large difference in risk, and the insured would have a clearer understanding of the local topography than the insurer. This meant that insurers who would typically use large territories for rating would be subject to adverse selection in which insureds at the highest risk of flood would be most likely to want the coverage.

The NFIP was created to fill that gap, and for many years provided the dominant market in the United States for residential flood insurance. To fulfill its mission of affordable and available insurance, the NFIP's premiums have historically been set in aggregate at a level that is below the actuarially sound rate, although some policies are above and some are below. Take-up rates are highest in the most risky areas due to mandatory purchase requirements, but overall they are very low and each year many homeowners experience flood claims that are not covered by insurance. There is an increasing awareness among various constituencies (regulators, legislators, consumers, insurers, real estate agents) that too many uninsured homes are subject to devastating losses from flood events, and the NFIP alone cannot solve the problem. This is true today, and will be even more true if changing conditions result in rising sea levels and/or more extreme rainfall events in the future.

The current distinction of the 1-in-100-year flood zones for mandatory coverage has led consumers to believe erroneously that they do not have significant flood risk when they are not required to purchase flood insurance. It is politically and logistically infeasible to require mandatory flood insurance coverage for all property owners, or even to significantly expand the existing mandatory footprint. However, increasing consumers' awareness and educating them about their flood risk can potentially increase take-up in areas outside the mandatory coverage areas.

Over time, access to more granular data and the developing sophistication of catastrophe models to manage exposures arising from low-frequency events made the flood risk more insurable from a technical perspective. However, because the NFIP rates were perceived to be low relative to the actual risk, there was not much interest on the part of catastrophe modelers and private insurers to invest in offering this insurance coverage.

In the past few years, however, there has been a push to raise NFIP rates in response to losses from Katrina and Sandy (such as changes to rates in the Biggert-Waters Act) and to lower the competitive bars to a private market alternative (such as would be accomplished by the proposed Flood Insurance Market Parity and Modernization Act). At the local level, state legislation has been introduced to encourage private insurance investment in the flood risk (such as Florida Senate Bill 542 in 2014). As a result, there have been several new catastrophe models introduced for the purpose of measuring and managing flood losses, and in Florida there have been a number of new entrants in the private admitted insurance flood market offering primary and excess of NFIP coverage.

As outlined in Section 10, there are several benefits to private insurers offering flood insurance. However, this step also entails significant risks to those companies, which in many cases may be perceived as posing an existential threat. It is unlikely that flood insurance will be offered on a widespread basis by private insurers unless the risks are addressed through cooperation among legislators, regulators, and the industry.

We believe that private insurance is most likely to take a foothold in the states that recognize the realities facing private insurers and are evenhanded in protecting consumers and insurers. In general, the higher the level of confidence around state and federal regulation, the greater the potential that the private insurance market will be willing and able to innovate, invest, and offer protection to a significant number of consumers.

Beyond private insurance, some combination of the NFIP and/or state residual markets are likely to be needed for many years to cover homes that are deemed to be too risky for the private insurance market, and to provide a counterbalance to market forces that affect supply and price. In addition, there will be a need to address affordability issues for consumers who cannot pay the full actuarially sound premiums, whether they are provided by the NFIP or the private market.

While this Academy work group does not advocate any particular set of policies, we do suggest that Congress carefully consider the following specific issues affecting the NFIP in the reauthorization process:

- **Take-up rates in "low-risk" areas.** As discussed above, increasing the number of properties covered for flood will not only help protect consumers, lending institutions, and local communities but will also improve the financial solidity of the insurance system by increasing revenues and achieving a better spread of risk.
- **The inherent contradictions in NFIP mandates.** The NFIP is tasked with both achieving solvency and making coverage widely available at "affordable" rates, policy goals that may not be simultaneously achievable.
- **The non-insurance activities of the NFIP.** The NFIP performs a number of tasks in the public interest, such as promulgating maps, encouraging smart land use policies and building codes, and reducing the public's dependence on post-event disaster assistance. The benefits of such tasks are not directly measured in the NFIP's financial results from underwriting flood insurance.
- **The NFIP's interaction with other federal budget functions.** The activities noted in the prior bullet point affect federal outlays in other areas such as disaster assistance or infrastructure investment to protect properties. A holistic view of the NFIP's value needs to consider these functions.
- **Changing hazard over time.** The concern of rising sea levels illustrates the importance of looking at NFIP finances over a multi-decadal time horizon. Such long-term analysis is used by Congress in social insurance programs such as Social Security and Medicare.
- **The impact of technology on what is possible to underwrite in the private market.** Improvements in data and modeling tools have significantly improved the ability of private insurers and reinsurers to underwrite flood risk.
- **The challenges of state regulation for private insurers.** Private insurers are subject to state-level regulation, creating challenges for privatization of what is now a nationally structured program lacking a state focus on matters like rate adequacy.
- **State-level solutions to property insurance market challenges.** States such as Florida have tackled problems similar to those faced by the NFIP; Congress can look to these efforts to inform decisions on NFIP policy.

- **The desirability for some "probability of sufficiency" standard for determining where public contributions to NFIP finances are appropriate**. Most insurance systems have some trigger for socializing risk of extreme events, such as a solvency standard based on a "100-year event" beyond which mechanisms like guaranty funds pay losses. Adopting an explicit standard of this type for the NFIP would provide clarity as to what its funding sources should be and give taxpayers an understanding of when NFIP debt should be forgiven.
- **The need for clarity around NFIP funding sources for it to compute actuarially sound rates.** Actuarial standards and principles promulgated to guide ratemaking for private entities may not be completely relevant for public programs such as the NFIP, largely due to access to funding sources such as the ability to borrow from the Treasury and/or other means of post-event financing such as debt repayment surcharges. Addressing probability of sufficiency issues would mitigate this issue.
- **The likelihood of adverse selection from private sector competition.** Private markets will seek out policies that offer the greatest likelihood of profit. Increasing private sector participation in flood will make it increasingly difficult for the NFIP to subsidize high-risk policies absent taxpayer funding.
- **Depopulation of the NFIP will affect its ability to repay public debt.** If policies are moved to the private market without a mechanism to collect debt retirement surcharges from them, the NFIP may be unable to repay debt.

The American Academy of Actuaries Flood Insurance Work Group looks forward to assisting Congress in the NFIP reauthorization effort.

Appendix 1: What Can We Learn From Citizens Property Insurance Corporation (Florida)?

What is Citizens?

Citizens Property Insurance Corporation is the amalgamation (by the Florida legislature in 2002) of three formerly distinct Florida government-backed property insurance pools—one "windpool" established to insure coastal windstorm risk in the early 1970s, one established after Hurricane Andrew to address a statewide shortage of multi-peril personal residential property insurance, and one that provided statewide multi-peril property insurance to "commercial habitational" exposures such as condominium and apartment associations. The three pools are still legally separate "accounts" managed by the Citizens entity.

How Did Citizens Become a Threat to Florida's Economy and Fiscal Health?

Each account's size has expanded and contracted over the years, reflecting the relative health of the private insurance market, with the Coastal Account (windpool) more steady than the multi-peril Personal Lines Account (PLA) and Commercial Lines Account (CLA). The PLA grew rapidly upon its creation after Hurricane Andrew, and shrank as a bulk "depopulation" plan was created and pursued by private insurers in the late 1990s. It then grew rapidly after the 2004–2005 hurricane seasons produced eight storms impacting Florida, three significant insolvencies in 2006, and a dramatic spike in reinsurance costs for the remaining Florida-based insurers. The CLA and windpool were also affected by these tipping points in the marketplace.

Historically, Citizens' role in the market was determined by several public policy planks:

- **Coverage:** A statutory mandate to provide "comparable coverage" to that offered by private insurers;
- **Access:** Eligibility only after coverage has been denied by at least one admitted private insurer;
- **Rates:** A statutory mandate for a rating plan based on the highest rates (in consideration of several key rating elements) among the "Top 20" private insurers actively writing new business in Florida;

- **Funding:** Citizens addressed any annual deficits (e.g., losses exceeding accumulated surplus) by levying assessments on nearly all Florida property insurance policyholders; and
- **Reinsurance:** Private reinsurance to fund probable maximum losses was not required, but participation in the Florida Hurricane Catastrophe Fund was.

Reinsurance policy is important because only reinsurance actually purchased can be included in the rate calculations accepted by Florida regulators—no cost of capital is allowed on contingent capital obtained by assessment, or on retained capital used to fund catastrophes.

Eight storms impacted Florida in 2004–2005, causing insolvencies affecting over 320,000 Floridians, a dramatic spike in reinsurance prices, and coverage scarcity statewide. Amid this, the Florida legislature had mandated in 2005 that Citizens' rates become actuarially sound as well as noncompetitive, which resulted in premium increases.

In early 2007, the market failure and political backlash led the new governor and legislature to reset the role of Citizens as follows:

- Coverage remained "comparable," but a mandate for "affordability" was added.
- Eligibility was assured for any consumer unable to find a private insurer premium within 15 percent of Citizens' premium.
- The FHCF was expanded from $16 billion to $28 billion, far beyond its actual ability to pay claims, and no private reinsurance costs that duplicated the theoretical FHCF coverage could be included in rates.
- Significant premium credits for windstorm mitigation construction features (up to 44 percent of wind premium) already mandated since 2003 were doubled, with no revenue offset in base rates for higher-risk homes.
- Actuarially sound rates for Citizens were rescinded, resulting in a rollback of 10 to 20 percent, then further reduced to reflect both the expansion of the FHCF and implementation of the doubled mitigation credits. Written premiums per unit of insured value declined by almost half.
- Citizens' assessment base was expanded from property insurance to include nearly all property-casualty lines, more than tripling the scope of assessments.

Citizens grew rapidly almost immediately. It is impossible to untangle the interacting effects of public policy and market health, but the result is clear—Citizens reached a peak policy count of 1.47 million and a peak total value insured of $511 billion in late 2011. A 100-year storm would have produced an estimated $11.6 billion in assessments.

How Did Citizens Reverse Course and Sustainably Reduce Taxpayer Risk?

A new state political climate influenced by the economic and fiscal threats demanded actions to shrink Citizens beginning in late 2011. The pillars of the risk-shifting strategy coalesced over time as follows, each coupling a major change with a retention of consumer safeguards to address the continuing affordability and availability mandates.

- **Depopulation:** Citizens rejuvenated an existing program, dating to 1996, allowing private insurers to select and assume blocks of policies mid-term with few acquisition costs and Citizens servicing the policies until their expiration date. One element of this program was elimination of a ceding commission of up to 16 percent, allowing full unearned premium to be transferred just after the assumption date. Citizens also dramatically improved the quality of its individual property data over time, allowing private insurers to effectively model catastrophe risk and determine likely profitability of individual policies. Finally, more policies became attractive with progress toward price adequacy. However, consumers and their agents can still decline a private "takeout" offer for any or no reason.
- **Clearinghouse:** Citizens sought and received legislative approval to require most new and renewal policies be "shopped" among multiple insurers prior to acceptance or renewal. This involves a technology interface among private insurers and Citizens products and rating plans that compares coverage and premium. Previously, agents representing a single or few insurers often affirmed eligibility and placed policies with Citizens with little oversight. A price-based threshold remains in effect—renewals must be offered private coverage at lower prices, and new business within 15 percent of Citizens' prices, in order to make the property ineligible for Citizens.
- **Rates:** The legislature squared the mandates of financial soundness and affordability by requiring Citizens, beginning in 2010, to annually recommend actuarially sound rates to the Florida Office of Insurance Regulation, with the regulator establishing the final rates, and with the provision that no single policy issued receives an annual rate increase of more than 10 percent—the "glide path" exception. It has taken Citizens

years to dig out from the severe underpricing imposed in 2007, and some products and regions make only gradual progress due to the glide path. However, the trajectory has made an increasing share of Citizens' customers attractive in the long term to private insurers, spurring depopulation, marketplace competition, and more effective screening through the clearinghouse.

- **Reinsurance:** Since 2011, Citizens has steadily increased the share of its PML funded via private reinsurance in the windpool. Along with the good fortune of storm-free seasons that allowed increased accumulation of surplus, the build-out of reinsurance has better protected that surplus against depletion from a large storm or series of storms. Potential 100-year storm assessments of $11.6 billion in 2011 dropped each year, finally disappearing in 2015. Now, only about 60 percent of surplus is exposed to such an event, with the eventual goal to reduce that share to 25 percent or less exposed by highly rated private insurers.

Appendix 2: Glossary

Note: This glossary of terms related to flood insurance first appeared in the American Academy of Actuaries' 2011 monograph *National Flood Insurance Program: Past, Present … and Future?*

Glossary

Actuarial rate
Term frequently used to describe NFIP full-risk rates.

Actuarially sound premium rate
Premium rates calculated such that they return to the insurer the expected value of all future costs associated with an individual risk transfer, plus an additional margin or contingency loading.

Additional living expenses
Extra charges covered by homeowners' policies above policyholders' customary living expenses. Additional living expenses apply, where applicable, to situations in which the insured requires temporary shelter because damage by a covered peril has rendered the home temporarily uninhabitable. Examples include costs for hotel or motel, costs for restaurant meals, and costs for clothes-laundering service.

Borrowing authority
Statutory authority that permits a federal agency to incur obligations and make payments for specified purposes with money loaned by the U.S. Treasury.

Business interruption coverage
Commercial coverage that reimburses a business owner for lost profits and continuing fixed expenses during the time that a business must remain closed while the premises are being restored after physical damage from a covered peril. Business interruption insurance also may cover financial losses incurred when civil authorities limit access to an area after a disaster and such actions prevent customers from reaching the business premises.

Claims

A demand for payment for a loss incurred from a potentially insured peril under the terms of a plan or insurance contract.

Coastal Barrier Resource System

Coastal areas, e.g., certain barrier islands, designated by Congress in the Coastal Barrier Resources Act (Pub. L. 97- 348) and the Coastal Barrier Improvement Act of 1990 (Pub. L. 101-591). These federal laws were enacted on Oct. 18, 1982, and Nov. 16, 1990, respectively. The laws were implemented as part of a Department of the Interior initiative to minimize loss of human life by discouraging development in high-risk areas, reduce wasteful expenditures of federal resources, and preserve the ecological integrity of areas designated by statute as Coastal Barrier Resources Systems and Otherwise ProtectedAreas. The laws provide protection by prohibiting all federal expenditures or financial assistance, including flood insurance, for residential or commercial development in areas so identified.[73]

Contingency provision

A provision for the expected differences, if any, between estimated costs and average actual costs that cannot be eliminated by changes in other components of the ratemaking process.

Federal disaster assistance

Money or direct assistance provided by agencies of the federal government (notably FEMA) to individuals, families, and businesses in an area in which property has been damaged or destroyed and for which losses are not covered by insurance. It is meant to help with critical expenses that cannot be covered in other ways. This assistance is not intended to restore damaged property to its condition before the disaster.

Federally regulated lending institutions

Loans issued by the VA and FHA are subject to the supervision of federal institutions and are federally backed. Mortgage loans bought by Fannie Mae and Freddie Mac are considered federally backed, too, since the two organizations are federally chartered. These two entities buy more than 40 percent of all the conventional mortgages issued every year.

73 *Flood Insurance Manual*; FEMA; May 2007.

Flood Insurance Rate Map (FIRM)
Produced by FEMA, an official map of a community that delineates both the special hazard areas and the risk premium zones applicable to the community.

Floodplain
Any land area susceptible to being inundated by flood waters from any source. For NFIP purposes, floodplains are equivalent to Special Flood Hazard Areas (SFHAs).

Government Accountability Office
The Government Accountability Office (GAO) is the nonpartisan audit, evaluation, and investigative arm of Congress and an agency in the legislative branch of the U.S. government.

Historical average loss year (HALY)
A concept used by the NFIP beginning in the 1980s to establish a benchmark by which to judge the level of premium rates for subsidized policies. The HALY concept was developed to determine how much of a discount subsidized policies should receive. HALY is the mean of all the NFIP annual losses and loss-related expenses for a specific period of years (e.g., 1978 to the present), after trending (for inflation and flood policies' distributional changes) each year's losses to the present. HALY, therefore, is the average of the estimate for each historical loss year of what those storms would produce in losses in current dollars and assuming a current distribution of policies by rating class. While premiums for post-FIRM full-risk rated policies have always contemplated the full range of loss probabilities, the concept of HALY has been used to assure that the NFIP's aggregate premium (the sum of both full-risk and subsidized premiums) generates sufficient income after operating expenses to pay for the typical non-catastrophic-loss year that had been the NFIP's experience prior to Katrina. The NFIP incorporates Katrina experience in the HALY average by weighting the 2005 accident year one percent and all other years 99 percent. HALY has helped determine a minimum for subsidized premiums. Subsidized premiums through the years, however, have reached levels well above that minimum. While even the non-catastrophic-loss years of the NFIP vary greatly, HALY is the center around which those loss years will vary.

Insurance Services Office

A corporation headquartered in Jersey City, N.J., that provides data, analytics, and decision-support services for professionals in several fields, including insurance. Its services include the calculation of property and liability insurance loss costs and the development of insurance policy forms.

Mandatory purchase

Pursuant to the provisions of the Flood Disaster Protection Act of 1973, individuals, businesses, and others buying, building, or improving property located in identified areas of special flood hazards within NFIP-participating communities are required to purchase flood insurance as a prerequisite for receiving any type of federal financial assistance (e.g., any loan, grant, guaranty, insurance, payment, subsidy, or disaster assistance) when the building or personal property is the subject of or security for such assistance.

Mitigation practices

In the context of flood risk emergency management, mitigation efforts attempt to prevent hazards from developing into disasters and to reduce the effects of disasters when they occur. Mitigation focuses on long-term measures for reducing or eliminating risk. The implementation of mitigation strategies can be considered a part of the recovery process if initiated after a disaster occurs. Mitigative measures can be structural or non-structural. Structural measures use technological solutions, such as flood levees; nonstructural measures include legislation and land-use planning.

Profit provision

The provision for underwriting profit in an actuarially developed rate, typically expressed as a percentage of the rate.

Return on capital

A financial measure that quantifies how well a company generates profit relative to the capital it has invested in its business. It is defined as net operating profit divided by invested capital and usually is expressed as a percentage.

Special Flood Hazard Area

An area having special flood, mudflow, or flood-related erosion hazards. Each such area is shown on a Flood Insurance Rate Map as Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE, or V.[74] Under NFIP mapping standards, those zones comprise areas having a "100-year flood risk," i.e., their probability of inundation in any year is 1 percent.

Subsidized rates

NFIP subsidized rates are national rates set by broad occupancy type classifications, which produce a premium income less than the expected expense and loss payments for the flood insurance policies issued on that basis. The difference between the full-risk premiums for these policyholders and the subsidized premiums they actually pay is revenue forgone by the National Flood Insurance Fund.[75]

Sunset provision

In public policy, a provision in a statute or regulation that terminates or repeals all or portions of the law after a specific date, unless further legislative action is taken to extend it. Not all laws have sunset clauses; in the absence of a sunset clause, the law remains in effect until repealed.

Underwriting

Examining and accepting or rejecting insurance risks and classifying the ones that are accepted to charge appropriate premiums for them.

Underwriting gain or loss

The difference between the premium income and the claims and expenses incurred; excludes any investment gains or losses.

74 *NFIP Flood Insurance Manual*; FEMA; April 2017.

75 *NFIP Actuarial Rate Review in Support of the May 1, 2006 Rate and Rules Changes*; FEMA; January 1, 2007.

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