2016 Flood Insurance Work Group Briefing Book

April 4 -6, 2016
Washington, DC

NATIONAL ASSOCIATION of REALTORS®

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NAR Work Group Charge

NATIONAL ASSOCIATION of REALTORS®

FLOOD INSURANCE CHARGE

1. Conduct more in-depth research and analysis into the following issues raised by the Insurance Committee:
    a. Streamlining mitigation loan, grant and buyout programs for property owners to reduce their flood risk and insurance rates.
    b. Encouraging participation in the Community Rating System which offers flood insurance discounts for adoption of additional floodplain management measures.
    c. Improving the accuracy of the flood mapping program and streamlining the appeals process so it is simpler, quicker and less expensive.
    d. Complementing the National Flood Insurance Program with a private market that provides consumer options and protections (e.g., model state legislation).
2. Build up a knowledge base and expertise so the Committee is prepared to respond to these and other emerging issues as they arise in Congress or the Administration.
3. Identify ways to educate real estate professionals about mitigation, mapping and other programs and solicit ongoing feedback from NAR members who are experiencing issues and/or have found solutions that can benefit other members.
4. Report back to the Committee with any findings and/or recommendations regarding NAR policy.

Work Group Members:
Scott Louser – ND -- Chair
Ken Austin – MS
Mark Ashworth - NV
Andrea Bushnell – NC/AE
Dutch Dechert - NJ
Frank Dickens - AZ
Russell Grooms - FL
Trey Goldman - FL
Harold Huggins – MD/Commercial
Stan Sieron - IL
Gary Wright - WA
Steven Fischer – GA
Annie Engel – PA
Donna Smith – SC
John Sebree - MO

Agenda

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AGENDA
NATIONAL ASSOCIATION OF REALTORS®
FLOOD INSURANCE WORK GROUP

500 New Jersey Ave, NW
Washington, D.C.
April 4-6, 2016

Monday, April 4, 4:00pm – 5:00pm

4:00pm	Welcome & Meeting Overview - Maria Wells, NAR Insurance Committee Chair
	Legislative/Political Overview- Jerry Giovaniello, NAR Chief Lobbyist & Senior VP
5:00pm	Dinner (on your own)

Tuesday, April 5, 8:00am – 5:00pm

7:30am	Group Breakfast
8:00am	Overview & Introductions - Scott Louser, NAR Work Group Chair
9:00am	Streamlining Mitigation -Chad Berginnis, Association of State Floodplain Managers
10:00am	Aligning NFIP Rates to Risk - Larry Larson, ASFPM, National Academies Panel Member
11:00am	Strengthening NFIP Training & Homeowner Advocacy - Lisa Sharrard, US Flood Solutions
12:00pm	Group Lunch with SmarterSafer Coalition
	+ Steve Ellis, Taxpayers for Common Sense
	+ Josh Saks, National Wildlife Federation
	+ Jenn Fogel-Bublick, Capitol Counsel
1:00pm	Improving Flood Mapping & Community Rating System - Maggie Mathis, Dewberry
2:00pm	Enhancing Flood Risk Determinations & Appeals - Scott Giberson, CoreLogic
3:00pm	Work Group Discussion
5:00pm	Recess
6:00pm	Group Dinner at Art & Soul Restaurant (415 New Jersey Ave, NW)

Wednesday, April 6, 8am – 1pm

7:30am	Breakfast
8:00am	Overview – Scott Louser, Chair
9:00am	National Flood Insurance Opportunities & Challenges
	+ David Stearrett, Joe Cecil & Melissa Anderson, Office of the Flood Insurance Advocate
	+ Andy Neal, FEMA Chief Actuary, NFIP Insurance Rates
	+ Carolyn McGill, FEMA Increased Cost of Compliance Program
	+ Ryan Janda, FEMA Flood Mitigation Assistance Grant Program
	+ Jana Green, FEMA Risk Mapping, Assessment & Planning Program
	+ Bill Lesser, FEMA Community Rating Services Coordinator
12:00pm	Closing Thoughts & Next Steps – Scott Louser, Chair
12:15pm	Group Lunch
1:00pm	Adjourn

Speaker Bios

SPEAKER BIOGRAPHIES

CHAD BERGINNIS, Certified Floodplain Manager (CFM), became Executive Director of the Association of State Floodplain Mangers (ASFPM) in July 2012. There, Mr. Berginnis coordinates the implementation of all Board policies, communicates with Congress and Federal agencies, and promotes effective flood risk programs. Since 2000, he has served ASFPM as chair of the Insurance and Mitigation Policy Committees. Since 1993, his work has focused on floodplain management, hazard mitigation and land use planning at the state, local and private sector levels. Mr. Berginnis has a Bachelor's of Science in natural resources from Ohio State University.

LARRY LARSON is Director Emeritus and a founding member of ASFPM. Mr. Larson was national Chair from 1979-82 and Executive Director from 1982-1997. As Director Emeritus, he serves as policy advisor to ASFPM. Mr. Larson also served on the National Academies of Sciences panel that examined National Flood Insurance Rates. He has worked in the water resources profession for 50 years, since graduating from the University of Wisconsin with a B.S. in Civil Engineering, and is a registered Professional Engineer in Wisconsin and California.

LISA SHARRARD (JONES), CFM, is the principal of U.S. Flood Solutions which provides comprehensive consulting services related to floodplain management, mitigation, insurance and mapping. Ms. Sharrard chaired ASFPM from 1999-2001 and has over 25 years of floodplain management and NFIP experience. From 1994-2010, she worked for the state of South Carolina as Flood Mitigation Coordinator, managing community assistance and flood mitigation programs and FEMA's Risk MAP with the Department of Natural Resources. Ms. Jones also served on FEMA's CRS Task Force (2002-2009) as well as numerous other committees and task forces, and has testified before Congress.

STEVE ELLIS joined Taxpayers for Common Sense in 1999 and serves as Vice President, overseeing programs and serving as a leading media and legislative spokesperson. A persistent critic of the mounting budget deficit and federal fiscal policy, Mr. Ellis has testified before numerous congressional committees and has appeared on national network news programs, including programs on CBS, NBC, ABC, Fox, CNN, MSNBC, PBS, and NPR. His expertise ranges from earmarks to flood insurance and a lot of spending issues in between. He formerly served as an officer in the U.S. Coast Guard for six years and received a B.S. in Government from the U.S. Coast Guard Academy.

JOSH SAKS serves as the National Wildlife Federation's Legislative Director, helping set strategy and coordinate outreach to Members of Congress on key campaign priorities, including clean water and wetlands issues, energy policy, and federal appropriations for wildlife conservation and public lands protection. Mr. Saks joined NWF in 2010 as a Senior Legislative Representative for water resources campaigns where he worked on aquatic ecosystem restoration of America's Great Waters, Clean Water Act defense, Army Corps reform and more. He has a B.A. from Ithaca College and is currently pursuing an M.A. in applied economics at Johns Hopkins University.

JENN FOGEL-BUBLICK is a partner with Capitol Counsel LLC where she brings over 15 years of diverse experience to the firm, having worked on housing, insurance, banking and general financial services issues in the administration, on Capitol Hill, at non-profits and in the private sector. At Capitol Counsel, Ms. Fogel-Bublick manages and leads the advocacy efforts of the SmarterSafer Coalition. Before joining the private sector, she spent over seven years as counsel to the Senate Banking Committee where she advised former Senators Paul Sarbanes (D-MD) and Chris Dodd (D-CT) on insurance, housing and lending issues. She received her B.A. from the University of Michigan and J.D. from Boalt Hall School of Law at U.C. Berkeley, and is a member of the Maryland Bar.

MAGGIE MATHIS, CFM, is Associate Vice President for Dewberry, a large engineering, surveying and GPS firm and flood mapping contractor for FEMA. Ms. Mathis has served as one of Dewberry's key project managers on FEMA flood mapping, floodplain management, and mitigation-related contracts over a career spanning 30 years. Her experience includes flood map production, NFIP regulatory processing, community outreach, and risk communication. She's also Dewberry's Community Rating System (CRS) lead and has supported/trained communities and agencies in developing CRS applications and activities across the nation. Ms. Mathis is a graduate of the University of Maryland, with a B.S. in Geography.

SCOTT GIBERSON manages the flood program for CoreLogic and serves on the Board of Directors for the National Flood Determination Association. Mr. Giberson specializes in regulatory issues surrounding flood determinations and the mandatory purchase of flood insurance requirement, as well as policies related to the NFIP. Mr. Giberson consults on legislative and regulatory developments at the federal and state levels, and has presented at various conferences, seminars and workshops on flood insurance and mapping issues.

NAR Flood Policy

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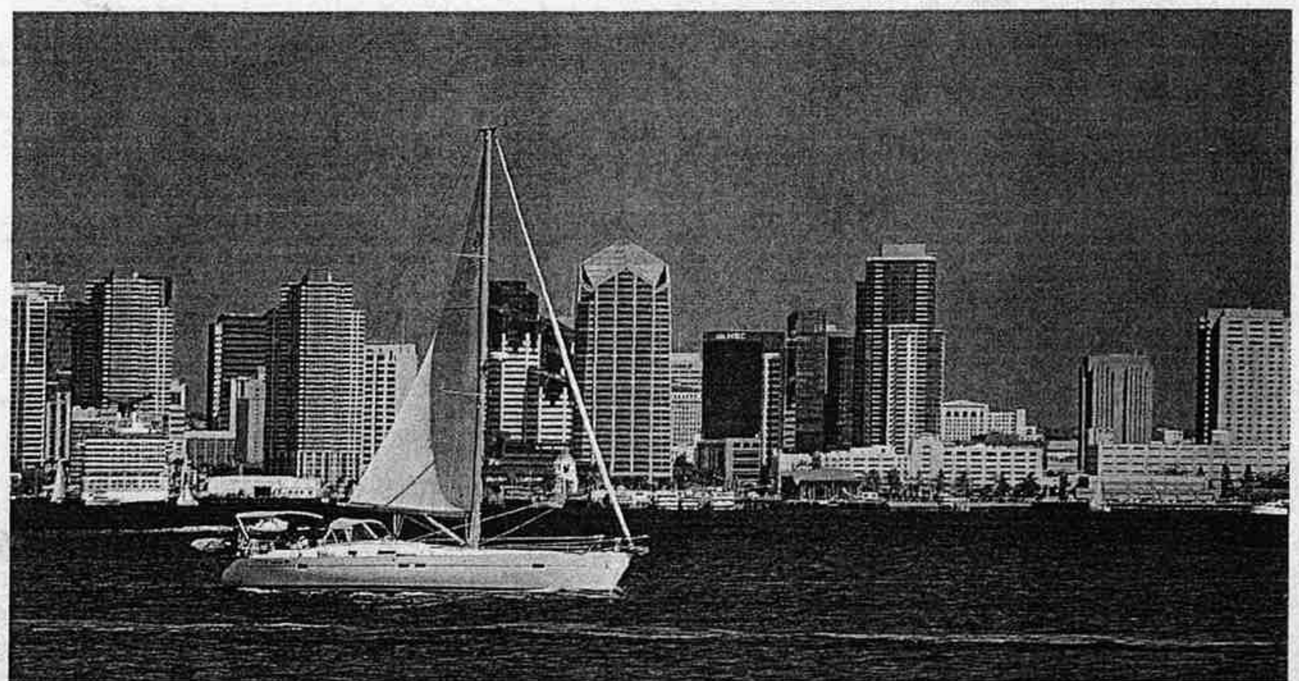
NAR Principles for Flood Insurance Reform

(February 2, 2016)

The National Flood Insurance Program (NFIP) was essential to completing nearly a half million home sales in 2015, according to NAR research. However, the program as currently structured is unsustainable for policyholders and taxpayers alike. For these reasons, NAR supports a strengthened NFIP coupled with a robust private market to offer choices and maintain access to flood insurance in all markets at all times. NAR believes:

- NFIP reauthorization should be long term.
- To keep rates affordable, the federal government should provide pre-disaster risk mitigation options – including guaranteed loans, grants and buyouts for property owners to build stronger or relocate to higher ground.
- Private flood insurance options should also be encouraged where cost effective, provided that NFIP remains a viable option for property owners.
- Premiums should be more accurately priced to the property specific risk, but any rate increases should be gradual and phased in over many years.
- There should be better oversight and training of insurance companies marketing NFIP policies, and an adequately supported Homeowner's Advocate at NFIP to directly assist policy holders with rate disputes.
- Flood mapping should be done at higher resolutions with a streamlined and less expensive appeal process.

PUBLIC POLICY COORDINATING COMMITTEE REPORT



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November 2015

Insurance Committee
2015 REALTORS® Conference

Chair:	Donna Smith, SC	**Vice Chair:**	Maria Wells, FL
Committee Liaison:	Russell Grooms, FL	**Staff Executive:**	Austin Perez, Russell Riggs, DC

Recommendation(s):

1) That NAR support the development of a private market for flood insurance that is guided by the following principles:

PRIVATE MARKET FLOOD INSURANCE PRINCIPLES

a) Private Flood Insurance Options-- The development of private market flood insurance options should be encouraged when property owners lack access to affordable coverage under the National Flood Insurance Program (NFIP).

b) NFIP – An Essential Component-- While private flood insurance options are a vital complement, a reformed NFIP is essential to ensuring that flood insurance coverage is available to all property owners in all markets at all times, and especially those not served by the private flood insurance marketplace.

c) Continuous Coverage-- Private flood insurance coverage should be taken into consideration when FEMA assesses whether a property owner has maintained "continuous coverage" for purposes of rate setting under the NFIP.

d) Dispute Resolution -- Private flood insurance customers should have access to alternative conflict resolution methods (e.g., arbitration, mediation, etc.) that provide a less costly alternative to litigation to resolve disputes over coverage terms or claims payments.

e) Flood Insurance Disclosure-- Consumers have a right to know the full terms and costs of coverage purchased, including any caps on claim payments, limitations or exclusions, as well as whether the flood insurance rates and coverage terms are regulated by the state. Standard consumer disclosures should be developed and implemented to serve this purpose.

f) Federal Over-Regulation-- Duplicative, overlapping or unnecessary federal requirements should be removed for private flood insurance companies that are already licensed and regulated by the state.

g) Federal Mortgage Programs and Regulatory Oversight- - Federal flood insurance laws should not limit or supersede the authority of federal mortgage programs (e.g. Fannie, Freddie, FHA, VA, etc.) or federal financial regulators (e.g. FDIC, Federal Reserve, OCC, etc.) to set requirements on the financial solvency and claims-paying ability of private insurers underwriting flood insurance coverage for federally related mortgages.

Rationale: Congress is currently considering legislation to encourage the development of a private market for flood insurance. NAR does not currently have policy principles to guide NAR staff on private market legislation. These principles would position the Association in support of more flood insurance options for property owners as well as consumer protections including adequate disclosure, conflict resolution and financial oversight.

2) That NAR support national flood insurance program reforms in addition to a robust private market:

NATIONAL FLOOD INSURANCE PROGRAM REFORMS

The National Flood Insurance Program (NFIP) plays a critical role in ensuring that flood insurance remains available in all markets at all times and should continue to exist as an option for residential and commercial property owners. NAR will continue to work to reauthorize, build on and improve the NFIP, not phase out or replace it.

a) Long-term Reauthorization-- NFIP's authority to provide flood insurance should be extended for multiples of years rather than months to bring certainty to real estate markets.

b) Incremental Fiscal Reform -- Congress is considering ways to pay down or avoid future borrowing from the U.S. Treasury. Improving the enforcement of mandatory purchase of flood insurance requirements; temporarily establishing nominal surcharges; and allowing the NFIP to buy reinsurance are all options that could help the program to remain financially solvent in the long run. However, any major reforms should be incremental, gradual over a long period of time and provide sufficient advanced notice to avoid severely disrupting communities, neighborhoods or households.

c) Affordable Insurance -- As "full risk" premium rates phase in particularly for the pre-Flood Insurance Rate Map properties, many property owners will no longer be able to afford national flood insurance or sell their properties without a loss. Congress should provide reasonable alternatives to help ease the transition and make these families whole again, including:

1) Providing federally backed mitigation loans or grants directly to property owners to build higher or stronger; such assistance should be made available before floods as well as after.
2) Offering a one-time buy-out of high risk properties at fair market values for communities to convert to open space, parks or other flood-compatible uses that enhance neighborhood property values.
3) Streamlining and making consumer friendly the process for property owners to obtain mitigation loans, grants or buyouts with a minimum of paperwork, burden and red tape.
4) Providing a gradual glide path for flood insurance rates to reach full-risk levels so no one sees sudden or unreasonable premium jumps overnight or through no fault of their own.
5) Ensuring the accuracy of flood maps and insurance rates by providing for performance-based incentives as well as adequate training, quality assurance/control and oversight of the Write-Your-Own insurance companies and other NFIP contractors.
6) Grandfathering property owners who build/built higher or stronger so they won't build to one set of standards only to have them raised in the next flood map update only a few short years later.
7) Enabling communities to purchase flood insurance as most insurance pricing and

coverage decisions are best kept at the state or local level.

8) Streamlining and encouraging the use of the Community Rating System, which offers insurance discounts in exchange for additional floodplain management investments by communities.

d) Fair Premium Rates-- According to independent actuaries, NFIP's rate setting methods are outdated and result in many property owners being overcharged. The federal program should modernize in order to better align insurance rates to the specific flood risk of properties, for instance by:

1) Dividing flood zones into coastal and inland subzones and creating a new rate table for each.
2) Moving toward site-specific hazard assessments rather than averaging across 30 national flood hazard scenarios.
3) Incorporating more precise risk factors (e.g., distance to river) in addition to the elevation and the general location of a structure.
4) Investigating the adoption of modern technologies such as catastrophe modeling or LIDAR.
5) Obtaining more granular and reliable property data, e.g., through commercial sources or incentivizing property owners to obtain elevation certificates.

e) Accurate Flood Maps-- The NFIP should:

1) Move toward higher resolution and property specific flood maps to improve the accuracy of the flood risk determinations;
2) Take advantage of recent technological advances including the availability of LIDAR and web-based mapping, as well as catastrophe modeling alternatives;
3) Provide a simpler, quicker and inexpensive appeals process in order to remove low-risk properties from high-risk maps; and
4) Reimburse all property owners who successfully appeal the accuracy of their flood map.

f) Homeowner's Advocate-- Even in its rudimentary current form, understanding the NFIP and the process of properly determining a property's risk is complex. As such, a fully funded and robust office of the homeowner's advocate is a key part of the solution to problems that property owners have in finding answers and/or assistance.

g) NFIP Depopulation - - If NFIP rates continue to rise, more policyholders may be able to find better coverage at lower cost from private insurance companies, where available. FEMA should encourage a private primary flood insurance market to assume NFIP policies, while preserving the federal program for those who need it.

Rationale: Next year, Congress will debate the future of national flood insurance. Congress has until September 30, 2017, to reauthorize the federal program, which is essential to completing half a million property sales annually according to NAR research. However, some members of Congress could propose to privatize parts or all of the program. Flood insurance is required for a federally related mortgage in 20,000 communities nationwide, and while the private flood insurance market is growing, often the NFIP is the only alternative for most of these communities. NAR has not updated its policy positions on flood insurance for many years. The Insurance Committee recommends that NAR adopt this updated statement of policy to help position the Association to respond in real time to the full range of proposals expected to be discussed next year.

The following is reported for your information only and does not affect Association policy or budget.

1) David McKey, chair of the informal flood work group, summarized the work group's activities (see Exhibit A) and recommended that NAR release a report by independent actuaries on NFIP insurance rates. The report finds that older homes along rivers and coasts are being "cross subsidized" by newer homes located further inland or elevated above the floodplain. By expanding NFIP's approach to include additional rate tables and risk factors, NFIP could better align the rates to the risk for more property owners and improve fairness in the program's rating structure.

2) Henry Kammandel, chair of the informal natural disaster work group, summarized the work group's activities and recommended that the Committee continue the discussion over natural disaster legislation next year but keep the focus on NFIP. Reauthorization is critical for half a million property sales annually according to NAR research. Since September, the work group held 4 conference calls and met with 7 experts on various aspects of the legislation, but members did not feel they had the time or information necessary to support policy development at this time. The work group did identify several critical questions for further research by the Committee and agreed that this was an important issue for the real estate industry. The full report is Exhibit B.

3) Lisa Miller, CEO of Lisa Miller Consulting, shared her experience as former Florida deputy insurance commissioner in successfully transferring 1 million Citizens property insurance policies to the private market. Miller noted several parallels between the situation Citizens faced ten years ago and the situation NFIP is now facing. She also believes the many of same reforms could help improve the financial solvency of the NFIP.

4) Rep. Brad Sherman (CA-30) provided an outlook on insurance issues in the remainder of the 114th Congress. The Committee identified flood and natural disaster insurance as two federal priority issues in 2016.

5) The Committee approved the previous meeting's minutes and achieved 100% RPAC participation.

EXHIBIT A

Date:	**November 4, 2015**
To:	**NAR Insurance Committee**
From:	**David McKey, Chair, Flood Informal Work Group**
Subject:	**National Flood Insurance Reform Report and Recommendations**

Charge: An informal work group was formed to deep dive into the National Flood Insurance Program (NFIP) and report back to the Insurance Committee with any recommendations for NAR policy.

The Work Group recommends that the Committee:

1. Ratify the private market flood insurance statement as adopted earlier this year (see Appendix).
2. Release Milliman's NFIP report which provides the basis and context for our recommendations.
3. Adopt the following NFIP reform position statement:

NATIONAL FLOOD INSURANCE REFORM

The National Flood Insurance Program (NFIP) plays a critical role in ensuring that flood insurance remains available <u>in all markets at all times</u> and should continue to exist as an option for property owners. We will continue to work to reauthorize, build on and improve the NFIP, not phase out or replace it.

Long-term Reauthorization. *NFIP's authority to provide flood insurance should be extended for multiples of years rather than months to bring certainty to real estate markets.*

Incremental Fiscal Reform. *Congress is considering ways to pay down or avoid future borrowing from the U.S. Treasury. Improving the enforcement of mandatory purchase of flood insurance requirements; temporarily establishing nominal surcharges; and allowing the NFIP to buy reinsurance are all options that could help the program to remain financially solvent in the long run. However, any major reforms should be incremental, gradual over a long period of time and provide sufficient advanced notice to avoid severely disrupting communities, neighborhoods and households.*

Affordable Insurance. *As "full risk" premium rates phase in particularly for the pre-Flood Insurance Rate Map properties, many homeowners will no longer be able to afford national flood insurance or sell their properties without a loss. Congress must provide reasonable alternatives to help ease the transition and make these families whole again, including:*

- *Providing federally backed mitigation loans or grants directly for property owners to build higher or stronger; such assistance should be made available before floods as well as after.*
- *Offering a one-time buy-out of high risk properties at fair market values for communities to convert to open space, parks or other amenities that enhance neighborhood property values.*
- *Streamlining and making consumer friendly the process for property owners to obtain mitigation loans, grants or buyouts with a minimum of paperwork, burden and red tape.*
- *Providing a gradual glide path for flood insurance rates to reach full-risk levels so no one will see sudden or unreasonable premium jumps overnight or through no fault of their own.*
- *Ensuring the accuracy of flood maps/insurance rates by providing for performance-based incentives as well as adequate training, quality assurance/control and oversight of Write-Your-Own insurance companies and other NFIP contractors.*
- *Grandfathering property owners who build/built higher or stronger so they won't build to one set of standards only to have them raised in the next flood map update only a few short years later.*

- *Enabling communities to purchase flood insurance as most insurance pricing and coverage decisions are best kept at the state or local level.*
- *Streamlining and encouraging the use of the Community Rating System, which offers insurance discounts in exchange for additional floodplain management investments by communities.*

Fair Premium Rates. *According to independent actuaries, NFIP's rate setting methods are outdated and result in many property owners being overcharged. The federal program should modernize in order to better align insurance rates to the specific flood risk of properties, for instance by:*
- *Dividing flood zones into coastal and inland subzones and creating a new rate table for each.*
- *Moving toward site-specific hazard assessments rather than averaging across 30 national flood hazard scenarios.*
- *Incorporating more precise risk factors (e.g., distance to river) in addition to the elevation and the general location of a structure.*
- *Investigating the adoption of modern technologies such as catastrophe modeling or LIDAR.*
- *Obtaining more granular and reliable property data, e.g., through commercial sources or incentivizing property owners to obtain elevation certificates.*

Accurate Flood Maps. *The NFIP should:*
- *Move toward higher resolution and property specific flood maps to improve the accuracy of the flood risk determinations;*
- *Take advantage of recent technological advances including the availability of LIDAR and web-based mapping, as well as catastrophe modeling alternatives;*
- *Provide a simpler, quicker and inexpensive appeals process in order to remove low-risk properties from high-risk maps; and*
- *Reimburse all property owners who successfully appeal the accuracy of their flood map.*

Homeowner's Advocate. *Even in its rudimentary current form, understanding the NFIP and the process of properly determining a property's risk is complex. As such, a fully funded and robust office of the homeowner's advocate is a key part of the solution to problems that property owners have in finding answers and/or assistance.*

Key Findings:

The Problem is Affordability *and Risk*

- Congress is phasing out subsidies for about one-fifth of NFIP properties without an alternative in place for those who can't afford flood insurance at the end of the phase out.
- Most of these properties would be underwater in the next 100-year flood, according to NFIP.
- Unabated, the rates could climb into the tens of thousands of dollars, rendering the properties unsellable and disproportionately impacting the communities where they are concentrated.
- Congress shares a measure of responsibility in this, having not informed the property owners of their true flood risk before they built or bought in harm's way.
- While there is not a "one-size-fits-all" solution for every property, the Work Group believes that there are a number of reasonable, incremental NFIP reforms that would dramatically improve the situation for many.

Fairness in NFIP Rates:

- NFIP is charging national average insurance rate for virtually all high risk properties across the U.S.; one in five of these is being subsidized.
- This means that:
    - Properties with a 1% annual flood risk are being charged the same as those with double or triple the risk; and
    - Two properties with an identical 1% risk are being charged substantially different rates.
- According to an independent actuarial analysis of five NFIP counties,
    - Current NFIP rates are not aligned with the risk, an important measure of fairness.
    - Some properties are being undercharged while others are over-charged.
    - There are several ways that NFIP rates could be improved to increase fairness.
    - Increasing fairness could result in more property owners buying flood insurance.
    - Increasing "take-up" of flood insurance could help strengthen NFIP solvency.

Federal Mitigation Assistance:

- Federally backed loans or grants for subsidized property owners to build stronger and higher represents a "win-win" solution, and should be a central focus of NFIP reform efforts.
    - By mitigating, property owners can reduce their flood risk and insurance rates;
    - By reducing risk, federal taxpayers spend less on NFIP borrowing and disaster relief.
- Current federal programs are underfunded and cumbersome, requiring applications from both the county and state in addition to the property owner, and approval can take 2-10 years before a successful applicant receives mitigation funds.
- The Work Group heard from REALTORS® who have tried to obtain loans/grants from these federal programs but were thwarted by the red tape, paper work, and unnecessary burden.

Grandfathering for Code Compliance

- Property owners who build and maintain to base flood elevation in one flood zone get to keep their current rating if the area is later remapped into a higher cost zone or elevation.
- These property owners are paying a "full risk" premium rate – just not based on current flood maps; instead, they're paying the full risk rate from the previous map in effect at the time the property was built.
- This is to protect property owners from having the goal posts moved on them (i.e., build "this high," then "no, higher") after they've made substantial investments in code compliance and/or mitigation.
- It also incentivizes property owners to "do the right thing" and build higher/stronger not only to reduce their own flood risk but also benefits their communities and taxpayers.
- It is a critical tool which deserves to be preserved and used to leverage mitigation investments.

Strengthening the Homeowner's Advocate

The office of the Advocate, championed by NAR in NFIP reform legislation last year, has since intervened on a number of occasions already and helped address many problems, including:

- Scaling back use of special "submit-to-rate" procedures which caused the most inaccurate rate increases under the Biggert-Waters Act; instead, Write-Your-Own (WYO) companies are now required to stick to FEMA's rate tables, except in the most special of cases.
- Requiring that WYOs re-underwrite all their flood policies to ensure that the rates are based on the correct flood map [Note: this is generally expected to result in rate reductions].

- Hiring McKinsey & Company to review the consumer experience with NFIP and recommend improvements ranging from the small [e.g., more training of insurance agents] to complete overhaul of the WYO program; more on this to come.
- Intervening in flood insurance rate map disputes, including:
  - One between a Georgia property owner and an insurance agent who appears to have committed fraud (i.e., the buyer was told his V-zone property could be grandfathered into the A zone at a substantially lower rate, but by the time the company requested the documentation months later, the agent was long gone);
  - Another prevailing on FEMA to finish the flood maps in Pinal County, AZ; otherwise, local property owners would have had to pay to finish them, before being allowed to appeal their inaccurate risk determinations and adding perhaps years and tens of thousands of dollars to their appeals expense.

Conference calls & Meetings: April 10, 17; May 12; June 11; and October 16, 2015

Speakers & Presentations:

- **Nancy Watkins and Matt Chamberlain (Milliman Actuarial Group):**
  - Provided an overview of how NFIP sets the insurance rates.
  - Collaborated with the Work Group to develop an actuarial analysis of NFIP rates in five counties: Pinellas, FL; Harris, TX; Ocean, NJ, Merced, CA; and Hancock, OH.
  - Presented the results of the analysis at the May meeting and in a written report.
- **David Stearrett (Property owner's Advocate)** briefed the Work Group on efforts to stand up the office within FEMA to advocate on behalf of property owners. NAR championed this office in the Biggert-Waters reform legislation passed last year.
- **Lisa Sharrard Jones (NFIP Expert Consultant)** updated the work group on remaining issues since the Biggert Waters law was amended in 2014 and ways to strengthen the Advocate's office to help.
- **Chad Berginnis (Association of State Floodplain Managers)** provided an overview of government mitigation loan and grant programs at the national, state and local levels and offered ways to streamline the programs for property owners to reduce their flood risk and insurance rates.
- **Dave Canaan (Charlotte-Mecklenberg, NC)** shared his experience directing one of the most successful county mitigation programs in the country; he also provided insight into what it takes for more counties to adopt similar programs.

Work Group Members

David McKey (LA), Chair
Debra Chamberlain (CT)
Dutch Dechert (NJ)
Frank Dickens (AZ)
Greg Larson (ND)
Ken Austin (MS)
Linda St. Peter (CT)
Nancy Riley (FL)
Norman Morris (LA)
Patricia Pipkin (NM)
Patrice Willetts (NC)
Steven Fischer (GA)
Tim Kellogg (IL)

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APPENDIX:
INSURANCE COMMITTEE APPROVED STATEMENT OF NAR POLICY ON PRIVATE FLOOD INSURANCE

Recommendation(s):

1. **That NAR endorse the following principles related to private market flood insurance:**
   - **Private Flood Insurance Options --** The development of private market flood insurance options should be encouraged when property owners lack access to affordable coverage under the National Flood Insurance Program (NFIP).
   - **NFIP – An Essential Component --** While private flood insurance options are a vital complement, a reformed NFIP is essential to ensuring that flood insurance coverage is available to all property owners in all markets at all times, and especially those not served by the private flood insurance marketplace.
   - **Continuous Coverage --** Private flood insurance coverage should be taken into consideration when FEMA assesses whether a property owner has maintained "continuous coverage" for purposes of rate setting under the NFIP.
   - **Dispute Resolution --** Private flood insurance customers should have access to alternative conflict resolution methods (e.g., arbitration, mediation, etc.) that provide a less costly alternative to litigation to resolve disputes over coverage terms or claims payments.
   - **Flood Insurance Disclosure --** Consumers have a right to know the terms and full costs of coverage purchased, including any caps on claims, limitations and exclusions, as well as whether the flood insurance rates and coverage terms are regulated by the state. Standard consumer disclosures should be developed and implemented to serve this purpose.
   - **Federal Over-Regulation --** Duplicative, overlapping or unnecessary federal requirements should be removed for private flood insurance companies that are already licensed and regulated by the state.
   - **Federal Mortgage Programs and Regulatory Oversight --** Federal flood insurance laws should not limit or supersede the authority of federal mortgage programs (e.g. Fannie, Freddie, FHA, VA, etc.) or federal financial regulators (e.g. FDIC, Federal Reserve, OCC, etc.) to set requirements on the financial solvency and claims-paying ability of private insurers underwriting flood insurance coverage for federally related mortgages.

Exhibit B

Date:	**November 9, 2015**
To:	**NAR Insurance Committee**
From:	**Henry Kammandel, Chair, Disaster Informal Work Group**
Subject:	**Natural Disaster Legislation Report and Recommendations**

Charge: To evaluate natural disaster legislation, identify any gaps in NAR policy and report back to the Insurance Committee.

The Work Group recommends that the Committee:

1. **In the near term, keep the focus on reauthorizing the National Flood Insurance Program (NFIP).** Reauthorization is critical to tens of thousands of property sales that occur each month.
2. **Continue an important, longer term discussion on natural disaster legislation**. This issue is more complex and multifaceted than it first appears. More in-depth research, analysis and discussions are necessary than is possible in the current time frame. Nevertheless, the Work Group made significant headway by meeting with some experts and identifying the following topics for further discussion:
    a. *How could Congress structure natural disaster legislation to assure "all-perils" insurance?* Previous bills have offered what can be described as a "line of credit" for large losses if the state or private market agrees to provide insurance coverage; for some natural disasters, that's a big 'if.'
    b. *If proposals rely on state participation, how could Congress ensure there is disaster insurance coverage in non-participating states?* In order to qualify for federal assistance under some proposals, each state must first create its own "all perils" insurance program and charge actuarial rates. It is unclear how many states would have the resources or capacity to do so.
    c. *Should Congress consider a property insurance mandate for natural disaster coverage?* Without a requirement to participate, many property owners will opt out of insurance until only the highest risks remain. As a result of this "adverse selection," risk-based premiums could become too expensive for the average household, resulting in a premium base that is not broad enough to cover catastrophic loss years. In California for instance, where insurers are required to offer earthquake insurance but homeowners can refuse, the current take-up rate is about 10%. Whether NAR would support requiring property owners to buy natural disaster insurance is a question that should also be considered.
    d. *How does Congress design a natural disaster program that complements the NFIP?* Previous natural disaster bills excluded flooding because the unique challenges complicated program design. However, private flood insurers could also benefit from federal reinsurance.

NAR policy: No policy recommendations at this time; an informal work group would need to be re-established next year in order to spend more time and gather the data needed for policy development.

Key Findings:

- Insurance coverage for natural disasters tends to be expensive and few property owners will opt to pay or be able to afford the requisite full-risk premium rate.
- It is unclear how a federal backstop would change this, unless a) property owners are mandated to purchase insurance for those risks not now covered or b) are subsidized by taxpayers and/or other policyholders.
- A backstop may smooth out the volatility (peaks and valleys) of the losses so there is one constant yearly payment, but would not reduce the overall cost of natural disasters.
- Federal reinsurance however would be less expensive than turning to the private market that will demand a risk premium and has historically charged 2-6 times the expected loss according to RAND.

Natural Disaster Legislative Approaches

Federal Terrorism Risk Insurance Program (Current Law)

- Provides federal funding only for major attacks and after insurers cover an initial layer of losses
- Requires the private market to "make available" terrorism coverage up to a limit
- Doesn't charge an upfront premium to insurers but the federal government recoups some of its spending on claims through an assessment on commercial policyholders after a payout

Natural Disaster Backstop Legislation (HR 1101, 113th Congress)

- Provides a federal reinsurance fund and short-term loans only for qualifying states
- To qualify, the state:
    - Must create its own "all perils" insurance program *except floods*
    - Must charge actuarially sound rates and may not cross subsidize
- Charges upfront premiums to pre-pay the fund and provides for 100% loan repayment
- Provides mitigation grants for property owners to build stronger

Windstorm Amendment to National Flood Insurance Program (HR 1264, 111th Congress)

- Provides a "multi perils" insurance policy
- Requires purchase of insurance for federally related mortgages in high risk areas
- Charges full-risk premiums for most properties; one in five is explicitly subsidized
- Borrows from taxpayers in above average loss years when claims exceed premiums

Disaster Insurance Speakers & Experts:

- **Lloyd Dixon (RAND)** has extensively published on NFIP and the Terrorism Risk Insurance Program.
- **Ed Collins (Allstate)** co-wrote Federal Natural Disaster Backstop Legislation as part of the Protecting America Coalition.
- **Frank Nutter (Reinsurance Association of America),** as a leader of the Smarter Safer Coalition, opposed backstop legislation because he believes there is enough capacity in the private market.
- **Staff experts led by Michael Newman (Federal Insurance Office, U.S. Department of Treasury)**
    - Manages the Terrorism Risk Insurance Program
    - Reports to Congress on state insurance programs

Conference calls: Sept. 23; Oct. 15, 22; and Nov. 5, 2015

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Streamlining Mitigation

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BRIEFING ON STREAMLING MITIGATION

The Flood Insurance Affordability Issue

Over 5-10 years, subsidies will phase out for 1 million properties in the National Flood Insurance Program (NFIP)

- According to the National Academies, most of these properties were built before the Flood Insurance Rate Map (or "pre-FIRM") and below the Base Flood Elevation (i.e., the depth of the water in a 100-year flood).
- The top insurance rate possible in the NFIP is $62,500/year for $250,000 of structure-only coverage.
- Risk mitigation is the preferred method for rate reduction -- for property owners and taxpayers alike, but:
  - Most property owners lack access to private sources of capital to strengthen, elevate or relocate.
  - Government-backed financing is limited by community nonparticipation, red tape and paperwork.
  - Current focus is on previously flooded properties when pre-flood mitigation is more cost effective.

Proposal

- Affordability is a critical issue that must be addressed as part of the 2017 NFIP Reauthorization.
- The best way to address affordability is by reducing NFIP rates through voluntary risk mitigation.

More about the Concept

- Set a goal of mitigating 10,000 pre-FIRM properties per year; currently, FEMA is mitigating only 4,000.
- Fully utilize NFIP Increased-Cost-of-Compliance (ICC) Coverage and FHA 203k Loan Guarantee Programs
  - Part of each NFIP policy, ICC will cover up to $30,000 in mitigation cost, but FEMA won't allow it until after a pre-FIRM substantially floods – even though current law authorizes it for "properties for which the Administrator determines ICC is cost effective and in the best interest of NFIP" (42 USC 4011(b)).
  - FHA's 203k loan guarantee program encourages lenders to provide financing for both the purchase and rehabilitation of a property in need of repairs. It is a long standing program, and we have clarified that flood mitigation is one permissible use of the program. Yet few lenders know how to use the program.
  - Could provide the quickest response with least amount of red tape and paperwork.
  - Could be scaled up and targeted specifically to address affordability.
    - Double the amount of ICC coverage available to cover up to $75,000.
    - Remove ICC from the $250,000 cap on NFIP structural coverage.
    - Prioritize ICC specifically for the pre-flood mitigation of pre-FIRMs.
- Leverage other mitigation funds for same purpose – including Flood Mitigation Assistance, Hazard Mitigation Grant Program, Pre-Disaster Mitigation, Community Block Grants and SBA Disaster Loans.
- Front load this funding in order to mitigate before, not after the flood when rebuilding costs more.
- Suspend or eliminate as much red tape and paperwork as possible until the task is accomplished.
- Dedicate a team of technical experts to directly assist pre-FIRM property owners with mitigation options.

Funding Options

Total Annual Cost: $500 Million (10,000 pre-FIRM properties x average mitigation cost of $50,000 per property)
Total Annual Revenue Available:

- ICC Surcharge (up to $75/policy authorized by current law; NFIP charges closer to $15) – $375 Million
- Homeowner Flood Insurance Affordability Surcharge (assuming $100/policy on average)-- $500 Million
- Flood Mitigation Assistance Program (NFIP Act) -- $120 Million
- Pre-Disaster Mitigation Program (Stafford Act) -- $100 Million
- Hazard Mitigation Grant Program (Stafford Act) – 15% of disaster relief after Presidential Declaration
- Unspent Sandy Supplemental Funding – Up to $1.3 billion total, according to the Build Strong Coalition
- [NOTE: FEMA estimates the phase out of pre-FIRM subsidies amounts to more than $1.5 billion annually]

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February 29, 2016

A Vision for Implementing ICC as it Exists in Law Today

FEMA can make needed improvements to the Increased Cost of Compliance (ICC) coverage under current law. ICC changes are vital to effectively mitigate and provide future savings to the National Flood Insurance Program (NFIP). This paper is the first of two efforts by ASFPM to promote more effective use of ICC. This paper discusses how ICC might look today if implemented consistent with current law and Congressional intent. Recommendations contained in this paper do not require changes in statute. The second effort will be an ASFPM white paper to look into future changes in ICC that may require new or modified statutory authority. The ICC white paper should be finished later in 2016.

<u>Current State of ICC</u>

Since inception in 1997 through 2014, ICC has:

- Settled 30,042 claims paying $669,362,511 in paid losses, with an average claim payment of $21,682
- Averaged 1,669 claims annually, with the highest 10-year average (2003-2012) being 2,814.
- Collected $1,342,200,158 in earned premium, paid $429,504,051 in underwriting expenses (32%), paid $53,549,001 in LAE (8%), and paid $669,362,511 in claims (50%), leaving a balance of $189,784,595.

<u>Triggers</u>

Under Section 1304(b), there are four triggers for ICC:

1. Repetitive loss properties
2. Substantial damage
3. Properties for which the Administrator determines ICC is cost effective and in the best interest of the NFIF
4. Upon an offer of mitigation through FEMA's HMA programs and "any program authorized or for which funds are appropriated to address any unmet needs or for which supplemental funds are made available."

As ICC is being implemented today, effectively only trigger #2 is used. Trigger #4 was added during the 2004 Reform Act. Today, there are tens of thousands of repetitive loss properties in the NFIP that, if mitigated, could reduce future claims to the program. Also, based on FEMA data, from 2005-2014, an average of 2,160 properties were mitigated annually against flood through FEMA's HMA programs[1]. By fully implementing triggers #1, #3, and #4, a significant number of properties would be added that would be eligible for ICC.

FEMA should implement triggers #1, #2, and #4 now.

[1] Based on data tabulated by Jody Springer, FEMA, in October, 2015. Number includes FMA, HMGP, PDM as well as older programs such as RFC and SRL. Mitigation types that were included are acquisition, elevation, floodproofing and relocation.

Trigger #1 may be the most problematic to implement fully due to the sheer number of repetitive loss properties. However, FEMA could identify a subset such as severe repetitive loss properties to first allow ICC to be used in conjunction with. Trigger #1 should not be tied in any way to substantial damage determinations or cumulative substantial damage language in a community's ordinance.

Trigger #2, should be implemented when substantial damage occurs modified to include damage resulting from any hazard including fire and earthquake. Cumulative SD and SD based on a percentage other than 50% are already in law but are not uniformly implemented and allowed.

Trigger #3 is more complex to implement without changes to the surcharges and policy development, so it could be done at a later time.

Trigger #4 should be implemented without precondition of substantial damage for all HMA programs and other post-disaster program such as CDBG-DR. If it is used in conjunction with FMA or PDM, the FMA rules governing when a flood insurance must have been obtained/maintained could be used prevail. Any offer of mitigation through a program other than FEMA's HMA programs, must demonstrate cost-effectiveness using FEMA's benefit-cost tool or other technique substantially similar.

Coverage & Limits

ICC claims cap should be raised to $60,000 - $75,000. FEMA could also introduce the concept of co-insurance for any amount of ICC over a base of $30,000. FEMA could use the following formula:

- Up to $30,000, 100% ICC funded
- From 30,000 to 60,000 or 75,000, ICC funds 75%, insured pays 25% (co-insurance)

A co-insurance concept would provide less ICC funding for the policyholder compared to raising the cap. However it would also incentivize cost control by the insured (since the property owner has a vested interest to get the best estimate), and stretch ICC funding. In the accompanying spreadsheet, ASFPM also calculated scenarios for ICC being raised to $75,000.

ICC caps should be in addition to the coverage limits under the NFIP SFIP. As currently interpreted by FEMA, an ICC claim plus any damage claim in aggregate cannot exceed maximum coverage limits based on the general limitations of insurance coverage found in Section 4013. However, we would argue that 42 USC Section 4013 does not apply to ICC as there is no direct statutory reference to the additional coverage authorized in Section 4011. We note that ICC is authorized under 4011(b) and includes its own authorized rate – a surcharge – within that same section of law. At a minimum, ASFPM requests that FEMA's general council provide a written interpretation justifying why ICC is considered part of the maximum coverage limits.

A structure with an ICC claim should not have to be in an identified SFHA. Only one of the four triggers is based on the supposition that a property is in the SFHA – ones that are substantially damaged. However, as currently implemented essentially any ICC claim has to be for a structure located in the SFHA. This is not consistent with the law.

Eligible costs under ICC should be no more restrictive than those under a FEMA HMA grant for that particular mitigation activity. FEMA has continued to use a strict and literal interpretation of the statute pre-2004 as well as restrictions in the Standard Flood Insurance Policy (SFIP - which should not supersede the intent of the ICC statutes) to limit severely the amount available for acquisitions, contending that only a portion of the work is required for "compliance," i.e., demolition of the building. Acquisition costs that are eligible for ICC must be expanded to cover 1) the costs associated with purchasing the property when an assignment of claim is made to a community (and appropriate deed restrictions are in place), and 2) all elements of demolition that are required by the FEMA grant programs in order to return a lot to open space., should be eligible.

This is especially important under trigger #4 to ensure consistency with the HMA grant programs. This includes:

- Providing pre-flood market value of the building and structure to the property owner for the purposes of acquiring the structure and land in addition to physical relocation and/or demolition costs. This would put actions that totally eliminate the risk of flooding (acquisition) on equal footing with other flood mitigation alternatives
- Demolition of all improvements left on existing property necessary to return the property to green space, including restoring vegetation for acquisition projects
- New construction costs under mitigation reconstruction alternative are allowed
- Elevation to the FFRMS standard if higher than locally required standards (permissive but not required unless ICC is used in conjunction with other federally funded mitigation grant programs).

Prior to 2004, ICC was defined in statute to cover the cost of implementing activities compliant with community land use and control measures. In getting the consistent with language into statute in 2004, ASFPM wanted the program to acknowledge local mitigation planning efforts, community acquisition programs to reduce flood risk, and other community activities that result in a prioritization of a number of hazard mitigation activities. For more than a decade, ASFPM has been arguing that using ICC, for example, to pay for the acquisition of a structure that was being acquired under a HMA grant should not only be eligible, but the full cost of acquisition up to the ICC cap should be provided to cover acquisition costs in addition to the narrowly defined demolition costs historically eligible.

Ultimately the higher caps and the greater ability for ICC to result in full mitigation for a structure without needing a post-disaster mitigation grant could reduce overall disaster costs and make existing funds go further . For example, flood insurance claims payments for damages would still be considered duplication of benefits as it typically would in a HMA project; however, given that ICC would now make it more feasible to acquire the building quickly, overall costs savings would be higher / mitigation funds would go further, because a proper use of claim funds is to repair a structure that might later be acquired using taxpayer funded PDM or HMGP programs.

Pricing & Cost

ASFPM recommends an updated rating structure that increases all rates, but especially lower risk properties which would benefit from the other changes in ICC which are being proposed. This recognizes the unidentified risks to all properties including areas where FEMA has not mapped (and properties are receiving the benefits of a low-cost policy) and the fact that flood risk changes – and usually increases – over time.

The overall approach for pricing ICC has been virtually unchanged (other than the amounts) through the history of the coverage – essentially a token rate (as low as $4) is set for Zone B,C, X properties while the highest amounts are for Pre-FIRM subsidized properties in A or V zones (currently maximum $70). This approach made sense when ICC statutorily tied primarily to substantial damage, and the cost of compliance. However, the 2004 reforms did two important things fundamentally change the intent of ICC – triggering ICC upon an offer of mitigation (where there was no prerequisite of damage) and eliminate the word "compliance" in statute and instead substitute the phrase "consistent with." Regardless of how it has been interpreted since 2004, ICC in statute is not dependent on substantial damage and hence required compliance and should have other considerations taken into account for pricing. For example, by triggering ICC by virtue of a property being a repetitive loss or upon an offer of mitigation is not dependent on being in an A-Zone where compliance is required. Further, due to the incompleteness of mapping in the nation (1.1 million miles mapped of 3.5 million miles as well as little to no stormwater inundation mapping or residual risk mapping), many structures can obtain low-cost properties. Implementing triggers associated with repetitive loss and offers of mitigation are reflective of such a reality.

The bottom line is that the more expansive use of the four triggers should logically result in the low and medium risk policies to pay a larger share of ICC then they traditionally have. The accompanying scenario spreadsheet examines 10 different scenarios, up to a flat $75 fee per policy (which would generate $375,000,000/year based on 5 million policies), using a simplified three tiered pricing approach: A99, B, C, X Zone; Pre/Post FIRM Full Risk Rating; and Pre-FIRM Subsidized Rating

On the income side, the statutory authority for ICC allows for the imposition of a surcharge on each insured policy of not more than $75 per policy, without further instruction on its basis (actuarially based, etc. On the expense side, one of the more disturbing aspects of ICC is the amount of funding for U/W + LAE. Historically it has been 40% of premium collected, resulting in a total ICC cost of $483,053,052 since program inception in 1997. With 30,042 ICC claims during that same time period, the cost, per ICC claim is $16,079. ASFPM questions why these costs are so high and given the level of effort to settle an ICC claim, it would seem that $10,000 per claim would be more than reasonable ($30,000,000 per year based on 3,000 claims). Certainly, with the increased cap for ICC, WYOs shouldn't see their fees exceed what they have received historically from a constant dollar perspective ($16,079) per claim.

Of course the fundamental question becomes when you activate the other ICC triggers, how many more claims and expenses to the program will we see? ASFPM performed several scenario calculations up to an average of 5,000 full ICC claims annually. Since inception which includes Katrina and Sandy though 2014, ICC has averaged 1,669 claims per year. Another way to look at ICC claims is to look at the highest 10 year average which would be from 2003 to 2013 which results in an average of 2,814 claims per year. Based on our calculations, it is possible, under the current ICC surcharge cap, to increase the ICC claims to an average of 5,000 per year which would allow implementation of triggers #1, #2, and #4.

APPENDIX A. Statutory Authority for ICC -- 42 USC Section 4011(b)

(b) Additional coverage for compliance with land use and control measures.

The national flood insurance program established pursuant to subsection (a) shall enable the purchase of insurance to cover the cost of implementing measures that are consistent with land use and control measures established by the community under section 1361 [*42 USCS § 4102*] for--

(1) properties that are repetitive loss structures;

(2) properties that are substantially damaged structures;

(3) properties that have sustained flood damage on multiple occasions, if the Administrator determines that it is cost-effective and in the best interests of the National Flood Insurance Fund to require the implementation of such measures; and compliance with the land use and control measures.

(4) properties for which an offer of mitigation assistance is made under—

(A) section 1366 [*42 USCS § 4104c*] (Flood Mitigation Assistance Program);

(B) the Hazard Mitigation Grant Program authorized under section 404 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (*42 U.S.C. 5170c*);

(C) the Predisaster Hazard Mitigation Program under section 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (*42 U.S.C. 5133*); and

(D) any programs authorized or for which funds are appropriated to address any unmet needs or for which supplemental funds are made available.

(E) [Redesignated]

Benefit-Cost Analysis of FEMA Hazard Mitigation Grants

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Abstract: Mitigation decreases the losses from natural hazards by reducing our vulnerability or by reducing the frequency and magnitude of causal factors. Reducing these losses brings many benefits, but every mitigation activity has a cost that must be considered in our world of limited resources. In principle, benefit-cost analysis (BCA) attempts to assess a mitigation activity's expected net benefits (discounted future benefits less discounted costs), but in practice this often proves difficult. This paper reports on a study that applied BCA methodologies to a statistical sample of the nearly 5,500 Federal Emergency Management Agency (FEMA) mitigation grants between 1993 and 2003 for earthquake, flood, and wind hazards. HAZUS MH was employed to assess the benefits, with and without FEMA mitigation in regions across the country, for a variety of hazards with different probabilities and severities. The results indicate that the overall benefit-cost ratio for FEMA mitigation grants is about 4:1, though the ratio varies from 1.5 for earthquake mitigation to 5.1 for flood mitigation. Sensitivity analysis was conducted and shows these estimates to be quite robust.

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CE Database subject headings: Benefit cost ratios; Hazards; Disasters; Federal agencies; Remedial action.

Introduction

Background

Mitigation decreases the losses from natural hazards by reducing our vulnerability or by reducing the frequency and magnitude of causal factors. Mitigation would ideally be implemented as extensively as possible, but, in a world of limited resources, its costs must be considered. Benefit-cost analysis (BCA) is a widely used tool to evaluate expenditures in this context (see, e.g., Zerbe and Dively 1994; FEMA 2005). If a mitigation activity's total expected benefits (avoided losses) exceed its total costs, and at a level comparable to both private and public investment rates of return, then it represents an efficient use of society's resources. A longstanding question has been: to what extent do hazard mitigation activities pass the BCA test?

Several programs authorize the use of federal funds to mitigate risks from natural hazards. Between mid-1993 and mid-2003, more than $3.5 billion of federal and state/local matching funds have been spent to reduce flood, windstorm, and earthquake risk. In light of those expenditures, the U.S. Congress directed the Federal Emergency Management Agency (FEMA) to fund an independent study to assess the future savings resulting from mitigation activities (U.S. Senate 1999). This paper summarizes the results of applying BCA to a nationwide statistical sample of FEMA-funded mitigation activities.

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Note. Discussion open until April 1, 2008. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on January 31, 2006; approved on September 18, 2006. This paper is part of the ***Natural Hazards Review***, Vol. 8, No. 4, November 1, 2007. ©ASCE, ISSN 1527-6988/2007/4-97–111/$25.00.

Overview

The results of the benefit-cost analysis of FEMA hazard mitigation grants are presented and explained below. These results are based on the data and methods summarized in MMC (2005, Chaps. 3 and 4). Results are presented for two major categories of grants—project activities and process activities; and for three hazards—earthquake, flood, and wind (hurricanes, tornados, and other windstorms), for a total of six strata. The results for a third category of grants, Project Impact grants, are presented in MMC (2005, Chap. 5). The grant programs analyzed in this paper represent 72% of all FEMA hazard mitigation grants and 80% of all associated FEMA expenditures during the study period. Specific methods and data used in the estimation of each stratum are also briefly summarized.

Because this was an analysis of overall mitigation savings, rather than a review of FEMA grant-making procedures, the objective was to estimate major statistical indicators applicable to an entire stratum: the mean benefit and its standard deviation. This involved estimating benefits from a sample of individual grants such as purchase and demolition of property in floodplains, and base isolation of seismically vulnerable buildings, and then extrapolating results to the population of grants by a mathematical process detailed below.

Overall, the analysis of FEMA hazard mitigation grants found that the benefit-cost ratio (BCR) of each stratum was greater than 1.0. Moreover, this result is robust to formal sensitivity tests (tornado-diagram analyses, discussed below) and informal evaluations of methodological limitations and assumptions (discussed throughout the paper). The total national benefits of FEMA hazard mitigation grants between mid-1993 and mid-2003, in terms of avoided future losses during the useful life of these mitigation efforts (which varies by grant) are estimated to be $14.0 billion in year 2004 constant dollars, compared with $3.5 billion in costs. This yielded an overall BCR of 4.0. Thus, every dollar spent on a FEMA hazard mitigation grant produced, on average, four dollars of benefits—a significant return on public dollar expenditures, comparable to a 14% rate of return on a 50-year annuity.

Methodology

The benefits of hazard mitigation are the avoided losses, i.e., those losses that would have occurred (in a probabilistic sense) if the mitigation activity had not been implemented. It is important at the outset to note two key differences between mitigation costs and benefits. Mitigation costs are incurred primarily during a short period, such as during construction, and are relatively certain. The only exception pertains to operating costs and maintenance costs, but these are usually relatively minor in comparison to construction costs. Mitigation benefits, however, accrue over the useful life of the project or process activity and are highly uncertain because they are usually realized only if natural hazard events occur. At best, the expected value of benefits of mitigation measures currently in place can only be approximated by multiplying the potential total benefits of an event of various sizes by the probability of each event, and summing over all such events. In addition, benefits must be discounted to present value terms to account for the time value of money (see, e.g., Rose 2004b; Ganderton 2005).

The various categories of hazard mitigation benefits addressed in this paper are as follows:

1. Reduced direct property damage (e.g., buildings, contents, bridges, pipelines);
2. Reduced direct business interruption loss (e.g., factory shutdown from direct damage or lifeline interruption);
3. Reduced indirect business interruption loss (e.g., ordinary economic "ripple" effects);
4. Reduced (nonmarket) environmental damage (e.g., wetlands, parks, wildlife);
5. Reduced other nonmarket damage (e.g., historic sites);
6. Reduced societal losses (deaths, injuries, and homelessness); and
7. Reduced emergency response (e.g., ambulance service, fire protection).

Compared to benefit-cost analysis, loss estimation modeling is relatively new, especially with respect to natural hazard assessment. Although early studies can be traced back to the 1960s, only in the 1990s did loss estimation methodologies become widely used. A major factor in this development was the emergence of geographic information systems (GIS) technology that allowed users of information technology to easily overlay hazard data or information onto maps of urban systems (e.g., lifeline routes, building data, population information).

Loss estimation methodologies are now vital parts of many hazard mitigation studies. FEMA has recognized the value of loss estimation modeling as a key hazard mitigation tool. In 1992, FEMA began a major effort (which continues today) to develop standardized loss estimation models that could be used by nontechnical hazard specialists. The resulting tool, a software program called Hazards US-Multihazard (HAZUS MH), currently addresses earthquake, flood, and hurricane winds. HAZUS MH was extensively used in this study. A summary of HAZUS MH is presented in Appendix I, and more details of its application are presented during the course of the discussion below.

Not all benefits of mitigation evaluated in this study can be analyzed using traditional evaluation methods. Alternative approaches for assessing some categories of mitigation benefits were needed. For environmental and historic benefits, a feasible approach for measuring the benefits of hazard mitigation is the *benefit transfer* approach (see, e.g., Brookshire and Neil 1992; Bergstrom and DeCivita 1999). Valuation of environmental damages, cultural and historical damages, and lives is conducted by converting these "nonmarket" damages into dollars with the willingness to pay paradigm. The benefit of a policy is thus the amount of money, over and above expenditures or impacts, that members of society are willing to pay to obtain an increment in wellbeing or avoid a decrement in wellbeing. Willingness to pay is the theoretically correct measure of the economic benefits of a policy or project. Nonmarket valuation methodologies convert the intrinsic value of a nonmarket good into dollar values that can be added up and directly compared to policy costs. When the cost of primary data collection is prohibitive, as in this study, the benefit transfer approach is invoked, adapting previous estimates of willingness to pay.

Several assumptions underlie the analysis. Here we note the major ones and refer the reader to Appendix II for others. The base case real discount rate used is 2%, which is based on market interest rates. It is also the same rate that is recommended by the Congressional Budget Office, which is based on an estimate of the long-term cost of borrowing for the federal government (see "Treasury quotes" 2003) and is generally considered a conservative estimate of the long-term real market risk-free interest rate. (Results were sensitivity tested to discount rates between 0 and 7%, along with sensitivity tests of a variety of other model parameters.) The planning period was taken as 100 years for mitigation of important structures and infrastructure and 50 years for all other mitigation measures, regardless of property age. Avoided statistical deaths and injuries were valued using FHWA (1994) figures, brought to 2002 constant dollars (using the consumer price index), but not time discounted primarily because this would imply a death or injury in the future is worth less than today.

Translating injuries and loss of life into quantifiable dollar figures is difficult. Estimates of the value of life vary greatly—from $1 to $10 million depending on the agency making the assessment or the use of the figure (see Porter 2002 for discussion). One of the more applicable figures is from a study for the Federal Aviation Administration (1998), in which the authors select a value of $3 million per statistical death avoided, in order to value the benefit of investment and regulatory decisions.

Quantifying the costs of injuries is equally problematic. Little research has focused specifically on the cost of injuries from disasters. However, the Federal Highway Administration (1994) published a technical report that provided figures of estimated costs of damages in car accidents. These comprehensive costs include, but are not limited to: lost earnings, lost household production, medical costs, emergency services, vocational rehabilitation, and pain and lost quality of life (FHwA 1994). This severity scale, however, does not map directly into the HAZUS 4-level scale, and as such has been modified for this project. Using a geometric mean approach to combine categories, minor and moderate severity costs were merged for the HAZUS 1 level; the serious severity level was used for HAZUS level 2; and severe and critical severities were merged to form the HAZUS level 3 estimate. As discussed earlier, the FAA value of human life was used to represent the HAZUS level 4 category.

Regarding the decision not to discount deaths and nonfatal injuries avoided, there is substantial disagreement over whether or at what rate one should discount future avoided deaths and injuries. Farber and Hemmersbaugh (1993) provide a survey of studies suggesting that people would discount future lives saved at rates varying between 8 and 0%, and in some cases negative values (see also Van Der Pol and Cairns 2000). Some argue that because of long-term increases in productivity, the present value of lifetime earnings (part of the statistical value of fatalities avoided) should be discounted at a lower rate than other future values (Boardman et al. 2001). Several authors argue (e.g., Cowen and Parfit 1992) that discounting human lives is ethically unjustified. Absent a strongly defensible basis and consensus for discounting avoided statistical deaths and injuries, it seems reasonable not to do so.

Grant Selection

This study addresses all FEMA-funded mitigation grants that satisfy the following criteria: (1) the grant was listed in the National Emergency Management Information System (NEMIS) database provided by FEMA in July 2003; (2) the grant was associated with disaster number 993 (Midwest floods of June 1993) or higher; and (3) the grant was intended to reduce future losses associated with earthquake, flood, or wind risk from hurricanes or tornadoes, as determined using FEMA's project-type code in NEMIS. Where the project-type code did not reveal the hazard to be mitigated, the hazard was assumed to be the same as that of the declared disaster, and this assumption was crosschecked by a review of the grant application.

During the period studied, FEMA conducted three programs in support of hazard mitigation: the postdisaster Hazard Mitigation Grant Program (HMGP) and two predisaster programs, Project Impact (PI) and the Flood Mitigation Assistance (FMA) program. The HGMP, the oldest and largest of the three programs, was created in 1988 to assist states and communities in implementing long-term hazard mitigation measures following presidentially declared disasters. Between 1993 and 2003, FEMA, in partnership with state and local governments, obligated $3.5 billion for states and communities to invest in a variety of eligible earthquake, flood, and wind mitigation activities selected as the most beneficial by local officials.

Project Impact was a program funded between fiscal years 1997 and 2001. Unlike the HGMP, which provides funding after disasters, PI supported the development of predisaster mitigation programs. In total, 250 communities across all states and some United States territories received $77 million in grants. The one-time Project Impact grants were considered seed money for building disaster-resistant communities and encouraged government to work in partnership with individuals, businesses, and private and nonprofit organizations to reduce the impact of likely future natural disasters.

The Flood Mitigation Assistance Program (FMAP) was created as part of the National Flood Insurance Reform Act of 1994 with the specific purpose of reducing or eliminating claims under the National Flood Insurance Program (NFIP). The FMAP provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the National Flood Insurance Program. Annual funding of $20 million from the National Flood Insurance Fund is allocated to states that, in turn, obligate it to communities.

Note that our study did not estimate the benefits of all FEMA mitigation grant expenditures during the study period. Approximately $200 million in grants were not addressed for any of several reasons but primarily because they did not address one of the three hazards (earthquake, flood, and wind) examined in this study. Also, this paper reports only on the benefits of HMGP grants. The reader is referred to MMC (2005) for a discussion of PI grants.

HMGP grants comprise most of the grants and funds in the population of grants considered. The amount of funds is determined during the recovery period following a disaster declaration. During the 10-year period considered, the amount allocated for mitigation grants was approximately 15% of the amount spent by the federal government for emergency response and recovery programs. The nature of grants is influenced by the grantees (states), and the subgrantees (state agencies, local governments, and certain private nonprofit organizations) that prepare and submit applications to the states. FEMA asks states to determine priorities and to evaluate subgrantee applications for consistency with these priorities and other state requirements, and with FEMA requirements. Grant applications are accepted beginning several months after the disaster declaration. There may be more than one solicitation period and the solicitation process may last a few years. The rigor and time required for state-level application review depends on the number and complexity of applications received and the state's review capacity. FEMA only considers the applications forwarded by the states and generally acts within a few months, unless a proposed project affects historic or environmental resources and triggers federal reviews that might require a year or more. After application approval, the subgrantee must provide the matching funds and execute the project. Some mitigation projects

Table 1. Mitigation Costs and Sample Size by Hazard (in 2004 Dollars)

		Population		Sample	
Hazard	Type	Count	Cost ($M)	Count	Cost ($M)
Wind	Project	1,190	280	42	38
	Process	382	94	21	38
Flood	Project	3,404	2,204	22	84
	Process	108	13	6	2
Earthquake	Project	347	867	25	336
	Process	48	80	20	74
Total		5,479	3,538	136	572

may take years to complete and in some instances may involve funds derived from more than one disaster declaration. Projects undertaken reflect the priorities of the subgrantees and the states and their values, and do not necessarily reflect a policy to maximize the benefit-cost ratio.

Grant data were acquired in electronic format for 5,479 approved or completed grants to mitigate flood, earthquake, or wind risk. The data were stratified by hazard type (flood, earthquake, or wind) and mitigation type (project or process activity). A selection of 357 mitigation grants was made for detailed examination based on a stratification scheme and minimum sample size criterion developed early in the project. The study investigators collected additional data on as many of these grants as possible (see MMC 2005, Chap. 3).

A rigorous random sampling technique was applied to select these 357 grants (see MMC 2005, Chap. 4 for details). In particular, grants in each stratum were sorted in order of increasing cost. The stratum was then divided into a number of substrata of approximately equal total cost, and sample grants were selected at random from within each substratum. The sample grants thus represent the distribution of mitigation costs and to ensure the inclusion of low, medium, and high-cost mitigation efforts in each stratum. FEMA was able to provide paper copies of 312 grant applications. The paper grant-application files tended to contain more descriptive information about grants than did the NEMIS database. (All paper grant applications and the NEMIS database provided by FEMA were forwarded by the writers to the Washington, D.C. office of NIBS, where they can be reviewed by interested parties.) Of these, 136 contained sufficient data to perform a benefit-cost analysis. Data were extracted from these paper files and transcribed to electronic coding forms in a detailed and structured fashion. The form for project mitigation activities contained 200 data fields for each property or location mentioned in the grant application. Eventually, 54,000 data items were extracted for the stratified sample, consisting of 1,546 properties in project mitigation activities and 387 distinct efforts in process-type activities, representing nearly $1 out of every $6 spent on hazard mitigation in the population of grants examined here.

Table 1 summarizes the distribution of these grants by mitigation type and hazard for the entire population of grants that satisfy the criteria listed above and for the sample that was selected to represent the population. The table distinguishes grants that involve the actual mitigation of risk (*project* mitigation activities) from activities involving support functions (*process* mitigation activities). Project activities include physical measures to avoid or reduce damage resulting from disasters. Typically they involve acquiring and demolishing, elevating, or relocating buildings, lifelines, or other structures threatened by floods; strengthening buildings and lifelines or their components to resist earthquake or wind forces; or improving drainage and land conditions. Process activities lead to policies, practices, and other activities that reduce risk. These efforts typically focus on assessing hazards, vulnerability, and risk; conducting planning to identify mitigation efforts, policies, and practices, and to set priorities; educating decision makers, and building constituencies; and facilitating the selection, design, funding, and construction of projects. See MMC (2005, Chap. 2) for a more extensive discussion of the distinction between project and process grants.

Sample Results

Sampled Grants for Project Mitigation Activities

This section summarizes results for grants for project mitigation activities only for earthquake, wind, and flood. "Sampled Grants for Process Mitigation Activities" discusses the sampled grants for *process* mitigation activities for these hazards.

The results of the benefit-cost analysis of FEMA project grants are discussed below. Although some details are presented at the individual grant level, the benefit calculations and the benefit-cost ratio results are valid only at the aggregate level. This is consistent with the general nature of statistical studies of this kind. The benefit-cost ratios calculated in this part of the study were independent of those provided in grant applications. There were several reasons for this, including the need to develop and implement an independent methodology for estimating future benefits, and the fact that the focus of this study was on aggregate benefits and not on the benefits of individual grants. A list of methods used to measure each benefit type for each hazard is presented in Table 6.

Grants for Earthquake Project Mitigation Activities

The earthquake stratum of grants for project mitigation activities includes grants for both structural activities (e.g., base isolation of public buildings) and nonstructural activities (e.g., retrofit of pendant lighting in schools). Overall, the stratum sample included 25 grants involving 128 buildings. Pendant lighting projects in schools accounted for the majority of the buildings analyzed in this stratum, with one grant addressing the replacement or mitigation of seismically vulnerable light fixtures in 78 buildings. Higher-cost grants included seismic upgrades and seismic safety corrections of hospitals, university buildings, and other public buildings.

HAZUS MH was the primary methodology used in estimating property damage, direct and indirect business interruption losses, and some societal impacts such as number of deaths and injuries. It was applied using structural, economic, and societal information and data obtained from grant applications found in FEMA files, and supplemented with published data on some key projects.

New methods were developed for estimating some types of avoided losses, including business interruption impacts associated with utility outages, damage to pendant lighting and ceilings, environmental/historical benefits, and some societal benefits. The simple average benefit-cost ratio for the 25 grants in this stratum is 1.4, with a standard deviation of 1.3. The total benefit for this stratum is $1.2 billion. Individual grant benefit-cost ratios range from near zero for a nonstructural retrofit to an electricity substation (intended to reduce physical injury to workers) to 3.9 for a nonstructural retrofit of a hospital. Note that the presence of individual grants with estimated BCR <1 does not indict FEMA grant making. Not all details considered in the original grant application necessarily appear in the paper copy of the grant application transmitted to the project team.

HAZUS MH was used to estimate property damage avoidance (benefits) due to the structural upgrades. The total property loss reduction for this stratum is $319 million. Property loss reduction alone, however, was not sufficient for the average benefit-cost ratio from mitigation measures in this stratum to exceed 1.0. Of the 25 hazard mitigation grants in the earthquake project stratum, three avoided business interruption. The cases where business interruption was applicable included impacts on utilities and hospitals; no conventional business activities other than these were in the sample. (This estimation here and for other hazards excludes business interruption caused by damage to public buildings such as police and fire departments, civic arenas, and schools. These public sector activities, although not priced as a business product or service, do yield commensurate value even if usually not transacted through the market. However, they have been omitted from business interruption calculations because, in the aftermath of a natural disaster, most of their functions are provided by other locations or "recaptured" at a later date. Moreover, payments for major inputs continue even when the original facility is closed e.g., wages to unionized employees.) In addition, an inherent assumption of the HAZUS MH methodology is that only *structural* mitigation results in business interruption benefits. The vast majority of *nonstructural* mitigation measures in this stratum are for pendant lighting in schools, and are assumed only to affect casualty rates.

For the three applicable cases in the earthquake project grant sample stratum, business interruption benefits average $52.9 million, and range from a low of $1.3 million for a pump station to a high of $139.5 million for a hospital. Here and elsewhere in the study, we factored in some aspects of "resilience" to business interruption, or the ability to mute potential losses through inherent features of business operation (e.g., input substitution or using excess capacity) as well as adaptive behavior (identifying new sources of supply or making up lost production at a later date) (see, e.g., Rose 2004a). Business interruption benefits contribute about 10% to the overall average benefit-cost ratio for this stratum.

The largest component of benefits in the earthquake project stratum was the reduction of casualties, which accounted for 62% of the total benefits. Analysis shows that a reduction of about 542 injuries and 26 deaths in this stratum sample is expected. Extrapolating to the entire stratum population, it is estimated that these grants result in avoiding 1,399 injuries and 67 deaths. The mean total benefit per grant is about $6.3 million, with a standard deviation of $6.4 million. The projects with zero calculated casualty benefits included electrical substation upgrades, a school arcade replacement, and nonstructural mitigation activities to emergency power and communication facilities (rather than patient services) in a hospital.

Three earthquake grants in the sample provided environmental or historical benefits, including improving water quality, protecting historic buildings, and positive health benefits. The highest environmental benefit was for an earthquake retrofitting of a police headquarters building ($293,000), while the lowest pertains to health benefits of a hospital retrofit. The average benefit of these three grants is nearly $143,000, and they accounted for less than 1% of the total benefits in the earthquake project grant stratum. No significant outliers exist in the earthquake project stratum, with the exception of two nonstructural mitigation grants. These two grants did not provide much property protection, almost no casualty reduction, and no protection at all against business interruption. Those projects with low benefit-cost ratios include some cases of nonstructural mitigation intended primarily for life safety. Other cases of this same type of mitigation yield some of the higher benefit-cost ratios, along with structural retrofit of large buildings. The seeming incongruity of the benefits of nonstructural retrofits is explained primarily by differences in the number of individuals at risk of death and injury.

For this stratum, as well as for the others below, the overall approach was conservative (i.e., we made our decisions about assumptions, data, inclusion, in nearly all cases so as to err on the side of obtaining low benefit estimates). In this stratum, estimates of the diffusion of university research and of demonstration projects, as well as several types of societal impacts related to psychological trauma, were omitted because there was no adequate means of quantifying these measures. Also omitted in this and other strata were: indirect property damage (e.g., prevention of ancillary fires), avoided negative societal impacts relating to psychological trauma (e.g., crime, divorce), air quality benefits (improvements in visibility and health due to reduced burning debris), benefits from reduced disposal of debris (land quality), and aesthetic benefits including visibility and odors of reduced debris.

Grants for Wind Project Mitigation Activities

Although several mitigation measures are included in the sample grants for the wind project grant stratum, the majority deal with hurricane storm shutters and saferooms. HAZUS MH readily handles property benefit calculations for hurricane storm shutters. However, supplemental methodologies were developed by the study investigators to estimate property damage impacts of tornadoes and casualty impacts for both hurricanes and tornadoes. Benefit transfer methods were used to estimate environmental/historic benefits.

The simple average benefit-cost ratio for the 42 grants in the wind project stratum was 4.7, and the standard deviation was 7.0. The total benefit for this stratum is $1.3 billion. Individual grant benefit-cost ratios range from less than 0.05 for retrofit of a police department building to greater than 50, for a variety of utility protection measures.

Benefit-cost ratios outside these bounds were ignored for the purpose of calculating the stratum-average benefit-cost ratios, which results in a conservative estimate. That is, estimated benefits would have been greater had these samples been included. The projects with a benefit-cost ratio less than 0.05 or greater than 50 are referred to here as outliers; all projects with benefit-cost ratio between 0.05 and 50 are referred to as the censored set. The bounds of 0.05 and 50 were initially selected somewhat arbitrarily. However, when one calculates the 1st and 99th percentiles of the lognormal distribution with the same moments as the censored set (±2.3 SD), all members of the censored set have benefit-cost ratios within these 1st and 99th percentiles, so the bounds are in a way "stable." Note that the benefit-cost ratios of the censored set are approximately lognormally distributed, passing a Kolmogorov–Smirnov goodness-of-fit test at the 5% significance level.

Several of the grants that had large benefit-cost ratios (>10), including all four outliers that exceeded 50, were cases of electric utility mitigation, such as relocating utility power lines below ground. In these cases, property damage savings were relatively small, but the business interruption savings were large. A downed power line, or a substation that has been disrupted because of a hurricane, can cause the economy of a city to come to a halt for days (Rose et al. 1997). Even the prevention of an outage of a few hours can pay for itself several times over in some instances.

Property loss benefits can be significant, with reductions measuring up to four times the cost of the retrofit. The sample average benefit-cost ratio associated with property loss reduction is 0.59. The estimated total reduction in property loss for all wind project grants (not just those in the sample) is $166 million.

Casualty benefits apply to 25 grants in the wind stratum. All of these projects are either hurricane shelters or tornado saferooms. The hurricane grants involved mitigation of multiple properties, usually schools; however, not all of the schools are on the shelter inventory. The methodology calculated benefits for only those schools that also serve as hurricane shelters. Collectively, the schools that met this condition were able to shelter, at capacity, about 33,189 evacuees. The tornado grants involved the building of saferooms in public and private spaces, the majority of which were community shelters (sheltering 750–1,000) with one notable exception that sponsored the construction of saferooms in hundreds of private residences.

Considering both types of wind project grants—hurricane and tornado—together, mitigation activities reduced casualty losses in the sample by about $108 million, or an estimated $794 million for all wind project grants. The per-project mean casualty benefit is $4.3 million.

Some intangible benefits of shelters could not be quantified, and were therefore excluded from the benefit-cost analysis. Regardless of the financial benefit of sheltering, shelters are beneficial by reducing uncertainty and stress in those at risk. In addition, available hurricane shelter space keeps people off the highways during dangerous periods. More important, shelters offer the only safe haven for those without the financial means to take other protective measures.

Historical benefits were applicable to only one wind hazard grant: door and window protection for an historic town hall (a total estimated benefit of $115,000). For the wind project grant stratum overall, however, historic benefits contributed little to the average benefit-cost ratio.

Estimates of casualties avoided because of grants for wind mitigation project activities are high compared to the number of lives lost annually from high wind in the United States. In this study, the estimated casualties avoided are all tornado related. Because the body of peer-reviewed scientific literature relating to probabilistic estimates of loss reduction from tornado mitigation is scant relative to that of other natural hazards covered in the study, the project investigators developed loss models without benefit of years of input from the scientific community in developing, testing and validating modeling techniques.

Because of these issues, ATC contracted with Professor James McDonald of Texas Tech University, a noted wind engineering expert, to review and comment on the entire loss estimation methodology for tornado. Because of this review, changes were made to the methods used to quantify tornado impact areas. The Project Management Committee and the Internal Project Review Panel agree that the model used is logical. Avoided casualties have a limited effect on the aggregate results of the current study. The sensitivity analysis found that the benefit-cost ratio for the stratum of grants for wind project mitigation remained above 1.0 when casualty rates were reduced an order of magnitude lower than the estimated rates. If only 10% of the estimated benefits attributed to avoided casualties are counted, the benefit-cost ratio for grants for wind-project mitigation activities would decline from 4.7 to 2.1. Moreover, given the relatively small number and size of grants for wind mitigation, the benefit-cost ratio of all mitigation programs would be reduced from 4.0 to 3.8.

Grants for Flood Project Mitigation Activities

HAZUS MH damage functions formed the basis for estimating property damage due to flooding. The hazard calculations, however, were performed outside of the HAZUS MH flood module because this component was not available at the time of this study. Instead, an alternative methodology was developed that used a probabilistic approach to locate properties in the flood plane and to estimate the expected distribution of flood heights. Casualties and displacement costs, and historic site and environmental benefits were calculated separately using the methodologies summarized in MMC (2005, Chap. 4). Because all mitigation measures applied to residential properties, no business interruption benefit was calculated.

The study investigators coded 71 project files (consisting of 990 properties) into the project database. Approximately two-thirds, 625 properties, were geocoded through a combination of address matching tasks: (1) matching to previously located properties in the NEMIS database; (2) geocoding using TIGER street data; and (3) matching addresses with geographic coordinates using online services such as MapQuest.

Out of the 625 geocoded buildings, 486 were within an acceptable distance to allow mapping in the FEMA Q3 digital flood map and the USGS National Hydrography Dataset (NHD) stream data. Several projects were subsequently eliminated from the analysis because of insufficient data. A final selection of 483 properties corresponded to 22 grants. For each flood project, only properties that matched all the above criteria were analyzed for direct property damage.

The number of geocoded properties within the acceptable distance in a single grant ranged from 1 to 133, with a mean of 42 and a standard deviation of 33. The property benefits realized for grants range from $0.19 to $1.1 million. The average benefit per property ranged from $0.13 to $0.74 million, with an average benefit of $0.28 million, and a standard deviation of $0.14 million. The only significant outlier was the acquisition of a school, with a total benefit of $18.7 million.

Grants for flood acquisition projects also reduce the societal impacts of flooding by reducing injuries to the residents of the properties. For the flood project grant stratum, 22 grants had enough data to estimate casualty reduction benefits. The grants varied in size, with some mitigating many properties and others only a few. Overall, buying these properties reduced approximately 68 injuries for a total benefit of $12.3 million. On average, the 22 grants have a mean benefit of $0.56 million and standard deviation of $0.85 million. The large standard deviation for flood project grants results from the large grant size range.

The majority of the grants in the flood project grant stratum were for residential structures that had experienced repeated flooding. Costs associated with residential flooding included displacement costs for the families to relocate while their homes underwent repair. By buying out repeatedly flooded properties, mitigation activities reduced displacement expenditures. Twenty two sampled grants included sufficient information to estimate displacement costs. The total sampled stratum benefit is $2.3 million.

Sixteen of the flood mitigation grants yielded environmental benefits, and none yielded historical benefits. Fourteen of the environmental benefits pertained to establishing wetlands following the removal of structures, rather than direct environmental benefits of reduced flooding per se. The environmental benefits of these grants were estimated by applying wetland values from the literature to each acre created. Conservative assumptions were made about the wetland acreage created for each property purchased, the percentage of these acres that actually function as wetlands, and the number of years that the acreage would function as such. Strictly speaking, these are side effects of mitigation, rather than intended consequences. This analysis could have listed them as offsets to mitigation costs, but it is less confusing to list them under benefits.

The grant with the highest environmental benefit was for the purchase and removal of 262 flooded properties (approximately $0.32 million), while the lowest benefit was for the purchase and removal of one flooded property (approximately $6,000). The average environmental benefit associated with these 16 grants is nearly $96,000.

The total of all benefits realized for each grant ranged from $0.19 to $116.5 million, with a standard deviation of $27.3 million. The high standard deviation is directly attributable to the differences in the number of acquisitions.

All individual flood grants had benefit-cost ratios greater than 1.0, with an average benefit-cost ratio of 5.1, a minimum of 3.0, a maximum of 7.6, and a standard deviation of 1.1.

Sampled Grants for Process Mitigation Activities

Process grants do not yield benefits themselves, but rather provide the basis for subsequent mitigation action. The benefits estimated here reflect only a portion of eventual benefits, the cost of which is often borne by nonfederal government agencies or the private sector. The essence of the process benefit estimation procedure is that process grants have the same benefit-cost ratio as the eventual mitigation activities that they inspire. The analysis was based on what we call the "surrogate benefit" approach. While this study relies predominately on standard applications of benefit estimate transfer, the application of this approach to estimating the benefits of grants for process mitigation activities, however, stretches this method to its limits because there are no studies that measure the benefits of process activities. Studies of the implementation of process activities in related areas, or surrogates, (e.g., radon risk communication) were used instead.

Only the following three major types of process grants were evaluated:

- Information/warning (risk communication);
- Building codes and related regulations; and
- Hazard mitigation plans.

These three types of grants accounted for more than 85% of all process grants.

Grants for Earthquake Process Mitigation Activities

Twenty earthquake grants for process mitigation activities were evaluated. The average benefit-cost ratio of the sample is 2.5. Benefit-cost ratios for individual grants ranged from 1.1 for an engineering task force, to 4.0 for several grants for hazard mitigation plans and building codes. The surrogate benefit methodology analyzes each grant in its entirety and does not separate out the different types of benefits as was done for grants for project mitigation activities. The methodology does not lend itself to the calculation of the standard deviation of benefit-cost ratio, so that figure was omitted here. The majority of grants for earthquake process mitigation activities are for mitigation plans and improvement of building codes and regulations. The only grant for information activities was for vulnerability evaluations.

Grants for Wind Process Mitigation Activities

Twenty-one wind-related grants for process mitigation activities were evaluated. The average benefit-cost ratio is 1.7. Individual grant benefit-cost ratios ranged from 1.1 for risk communication grants to 4.0 for code development. Ten of the grants in this stratum were for hazard mitigation plans, and nine were for risk communication activities. The standard deviation of benefit-cost ratio was omitted because the surrogate benefit methodology does not lend itself to this calculation.

Grants for Flood Process Mitigation Activities

Only six process grants for flood mitigation activities were evaluated. The small number reflects the fact that the majority of flood hazard process grants originally sampled were Project Impact grants, which were subsequently dropped from the benefit-cost analysis of FEMA grants study component because sufficient data for performing a complete analysis were lacking in the grant files. The average benefit-cost ratio for this stratum is 1.3, with little variation across individual cases. Five of the six process grants were mitigation plans and the other was for streamlining a building permit process. Again, the standard deviation of benefit-cost ratio for process grants was omitted.

Summary of Results for Process Mitigation Activity Grants

A conservative estimate of the benefit-cost ratio for most process grants dealing with mitigation planning is about 1.4 (see MMC 2005, Chap. 4). This estimate is based on the Mecklenburg (Canaan 2000) studies, the study by Taylor et al. (1991), and the URS Group (2001) report, which is most applicable to multihazard planning grants. For grants for activities involving building codes a conservative estimate is higher than for multihazard planning grants, at a value of approximately 4. This estimate is an average based on the lower end of benefit-cost ratios provided in the studies by Taylor et al. (1991), Porter et al. (2006), and Lombard (1995). The estimate is likely conservative because of the very wide range of potential benefit-cost ratios estimated for actual adopted building codes and savings in property damage from hurricanes of different size categories, including a few very high benefit-cost ratios for building codes (Lombard 1995). With regard to a grant for seismic mapping, another estimate to confirm this range for the benefit-cost ratio is 1.3 based on the Bernknopf et al. (1997) study of the value of map information, which assumes that property value changes fully capitalize the hazard disclosure effects via the housing market.

Grants for building code activities likely will have a larger benefit-cost ratio than grants for information/warning and hazard mitigation plan activities. If a grant is inexpensive, it is quite likely that its net benefits will be positive, based on the Litan et al. (1992) study of earthquake mitigation, which found average benefit-cost ratios of about 3. Therefore, any small grant for process activities that does not have negative consequences in obtaining mitigation will only slightly raise costs and, therefore, only slightly reduce the benefit-cost ratios in this category. As Lombard (1995) notes, the benefit-cost ratio in some cases (e.g., smaller homes), and some hurricane categories (on a scale of 1–5), could be very large. An example is a benefit-cost ratio of 38 for anchorages for a Category 2 hurricane. Lombard's ratios are based on actual costs of mitigation, not related to grants per se, and there is no way to know how the probability of adopting specific building codes is changed by the grant.

Based on logic and effectiveness found in other contexts (Golan et al. 2000), there is reason to believe that grants for process mitigation activities provide positive net benefits in many

Table 2. Scaleup of Results to All FEMA Grants (All $ Figures in 2004 Constant Dollars)

	Project grants			Process grants			
	Quake	Wind	Flood	Quake	Wind	Flood	Total
Sample grant count	25	42	22	20	21	6	136
Sample grant benefit ($M)	365	219	388	93	44	2	1,111
Population grant count	347	1,190	3,404	48	382	108	5,479
Population grant cost ($M)	867	280	2,204	80	94	13	3,538
Population grant benefit ($M)	1,194	1,307	11,172	198	161	17	14,049
Total benefit-cost ratio (BCR)*	1.4	4.7	5.1	2.5	1.7	1.3	4.0
Sample standard deviation of BCR	1.3	7.0	1.1	n.a.[a]	n.a.[a]	n.a.[a]	n.a.[a]

[a]n.a.=not applicable because of estimation method used.

situations. Project mitigation activities in many cases would never take place if a process activity had not generated the initial plan or building code that led to implementation. A common sense conclusion is that when net benefits from mitigation in a particular category, exclusive of a grant for process activities, are large then a small grant certainly cannot reduce the net benefits by much; hence, any grant in that category is likely to be positive.

Several caveats are warranted. First, in the literature search, no studies were found that specifically and clearly estimated the benefits of a hazard mitigation process activity. To estimate process activity benefits would require knowledge of how the probability of decision makers adopting a mitigation strategy changed after implementation of a process activity. Possible key differences have been noted between radon risk communication and a natural hazard risk warning. In general, the information that is available, even for conventional natural hazards, largely pertains to benefits and costs for mitigation projects or mitigation costs in general, i.e., not related to any grant activity. Second, there is still not enough information in the literature on the effectiveness of process activities to induce adoption of a mitigation action to generalize in the above categories. Last, there is regional variation in rates of adoption of mitigation practices because of differences in conditions, experience, and perceptions (see the community studies discussion in MMC 2005; Chap. 5).

Extrapolation of Sample Results to Population

The results presented in previous sections were scaled to the population of grants using the following approach. Let i denote an index for a grant, j denotes an index for a stratum (e.g., earthquake project grants), C_j denotes the total cost for all grants in that stratum, N_j denotes the number of grants in the sample for that stratum, b_i denotes the estimated benefit of sample grant i (in stratum j), and c_i denotes the recorded cost for the sample grant. Then B_j, the benefit from stratum j, is estimated as

$$B_j = \frac{C_j}{N_j} \sum_{i=1}^{N_j} \frac{b_i}{c_i} \quad (1)$$

Table 2 presents the results. It indicates that the present value discounted benefits for grants for FEMA hazard mitigation activities between mid-1993 and mid-2003 is $14.0 billion. This is juxtaposed against grant costs of $3.5 billion, for an overall benefit-cost ratio of 4.0. Table 2 also summarizes the calculation of stratum benefit-cost ratios. The benefit-cost ratios for project mitigation activities in descending order, are 5.1 for flood, 4.7 for wind, and 1.4 for earthquake. Benefit-cost ratios are the reverse order for grants for process mitigation activities, with 2.5 for earthquake, 1.7 for wind, and 1.3 for flood.

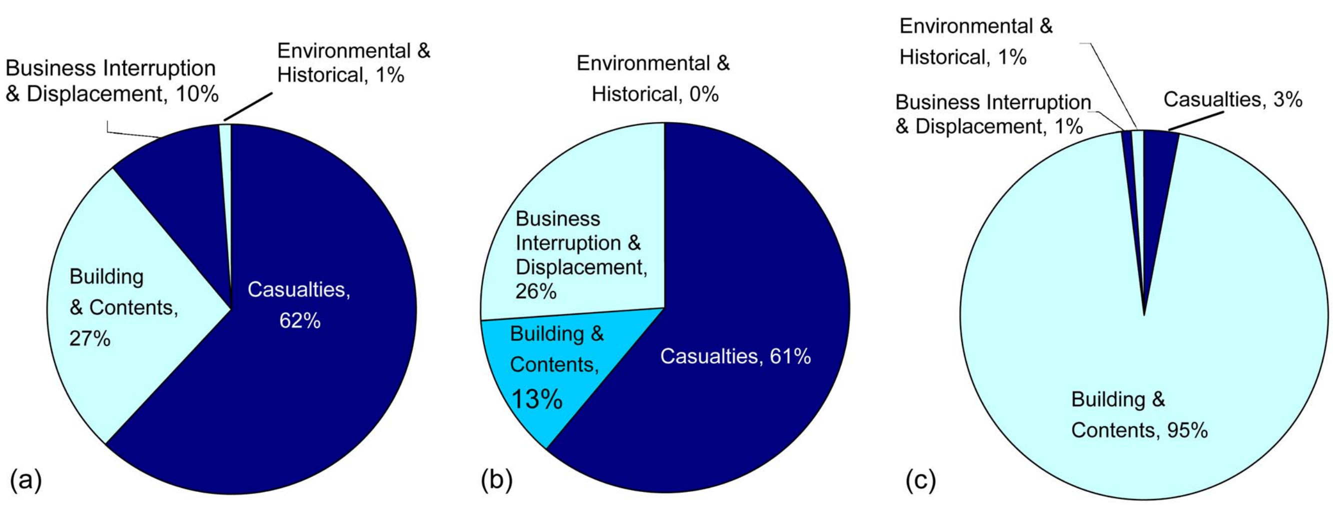

Fig. 1. Contribution to benefit-cost ratio by factor for: (a) earthquake; (b) wind; and (c) flood

Table 3. Summary of Benefits and Costs by Hazard

Hazard	Cost ($M)	Benefit ($M)	Benefit-cost ratio
Earthquake	947	1,392	1.5
Wind	374	1,468	3.9
Flood	2,217	11,189	5.0
Total	3,538	14,049	4.0

As shown in Fig. 1, in terms of contribution to the benefit-cost ratio overall, casualty reduction was by far the dominant factor in earthquake and wind, and avoidance of property damage was the dominant factor in flood. This is attributable to a great extent to the life safety feature of most earthquake, hurricane and tornado project grants, and the property emphasis of flood grants (in addition to the longer warning time for the latter). Given the sample studied, business interruption avoidance was significant in earthquake and wind, but not for flood. This stems from the fact that the vast majority of flood project grants were for buyouts of residences in floodplains. Environmental and historic benefits proved to be very minor in dollar terms, but still do affect a large number of people in each affected community.

Breakdown of Results

The results are summarized by grants for each hazard type in Table 3, which shows that overall, mitigation grants for each hazard have benefit-cost ratios greater than one, with the grants for flood mitigation being the most cost-beneficial (BCR=5.0). Table 4 summarizes the benefit-cost analysis results by major mitigation type. It shows that both project and process activities are cost beneficial, with projects having an average benefit-cost ratio of 4.1, and processes having an average benefit-cost ratio of 2.0. Overall, flood grant benefits (both project and process) represent 80% of the total FEMA grant benefits. Wind and earthquake benefits each represent approximately 10% of the total.

In assessing the results, recall that grants for process activities (including Project Impact) represent only 10% of the total number of FEMA grants in the NEMIS database (the total population). Moreover, they represent only about 5% of the total FEMA grant expenditures nationwide. As shown in Table 4, process grant benefits represent 2.7% of FEMA grant total benefits to the nation. This is consistent with the result that the benefit-cost ratio for project grants is estimated to be twice as high as for process grants.

Deaths and Injuries

Table 5 highlights the reduction of casualties as a result of the mitigation activities conducted under the grants in the sample and for the entire population of grants. Because the NEMIS database does not include data on the number of people affected by each grant, it was necessary to estimate reduction in casualties for the population of grants using grant costs. Total reduced casualties among the population of grants is estimated as the reduction among the sample grants times the ratio of population cost to sample cost.

Table 4. Summary of Benefits and Costs by Mitigation Type

Type	Cost ($M)	Benefit ($M)	Benefit-cost ratio
Project	3,351	13,673	4.1
Process	187	376	2.0
Total	3,538	14,049	4.0

Table 5. Estimated Reduction in Casualties by Grants for Both Project and Process Mitigation Activities

	Injuries	Deaths
Earthquake sample	542	26
Population	1,399	67
Flood sample	63	0
Population	1,510	0
Wind sample	275	24
Population	1,790	156
Total samples	880	50
Population total	4,699	223

Mitigation grants in the population of FEMA grants will prevent an estimated 4,699 injuries and 223 deaths over the assumed life of the mitigation activities, which in most cases is 50 years. As illustrated in Table 5, grants for wind mitigation activities will prevent the most injuries (1,790) and the most deaths (156). As with any casualty figures, these estimates require caution, as they are based on a scientifically sound methodology, but are difficult to validate because of limited available empirical data. The grants examined not only benefit society by reducing financial expenditures, but also, and equally as important, reduce associated stress and family interruption. While consideration was not able to be given to the financial benefit of these reductions, they are an important component of the benefit of mitigation.

Net Benefits to Society

The overall benefit to society for all 5,479 grants is approximately $14.0 billion, and the cost to society is $3.5 billion. The net benefit to society of FEMA-funded mitigation efforts is thus $10.5 billion, which includes the financial benefits and dollar-equivalent benefit of saving 223 lives and avoiding 4,699 nonfatal injuries.

Interpretation of Results

Benefit-cost ratios vary significantly across hazards. One major reason is that the type of avoided damage differs significantly between earthquakes, hurricanes, tornados, and floods. For example, 95% of flood benefits are attributable to avoided losses to structures and contents, and only 3% is for casualty reduction, as opposed to casualty reductions slightly over 60% each for the cases of earthquake and wind hazards. The cost effectiveness of measures to reduce property damage from frequent flooding is higher than that for reducing casualty in the wind and earthquake grants sampled in our study. This is in part because of the lower variability of factors affecting structures (which are of a fixed location, size, etc.) than of casualties (where occupancy rates vary by time of day), thereby making it harder to protect the latter. For example, mitigation grants to replace pendant lighting in schools provide potential protection but did yield actual benefits only for earthquakes that occur during hours when the buildings are occupied. In a similar vein, a higher proportion of wind mitigation grants is for the purpose of reducing the vulnerability of electric utilities to hurricane and tornado winds, than is the case for earthquakes. The largest individual grant benefit-cost ratios found in our study stemmed from reduced business interruption associated with damage to utilities.

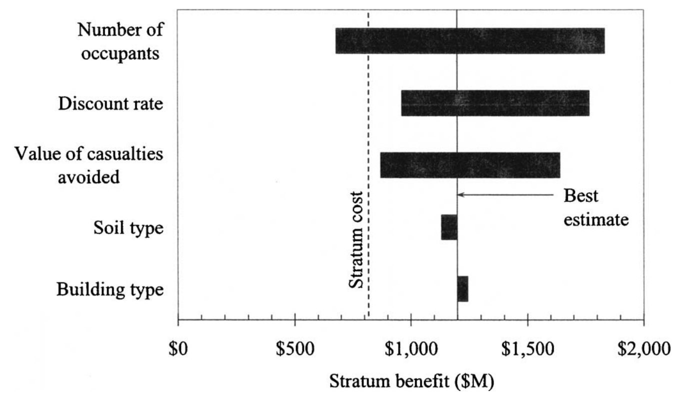

Fig. 2. Sensitivity of benefit to uncertainties (grants for earthquake project mitigation activities)

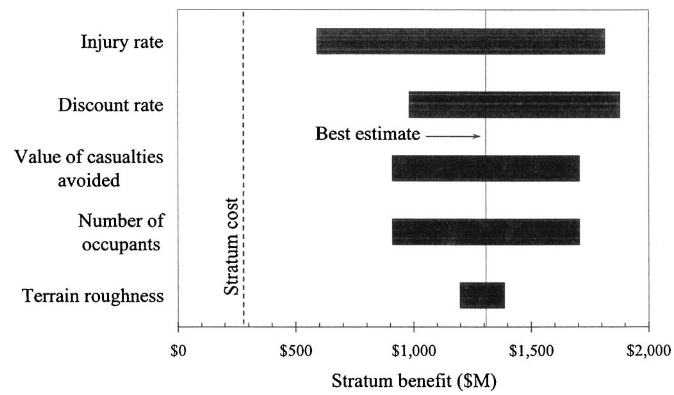

Fig. 3. Sensitivity of benefit to uncertainties (grants for wind project mitigation activities)

Flood mitigation grants have a higher probability of success, and hence a higher benefit-cost ratio because they pertain to properties with known histories of vulnerability in the heart of floodplains, and recurrence of floods in a given location is much more certain than for other hazards. Given that process mitigation grants have lower benefit-cost ratios than project mitigation grants across all hazard categories, the fact that process grants represented only 0.15% of total flood project mitigation benefits, in contrast to 1.2% of wind mitigation grant benefits, kept the flood process mitigation grants from pulling down the overall flood BCR as much as they did for overall wind benefit-cost ratio.

When considering why the BCRs for earthquake mitigation are lower than flood and wind mitigation, one must consider policy emphases (i.e., California's earthquake mitigation priorities and FEMA's flood mitigation priorities) and hazard probabilities. Most of the sampled earthquake grants were from California, where the state's priorities emphasized reducing casualties, and making schools and hospitals safer and more reliable. Local priorities emphasized retrofit of city-owned emergency facilities and administrative buildings. The bulk of earthquake grants went to school districts for nonstructural mitigation intended to reduce casualties, and government agencies for government-owned buildings, only a few grants had business interruption implications. Because seismic codes with seismic provisions have been followed for decades in California, these buildings are not too vulnerable to the less intense earthquakes estimated to occur with the frequency associated with floods (within the 100-year recurrence areas). Earthquake mitigation is motivated by concern for preventing casualties from large magnitude low probability earthquakes, not smaller frequent earthquakes. Earthquake retrofit projects reduce, but do not eliminate vulnerability to these rare events, so the increment of avoided physical damage is small.

This situation differs for flood mitigation, where many of the grants are to remove private structures from the 100-year or more frequent return hazard area (repetitive loss areas). Mitigation often eliminates flood damage except in the very large events, but our study placed less consideration on events that recurred less frequently than once in 100 year.

Our study found BCRs for grant activities related to electric utility mitigation projects to be much higher for wind than for earthquake. However, this is due to the higher prevalence of publicly owned utilities in areas relatively more vulnerable to wind hazard than in high-risk earthquake zones (as well as the idiosyncratic nature of an earthquake project grant in our sample oriented toward life safety). However, *potential* BCRs of future mitigation projects for public and private electric utilities are similar between wind and earthquake. Any comparison between BCRs must also consider these policy decisions and background conditions, in order to avoid mistaken generalizations that some hazards and mitigation types will always produce higher BCRs.

BCA focuses on the aggregates of benefits and costs, but their distribution is also important from a public policy standpoint (see, e.g., Rose and Kverndokk 1999). There are often large disparities in losses from natural hazards, with disadvantaged groups often bearing a disproportionate share, as dramatized most recently by the impacts of Hurricane Katrina. Thus, mitigation in general is likely to benefit lower income and other disadvantaged groups. Unfortunately, data were not available to evaluate the distribution of benefits across socioeconomic groups for grants in this study, and are generally not readily available for most mitigation activities.

Sensitivity Analysis

Uncertainties in the loss-estimation procedure lead to uncertainty in the estimated benefit. For this reason, it is reasonable to question how robust the results are to these uncertainties, i.e., how confident can one be that benefits exceed cost? Sensitivity analyses were performed on the analysis parameters that were judged most likely to most strongly influence the results. Figs. 2–4 illustrate how making different assumptions about each of these parameters affects the total estimated benefit for those that revealed

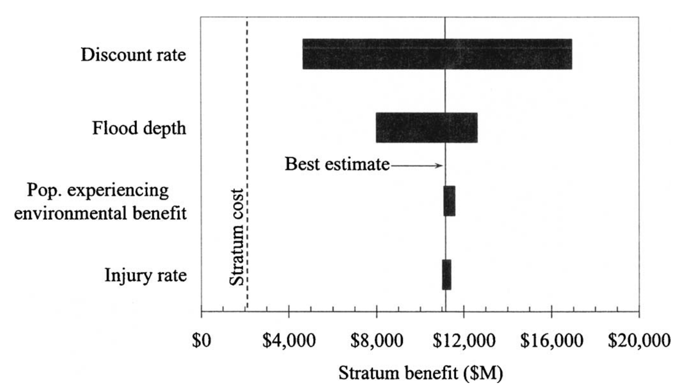

Fig. 4. Sensitivity of benefit to uncertainties (grants for flood project mitigation activities)

the greatest range of sensitivities. (Tests were performed on the sample, and the results applied to the population.) In each figure, there is a solid vertical line that represents the baseline (best) estimate of total benefit for all mitigation grants for that hazard. There is a dashed vertical line that represents the total cost for mitigation grants for that hazard.

Each black bar in the diagram reflects what happens to the total population estimated benefits for that hazard if one parameter (number of occupants, discount rate, etc.) is changed from a lower-bound to an upper-bound value. A longer bar reflects greater sensitivity of benefit to that parameter. Here, the "lower-bound" and "upper-bound" values are estimates of the 4th and 96th percentile values of the parameter in question for reason having to do with a subsequent mathematical procedure. In the case of the discount rate, the values shown are for 0% (higher benefit) and 7% (lower benefit). The parameters are sorted so that the longest black bar—the one for the parameter to which the benefit is most sensitive—is on top, the next most sensitive is second from the top, etc. The resulting diagram resembles a tornado in profile, and is called a tornado diagram.

The diagram does two things: first, it shows the conditions under which benefit exceeds cost. For example, Fig. 2 shows that benefit exceeds cost even if the discount rate is set to its upper bound (7%). Second, the baseline benefit and the values of benefit at the ends of the bars can be used to estimate the parameters of a probability distribution of total nationwide benefit. These parameters include the mean and standard deviation of total benefit, among others. To calculate them, a mathematical procedure called an "unscented transform" was used (Julier and Uhlman 2002). This procedure allows one to estimate the moments of a probability distribution of an uncertain output variable that is itself a deterministic function of one or more uncertain input variables. In the present application, the total nationwide benefit was treated as the output variable that is a function of the input uncertainties shown in Fig. 2. The sample points used in the unscented transform are the baseline benefit and the ends of the bars in Fig. 2. Note that the unscented transform produces a slightly different expected value of benefit than the baseline figure.

Results

Grants for Earthquake Project Activities

Results for earthquake project mitigation benefits are illustrated in Fig. 2. In the figure, the solid vertical line at $1.2 billion reflects the baseline benefit for earthquake project grants; the dashed line at $0.87 billion represents the cost of those grants. Total benefit is most strongly sensitive to number of occupants, then to discount rate, then to value of casualties. Notice that the only bar that crosses below the cost of mitigations is the first one, number of occupants. In all other cases, benefits exceed costs.

Using the unscented transform, it was found that the expected value of benefit from earthquake mitigation grants is $1.3 billion (approximately the same as the baseline figure of $1.2 billion). The standard deviation of benefit is $470 million. Assuming that benefit is lognormally distributed, the ±1 SD bounds of benefit are $850 million and $1.7 billion. Benefit exceeds cost with 0.83 probability. The expected value of benefit-cost ratio is 1.5, approximately the same as the baseline value of 1.4.

A word of caution regarding the comments about the probability that benefit exceeds cost. According to standard benefit-cost analysis, earthquake project grants are cost effective, because under baseline conditions, benefit exceeds cost by a ratio of 1.4:1. The additional diagram analysis merely acknowledges that the estimated benefit is uncertain, and that under most reasonable assumptions, benefits still exceed cost. Considering these uncertain parameters, earthquake projects are estimated to save $1.40 in reduced future losses for every $1 spent.

Grants for Wind Project Mitigation Activities

Fig. 3 shows the diagram for grants for wind project mitigation activities. In all cases, the benefit exceeds the cost. Wind project benefits are approximately equally sensitive to injury rate, discount rate, value of casualties, and number of occupants. The expected value of benefits is $1.3 billion, and the standard deviation is $560 million. Assuming a lognormal distribution, the ±1 SD bounds of benefit are $800 million and $1.8 billion. There is greater than 99% probability that the "true" benefit exceeds the cost, despite the uncertain parameters examined here. The expected value of benefit-cost ratio is 4.7. That is, every $1 spent on wind project grants is estimated to save almost $5.

Grants for Flood Project Mitigation Activities

Fig. 4 shows the diagram for grants for flood project mitigation activities. These benefits are more sensitive to discount rate than to uncertainties in flood depth. In all cases, the benefit exceeds the cost, i.e., under all reasonable assumptions about the values of these parameters, flood project grants are estimated to be cost effective. The expected value of benefit is $11 billion, and the standard deviation is $3.8 billion. Assuming lognormal distribution, the ±1 SD bounds of benefit are $7 and $15 billion. There is greater than 99% probability that the "true" benefit exceeds the cost, despite uncertainties in the parameters examined in this study. The expected value of the benefit-cost ratio is 4.8. That is, every $1 spent on flood project grants is estimated to save almost $5.

Other Sensitivity Analyses

Sensitivity analyses were not performed for direct business interruption for two reasons. First, direct business interruption estimates were derived to a great extent from direct property damage. Although not perfectly correlated, further sensitivity analyses would probably have been redundant. Second, there were few factors that could be subjected to sensitivity analysis of direct business interruption in HAZUS MH. Sensitivity analyses were performed for indirect business interruption with respect to the regional economy unemployment rate (as a proxy for excess production capacity). The analysis indicates that the overall stratum benefit-cost ratios are not sensitive to this parameter because of the small number of cases where business interruption was applied, the small size of indirect business interruption in all cases (except the few mitigation grants affecting utilities), and the narrow variation in this parameter.

Excess capacity is one of several sources of resilience Rose (2004a) to disasters factored into this study (recall the discussion in "Sampled Grants for Project Mitigation Activities"). Another is the "recapture factor" (the ability to make up lost production at a later date), which is automatically included in the HAZUS MH direct economic loss module (DELM). This recapture factor was also included in the HAZUS MH extension for utilities developed in this study, and in fact the recapture factor for services was increased in line with the study's conservative assumptions. Other aspects of resilience pertained to inventories, import of goods for which there is a shortage, and export of surplus goods. These were automatically computed in the HAZUS MH indirect economic loss module (IELM). Resilience effects were not separated out, because that was not the focus of this study. HAZUS MH default values were used for these parameters (inventories, import, and export of goods) and sensitivity analyses were not undertaken because HAZUS MH import and export resilience factors only affect indirect business interruption, which was relatively minor, and because inventories were not a factor in nearly all of the cases where direct business interruption was large (e.g., electricity cannot be stored). It was assumed that hospital inventories would not be significantly affected by most disasters, given the tendency of hospitals to place priority on this feature and to have emergency plans in place to meet shortages. This results in a narrow range in possible inventory holdings.

Combining Sampling Uncertainty and Modeling Uncertainty

Since the total benefit of FEMA grants is uncertain, it is useful to quantify and combine all important sources of uncertainty. This information can then be used to calculate two interesting considerations: (1) a probabilistic range for the total benefit of FEMA grants for each hazard; and (2) the probability that the "true" benefits exceed the cost. The uncertainty in total benefit of FEMA grants results from two principle sources:

1. *Sampling uncertainty*. Total benefits are uncertain because they are estimated from a sample (a subset) of FEMA grants, not the entire population of them. Here, sampling uncertainty is quantified in Table 3, via the sample standard deviation of the benefit-cost ratio.
2. *Modeling uncertainty*. Total benefits are uncertain because a mathematical model of benefits has been created and applied, and that mathematical model has its own uncertain parameters. For this report, modeling uncertainty is quantified in "Sample Results," via the standard deviation of benefit.

As detailed in MMC (2005; Appendix R), these two sources of uncertainty are combined to estimate overall uncertainty in benefit of FEMA grants. The following two observations are made:

1. Modeling uncertainty dominates total uncertainty so a larger sample would not significantly improve the accuracy of the estimated benefits; and
2. The results reaffirm the observation that grants for project mitigation activities produce benefits in excess of costs with high probability for all three hazards.

Conclusions

Congress requested that an independent study determine savings from FEMA-funded mitigation activities. In response, this study determined that the present value discounted net benefits to society from 5,479 FEMA grants between mid-1993 and mid-2003 for flood, wind, and earthquake hazard mitigation is $10.5 billion. The gross benefits are approximately $14.0 billion, and the cost to society is $3.5 billion. The benefit-cost ratios for these grants average 4.0. Thus, Americans benefited greatly from FEMA's investment in mitigation.

The benefits of mitigation include improved public safety. The projects funded by the grants will prevent an estimated 4,699 injuries and 223 deaths over the assumed life of the mitigation activities, which in most cases is 50 years. Also, another part of the study involving mitigation activities in eight communities confirmed the results from the statistical study of individual grants and found that additional benefits also accrue, some of which were not valued in monetary terms (MMC 2005, Chap. 7).

The study results are robust and reliable. They were tested for sensitivity to reasonable analytical variables.

The results of this study have numerous implications, some of which include:

1. Federal investments in mitigation benefit society. Societal benefits of grants made between 1993 and 2003 were four times greater than the cost;
2. The benefits from mitigation grants are greater than just the benefits that can be measured and valued in monetary terms;
3. Both project- and process-type mitigation activities have benefit-cost ratios exceeding 1.0. However, project mitigation activities in many cases would never take place if a process activity had not generated the initial plan or building code that led to implementation;
4. Deeper insight into the cost effectiveness of hazard mitigation project grants could be attained by developing and implementing a formal procedure to assess the performance of buildings and infrastructure after all types of disasters; and
5. Although this study did not specifically assess the combined benefits of mitigation activities across all hazards, the methodology could be adapted to do so. This could help government agencies responsible for providing mitigation to utilize an even more cost-effective all-hazards mitigation strategy.

Acknowledgments

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Table 6. Methods Used to Estimate Benefits for Grants for Project Mitigation Activities

	Hazard			
		Wind		
Benefit type	Earthquake	Hurricane	Tornado	Flood
Property damage	HAZUS MH	HAZUS MH	HAZUS MH reduced form	HAZUS MH reduced form
Business interruption				
Utilities	HAZUS MH extension[a]	HAZUS MH extension[a]	HAZUS MH extension[a]	n.a.[b]
Other	HAZUS MH	HAZUS MH	HAZUS MH	n.a.[b]
Displacement	HAZUS MH[c]	HAZUS MH[c]	HAZUS MH extension[a,c]	HAZUS MH extension[a]
Casualty[d]				
Structural	HAZUS MH	Benefit transfer	HAZUS MH reduced form[e]	Benefit transfer
Nonstructural	Benefit transfer	n.a.[f]	n.a.[f]	n.a.[f]
Environmental and historical	Benefit transfer	Benefit transfer	Benefit transfer	Benefit transfer

Note: A "surrogate benefit" method was used to estimate all benefit categories for process activities (Section 4.3.5 and Appendix K).

[a]Extension refers to a method that builds on HAZUS MH with a similar and compatible approach.

[b]None of the sampled flood projects involved business interruption.

[c]Measured as part of business interruption.

[d]Also includes emergency services benefits.

[e]Reduced form refers to the use of component parts, such as functional relationships and data, from a HAZUS MH module.

[f]Only relevant to earthquakes.

Appendix I. Benefit Estimation Methods

Overview

Table 6 summarizes the methods used for each hazard and benefit type (avoided loss). HAZUS MH, in various forms, was the predominant method. "HAZUS MH extension" refers to methods developed expressly for this study to fill in a gap in the tool (e.g., its application to determining the full range of direct business interruption losses from lifeline failures as well as indirect business interruption losses). "HAZUS MH reduced form" refers to the use of various data and functional relationships from HAZUS MH (e.g., data and damage functions relating to flooding). More details of these adaptations of HAZUS MH can be found in the appendices of MMC (2005).

HAZUS MH

HAZUS MH is built on an integrated GIS platform that estimates losses due to earthquake, flood, and hurricanes. The software program is composed of seven major interdependent modules. The connectivity between the modules is conceptualized by the flow diagram in Fig. 5. The following discussion provides a brief description of each module; detailed technical descriptions can be found in the *HAZUS MH technical manuals* (NIBS and FEMA 2003a, c, 2003b).

Potential Hazards (1)

The potential-hazards module estimates the expected intensities or hazard severities for three hazards: earthquake, flood, and hurricane. For earthquake, this would entail the estimation of ground motions and ground failure potential from landslides, liquefaction, and surface fault rupture. For flood, this involves the estimation of flood heights or depths. For hurricane, this entails the estimation of wind speeds. For a probabilistic analysis, the added element of frequency or probability of occurrence would be included.

Inventory Data (2)

A national-level exposure database is built into HAZUS MH, which allows the user to run a preliminary analysis without having to collect additional local information or data. The default database includes information on the general building stock, essential facilities, transportation systems, and utilities. The general building stock data are classified by occupancy (residential, commercial, industrial, etc.) and by model building type (structural system, material of construction, roof type, and height). The default mapping schemes are state-specific for single-family dwellings and region-specific for all other occupancy types. In all cases, they are age and building-height specific.

Direct Damage (3)

This module estimates property damage for each of the four inventory groups (general building stock, essential facilities, transportation, and utilities), based on the level of exposure and the vulnerability of structures at different hazard intensity levels.

Induced Damage (4)

Induced damage is defined as the secondary consequence of a disaster event on property. Fire following an earthquake and accumulation of debris are examples.

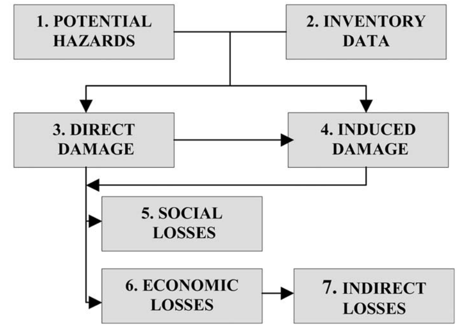

Fig. 5. HAZUS MH modules

Societal Losses (5)
Societal losses are estimated in terms of casualties, displaced households, and short-term shelter needs. The casualty model provides estimates for four levels of casualties (minor injuries to deaths), for three times of day (2:00 a.m., 2:00 p.m., and 5:00 p.m.), and for four population groups (residential, commercial, industrial, and commuting). The number of displaced households is estimated based on the number of structures that are uninhabitable, which is in turn estimated by combining damage to the residential building stock with utility service outage relationships.

Economic Losses (6)
Direct economic losses are estimated in terms of structural and nonstructural damage, contents damage, costs of relocation, losses to business inventory, capital-related losses, wage and salary income losses, and rental losses.

Indirect Economic Losses (7)
This module evaluates region-wide ("ripple") and longer-term effects on the regional economy from earthquake, flood, and wind losses. Estimates provided include changes in sales, income, and employment, by industrial sector.

The various modules of the HAZUS MH software have been calibrated using existing literature and damage data from past events. For earthquake, two pilot studies were conducted several years ago for Boston and Portland, Ore., to further assess and validate the credibility of estimated losses. A similar testing and validation effort was conducted for flood and hurricane wind.

Appendix II. Assumptions

Following are the most significant assumptions of our analysis. They were necessitated by a combination of standard practices, data limitations, and computational manageability.

1. *Risk neutrality*. This is a standard assumption of benefit-cost analysis;
2. *Meaning of benefits and costs*. Benefits were taken as the present value of reduced future losses. Costs were taken as the expected present value of the cost to undertake a mitigation measure. Some categories were ignored, such as facility operation and maintenance costs. Intangible (nonmarket) costs of mitigation could not be quantified;
3. *Implementation effectiveness*. We assume that each mitigation activity is fully implemented at maximum effectiveness;
4. *Accuracy of HAZUS MH*. While its accuracy remains to be fully proven, HAZUS MH represents the only available national standard multihazard loss-estimation tool. The complete HAZUS MH flood loss module was not ready for use, although its damage functions were used;
5. *HAZUS MH default values*. Several were used, most notably, relocation costs, repair duration, building recovery time, rental income, and recapture factor, import and export capability, restoration of function, rebuilding pattern, and inventory demand and supply;
6. *Time value of money*. Future economic values were brought to present value at time-constant discount rates of 2%, and results were sensitivity tested to discount rates between 0 and 7%;
7. *Inflation adjustment*. All dollar values of past costs were adjusted to January 1, 2002, terms using the consumer price index;
8. *Planning period*. Property mitigations were assumed to be effective for 50 years for ordinary structures and 100 years for important structures and infrastructure, regardless of property age;
9. *Accuracy of FEMA data*. Data in the NEMIS and grant applications were assumed to be correct, subject to some limited quality control;
10. *Accurate soil data*. U.S. Geological Survey and California Geologic Survey soil maps were assumed to be accurate;
11. *Value of avoided statistical deaths and injuries*. Avoided statistical deaths and injuries were valued using FHwA (1994) figures, brought to 2002 constant dollars, but not time discounted;
12. *Constant hazard*. Hazard levels were assumed to be time invariant;
13. *Direct business interruption*. These losses were not applied to residences;
14. *Indirect business interruption*. These losses were not applied to residences, schools, libraries, hospitals, and fire houses;
15. *Excess capacity*. The unemployment rate was used as a proxy;
16. *Boundaries of regional economies for indirect business interruption loss estimation*. Regional economies were delineated by the boundaries of the county or county group incurring physical damage, although most economic regions, or trading areas, do not conform precisely to political boundaries;
17. *Regional input-output (I-O) tables*. The HAZUS MH I-O algorithm is superior to standard I-O formulations, but retains the limitations of the lack of input substitution and the absence of the explicit role of prices; and
18. *No interaction between grants*. The analysis assumed no interaction between mitigation efforts.

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Flood Maps

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2

Flood Mapping and Flood Insurance

People have always settled near rivers and coasts, but population growth and the commensurate expansion of the built environment have increased their risk of losses to flooding over time. From the mid 1930s to the late 1960s, the federal government dealt with flood hazard primarily by building flood control structures, such as dams and levees. Flood insurance was not available because (1) the people most likely to buy it were those most prone to flooding, which meant that private companies could not profitably provide coverage at an affordable rate,[1] and (2) existing data about flood extent were insufficient to accurately assess flood risk.

Escalating flood losses and disaster relief costs, particularly the widespread damage caused by Hurricane Betsy, led to the creation of the National Flood Insurance Program (NFIP) in 1968. The objectives of the NFIP, which is administered by the Federal Emergency Management Agency (FEMA), are to identify and map floodprone communities and to make flood insurance available in communities that adopt and enforce floodplain management regulations (e.g., zoning, building requirements, special-purpose floodplain ordinances). More than 20,400 communities currently participate in the NFIP.[2] Although created for insurance and floodplain management purposes, FEMA's Flood Insurance Rate Maps (FIRMs) are now used for many other purposes, including disaster mitigation, land use planning, and emergency response. This chapter describes how FIRMs are created and maintained and how information technology is used to update and share flood-related data.

[1]The private sector stopped covering flood losses in 1929 after a series of devastating floods, including a 1927 flood of the Mississippi River, which inundated 13 million acres and killed several hundred people. See American Institutes for Research, 2002, *A Chronology of Major Events Affecting the National Flood Insurance Program*, 78 pp., available at <http://www.fema.gov/library/viewRecord.do?id=2601>.

[2]See <http://www.floodsmart.gov/floodsmart/pages/about/community_preparedness_ratings.jsp>.

FLOOD INSURANCE RATE MAPS

Flood Insurance Rate Maps delineate flood hazard areas, identify flood insurance rate zones within these areas, and may show elevation and other data related to flooding. The information that appears on individual maps (and the accuracy of those data) depends on the type of flood hazard (e.g., riverine, coastal) and the way the flood hazard was studied. The primary information portrayed on FIRMs is discussed below.

Flood Hazard Areas

Three types of flood hazard areas are shown on FIRMs:

1. Special Flood Hazard Areas (SFHAs) subject to a 1 percent or greater chance of flooding in any given year (44 CFR 59.1). The 1 percent annual chance flood, also known as the base flood or 100-year flood, is the NFIP standard for regulating new development in the floodplain and determining where mandatory flood insurance coverage is required.

2. Moderate flood hazard areas, including areas subject to a 0.2 percent annual chance (500-year)

flood (44 CFR 64.3) and SFHAs that are either small (drainage areas of less than 1 square mile), expected to flood less than 1 foot, or protected by levees from the 1 percent annual chance flood. Flood insurance is voluntary, although lenders may require flood insurance for structures. In addition, communities may choose to regulate land use and siting of critical services and emergency response facilities in these areas.

3. Areas in which flood hazards are minimal (e.g., less than a 0.2 percent annual chance of flooding) or undetermined, but still possible. These areas are not subject to federal regulations on insurance or land use, although communities and lenders may impose such requirements.

Each of these areas is divided into flood insurance rate zones, which designate the level and type of flood hazard (Box 2.1). The majority of SFHAs are either riverine and lacustrine (area along the shore of a lake or closed water basin) A zones (subject to a 1 percent annual chance flood) or coastal A zones and V zones (subject to storm surge where wave heights for the 1 percent annual chance flood are 3 feet or greater). Moderate flood areas are designated as shaded Zone X, and areas of minimal flood hazard include unshaded Zone X and zones for which flood hazard has not been determined. Example portions of FIRMs showing some of these zones in a riverine area and a coastal area are shown in Figures 2.1 and 2.2.

FEMA's Map Modernization Program was intended to produce digital FIRMs for all of the nation's 1 percent annual chance floodplains, but a midcourse adjustment gave priority to densely populated areas, where more lives and property are at risk (FEMA, 2006a). Risk-related priorities were based on total population, rate of population growth, number of housing units, number of flood insurance policies and claims, number of repetitive loss properties and claims, and number of declared flood disasters. This decision shifted emphasis from the risk of occurrence of a 1 percent annual chance flood to the risk of more significant flood damage.

BOX 2.1 Definitions of the Most Common Flood Insurance Rate Zones

Zone A: Special Flood Hazard Area (SFHA), defined as land subject to a 1 percent annual chance of flooding. The zone is divided into several subtypes, including

- **A (or unnumbered or approximate A)**: SFHA in which detailed analyses were not carried out and the base flood elevation is not shown.
- **AE, A1 through A30**: SFHA in which the water surface elevation has been determined and is shown on the map.

Zone V: Coastal SFHA subject to high velocity wave action from storms or seismic sources. The zone is divided into several subtypes, including

- **V (or unnumbered V)**: Coastal SFHA for which water surface elevations are not shown.
- **V1 through V30, VE**: Coastal SFHA with velocity hazard and water surface elevation determined and shown on the map. The VE designation is replacing the earlier numbered V designations.

Shaded Zone X, Zone B: Area of moderate flood hazard or future conditions flood hazard, generally defined as the 0.2 percent annual chance flood.

Unshaded Zone X, Zone C: Area of minimal flood hazard, commonly understood to have a lower probability of flooding than the moderate hazard area.

The numbers for zones A1 through A30 were determined by computing the difference between the 1 percent annual chance and 10 percent annual chance flood elevation, multiplying by 10, then applying a conversion factor (FEMA, 1983). The process was similar for numbered V zones, although different multiplication and conversion factors were used. Modernized maps have replaced the A1 through A30 designations with an AE designation, and the B and C designations with an X designation.

SOURCE: 44 CFR 59.1 and 44 CFR 64.3.

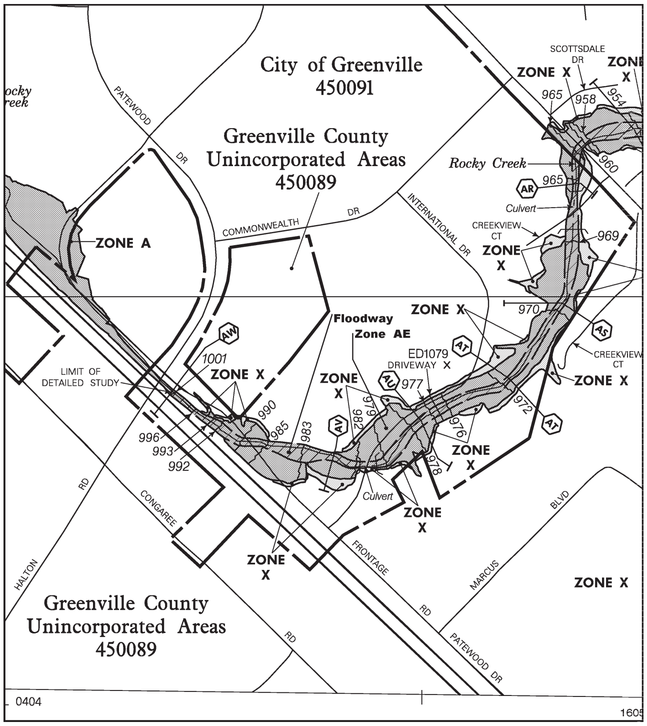


FIGURE 2.1 Extracted image from a paper map (FIRMette) for a riverine area in Greenville, South Carolina. The left side shows an approximate A zone (SFHA, shaded dark gray), where no elevation or floodway information is provided. The right side of the image shows an AE zone (SFHA, shaded dark gray) with lettered cross sections, base flood elevations (wavy lines with elevation), and floodway (hatched area bounded by heavy dashed lines), and a shaded Zone X (moderate flood hazard area, shaded light gray). The other areas are classified as unshaded Zone X (minimal flood hazard). SOURCE: FEMA's Map Service Center, <http://msc.fema.gov/>.

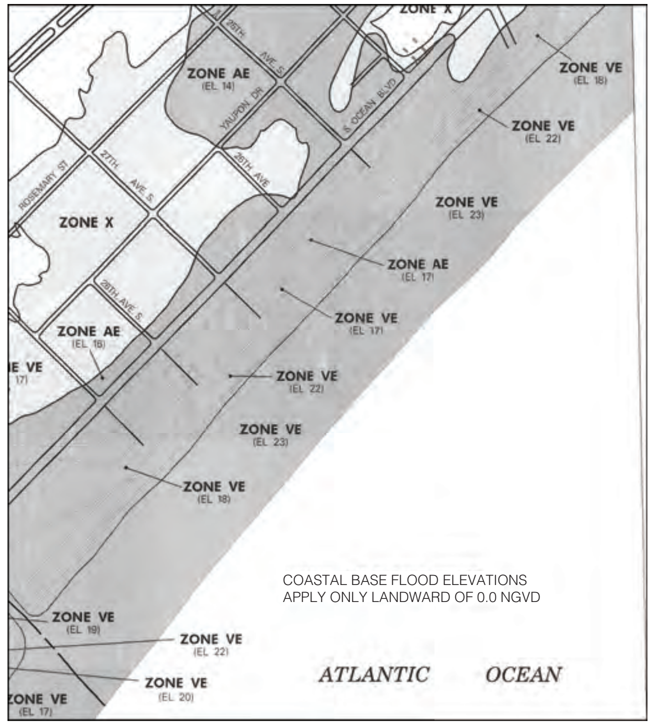


FIGURE 2.2 Example of a FIRMette for a coastal area near Myrtle Beach, South Carolina. The figure shows VE zones (SFHAs subject to coastal wave action) and associated elevations at the point on the ground to which the wave runs up during the 1 percent annual chance flood. Landward, the flood zones transition to Zone AE with their associated base flood elevations. SOURCE: FEMA's Map Service Center, <http://msc.fema.gov/>.

Base Flood Elevations

The base flood elevation (BFE) is the computed elevation of a flood having a 1 percent chance of being equaled or exceeded in a given year (base flood). It accounts for the volume and velocity of water moving through the watershed and reflects the cumulative effects of topography, soils, vegetation, surface permeability, and other factors. The BFE is the regulatory standard for the elevation or floodproofing of structures, and the relationship between the BFE and the elevation of a structure also determines the flood insurance premium. In general, the higher the first floor elevation, the lower the insurance premium. Consequently, the accuracy of BFEs on the flood maps is important for both regulating and insuring properties commensurate with the true risk of flooding.

Despite the importance of accurate BFEs in Special Flood Hazard Areas, in unnumbered A and V zones they are generally only estimated using approximate methods (see "Types of Flood Studies" below), which estimate key variables such as water volume. The determination of flood risk is less certain in these areas, so local communities may require a safety factor (known as freeboard) above the estimated BFE for additional financial protection. However, even where BFEs are established with more certainty, communities may impose freeboard to help protect against damage resulting from multiple 1 percent annual chance floods in a given year or higher than expected flood waters.

Future Hydrologic Conditions

Flood hazard information presented on FIRMs is typically based on conditions in the floodplain and watershed that existed when the map was made. In recent years, however, some growing communities have become interested in projecting how future land use and development in the watershed will affect the extent of the floodplain, and using those projections to regulate floodplain development. In response, FEMA issued a final rule in November 2001 that allows communities the option of showing future conditions floodplains based on land use change on the FIRM, along with the required existing conditions floodplain. The decision about how to use information on future conditions for regulatory decisions is left to the community. FEMA continues to use data on existing conditions for flood insurance purposes and has yet to consider the effects of climate change, long-term erosion of coastal areas, or long-term trends in hydrologic records on the determination of future conditions. By mid-century, the absolute flood elevations on structures along the Gulf Coast will be higher than at the time of their construction because of sea level rise and subsidence. The U.S. Army Corps of Engineers is including location-dependent adjustments in the design of structures to compensate for the expected rise.

FLOOD MAP PRODUCTION

The process for producing flood maps involves three main phases (Figure 2.3):

1. Scoping, including identifying flood risk, assessing immediate and future needs (e.g., development of floodprone areas), and determining what type of flood study is feasible with available resources. This step is carried out by FEMA in conjunction with state and local officials.

2. Development, including collecting technical data, modeling, creating a preliminary map, and performing quality control and quality assurance. Modeling and map production are carried out by a FEMA mapping partner (e.g., contractor, state or local government employee). Once the technical work has been completed, it is reviewed by a FEMA contractor, then preliminary maps are prepared and released to the relevant communities for review.

3. Adoption, including periods for public comment and appeal. FEMA, contractors, and state and local government agencies involved in the process must respond to comments made within the appeal period. Once the protest and appeal process is completed and any outstanding issues are resolved, the maps are finalized and FEMA issues a Letter of Final Determination. The local community then has up to six months to adopt the new map and update its floodplain management ordinances, if necessary, before the map becomes effective (i.e., the most current legal map for regulatory and insurance purposes).

Data for Digital FIRMs

Digital Flood Insurance Rate Maps (DFIRMs) are built from three layers of information (Figure 2.4).

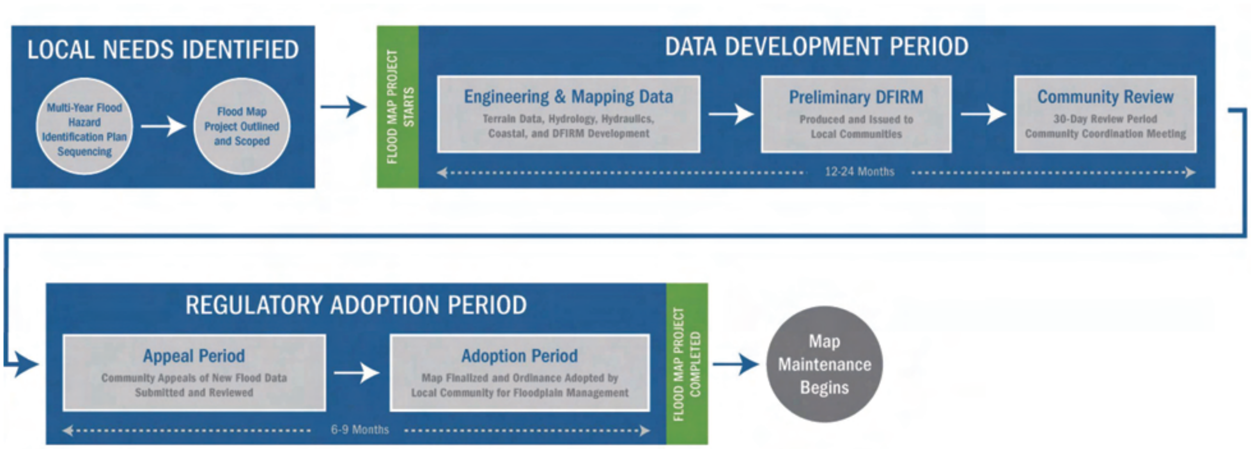


FIGURE 2.3 Flood map production process. SOURCE: Courtesy of Michael Godesky, FEMA.

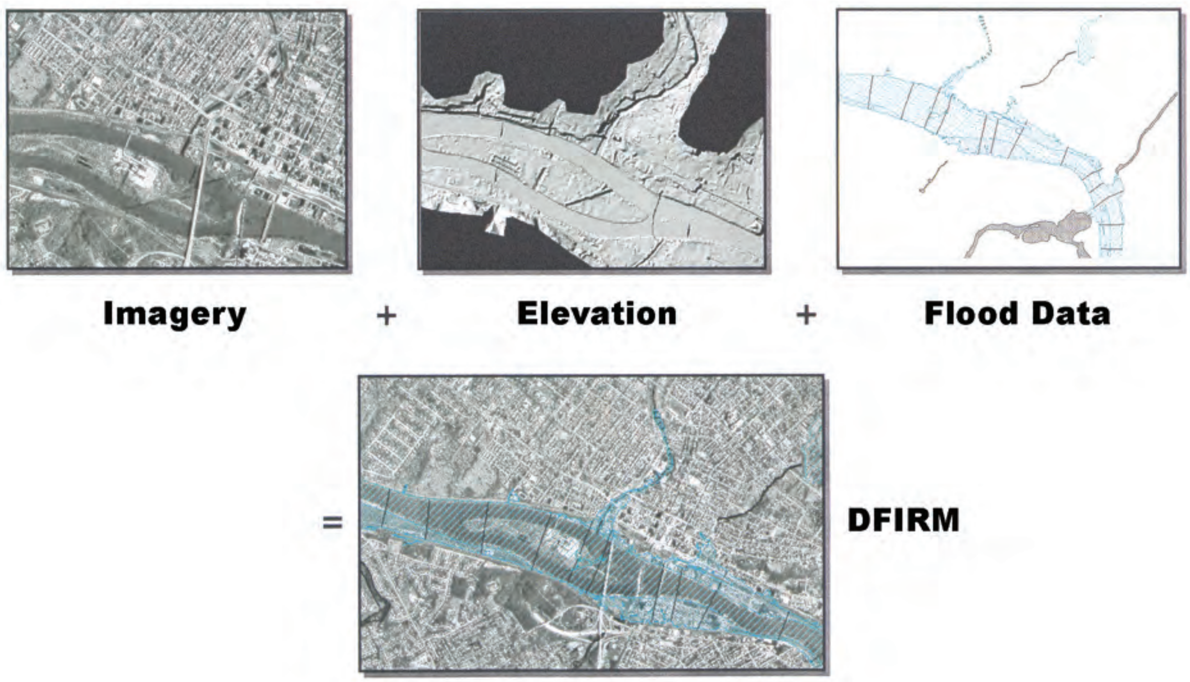


FIGURE 2.4 Major components of DFIRMs. SOURCE: Modified from Maune (2007). Reprinted with permission from the American Society for Photogrammetry and Remote Sensing.

The base map imagery (orthophoto or vector) shows planimetric features such as roads, rivers, and buildings. Digital elevation data are overlain to give each feature in the base map image a vertical position. Finally, flood hazard data, collected and modeled by surveyors and engineers, are overlain to produce the DFIRM.

Methods for Mapping Flood Hazard

FEMA's methods for mapping the most common flood hazards are summarized below and discussed in more detail in Chapters 4 and 5.

Riverine Flooding. Overbank flooding, the most common type of flooding in our nation, occurs when downstream channels receive more water than they can accommodate due to rain, snowmelt, blockage of channels by ice or debris, or dam or levee failure. Mapping riverine flood hazards requires hydrologic and hydraulic studies to determine ground elevations, the depth of floodwaters, the width of floodplains, the amount of water that will be carried by watercourses during flood events, and obstructions to water flow (FEMA, 2003, V. 1 and Appendix C). Cross sections, based on topographic data collected in the field or scaled from U.S. Geological Survey topographic quadrangle maps, are taken to define the floodplain. The locations of these cross sections are chosen to capture variations in topography and possible obstructions to flow.

Coastal Flooding. The coasts of the Great Lakes and the oceans are subject to severe flooding from storm surge, the result of high winds and air pressure changes that push water toward the shore. Coastal flood studies assess the effects of storm surge and wave action and determine base flood elevations (FEMA, 2003, V. 1 and Appendix D). The study process is similar to that for riverine flooding, except that instead of cross sections, transects are surveyed perpendicular to the coastline, yielding onshore and offshore ground elevations. The elevations are then used to compute the expected height of wave crests and wave runup that are added to the storm surge as it approaches the shoreline.

Shallow Flooding. Even a minimal rise in water level can lead to extensive inundation in relatively flat areas

TABLE 2.1 Types of Flood Study Methods

	Detailed (Riverine)	Detailed (Coastal)	Limited Detailed	Approximate	Redelineation
Base map[a]	Orthophotography or vector	Orthophotography or vector	Orthophotography or vector	Orthophotography or vector	Orthophotography or vector
Hydrology (flows)	Regression equations, stream gage data, or rainfall-runoff models	Historical water marks and tide gage data	Regression equations or stream gage data	Analysis not technically reviewed	Uses previously published flow information
Hydraulics (flood elevations)	Modeled (steady state or dynamic) with detailed structure survey data	Modeled storm surge, waves, erosion, and wave runup	Modeled (steady state) without survey information on bridge or culvert structures	Analysis not technically reviewed	Uses previously determined elevations
Mapping presentation	Typical zone representations include AE with floodway	Typical zone representations include AE and VE	Zone representation limited to AE	Typical zone representations include A and V	New floodplain boundaries matching new base map information; Letters of Map Change (LOMCs)
Study report	Provides flow estimates, floodway data tables, and flood elevation profiles	Provides shoreline profiles and stillwater data tables	Provides flood elevation and profile information	Not applicable	Republishes flood study
Cost per mile[b]	$10,000-$25,000 (typically $13,500)	Approximately $9300	$1500-$5000 (typically $3000)	$250-$2000 (typically $900)	

[a]All flood study methods use best available base map at the time of production; the current FEMA minimum standard is digital orthoquarter quadrangles.
[b]SOURCE: Paul Rooney, FEMA.

such as Florida. The low relief and absence of channels in these areas can cause water to flow in sheets across the land surface, often in unpredictable directions. Drainage ditches and stormwater management facilities may be overloaded by storms more severe than the 10 percent annual chance floods for which they are usually designed. Ponding of rainfall in depressions often creates local floods, which may be alleviated by infiltration, evaporation, or mechanical pumping. Shallow flood studies yield a uniform depth of flooding, which is either added to the ground elevation or used to determine a single base flood elevation for a large area (FEMA, 2003, V. 1 and Appendix E). When adequate topographic data are not available, cross sections may be taken to determine storage volume for areas subject to ponding and average flood depths for areas subject to sheet flow.

Types of Flood Studies

The four main approaches used to study riverine flood hazard are (1) detailed studies, (2) limited detailed studies, (3) approximate studies, and (4) redelineation. Each approach yields different information, and the decision about which to use depends on the type of flood hazard, the resources available, and the risk of flood damage. Coastal flood mapping is currently done using the equivalent of detailed studies. Table 2.1 compares the information used and presented in the four study types.

Detailed studies are most expensive and provide the most information about flood hazards, establishing base flood elevations, special and moderate flood hazard areas, and where appropriate, floodways.[3] Limited detailed studies provide a reasonable representation of the floodplain limits and often a base flood elevation. Structures such as bridges or culverts are represented in the models, but their dimensions and elevations are not verified in the field. Approximate studies yield

[3]A floodway is the river channel and adjacent land areas required to discharge the base flood without significantly increasing flood heights. Coastal high hazard areas and tidal rivers, which experience regular fluctuations in water surface elevations, do not have designated floodways.

an approximate outline of the floodplain, but no base flood elevations, floodways, moderate hazard areas, or other details. Although comparison of the floodplain boundaries to a topographic map provides an estimate of the base flood elevation, this estimate is inadequate for regulatory purposes. FEMA provides written guidance (FEMA, 1995) and a computer program for calculating approximate water surface elevations on open channels based on specified field measurements (see Appendix A for a list of methods used to estimate BFEs in approximate studies).

Redelineation studies are aimed at producing digital representations of flood maps as part of a national digital flood layer. Redelineation uses existing flood elevation information and redraws the flood boundaries on new or updated topographic maps. All approved changes to the flood maps (see "Map Maintenance" below) are incorporated, resulting in an updated map that reflects the most current effective flood elevation and hazard information. In contrast, the digital conversion method simply scans the flood boundaries shown on paper maps and transfers them to a new digital map. Fifty-four percent of the stream miles mapped until 2007 were the result of the digital conversion process.[4] This approach was discontinued for new studies following FEMA's midcourse adjustment (FEMA, 2006a) and prior to issuance of a new floodplain boundary standard (see below).

FEMA'S MAP MODERNIZATION PROGRAM

The nation has floodplains along approximately 3.5 million miles of rivers and coasts (FEMA, 2006a). Prior to 2003, only 1 million miles had been mapped, often at a lower quality than meets NFIP needs, and most flood maps and related products were outdated and available only in paper form. FEMA's Map Modernization Program was established to collect new flood data in unmapped areas, to update or validate existing flood data, and to create digital flood maps. The federal government invested about $1 billion in this 2003-2008 mapping effort, and considerable matching funds were provided by FEMA's state government and local community partners. This investment in more accurate maps was intended to benefit communities that use the maps to establish zoning and building standards; insurance companies, lenders, real estate agencies, and property owners who use the maps to determine whether flood insurance is required; and government officials who use the maps to support infrastructure, transportation, and other planning and to prepare for and respond to flooding.

Mapping costs and map accuracy are directly related, and funding for the Map Modernization Program was insufficient to produce high-quality maps of the entire nation (GAO, 2004). Moreover, the Government Accountability Office, Congress, and stakeholders were concerned about the accuracy of the mapped floodplain boundaries that were to be digitized (FEMA, 2006a). In response, FEMA made a midcourse adjustment to the Map Modernization Program. Two criteria were used to quantify map and engineering accuracy: (1) a floodplain boundary standard and (2) validation guidelines for flood data and engineering analyses used to delineate floodplains. The floodplain boundary standard is a statistical measure of the vertical discrepancy between the water surface elevation at the boundary of the floodplain and the land surface elevation at that location (FEMA, 2007c). The measure is computed at a sequence of points along the floodplain boundary and a specified percentage of these points must lie within defined error ranges that are more strict for maps produced from detailed studies than for maps produced from approximate studies. The standard is aimed at ensuring that the flood maps match the topographic data used, although adherence to the standard does not itself validate the topographic data. The validation guidelines for flood data and engineering analyses are a set of rules which define whether a flood study done in the past is adequate for current use or whether physical, hydrologic, or methodological changes since the time of the original study are sufficiently great to warrant an updated study (FEMA, 2007b). The intention of these changes was to improve the percentage of studies meeting these criteria while relaxing the original program goal of complete digital flood map coverage of the nation. Doing so is consistent with stakeholders' comments on the midcourse adjustment that "The goal of digitization of the nation's flood maps . . . should not outweigh the goal of achieving accuracy on the newly updated maps" (FEMA, 2008c, p. 22). A map of the data quality standards achieved for U.S. counties by March 2008 is shown in Figure 2.5.

[4]Presentation to the committee by Patrick Sacbibit, FEMA, on November 8, 2007.

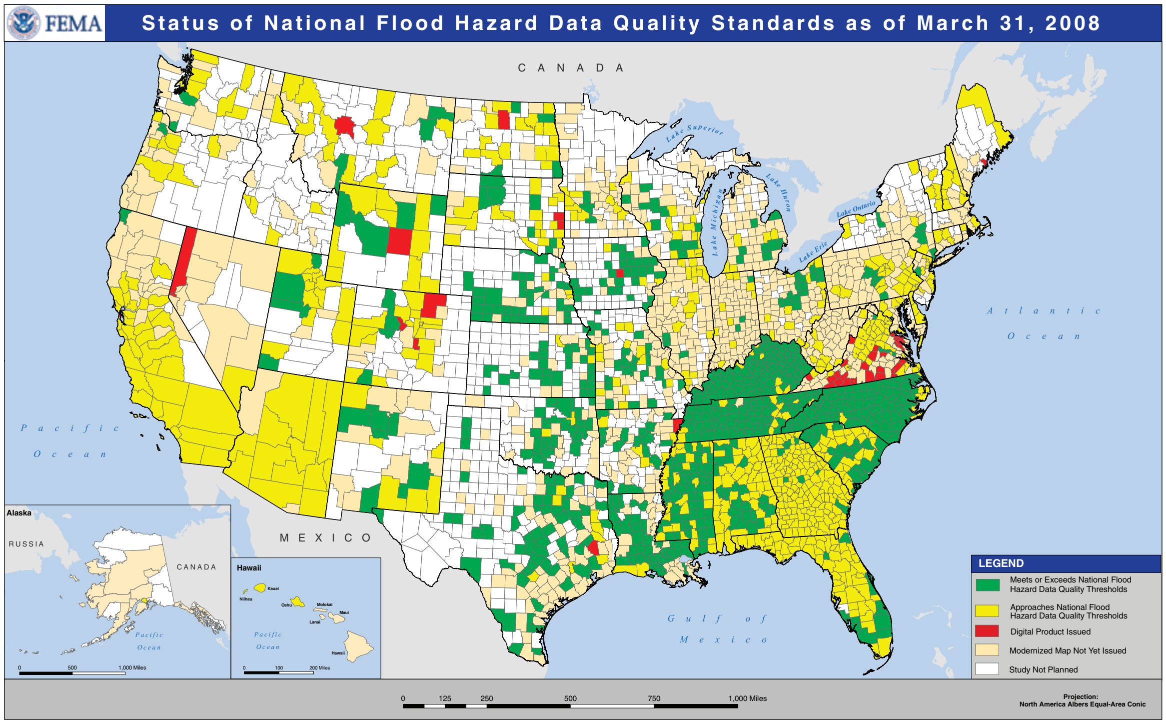


FIGURE 2.5 Data quality standards achieved by individual counties as of March 31, 2008. Green counties (21 percent of the population) meet or exceed the floodplain boundary standard and the engineering analysis standard. Yellow counties (47 percent of the population) meet either the floodplain boundary standard or the engineering analysis standard or part of either standard but below thresholds. In red counties (1 percent of the population), the maps have been updated digitally and a digital product has been issued. Compliance with data quality standards was not required for such digital conversions, although a limited FEMA audit suggests that some portions of these counties meet the standards. In beige counties (26 percent of the population), modernized maps have not yet been issued because the first phase of map production (scoping) has not been completed or quality data do not exist. No study is planned in white counties (5 percent of the population). SOURCE: Paul Rooney, FEMA.

The adjusted goal is to have 65 percent of the U.S. continental land area and 92 percent of the U.S. population covered by digital flood maps (Table 2.2; FEMA, 2006a). For 30 percent of the mapped stream and coastal miles covering 40 percent of the population, the maps should meet the engineering analysis standard. For 75 percent of the mapped stream and coastal miles covering 80 percent of the population, the maps should meet the floodplain boundary standard. These figures illustrate the challenges of increasing flood map accuracy: even if the goals articulated in the midcourse adjustment are achieved, 70 percent of the mapped stream miles will not have validated engineering analyses supporting the flood map, and 25 percent will not meet the floodplain boundary standard. In addition, this standard ensures that the maps match existing topographic data within defined error tolerances, but it does not ensure the accuracy of the topographic data.

MAP MAINTENANCE

A map records the conditions that existed when the data for its compilation were gathered. By the time the data are gathered and analyzed and the map is published, it may already be outdated. Corporate boundaries and other non-flood-related features can change, affecting regulation of floodplain development. Ground elevations in the floodplain can change—for example, when fill is placed in the floodplain to raise building sites or when a new flood control project introduces levees, reservoirs, or stream channel modifications—affecting the spread of floodwater. Small projects, such as clearing channels or building retention basins in new subdivisions, commonly do not have a measurable effect on the base flood and thus do not warrant a map change on their own. Cumulative effects of small projects, however, may be significant.

TABLE 2.2 Adjusted Targets for FEMA's Map Modernization Program

Performance Measure	Original Target (%)	Adjusted Target (%)
Percentage of continental U.S. land area covered by digital flood maps	100	65
Percentage of U.S. population covered by digital flood maps	100	92
Percentage of mapped stream and coastal miles with new, updated, or validated engineering analysis	22	30
Percentage of population covered by maps with new, updated, or validated engineering analysis	15	40
Percentage of mapped stream and coastal miles that meet the 2005 floodplain boundary standard	57	75
Percentage of population covered by maps that meet the 2005 floodplain boundary standard	32	80

SOURCE: FEMA (2006a).

Finally, better topographic data, models, or statistical data on hazard events may become available, potentially improving the depiction of the flood hazard.

FEMA has four approaches to changing flood maps:

1. Restudy, in which a new Flood Insurance Study is carried out to establish new flood profiles, data tables, and flood boundaries when development has substantially changed stormwater runoff conditions or when growth is occurring in a floodprone area that lacks base flood elevations. Restudies can be completely new work or new analysis of existing data using different models, and they result in addition of or adjustment to the BFEs, addition of the 0.2 percent annual chance floodplain, and/or changes in the horizontal extent of the SFHA.

2. Limited map maintenance projects, which are restudies that are limited in size and cost. They are frequently used to increase detail in approximate studies in unnumbered A zones.

3. Revisions, which are made after a flood map is published to reflect changes in the horizontal or vertical extent of the floodplain. Revisions may add or adjust the BFE; add, remove, expand, or contract the mapped floodplain; and/or add or remove a defined floodway.

4. Amendments, which are made to correct mapping inaccuracies, including non-flood-related map elements (e.g., north arrows, graphic scale) and inadvertent inclusion of higher areas in the mapped floodplain. Inadvertent inclusions are commonly found through more accurate or detailed topographic study; when they are too small to depict graphically, they are only correctable in Letters of Map Amendment.

Amendments and revisions generally result in the issuance of a Letter of Map Change (LOMC), and revisions may also result in a physical map revision. Letters of Map Change originated when the production of FIRMs was an expensive photographic-based process, and it was less expensive to issue a letter than to publish a new version of an affected map panel. Applications for LOMCs are approved if computer models and ground surveys technically demonstrate that the ground surface (and the lowest floor elevation, depending on the type of LOMC) is a tenth of a foot above the established BFE, even though current mapping methodologies are not that accurate. Approved LOMCs are used with the associated FIRMs for floodplain regulation and insurance purposes.

Despite ongoing changes in the floodplain, FEMA flood maps are not updated on a regular schedule. Requests for changes are made irregularly and physical map revisions are infrequent due to funding constraints. Priorities must be set, and FEMA developed the Mapping Needs Assessment Process and the Map Needs Update Support System (MNUSS) to document and rank map update needs nationally. However, even high-priority updates (e.g., areas with known unmapped flood hazards, communities that are undergoing rapid growth or that can contribute to the map update) may not be made. Moreover, the time lag between approving and publishing LOMCs and physical map revisions lengthened when FEMA directed funds from map maintenance to digital conversion of paper maps during the Map Modernization Program. As a result, some parcels and structures may not be regulated or insured properly, even though the change in risk is known.

FLOOD MAP INFORMATION TECHNOLOGY

In the early days of the NFIP, data were published and revised in the form of paper maps, Flood Insurance Study reports, and Letters of Map Change—a costly,[5] inefficient, and time-consuming process. Initial steps toward a less paper intensive process led to the creation of FEMA's Map Service Center website in the late 1990s and the development of new mapping products. Through this website, users can extract images from a full-sized paper map to create FIRMettes (e.g., Figure 2.1) that are legally equivalent to the original paper product. The recent availability of LOMCs and Flood Insurance Study reports online has made data even more accessible. Yet although more products are available and distribution has improved, digital updating processes have lagged.

FEMA created the Mapping Information Platform (MIP)[6] on a secure website to allow its mapping partners (e.g., communities, engineers, surveyors, flood control districts, Cooperating Technical Partners) to submit data for review and share work responsibilities. With this system, map information (e.g., flood study data, LOMCs) is being shared, rather than the maps themselves. This system of information sharing shows what might be possible for map updates, which are often slow to be integrated with other map information.

Recommendation. FEMA should ensure that new flood information, revisions, and Letters of Map Change are incorporated into the digital Flood Insurance Rate Maps as soon as they become effective.

The digital environment could also facilitate communication of metadata—information about how flood data were generated. A variety of study methods are often used along a stream reach or coastline. For example, different segments of the same stream flowing through two adjacent communities may have been studied using different techniques and in different years. This distinction was commonly lost when the information was consolidated in the Map Modernization Program. Documenting how each mile was studied—including what input data, mapping, and modeling methods were used, the date of mapping, the contractor, and the starting and ending points of each study segment—would help users better understand the reliability and accuracy of the data. Many of these metadata are not currently included in Flood Insurance Study reports, particularly to this level of detail. However, metadata can easily be linked with digital flood map information, enabling users to examine data age, gathering, and analysis techniques to decide whether the flood data are suitable for the intended use. This is especially important, given that FEMA flood data are increasingly being used for land use planning, emergency response, and risk assessment, in addition to the insurance and regulatory purposes for which they were collected.

Recommendation. FEMA should require that every flood study be accompanied by detailed metadata identifying how each stream and coastline reach was studied and what methods were used to identify the magnitude and extent of the flood hazard and to produce the map.

FLOOD DATA AND A NATIONAL HYDROLOGIC INFORMATION SYSTEM

The FEMA Map Modernization Program is by far the largest investment that the nation has made in hydrologic information in recent years. It is also the largest effort that the nation has ever made to digitally describe the morphology of its streams and rivers. This investment could have many benefits beyond flood mapping. The flood models could be used for flood management and planning studies or for building real-time flood inundation mapping systems. The digital terrain and stream channel information could be used for water quality studies of contaminant transport in streams. FEMA is one of several federal agencies generating spatial hydrologic information and it is reasonable to ask how the data and models compiled during the Map Modernization Program could be made part of a National Hydrologic Information System.

Each of FEMA's flood studies covers a geographic region, often a county. Within that region, each stream reach is considered a separate entity with its own flood

[5] FEMA distributes more than 1 million paper maps each year, and the average cost of producing maps for a typical county is $250,000 to $500,000. Presentation to the committee by Paul Rooney, FEMA, on August 20, 2007.

[6] See <https://hazards.fema.gov/femaportal/wps/portal>.

discharge estimate, stream cross sections, and BFE. The floodplain boundaries of individual reaches are merged to delineate the Special Flood Hazard Area on a map panel. The digital information describing a single flood study is stored in hundreds or even thousands of files, which must be compiled for each county mapped in the nation. A key purpose of FEMA's MIP is to store these files so that they will be available for later retrieval. Two types of files are involved: the files that comprise the flood map (DFIRMs) and files of raw field data analyzed in engineering studies to define the BFE (Data Capture Standard database; FEMA, 2003, Appendix L).

Walker and Maidment (2006) examined the design of a geodatabase model to store flood map information. They showed that the most critical parts of the data capture standards are the stream centerlines and cross sections used in the flood hydraulics model. If accurate geographic information system (GIS) files of these are maintained along with the flood hydraulics model, the model could be georeferenced and used in subsequent applications. This involves preserving data defining the connection between two coordinate systems: the Cartesian (x, y, z) coordinate system used to record the meandering of the channel through the landscape and the (s, n, z) coordinate system used in the river hydraulics model, in which s represents stationing distance along the river and n represents the distance across a particular cross section in the river. In effect, the hydraulic model "straightens" the channel by ignoring the bends and considering only how far along and transverse to the stream centerline the water flows. Unless both sets of coordinates are stored in the archived map and model information, it will be difficult or impossible at a later date to place a hydraulic model cross section at the correct map location along the stream.

One limitation of FEMA studies is that they are done county by county and there is no requirement that the underlying streamlines match across county boundaries. This difficulty can be overcome if FEMA streamline data are matched with those of the U.S. Geological Survey (USGS) National Hydrography Dataset (NHD).[7] The NHD is a seamless, digital representation of streams and water bodies at map scales of 1:24,000 and 1:100,000 in the continental United States.[8] Walker and Maidment (2006) showed that for Fayette County, Texas, the 1:24,000 NHD streamlines cover all the streams mapped in the Map Modernization Program, and that each FEMA-mapped stream segment could be located in a corresponding position on the NHD. Thus, the flood study data collected by FEMA could be linked to and become a part of the nation's larger repository of hydrologic information, enabling it to be used for much more than flood mapping.

Recommendation. FEMA should reference all stream and coastal studies within its Mapping Information Platform to the USGS National Hydrography Dataset.

[7]Presentation to the committee by Sally McConkey, Association of State Floodplain Managers, on November 8, 2007.

[8]See <http://nhd.usgs.gov/>.

6

Benefits and Costs of Accurate Flood Mapping

All societies have more needs and desires than resources to fulfill them. Benefit-cost analysis provides a framework to understand and balance the various requirements of society against available resources. If the benefits are greater than the costs, the project contributes positively to society. Benefit-cost analysis of maps and their underlying data suggests that increasing the accuracy of maps or portraying additional information yields positive net benefits (Bernknopf et al., 1988, 1990, 1993, 1997; Mileti et al., 1992; Olson and Olson, 2001; Halsing et al., 2004; NRC, 2006). These "value of information" studies show that the information itself has value, which increases with greater accuracy or comprehensiveness.

Few studies have evaluated the net benefits of improved flood map accuracy. The most comprehensive assessment was undertaken by the Federal Emergency Management Agency (FEMA) in 1997 and updated in 2000. This chapter describes the benefits and costs of more accurate flood maps and summarizes the results of benefit-cost analyses carried out by FEMA and the State of North Carolina. The benefit-cost analyses focused on mapping, not related topics such as flood hazard mitigation.

BENEFITS AND COSTS

Most of the costs and some of the benefits of more accurate flood maps can be quantified, drawing on studies of floods and other kinds of hazards (e.g., Bernknopf et al., 1993; NRC, 2006). Direct costs (e.g., collection of elevation data) and indirect costs (e.g., implementation of required mitigation measures) are generally measurable using observed expenditures. Direct benefits (e.g., use of the data to estimate flood risk more accurately) are easier to measure than benefits that are non-market or temporal in nature.[1] Improvements in models, data collection, or mapping methods generally yield incremental benefits (e.g., improved land use regulation).

For flood map creation and accuracy improvement, most of the direct costs and some of the direct benefits are borne by the public sector; other costs and benefits are spread across society (Table 6.1). The direct costs to FEMA are a function of the level of effort required to carry out flood studies, evaluate the results, update and maintain the maps, and produce and distribute paper and digital products. The direct costs to users include the time and effort required to use the maps and request updates, as well as the monetary costs of complying with insurance and land use regulations.

The benefits of more accurate flood maps accrue to individuals, communities, and society as a whole. Flood-related information is a public good—that is, a product or service that can be shared by many users simultaneously without detracting from its value to any one of them. Flood maps are used an estimated 30 million times each year by government agencies, FEMA contractors, lenders, insurance agents, land developers, realtors, community planners, property owners, and

[1]Where market prices do not exist because the commodity (flood information) is not "traded," non-market valuation is sometimes used to estimate benefits.

TABLE 6.1 Benefits and Costs of Improved Map Accuracy

Category	Impact	Benefits	Costs
Land use: floodplain regulations	Reduced loss of life	• Able to target higher-risk areas • Able to identify evacuation needs	
	Reduced loss of property	• Able to target higher-risk areas • Lower-risk areas less restricted • Building restrictions match risk • Less time and money spent on contesting maps • Eventual payback on freeboard costs • Wise floodplain investment, including infrastructure	• Increased construction costs • Loss of land to development • Need to update regulations and inform the public of changes
	Reduced loss of business	• Fewer business interruptions • Fewer public service interruptions	• Increased construction costs
	Preservation of natural functions of floodplains	• Natural storm water management • Improved water quality • Increased ecological diversity	• Loss of land to development
Insurance	Rates	• Structures insured at appropriate levels • More consistent insurance ratings through better information about risk	• Rates may increase for some
	Coverage	• More insurance purchased because of improved understanding of risk	
Property values		• Lower (or no) devaluations because of better information on risk • Change in practices that have led to devaluations	
Emergency services	Resource deployment	• More efficient allocation in planning and response	

SOURCE: Compiled from FEMA (1997) and NRC (2006).

others for insurance purposes, land management, mitigation, risk assessment, and disaster response.[2] Because these uses are not mutually exclusive, it is appropriate to sum the benefits, as is done in conventional benefit-cost analyses (e.g., NRC, 2006).

Several categories of benefits emerge from benefit-cost analyses of flood maps (FEMA, 1997; NCFMP, 2008) and work on flood and seismic hazards (Bernknopf et al., 1993; Chivers and Flores, 2002; NRC, 2006). Most of these benefit categories arise from improvements in both horizontal accuracy (i.e., proper depiction of the floodplain boundary) and vertical accuracy (i.e., proper assessment of risk), although the nature and level of benefits may differ for each type of accuracy. These benefit categories and their associated costs are summarized in Table 6.1 and described below.

Land Use

More accurate flood maps provide a more reliable measure of risk and enable floodplain managers to better target land use regulations. Owners of properties that were incorrectly designated within the floodplain benefit by having building restrictions lifted or lessened, which will lower future construction costs, eliminate mandatory retrofitting, and enable the land to be used in more ways. Adding building and land use restrictions to properties that should have been designated within the floodplain can lead to measures to protect equipment, inventories, and personal possessions. Although up-front costs are higher, developing and using land commensurate with the true risk will reduce future losses of life, property, and business. A benefit-cost analysis of National Flood Insurance Program (NFIP) building standards in coastal areas found that the benefits of freeboard exceed the construction costs by 3 to 7 percent (Jones et al., 2006).

Another possible benefit of more accurate maps is that fewer individuals will contest floodplain boundaries and levels of risk, saving time and money. Greater trust in the maps could also lead to more, but wiser, investment. Finally, management of floodplains to preserve important natural functions (e.g., slowing storm water runoff, buffering water quality) benefits the entire community. Although some work has been done on valuing

[2]Presentation to the committee by Paul Rooney, FEMA, on August 20, 2007.

these beneficial functions (e.g., CDWR, 2005), many are still unquantified.

Insurance

Better estimates of flood risk enable structures to be insured at appropriate levels, which benefits both individuals and the nation. Those for whom flood insurance is not mandatory will not be required to purchase it, while those who need or want it can purchase the right amount (e.g., Box 6.1). Two problems remain. First is the problem of those who need but do not carry flood insurance (e.g., owners of mortgage-free properties in the floodplain). Nationwide about half of the single-family homes in Special Flood Hazard Areas (SFHAs) are insured, although market penetration in the areas hit by the 2008 Midwest flood was less than 10 percent (coastal areas have higher participation) (Maurstad, 2008). Greater accuracy may lead to improved understanding of flood risk and ultimately to more widespread insurance coverage. In addition, insurance rates and coverage will be more accurate and consistent because the risk ratings will be more accurate and consistent. Second is the problem of moral hazard wherein the availability of flood insurance encourages people to build in places they might not otherwise. Accurate pricing of insurance premiums, relative to risk, may reduce this problem.

BOX 6.1 Impact of Improved Flood Maps on Insurance

More accurate flood maps can increase or decrease insurance premiums of individual property owners, as the following examples from two counties in New Jersey illustrate. In Monmouth County, more accurate flood maps created using lidar (light detection and ranging) elevation data resulted in an additional 3,680 structures being redesignated as within the floodplain. The property owners with mortgages are now required to pay for flood insurance, causing financial hardship for some (e.g., people living on a fixed income). Passaic County flood maps were updated to include flood mitigation measures installed along Molly Ann's Brook by the U.S. Army Corp of Engineers. The more accurate maps had the opposite effect of the revised Monmouth County maps, removing 56 homes and 6 commercial buildings from the floodplain designation and relieving many homeowners of the mandatory requirement for flood insurance.

SOURCE: S. Kempf, 2008, Community flood maps: A tale of two NJ cities, *Association of State Floodplain Managers Newsletter,* May.

Property Values

Numerous studies have analyzed the impacts of flooding, coastal storms, and the NFIP on property values (e.g., Montz and Tobin, 1988; Holoway and Burby, 1990; Chivers and Flores, 2002; Bin and Polasky, 2004; Hallstrom and Smith, 2005; Smith et al., 2006), although additional information is needed to connect property values and map accuracy. The impacts of more accurate maps on property values are both location specific and hard to measure. In cases where buildings in the floodplain are devalued relative to buildings in areas with lower flood risk, more accurate floodplain boundaries could either increase or decrease property values. An adverse impact could be lessened because the risk will be better understood and property values could be assessed at appropriate levels. More accurate maps may also be less costly to use because there will be fewer questions about the accuracy or interpretation of the map in mortgage determinations.

Temporal Considerations

The accuracy of flood maps changes with time and so do the benefits and costs. Costs are highest at the outset when flood-related data are being collected, modeled, and analyzed (Bernknopf et al., 1993; FEMA, 1997). The more detailed the flood study method, the greater are the data, modeling, and analysis demands, and the higher are the initial costs (Table 2.1). Costs can decrease significantly when maps exist and require only updates or reanalysis.

Maps created using state-of-the-art techniques and the most current information provide the best possible representation of flood hazard, at least for a short time. These accurate maps provide the immediate benefit of enabling society to better prepare for and respond to future flooding. Thereafter, development and changes in hydrology and hydraulics will degrade map accuracy, while mapping updates and incorporation of knowledge from previous flood events will increase map accuracy. The accumulation of information from flood events has intermediate and long-term benefits. Post-flood inspections yield information needed to improve models and update the maps. For example, inundation maps of the June 2006 floods in New York are being used to update Flood Insurance Rate Maps created in 1985. Knowledge about how the built environment responds to floods and coastal surges leads to improved building design and safer siting and thus to reduced future damage, social losses, and the need for federal disaster assistance. Similarly, experience responding to floods leads to more robust plans for emergency services and thus minimizes future loss of life and property. The information gained also contributes to society's underlying knowledge base across multiple disciplines.

FEMA BENEFIT-COST ANALYSES

In 1997, FEMA analyzed the incremental costs and benefits of modernizing its Flood Hazard Mapping Program (FEMA, 1997). The analysis considered all costs, including costs for flood data updates, map maintenance, new mapping, conversion to new standards, and customer service. It also calculated three benefits that could be quantified with reliable data:

1. Reduced damage to new residential properties,
2. Reduced damage to new non-residential structures, and
3. Reduced costs of map reviews.

The first two were calculated by determining the annual damage that would be prevented by designing new construction using more accurate flood data and subtracting the increased construction costs for complying with NFIP requirements (up to 5 percent). The third was based on estimates of the time saved by using improved maps and digital products for mortgage and permit applications and flood insurance policy ratings. The study found incremental benefits of $1.75 billion and incremental costs of $848 million over a 50-year period, for a benefit-cost ratio of 2.1.

In 2000, FEMA repeated the analysis, modifying the projected number of new structures in SFHAs and factoring in survey responses on flood map inventory needs from all mapped communities (the original analysis considered only 10 percent of mapped communities; FEMA, 2000). The updated analysis yielded incremental benefits of $1.33 billion and incremental costs of $799 million, for a benefit-cost ratio of 1.7. The analysis also estimated how the new construction benefit would change over time. The benefits to new construction are greatest in areas that are unstudied or studied through approximate methods because no flood elevation data are available to site new buildings. As more flood elevation data become available through map modernization, the benefits for new construction decline. FEMA estimated that factoring in this declining benefit decreases the benefit-cost ratio to 1.5.

FEMA's Office of Inspector General audited its cost estimate for the Map Modernization Program in 2000 (OIG, 2000). It found that FEMA's methodology was sound and no major costs were overlooked, but that the estimate could be significantly in error because costs were not always verified or drawn from reliable sources, some assumptions (e.g., cost of flood studies) have a major effect on cost, and cost savings from partnerships and technological innovation (e.g., use of lidar) were not considered. FEMA agreed with most of the findings and outlined steps for improving future cost estimates in the report's appendix. The revised costs have not yet been incorporated in a benefit-cost analysis.

NORTH CAROLINA CASE STUDY

Many benefits and costs are too varied to assess generically—case studies are required to understand them at the local level, where implementation occurs. The North Carolina Floodplain Mapping Program (NCFMP) determined the costs and three benefits of more accurate maps in three different physiographic regions in North Carolina and also examined the costs and benefits of different flood study methods for the entire state (NCFMP, 2008). The communities chosen represent the typical level of development within three physiographic regions: Pasquotank County in the coastal region, Mecklenburg County in the piedmont region, and the city of Asheville in Buncombe County within the mountain region (see Chapter 1, "Case Studies"). Geospatial data necessary to complete the assessment (e.g., parcel boundaries attributed with zoning, building value, and construction date; digital flood hazard information) were available for each of

TABLE 6.2 Profile of Case Study Areas

		Number of Buildings[b]		Percentage of Buildings[b]		Number of Insurance Policies[b]		Percentage of Policies[b]		Percentage of Buildings Insured	
Area	Population[a]	Inside the SFHA	Outside the SFHA	Inside the SFHA	Outside the SFHA	Inside the SFHA	Outside the SFHA	Inside the SFHA	Outside the SFHA	Inside the SFHA	Outside the SFHA
Pasquotank	39,951	5,652	8,309	40	60	979	279	78	22	17.3	3.4
Mecklenburg	827,445	22,091	178,614	11	89	1,765	1,267	58	42	8.0	0.7
Asheville	69,045	1,307	23,711	5	95	269	83	76	24	20.6	0.4

[a]In 2006 for Pasquotank and Mecklenburg Counties; in 2003 for Asheville.
[b]Determined using FIRMs effective prior to creation of the North Carolina Floodplain Mapping Program. Not all the buildings located outside the SFHA are in a delineated floodplain and are in areas covered by the FIRMs.
SOURCE: NCFMP (2008).

the counties or municipality. Building, population, and insurance information for the study areas is summarized in Table 6.2.

The percentages of homes in the SFHA carrying flood insurance are low, given that anyone with a federally backed mortgage is required to carry insurance, but they are generally consistent with national averages for riverine areas, which range from 10 to 25 percent.[3] Both the national and the North Carolina percentages reflect the unwillingness of floodplain residents to obtain insurance, perhaps because of their lack of trust in the maps or their lack of understanding of what the maps portray. More credible maps might encourage individuals to take action to minimize their risk, such as carrying flood insurance or elevating their buildings.

The NCFMP selected three types of benefits for analysis, based on the availability of geospatially referenced map data:

1. Expected annual flood losses avoided to new buildings and infrastructure through accurate identification of flood elevations and/or areal extent of the floodplain.
2. Expected additional annual flood insurance premiums to be collected by the NFIP for properties newly designated within the SFHA on more accurate maps. This is a benefit because Congress intended the NFIP to be funded through collection of premiums.
3. Expected annual flood insurance premium savings to policy holders who, as a result of more accurate maps, are placed in lower-rate zones or removed from the mandatory insurance requirements of the NFIP.

To calculate the incremental benefits of more accurate maps, the NCFMP compared Q3 flood data[4] digitized from Flood Insurance Rate Maps (FIRMs) with data from new digital FIRMs (DFIRMs) produced using detailed study, limited detailed study North Carolina, and redelineation methods (Table 6.3). The limited detailed study method used by North Carolina is different from the limited detailed study method used nationally (see "North Carolina Flood Mapping Case Study" in Chapter 4). The DFIRMs contain better flood hazard information than the old FIRMs, including

1. Identification of new SFHAs or more accurate portrayal of existing SFHAs,
2. Determination of base flood elevations (BFEs) where none existed, and
3. Updates of existing BFEs using revised hydrologic and/or hydraulic analyses.

The areal differences in the SFHAs and other flood insurance rate zones in the old FIRMs were compared with the SFHAs and other zones in the new DFIRMs using a geographic information system (GIS). Then the buildings in each of the zones were counted to determine the number of parcels that changed hazard designation as a result of the remapping. This change

[3]Personal communication from Mary Jo Vrem, FEMA, on July 14, 2008.

[4]Q3 data are digital representations of certain flood data on paper FIRMs, such as 1 percent and 0.2 percent annual chance floodplain boundaries and flood insurance zone designations.

TABLE 6.3 Distribution of Flood Study Methods in the Case Study Areas

	Linear Study Miles		
Study Method	Asheville	Mecklenburg	Pasquotank
Limited detailed study North Carolina	27	0	40
Redelineation	56	0	81
Detailed study	27	569	40

SOURCE: NCFMP (2008).

analysis was performed for five different types of buildings: single-family residential, two- to four-family homes, other residential, nonresidential, and mobile homes. For example, some single-family residential parcels identified as outside the SFHA (Zone B, C, or X; see Box 2.1) on old FIRMs were found to be within the SFHA (e.g., Zone AE, AO) on the new DFIRMs. The new DFIRMs provide base flood elevations, while many older FIRMs do not. The losses avoided for each building were calculated as a percentage of the current value of the building. This percentage was based on FEMA assumptions for potential property damage to structures in zones without BFEs (FEMA, 1989). The study calculated the losses avoided to structures that would be built at or above the BFE on vacant parcels zoned for homes or buildings in and outside the SFHA. Depth-damage relationships used in risk assessments (e.g., HAZUS [Hazards US]; see Chapter 7) were not explored.

Changes in flood hazard zones as a result of better mapping affect insurance premiums. To calculate the incremental benefits of flood insurance premiums better matching risk, the NCFMP quantified the difference in annual flood insurance premiums for each property based on its location relative to the SFHA on the old FIRM and the new DFIRM.

Benefit 1. Flood Losses Avoided for New Buildings and Infrastructure

The development of vacant parcels (buildout) that are zoned for building cannot be predicted each year. Therefore, the case study estimated future flood damage avoided to new or improved buildings by assuming that 20 percent, 40 percent, and 60 percent of vacant parcels zoned for building were to have structures constructed in compliance with NFIP floodplain management regulations (i.e., with the lowest floor at or above the new BFEs). Using population growth from U.S. census projections for the state (Census Bureau, 2005) as a proxy for the rate of development, the 20 percent buildout scenario could be realized between 2020 and 2025. For the 20 percent buildout scenario in Pasquotank County, an estimated $354,000 in annual flood losses could be avoided, including

- $284,000 by building the lowest floor at or above the new BFEs,
- $65,000 by more accurately determining BFEs, and
- $5,000 by using updated detailed studies for siting and design of structures.

Annual flood losses and related disaster assistance expenditures avoided for public infrastructure and buildings were estimated based on payouts for flooding and hurricane disasters between 1993 and 2005. The study found that $1.32 of flood losses have occurred to public infrastructure for every $1.00 of flood losses to insured buildings. The NCFMP evaluated average annual disaster-related expenditures to repair or reconstruct public infrastructure (e.g., roads, bridges, wastewater facilities, public buildings, public utilities) compared to average annual flood insurance claims throughout the state. It assumed that the same ratio could be expected for flood losses avoided by implementing minimum NFIP floodplain management regulations based on reliable flood hazard data. In Pasquotank County, the calculated benefit of flood damages avoided for new infrastructure was $465,000. This resulted in the total benefits from structural and infrastructure loss avoidance of $819,000.

These benefits would double and triple with the 40 percent and 60 percent buildout scenarios, respectively. Analyses of Mecklenburg County and Asheville yielded similar results, although the financial benefit

TABLE 6.4 Annual Flood Losses Avoided for Buildings Sited Using Different Study Methods

Percent Buildout	Area	Benefits (thousand dollars per year)				
		Limited Detailed Study North Carolina	Redelineation	Detailed Study	Infrastructure	Total
20	Pasquotank	53	130	171	53	819
	Mecklenburg	NA	NA	21,920	NA	21,920
	Asheville	287	312	220	287	595
40	Pasquotank	106	260	824	106	1,638
	Mecklenburg	NA	NA	43,830	NA	43,830
	Asheville	674	624	440	674	1,190
60	Pasquotank	158	390	1,236	158	2,457
	Mecklenburg	NA	NA	65,750	NA	65,750
	Asheville	861	936	660	861	1,785

NOTE: NA = not applicable.
SOURCE: NCFMP (2008).

of more accurate flood maps is significantly greater in Mecklenburg County (Table 6.4), which has higher population and building values than the other case study areas. Overall, the study found that benefits were greatest in areas that previously had no defined BFEs.

Benefits 2 and 3. Flood Insurance Better Matching Risk

Better mapping enables more accurate determination of the need for flood insurance and the means of rating risk. The new DFIRMs increased the number of buildings designated within Special Flood Hazard Areas by 807 (NCFMP, 2008). The increase in number of property owners who must purchase flood insurance benefits the NFIP, which would collect additional premiums of $935,600 in the three case study areas. The expected annual increase in premiums reflects the actual market penetration for each county or municipality (see Table 6.2), with an expected growth in the number of insurance policies of 4 percent due to increased enforcement of mandatory purchase requirements, public awareness, and/or confidence in the map products. The number of policies in force for North Carolina increased by 4 percent between 2006 and 2007. Of the property newly designated within the SFHA, 491 buildings now have BFE data where none previously existed. The BFE data allow a finer discrimination of flood insurance rate zones, lowering premiums for owners of buildings with BFEs that are lower as a result of updated studies (505 buildings). Properties with new or lowered BFEs would have lower premiums that would result in annual savings for their owners of $498,000.

The NCFMP study estimated that policy holders whose properties are no longer identified as being within the SFHA but continue to carry flood insurance because reduced (preferred) rates are available would save $642,900 in premiums annually in the three study areas. However, property owners who had been paying Zone A insurance premiums but cancel their flood policies as a result of the new information expose themselves to financial risk and the government to emergency payments. Recent studies carried out as part of the five-year evaluation of the NFIP recommend that owners of property located between the 100-year and 500-year floodplains be required to carry flood insurance (Galloway et al., 2006; Wetmore et al., 2006). Under the 20 percent buildout scenario, premiums to the NFIP are estimated to increase by $112,100 and policy holders would save $607,900 annually in the three case study areas (NCFMP, 2008).

Benefits of Different Mapping Approaches

To determine which flood study method yields the greatest net benefits, the NCFMP examined four methods: approximate studies using the National Elevation Dataset (APPROX-NED), limited detailed studies, detailed studies (see Table 2.1), and a combination of methods used by North Carolina. The analysis showed that use of APPROX-NED, the only method

TABLE 6.5 Estimated Benefits and Costs of Flood Study Methods

Study Method[a]	Unit Cost per Mile	Total Discounted Benefits[b] (million dollars)	Total Discounted Costs[b] (million dollars)	Benefit-Cost Ratio
APPROX-NED study	$1,423	$335.42	$391.40	0.86
Limited detailed study, North Carolina method	$1,908	$582.32	$404.59	1.44
Detailed study	$6,539	$922.13	$519.22	1.78
Combination, North Carolina method	$2,419	$933.21	$417.23	2.24

[a]The APPROX-NED study is assumed to have 20% of the flood damage losses avoided by the detailed study, and the limited detailed study North Carolina method to have 60% of the flood damage losses avoided by the detailed study.
[b]A 7% annual discount rate was used to transform gains and losses occurring in different time periods to a common unit of measurement in accordance with OMB (1992).
SOURCE: NCFMP (2008).

that does not yield a base flood elevation, resulted in net costs to the state and that the other methods produced net benefits (Table 6.5; NCFMP, 2008). The net benefit of statewide mapping would have been $173 million using all limited detailed studies and $398 million using all detailed studies. However, when the decision on which method to use was based on factors such as demographics, development plans, quality of existing data, flood history, and the nature of the terrain—the approach followed by the state—the net benefits were $511 million.

Statewide Benefit-Cost Analysis

The NCFMP followed the FEMA (1997) benefit-cost methodology to determine the net benefits of more accurate maps for North Carolina (NCFMP, 2008). Benefits were determined by extrapolating the results of the three case studies to the entire state and calculating additional savings from fewer flood-related business interruptions, reduced costs of map reviews (including mandatory flood insurance purchase determinations by lenders as part of the mortgage lending process, flood insurance policy ratings when a policy is sold, and building permits by local officials), and use of the data by multiple agencies. Engineering and mapping costs and the increased cost of construction for new buildings located in previously unmapped or undermapped areas were quantified and other cost estimates were taken from FEMA (1997). For 2000 through 2050, the NCFMP found a benefit-cost ratio of 2.3. This is comparable to FEMA's (1997) assessment of 2.1 for map modernization.

CONCLUSIONS

The potential benefits (and beneficiaries) of more accurate flood maps are numerous. By far the greatest benefit calculated was avoided losses to planned new buildings (FEMA, 1997; NCFMP, 2008) and avoided repairs to infrastructure (FEMA, 1997) through more accurate identification of flood elevations and the areal extent of the floodplain. Only detailed studies and most limited detailed studies provide base flood elevations.

In North Carolina, detailed and limited detailed studies rely on lidar data, rather than the U.S. Geological Survey's National Elevation Dataset. Lidar surveys cost $27 million for the entire state, yet the benefits of carrying out detailed and limited detailed studies outweigh these costs. This is significant because the analysis in Chapter 3 showed the importance of high-resolution, high-accuracy terrain data such as lidar in the accuracy of flood maps.

The NCFMP (2008) study is the first detailed analysis of the economic benefits of improved flood map accuracy in a digital environment. One of its key contributions is demonstration of a method to realistically assess the value of modernized mapping programs and to choose the type of flood study method. Although the analysis focused on areas subject to riverine flooding, the method would also work for areas subject to coastal flooding.

Both the FEMA (1997) and the NCFMP (2008) studies calculate a benefit-cost ratio of more than 2, but the exact economic benefits are unknown because of uncertainties in the assumptions, variations in costs and benefits across the country, and the difficulty of quantifying some kinds of benefits. Nevertheless, because all of the costs but only some of the benefits were considered, the results are likely the right order of magnitude, suggesting that more accurate maps produce net benefits for the nation.

Finding. Significant flood losses could be avoided by replacing maps that contain inaccurate spatial definitions and that lack base flood elevations with maps that accurately define the spatial extent of the SFHA and provide base flood elevations. The marginal benefits derived from these more accurate maps exceed the marginal costs of their preparation. Determination of base flood elevations produces the greatest increment of benefits.

Finding. No single approach to map preparation is appropriate for all circumstances. The benefits and costs of each method are risk and vulnerability dependent.

Recommendation. The flood study method should be determined based on the accuracy of the topographic data in the county or watershed under study and the current and future risk to those in the mapped area.

Appendix C

Glossary

0.2 Percent Annual Chance Flood—A flood that has a 0.2 percent chance of being equaled or exceeded in any given year; also known as a 500-year flood (FEMA, 2003)

1 Percent Annual Chance Flood—A flood that has a 1 percent chance of being equaled or exceeded in any given year; also known as a 100-year flood (FEMA, 2003)

100-Year Flood—See 1 percent annual chance flood (FEMA, 2003)

500-Year Flood—See 0.2 percent annual chance flood (FEMA, 2003)

Accuracy—The degree of correctness attained in a measurement. (FEMA, 2003)

- **Horizontal Accuracy—**The positional accuracy of a dataset with respect to a specified horizontal datum (Maune, 2007)
- **Vertical Accuracy—**The positional accuracy of a dataset with respect to a specified vertical datum (Maune, 2007)

Amendment—A determination by the Federal Emergency Management Agency (FEMA) that a property has inadvertently been included in a Special Flood Hazard Area (SFHA) as shown on an effective Flood Insurance Rate Map (FIRM) and is not subject to inundation by the 1 percent annual chance flood. Generally, the property is located on natural high ground at or above the BFE or on fill placed prior to the effective date of the first NFIP map designating the property as within an SFHA. Limitations of map scale and development of topographic data more accurately reflecting the existing ground elevations at the time the maps were prepared are the two most common bases for amendment requests (FEMA, 2003)

Approved Model—A numerical computer model that has been accepted by FEMA for use in performing new or revised hydrologic or hydraulic analyses for National Flood Insurance Program (NFIP) purposes. All accepted models must meet the requirements set forth in Subparagraph 65.6(a)(6) of the NFIP regulations (FEMA, 2003)

Approximate Study—A flood hazard study that uses topographic data, typically without bathymetry or bridge or culvert opening geometry, to conduct approximate hydrologic and hydraulic analyses. The analysis results in the delineation of floodplain boundaries for the 1 percent annual chance (100-year) flood, but does not include the determination of base flood elevations (BFEs) or base flood depths (FEMA, 2003)

Backwater—Water backed up or retarded in its course compared to its normal or natural condition of flow (FEMA, 2003)

Base Flood—A flood that has a 1 percent chance of being equaled or exceeded in any given year, also referred to as the 100-year flood. The base flood is the national standard used by the NFIP and all federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development (<http://www.fema.gov/NFIPKeywords/>)

Base Flood Elevation (BFE)—The elevation of a flood having a 1 percent chance of being equaled or exceeded in any given year (FEMA, 2003)

Bathymetry—The measurement and study of water depths. Traditionally bathymetry has been expressed with contours and hydrography with spot depths (Maune, 2007)

Benchmark—A permanent monument established by any federal, state, or local agency, whose elevation and description are well documented and referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29) or the North American Vertical Datum of 1988 (NAVD 88) (FEMA, 2003)

Benefits—Positive effects of an action. For FEMA flood hazard mitigation projects, benefits are defined as avoided damages and losses (FEMA, 2001)

Calibration—The process of identifying and correcting for systematic errors in hardware, software, or procedures; determining the systematic errors in a measuring device by comparing its measurements with the markings or measurements of a device that is considered correct (Maune, 2007)

Catchment Area—An area of land that is occupied by a drainage system consisting of a surface stream or a body of impounded surface water, together with all tributary surface streams and bodies of impounded surface water that drains into a single outlet; also called drainage basin or watershed (<http://water.usgs.gov/glossaries.html>)

Coastal Flooding—Flooding that occurs along the Great Lakes, the Atlantic and Pacific Oceans, and the Gulf of Mexico (FEMA, 2003)

Confidence Level—The probability that errors are within a range of given values (Maune, 2007)

Cooperating Technical Partners—Participating NFIP communities, regional agencies, and state agencies that are active participants in the FEMA Flood Hazard Mapping Program (FEMA, 2003)

Cross Section—A line across a floodplain, developed from topographic data, at which a computation of flood flow has been made to establish a potential flood elevation (<http://www.fema.gov/media/fhm/champ/ot_chmp.htm>)

Datum—A common vertical or horizontal elevation reference point (<https://hazards.fema.gov/femaportal/>)

- **Ellipsoidal Datum**—A set of constants specifying the coordinate system used for geodetic control, that is, for calculating coordinates of points on the Earth; also known as geodetic datum (<http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS_Glossary.xml>)
- **Orthometric Datum**—The reference surface from which orthometric heights are measured (i.e., NAVD 88 or NGVD 29)
- **Tidal Datum**—A surface with a designed elevation from which heights or depths are reckoned, defined by a certain phase of the tide. A tidal datum is local, usually valid only for a restricted area about the tide gage used in defining the datum (Maune, 2007)

Design Storm—A rainfall event of specified size and return frequency that is used to calculate runoff volume. It is assumed that the design storm for a given frequency will produce a simulated runoff peak and volume having the same return frequency. Thus, a 100-year design storm should produce a 100-year runoff and volume (New York Department of Environmental Conservation, 1992)

Detailed Study, Coastal—A coastal flood hazard study that uses transects and offshore bathymetry to conduct detailed erosion, wave height, and wave runup analyses and to prepare floodplain mapping. The analysis results in the determination and publication of BFEs and designation of the coastal high-hazard areas (V zones) (FEMA, 2003)

Detailed Study, Riverine—A riverine flood hazard study that uses topographic data, channel bathymetry, and bridge or culvert opening geometry to conduct detailed hydrologic and hydraulic analyses and floodplain mapping. The analysis results in the delineation of floodplain boundaries for the 1 percent annual chance (100-year) flood, determination of BFEs or flood depths, and normally, a regulatory floodway (FEMA, 2003)

Digital Elevation Model (DEM)—A file with terrain elevations recorded for the intersection of a fine-grained grid and organized by quadrangle as the digital equivalent of the elevation data on a topographic base map (FEMA, 2003)

Digital Flood Insurance Rate Map (DFIRM)—A Flood Insurance Rate Map that has been prepared as a digital product, which may involve converting an existing manually produced FIRM to digital format or creating a product from new digital data sources using a geographic information system (GIS) (FEMA, 2003)

Digital Terrain Model (DTM)—A land surface represented in digital form by an elevation grid or lists of three-dimensional coordinates (FEMA, 2003)

Discharge—The volume of water that passes a given location within a given period of time. Usually expressed in cubic feet per second (<http://water.usgs.gov/glossaries.html>)

Drainage Area—The area upstream of a specific location, measured in a horizontal plane, that has a common outlet at the site for its surface runoff from precipitation that normally drains by gravity into a stream. Drainage areas include all closed basins, or noncontributing areas, within the area unless otherwise specified (<http://water.usgs.gov/glossaries.html>)

Elevation—The distance of a point above the specified surface of constant potential; the distance is the direction of gravity between the point and the surface (<http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS_Glossary.xml>)

Elevation Certificate—A form on which the lowest floor elevation, lowest adjacent grade, and highest adjacent grade of a building are certified relative to the base flood elevation for the location of the building. Other descriptive information is also provided to help identify the flood risk to the building surveyed (Maune, 2007)

FIRMette—A full-scale section of a Flood Insurance Rate Map created by users online by selecting the desired area from a FIRM image. It also includes the map title block, north arrow, and scale bar (<http://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1>)

Flood—A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters or (2) the unusual and rapid accumulation or runoff of surface waters from any source (FEMA, 2003)

Flood Hazard Mapping Partner—Community officials; regional agency officials; state agency officials; communities, regional agencies, and state agencies participating in the FEMA Cooperating Technical Partners Program; other federal agencies; FEMA contractors; contractors of communities, regional agencies, and state agencies; community residents and property owners; other program constituents, including the U.S. Congress; insurance lending, real estate, and land development industries; and federal, state, and local disaster and emergency response officials whose combined contribution with FEMA staff obtain and maintain accurate, up-to-date flood hazard information (FEMA, 2003)

Flood Insurance Rate Map (FIRM)—The insurance and floodplain management map produced by FEMA that identifies, based on detailed or approximate analyses, the areas subject to flooding during a 1 percent annual chance (100-year) flood event in a community and flood insurance risk zones. In areas studied by detailed analyses, the FIRM shows BFEs to reflect the elevations of the 1 percent annual chance flood. For many communities, when detailed analyses are performed, the FIRM also may show areas inundated by a 0.2 percent annual chance (500-year) flood and regulatory floodway areas (FEMA, 2003)

Flood Insurance Risk Zones—The areas, also referred to as flood insurance rate zones, shown on a FIRM that are used to determine flood insurance premium rates for properties in the community covered by the FIRM. The flood insurance risk zones include SFHAs (e.g., Zones A, A1-30, AE, V, V1-30, VE, V0) and areas outside SFHAs (e.g., Zone X) (FEMA, 2003)

Flood Insurance Study (FIS)—A compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. When a flood study is completed for the NFIP, the information and maps are assembled into an FIS. The FIS report contains detailed flood elevation data in flood profiles and data tables (<http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/fis.shtm>)

Flood Insurance Study Report—A document, prepared and issued by FEMA, that presents the results of the detailed flood hazard assessment performed for a community. The primary components of the FIS report are text, data tables, photographs, and flood profiles (FEMA, 2003)

Flood Peak—The highest value of the stage or discharge attained by a flood; thus, peak stage or peak discharge (<http://water.usgs.gov/glossaries.html>)

Flood Profile—A graph of elevation of the water surface of a river in flood, plotted as ordinate, against distance, measured in the downstream direction, plotted as abscissa (<http://water.usgs.gov/glossaries.html>)

Flood Stage—The height of a water surface above an established datum plane (FEMA, 2003)

Floodplain—Any land area that is susceptible to being inundated by water from any source (FEMA, 2003)

Floodplain Management—The operation of a program of corrective and preventative measures for reducing flood damage, including emergency preparedness plans, floodcontrol works, and floodplain management regulations (FEMA, 2003)

Floodplain Management Regulations—The zoning ordinances, subdivision regulations, building codes, health regulations, special-purpose ordinances, and other applications of enforcement used by a community to manage development in its floodplain areas (FEMA, 2003)

Floodway—The regulatory area defined as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the base flood discharge can be conveyed without increasing the BFEs more than a specified amount (FEMA, 2003)

Freeboard—A factor of safety usually expressed in feet above a flood level for purposes of floodplain management. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed (44 CFR 59.1)

Geographic Information System (GIS)—A system of computer hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling, and display of spatially referenced data for solving complex planning and management problems (FEMA, 2003)

Geoid—The equipotential (level) surface of the Earth's gravity field, which on average coincides with mean sea level in the open undisturbed ocean. The geoid undulates up and down with local variations in the mass and density of the Earth (Maune, 2007)

Global Positioning System (GPS)—A satellite-based navigation and positioning system that enables horizontal and vertical positions to be determined (FEMA, 2003)

Height—The distance, measured along a perpendicular, between a point and a reference surface (e.g., height of an airplane above the ground surface). The distance, measured upward along a plumb line (line of force), between a point and a reference surface of constant geopotential. *Elevation* is preferred if the reference surface is the geoid (Maune, 2007)

- **Ellipsoid Height—**The height above or below the reference ellipsoid (i.e., the distance between a point on the Earth's surface and the ellipsoidal surface, as measured along the normal [perpendicular] to the ellipsoid at the point and taken positive upward from the ellipsoid) (Maune, 2007)

- **Orthometric Height (Elevation)—**The height above the geoid as measured along the plumbline between the geoid and a point on the Earth's surface, taken positive upward from the geoid (Maune, 2007)

Hydraulic Analysis—An engineering analysis of a flooding source carried out to provide estimates of the elevations of floods of selected recurrence intervals (FEMA, 2003)

Hydraulic Model—A computer program that uses flood discharge values and floodplain characteristic data to simulate flow conditions and determine flood elevations (FEMA, 2003)

Hydrograph—A graph showing stage, flow, velocity, or other water properties with respect to time (FEMA, 2003)

Hydrologic Analysis—An engineering analysis of a flooding source carried out to establish peak flood discharges and their frequencies of occurrence (FEMA, 2003)

Inundation Map—A map depicting the spatial extent and depth of floodwaters in the vicinity of National Weather Service river forecast locations (<http://www.floodsafety.noaa.gov/inundation.shtml>)

Letter of Final Determination—The letter in which FEMA announces its final determination regarding flood hazard information, including (when appropriate) proposed and proposed modified BFEs presented on a new or revised FIRM, and FIS report. The letter begins the compliance period and establishes the effective date for the new or revised FIRM and/or FIS report (FEMA, 2003)

Letter of Map Change (LOMC)—A collective term used to describe official amendments and revisions to FIRMs that are accomplished by an administrative procedure and disseminated by letter (FEMA, 2003)

Leveling—The process of finding differences of elevation (Maune, 2007)

Light Detection and Ranging (lidar)—An airborne laser system that is used to acquire *x*, *y*, and *z* coordinates of terrain and terrain features that are both manmade and naturally occurring. LIDAR systems consist of an airborne GPS with attendant base station(s), inertial measuring unit, and light-emitting scanning laser (FEMA, 2003)

Limited Detailed Study—A flood hazard study based on fewer surveyed cross sections than detailed studies. The analysis results in the delineation of floodplain boundaries for the 1 percent annual chance (100-year) flood and often base flood elevations (FEMA, 2006a)

Map Modernization Program—A multiyear FEMA initiative (1) to provide a technology-based, cost-effective, long-term process for updating, maintaining, storing, and distributing the flood risk information portrayed on the flood maps; and (2) to use engineering tools and analysis to update the flood maps so that they reflect physical changes that have occurred since the original mapping (FEMA, 2006a)

Mitigation—A sustained action taken to reduce or eliminate long-term risk to people and property from flood hazards and their effects. Mitigation distinguishes actions that have a long-term impact from those that are more closely associated with preparedness for, immediate response to, and short-term recovery from specific events (FEMA, 2003)

Monument or control monument (also called reference mark)—A structure that marks the location of a corner or point determined by surveying; generally, any material, object, or collection of objects that indicates the ground location of a survey station or corner (<http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS_Glossary.xml>)

National Flood Insurance Program (NFIP)—The federal program under which floodprone areas are identified and flood insurance is made available to the owners of the property in participating communities (FEMA, 2003)

Orthophoto—A photograph prepared from a perspective photograph by removing displacements of points caused by tilt, relief, and perspective (Maune, 2007)

Peak Flow—The maximum instantaneous discharge of a stream or river at a given location; usually occuring at or near the time of maximum stage (<http://water.usgs.gov/glossaries.html>)

Photogrammetry—The science of deducing the physical three-dimensional measurements of objects from measurements on stereo photographs that photograph an area from two different perspectives (Maune, 2007)

Q3 Flood Data Product—A digital representation of certain features of the FIRM that is intended for use with desktop mapping and GIS technology. The Q3 flood data product is created by scanning the effective FIRM paper maps and digitizing selected features and lines (FEMA, 2003)

Recurrence Interval—The average interval of time within which a given flood will be equaled or exceeded once; also known as the return period (FEMA, 2003)

Redelineation—A data update method that involves no new analyses, but uses effective information and new topographic data that are more up-to-date and/or detailed than those used to produce the effective FIRM to redelineate floodplain boundaries (FEMA, 2003)

Regression Equation—An experimentally determinable equation of a regression curve; that is, an approximate, generally linear relation connecting two or more quantities and derived from the correlation coefficient (FEMA, 2003)

Resolution—In the context of gridded elevation data, resolution is synonymous with the horizontal post spacing; sometimes used to state the number of points in x and y directions in a lattice (e.g., 1,201 × 1,201 mesh points in a U.S. Geological Survey [USGS] one-degree DEM) (Maune, 2007)

Restudy—A revised study of flood hazards performed for a community that already has an effective FIRM (FEMA, 2003)

Return Period—See recurrence interval

Revision—A change to an effective NFIP map based on new or revised scientific or technical data (<http://www.fema.gov/plan/prevent/floodplain/nfipkeywords/revision_maps.shtm>)

Riverine Flooding—The overbank flooding of rivers and streams (FEMA, 2003)

Runoff—That part of the precipitation that appears in surface streams (<http://water.usgs.gov/glossaries.html>)

Shallow Flooding—Unconfined flows over broad, relatively low relief areas; intermittent flows in arid regions that have not developed a system of well-defined channels; overbank flows that remain unconfined; overland flow in urban areas; and flows collecting in depressions to form ponding areas. For NFIP purposes, shallow flooding conditions are defined as flooding that is limited to 3.0 feet or less in depth where no defined channel exists (FEMA, 2003)

Special Flood Hazard Area (SFHA)—The area delineated on an NFIP map as being subject to inundation by the base flood. SFHAs are determined using statistical analyses of records of riverflow, storm tides, and rainfall; information obtained through consultation with a community; floodplain topographic surveys; and hydrologic and hydraulic analyses (FEMA, 2003)

Stillwater Flood Elevation (SWEL)—Projected elevation that floodwaters would assume, referenced to NGVD 29, NAVD 88, or other datum, in the absence of waves resulting from wind or seismic effects (FEMA, 2003)

Storm Surge—The rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure (<http://www.fema.gov/media/fhm/champ/ot_chmp.htm>)

Stream Reach—The length of a channel for which a single gage affords a satisfactory measure of the stage and discharge (<http://water.usgs.gov/glossaries.html>)

Structure—For floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank that is principally above ground, as well as a manufactured home. For flood insurance purposes, a walled and roofed building, other than a gas or liquid storage tank, that is principally above ground and affixed to a permanent site, as well as a manufactured home on a permanent foundation (FEMA, 2003)

Terrain—See topography

Topography—The form of the features of the actual surface of the Earth in a particular region, considered collectively; also called terrain (Maune, 2007)

Total Station—A tachymeter that senses angles and distances electronically. A tachymeter is a surveying instrument for the rapid determination of distance, usually together with the measurement of direction and difference of elevation (<http://www.ngs.noaa.gov/CORS-Proxy/Glossary/xml/NGS_Glossary.xml>)

Transect—Cross section taken perpendicular to the shoreline to represent a segment of coast with similar characteristics (FEMA, 2003)

Uncertainty—Degree to which an outcome is unknown or not established and is therefore in question (NRC, 2000)

- **Knowledge Uncertainty**—Sometimes called epistemic uncertainty—deals with a lack of understanding of events and processes, or with a lack of data from which to draw inferences; by assumption, such lack of knowledge is reducible with further information. The word epistemic is derived from the Greek "to know." Knowledge uncertainty is also sometimes referred to as functional, internal, or subjective uncertainty.

- **Natural Variability**—Sometimes called aleatory uncertainty—deals with inherent variability in the physical world; by assumption, this "randomness" is irreducible. The word aleatory comes from the Latin *alea*, meaning a die or gambling device. In the water resources context, uncertainties related to natural variability include things such as streamflow, assumed to be a random process in time, or soil properties, assumed to be random in space. Natural variability is also sometimes referred to as external, objective, random, or stochastic uncertainty.

Watershed—See catchment area

Wave Crest—The highest point on a ridge, deformation, or undulation of the water surface (<http://www.fema.gov/media/fhm/champ/ot_chmp.htm>)

Wave Envelope—A combination of representative wave runup elevation and the wave crest profile determined by the wave results computed using the Wave Height Analysis for Flood Insurance Studies (WHAFIS) program (FEMA, 2003)

Wave Height—Vertical distance between the wave crest and the wave trough (FEMA, 2003)

Wave Runup—Rush of waves up a slope or structure (FEMA, 2003)

Wave Setup—The increase in the stillwater surface near the shoreline, due to the presence of breaking waves (FEMA, 2003)

Wind Setup—The vertical rise in the stillwater level at the face of a structure or embankment caused by wind stresses on the surface of the water (FEMA, 2004)

Flood Mapping for the Nation

A Cost Analysis for the

Nation's Flood Map Inventory

The Association of State Floodplain Managers (ASFPM)

March 1, 2013

Flood Mapping for the Nation

Executive Summary

The Association of State Floodplain Managers has developed an estimate, based on a careful analysis, of the total cost to provide floodplain mapping for all communities in the nation based on the parameters specified in the Biggert-Waters Flood Insurance Reform Act of 2012. The Nation has invested $4.3 billion in flood mapping to date, and has enjoyed multiple benefits from that investment, including providing the basis for guiding development that saves over $1 billion/year in flood damages. ASFPM has identified criteria of what constitutes adequate flood mapping for the country, and has produced an estimate showing the initial cost to provide flood mapping for the nation ranging from $4.5 billion to $7.5 billion. The steady-state cost to then maintain accurate and up-to-date flood maps ranges from $116 million to $275 million annually.[1] This national investment in a comprehensive, updated flood map inventory for every community in the nation will drive down costs and suffering of flooding on our nation and its citizens, as well as providing the best tool for managing flood risk and building sustainable communities.

Objective of study

The Association of State Floodplain Managers (ASFPM) conducted a study to develop an overall estimate of the cost to adequately complete the mapping of flood hazards and communicate flood risk for all communities in the United States. The study has multiple objectives including:

1) Identifying the cost to complete the flood mapping effort in the nation consistent with the new congressionally established National Flood Mapping Program;

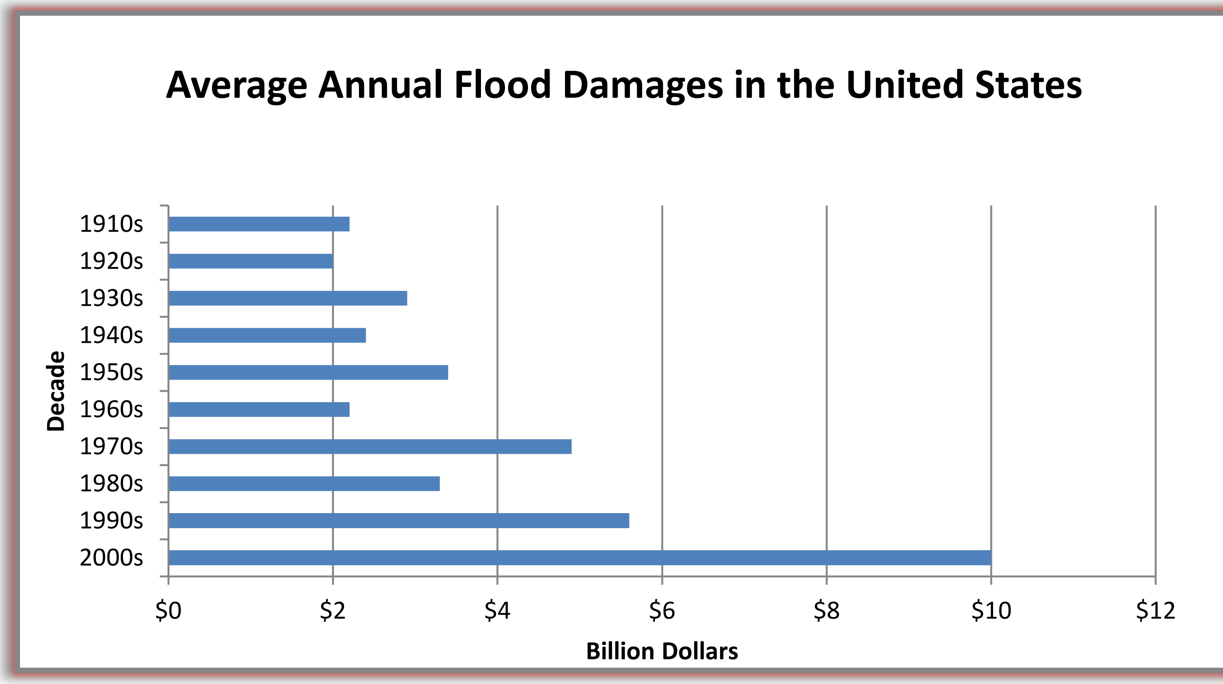
2) Identifying the annual, steady-state maintenance cost of the mapping program after the flood mapping has been completed for all parts of the nation;

3) Comparing these estimated costs with the Congressional authorization, of $400 million annually for the National Flood Mapping Program, to help decision makers determine if we are on track in moving toward getting the 22,000 flood prone communities in the nation mapped, and to keep the maps updated,

4) Identifying issues, cost savings and other considerations that the Federal Emergency Management Agency (FEMA) and the Technical Mapping Advisory Council (TMAC) should consider as they work to lay out the plan for mapping the flood risk areas of the nation.

[1] These estimates do not include revenue from the Federal policy fee which is primarily used to support administrative cost including the issuance of letter of map change, program management, and data dissemination.

Costs and Impacts of Flooding



At the time of writing of this report, the nation is recovering from Hurricane Sandy – which appears as if it is going to be the second most costly flood disaster in the modern history of the United States. Sadly, Sandy and the costliest flood on record, Hurricane Katrina, have both occurred in the last 7 years. The cost to the Federal taxpayers of these two storms alone will exceed $200 billion.

Floods are the leading cause of natural disaster losses in the United States, having cost approximately $50 billion in property damage in the 1990s and accounting for more than two-thirds of federally declared natural disasters (National Research Council, 2009). Direct average annual flood damages have jumped from approximately $5.6 billion per year in the 1990s to nearly $10 billion per year in the 2000s, with some years much more that. But the costs of flooding go far beyond these direct losses.

Individuals and businesses. The effects of a flooding event on individuals have been well documented and include lost wages, agricultural products, expenses for evacuating, and significant health and mental health issues for years following the event. For businesses, the effect is pronounced. Almost forty percent of small businesses do not reopen after a disaster (FEMA) and another 25 percent fail within one year according to FEMA. Similar statistics from the United States Small Business Administration indicate that over 90 percent of businesses fail within two years after being struck by a disaster. Businesses also experience lost revenues from being closed, which, in turn, means lost taxes, jobs and wages throughout the community. Businesses can be affected by employees being unable to get to work due to transportation system failures or their own homes being devastated. Supply lines can be disrupted.

Communities. Communities suffer as well. Loss of income taxes from closed businesses, and diversion of local funds earmarked for other uses, must instead go to flood repair and recovery, physical and mental health, and the use of community resources (staff, equipment, and infrastructure) for response and rescue. Community infrastructure can be severely impacted, including the most costly elements such as water and wastewater treatment facilities. Debris collection and environmental cleanup can be significant. Local taxes (income, property, etc.) are reduced, both in the short and long term.

Mega floods are not new to the California Central Valley. In fact, 7 such events have occurred based on the geologic record since the year 200 AD. ARKStorm is a product of the U.S. Geological Survey, Multi Hazards Demonstration Project (MHDP) and is a model based on the most recent of these storms to occur in 1861-1862 using 2008 development and population data. ARKStorm showed that if such an event happened today, over $725 billion in direct property and indirect business losses would result. This is nearly 3 times the loss deemed to be realistic by the ShakeOut earthquake scenario for a severe southern California earthquake (United States Geological Survey, 2011).

States. Roads, bridges, and other State infrastructure such as emergency facilities can be damaged or destroyed. State impacts of flooding include a diversion of state resources from necessary programs to response and recovery programs. State taxes (income, property, etc.) are reduced.

Federal Government. *A*ll taxpayers pay for the consequences of flooding. If property owners do not have flood insurance, taxpayers provide assistance through disaster relief. The casualty loss deduction allowance and lost wages due to business closure result in forgone tax revenue. Insurance subsidies, through either crop or flood insurance, result in cost to the U.S. Treasury.

Future costs

Given the brief period of history in which flood losses have been tracked in the United States, it is fair to say we have not seen the probable maximum flood for most areas. While Hurricanes Katrina and Sandy have caused over $200 billion in losses, either event could have been worse, and some future events likely will be.

Trends indicate that the Federal taxpayer is paying a greater share of disaster costs than any time in history. A recent analysis shows that from 1989 to 2004, Federal aid as a percentage of all economic costs from major hurricane events averaged 26%. Since 2005, the Federal aid proportion jumped dramatically to 69% (J. David Cummings, 2010).

The United States currently has a population of about 320 million, which is expected to be about 380 million by 2030 and 460 million by 2050. This population explosion combined with our desire to live near water will lead to significantly increased pressure to develop in flood risk areas. Climate change is resulting in sea level rise on the coasts, and more intense storms everywhere. Recent reports from the Government Accountability Office (GAO), and the National Climate Assessment and Development

Advisory Committee indicate that there will be significant risk exposure to families, communities, infrastructure, and federal assets due to climate change and sea level rise.

Benefits of Flood Mapping

Flooding is a natural phenomenon. Maps will not prevent floods from occurring, but they are an essential tool in avoiding or minimizing the damage to property and loss of life caused by floods, and for communicating flood risk. Without accurate flood maps, local officials face serious difficulties in guiding development away from the most hazardous areas or in ensuring that development in or near the hazard area is properly built and protected.

Flood maps are used for many purposes. FEMA's Flood Insurance Rate Maps—the primary type of flood maps in the United States—are used to determine flood insurance rates, development regulations, and flood preparation for those at risk. Government officials use them to establish zoning, land-use, and building standards; to support land use, infrastructure, transportation, flood warning, evacuation, and emergency management planning; and to prepare for and respond to floods. Insurance companies, lenders, realtors, and property owners depend on these maps to determine flood insurance needs. For citizens, businesses and communities, the FEMA flood maps are the essential tool for reducing flood losses and are the nation's default source of flood hazard information.

In the creation of quality flood hazard data, high quality topographic information is essential. This elevation dataset has multiple uses, and associated costs are avoided since these data can be used by multiple programs and agencies. Communities can use these data to determine safe evacuation routes for citizens, support first responders in emergencies, account for changes in tax base, and update a variety of local plans (e.g. hazard mitigation, comprehensive land use, and capital improvement plans). Such data can reduce the need to conduct field surveys by agencies such as departments of transportation, and to plan for resilient community growth. The Congressional Budget Office found that lack of up-to-date topographic information causes a downward bias on the actuarial soundness of the NFIP (Congressional Budget Office, 2009).

Maps depicting flood hazard areas are not only the foundation of the NFIP, but also the basis of sound floodplain management policies at the local, state, and federal levels. Adequate, accurate, and current maps are essential for the program to function. If a potential flood prone area is not mapped, the community has no tool to adequately guide development to be safer and to mitigate future flood losses. Local governments, with state assistance and authority are the level of government with the tools to reduce future flood losses. Those tools are land use and building codes, which they use to guide development to lower flood risk areas, and to build in a resistant way in flood risk areas so future damages and risk are reduced. Currently many communities assist in cost sharing or in providing modern topographic mapping. Without mapping of the flood prone area, there is no real tool to communicate flood risk to community officials, citizens, or businesses. The sale of flood insurance is not mandated in areas outside floodplains mapped on FIRMs. Without adequate, accurate, and current maps, neither construction nor the insurance regulatory elements of the program can be effective (Technical Mapping Advisory Council, 2000).

The State of North Carolina has the most comprehensive statewide flood mapping program in the country. All streams with a drainage area greater than 1 square mile are mapped, and the state has partnered with FEMA to provide over half of the funding investment needed to generate comprehensive statewide flood maps and data. High quality elevation data was obtained statewide and all flood zones have base flood elevations associated with them. A key feature of the North Carolina approach is education and outreach.

Floodplain mapping is a cost-effective taxpayer investment. In 1997, FEMA conducted a benefit-cost analysis of its proposed flood mapping program (Map Modernization). Based on that analysis, floodplain mapping showed a benefit to the taxpayer of over $2 for every $1 invested in flood mapping. Later, the State of North Carolina used the same methodology as FEMA and calculated a benefit-cost ratio of 2.3 to 1. The North Carolina report further determined the following range of values of avoided losses per stream mile studied:

Flood Study Type	Range of losses avoided / stream mile
Detailed Study	$5,482-$6,166
Limited Detailed Study	$1,713-$2,539
Approximate Study	$721

The North Carolina report indicates that for the 29,733 stream miles studied throughout the state, the average benefit provided is $3,400 per year per mile and clearly shows significantly higher benefits of having more detailed flood studies (State of North Carolina, 2008).

Flood mapping reduces disaster costs. Development that complies with the floodplain management requirements is better protected against major flood-related damage. Since flood mapping is the basis for community floodplain management regulations, then it stands to reason that new construction in mapped floodplains would have to comply with such codes and be constructed to be more resilient in future disasters. In fact, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance (Federal Emergency Management Agency, 2012). Lower damage amounts can be a proxy for lower impacts and demands on disaster assistance. In its final report the TMAC indicated that a small investment in mapping can result in huge savings in flood-related disaster assistance in the future (Technical Mapping Advisory Council, 2000).

History and Current Status of Flood Hazard Mapping

To meet the objective that studies be conducted to accurately assess the flood risk within each flood-prone community and develop appropriate flood insurance rates, the 1968 Act called for: 1) the identification and publication of information within five years for all floodplain areas that have special flood hazards; and 2) the establishment of flood-risk zones in all such areas to be completed over a 15-year period following passage of the Act (these initial objectives of the Act were never fully achieved). After an initial funding of flood mapping from 1974-1980, funds were relatively stagnant until 2003. Compounding matters, there was an incorrect assumption that once the initial flood maps were published there would not be a need for updating or republishing.

As a result, mapping that had not been completed still remained to be done and the existing flood map inventory started to become outdated – whether from changes in the watershed or the flood hazard that resulted in different flood heights, or from the need to develop detailed flood data in areas that had only approximate or no flood information.

Also during that time, significant advances in cartographic mapping, flood hazard analysis, and modeling occurred. The 1994 Flood Insurance Reform Act called for the establishment of the Technical Mapping Advisory Committee. Their annual TMAC reports from 1995-2000 provided momentum and a road map for the FEMA Map Modernization Program. Additionally, the TMAC developed recommendations that should still be considered today.

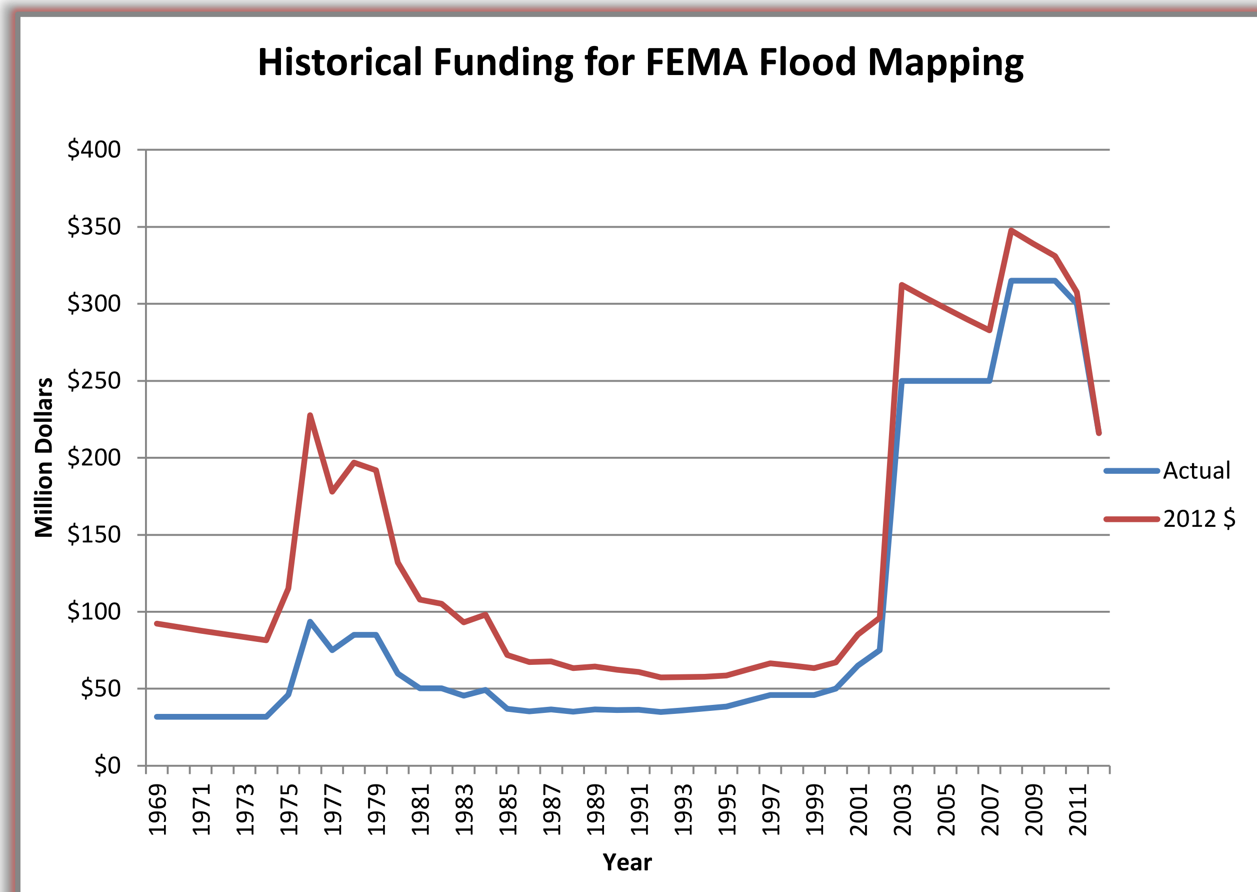
Map Modernization had a major goal to convert the nation's paper maps to a digital format—that was achieved for about 92% of population and 62% of the land area. While it was key that digital maps be provided for those areas, the limit on resources meant that few communities were provided new engineering models for updated flood levels and that large geographic areas of the United States still remained unmapped. Mapping efforts were focused on where the greatest population is located, equating population with risk. Unfortunately, this left a missed opportunity to provide maps for communities with emerging development which is being built in areas with limited or non-existent flood risk information.

> *Flood hazard is not the same as flood risk. Most flood maps express only flood hazard—that is, the places where flooding is possible. Many do not currently reflect the elements that are included in flood risk— the probability that a flood will actually occur in a given area, the chance any existing flood prevention systems will perform as designed, and the total consequences (costs) of flooding.*
>
> *FEMA's Risk MAP program is moving from simply portraying flood hazard and flood insurance rate zones to communicating and assessing risk, which will improve the utility of FEMA's flood maps for governments, business, and the public* (National Research Council, 2009).

FEMA's Risk MAP program became the successor to the Map Modernization program. An important aspect of Risk MAP is that it took lessons learned from Map Modernization and applied them. Such lessons included:

- Just providing a flood map outlining the flood hazard area perpetuates the concept that flood risk is an "in" or "out" proposition and doesn't convey flood risk. As a result, the Risk MAP program has developed non-regulatory products such as the Flood Risk Map and Flood Risk Report that provide communities the additional risk data needed to better communicate the potential flood risk to its citizens and to take mitigation actions to reduce risk.

- There is great importance in effective communications with communities during the mapping process. While Map Modernization only resulted in limited communication with communities (and this communication included significant lag time between contacts), Risk MAP includes a much more robust communication role – with multiple communications opportunities throughout the mapping life cycle and with multiple audiences to encourage a more complete dialog of flood risk.



Since the inception of the NFIP, $4.3 billion has been invested in the nation's flood mapping program ($6.2 billion adjusted to 2012 dollars). This amount includes both appropriated and fee generated funds.

Return on Existing Investment in the Nation's Flood Maps

What have been the results of investing in the nation's flood maps to date?

- There are $1.5 billion in avoided damages every year for buildings constructed in compliance with NFIP standards. The Federal taxpayer would have largely have paid for these losses through disaster relief and other programs. These losses avoided would have not been possible without the flood maps. So the investment in flood mapping since the inception of the program until now can be offset by losses avoided in just over 4 years.
- Over 22,000 communities participate in the NFIP. Many of them have reasonably good flood data and, as a result, have been able to reduce flood damages to new development. Additionally, over 5.5 million flood insurance policy holders have their financial investment in homes and businesses protected by flood insurance. These are all potential damages that are paid through an insurance mechanism rather than disaster assistance. Those who live at risk pay for part of the cost of those decisions. NONE of this would be possible without flood maps.
- This investment has resulted in the creation of a digital platform for flood maps. This was a huge undertaking given that previous flood maps were developed using multiple, older cartographic methods. Now, the digital platform is compatible with modern Geographic Information Systems which means the maps can be integrated into federal, state, and local systems; and it positions the nation to move quickly and more cost effectively to develop new and updated maps for every community in the nation.

What remains to be done?

We need to (1) complete mapping for those communities that do not have a map, (2) update maps for those who have a map but have no data in some areas of the community that are developing, and (3) update maps for those who have detailed data but need to reflect changed conditions. Further, professionals in floodplain management know that there are different types of flood hazards – many of these are not identified or if they are, they are not on the flood maps. The framework for flood mapping as prescribed by the National Flood Mapping Program in the Biggert-Waters 2012 Reform Act, recognizes many of these existing needs and sets a robust course for moving forward.

Cost of Flood Mapping for the Nation

What Does Flood Mapping for the Nation Mean?

Section 100216 of the Biggert-Waters Flood Insurance Reform Act of 2012, Pub. L. No: 112-141, establishes The National Flood Mapping Program and describes the responsibility of FEMA to develop and maintain flood maps that are adequate to: 1) Make flood risk determinations and 2) be used by state and local governments in managing development and reduce the risks associated with flooding. To accomplish this, the 2012 Act requires that FEMA shall review, update, and maintain NFIP maps with respect to:

1. All populated areas and areas of possible population growth located within the 100-year and 500-year floodplains;

2. Areas of residual risk, including areas that are protected by levees, dams, and other flood control structures and the level of protection provided by those structures;

3. Ensuring that current, accurate ground elevation data is used;

4. Inclusion of future conditions risk assessment and modeling incorporating the best available climate science; and

5. Including any other relevant data from NOAA, USACE, USGS and other agencies on coastal inundation, storm surge, land subsidence, coastal erosion hazards, changing lake levels and other related flood hazards.

> *"All flood hazard areas need to be mapped in order for the NFIP to fulfill its potential for reducing the rate of flood-related disaster costs."* (Technical Mapping Advisory Council, 2000)

Key Assumptions

To complete flood maps and flood risk data for the nation, it is necessary to make certain key assumptions about the mapping program. Below is the list of the key assumptions made in this report as it relates to what constitutes mapping the nation.

Assumption #1: The framework for mapping the nation going forward has been established in the 2012 Reform Act and dovetails well with FEMA's Risk MAP program and previous recommendations to improve floodplain mapping. In the past, and in the absence of clear Congressional direction, the mapping program was almost solely focused on supporting flood insurance rating as well as serving as a tool for the adoption and enforcement of local floodplain management regulations. However, the purpose of the National Flood Mapping Program is clearly meant to fulfill a broader mandate – to create the nation's flood risk data set so communities, states, and individuals can take action to reduce losses.

FEMA's Risk MAP program moved the discussion of flood hazard identification away from just the 1% chance flood and Flood Insurance Rate Maps to identifying multiple types of flood hazards and frequencies of flood risk. Further, the discussion has been shifted more to one on risk and what the property owner/community can do about it, rather than whether a person is in out of the Special Flood Hazard Area for purposes of flood insurance.

The Act makes a clear and unequivocal statement that flood maps produced by FEMA will be forward looking and inclusive of several types of flood risk data. The Congress has, in effect, acknowledged what most state and local officials already know – that the FEMA Flood map data is and should be the default national dataset for flood risk.

Assumption #2: Flood data and maps are developed for the entire nation. Based on the National Hydrographic Dataset, there are 3.5 million miles of streams in the nation. Currently, only 1.2 million miles have flood maps. FEMA's floodplain mapping programs to this point have chosen to prioritize limited resources to those areas of greatest population and flood insurance policies on the assumption these are the highest risk areas. While this approach has produced accurate and detailed maps in counties and communities with higher population levels (even in these communities there are flood prone areas that have not yet been mapped), there are many counties and communities throughout the nation that *continue* to have paper maps over 30 years old that are based on using obsolete mapping methods or that *do not have flood maps at all*. The current approach ignores lesser populated areas – that have considerable flood risk especially in relation to the local economy, and may have rapidly developing areas with no flood data to guide development. These communities are found all over the nation and continue to find themselves less able to be resilient because the foundational flood data does not exist. Unmapped flood hazard areas present a serious threat to people who may choose to buy or build within them (Technical Mapping Advisory Council, 2000).

Over 1 million miles of streams exist on Federal lands. While some development and infrastructure exists on these lands, the low future development potential coupled with other Federal agencies primacy over such areas, this cost model only shows the cost to map these areas in the high cost range scenario. ASFPM believes that mapping these areas could have benefits; however, flood mapping could, and probably should be developed by the owner agency as required by the federal Executive Order 11988.

Assumption #3: The minimal flood mapping level for the nation should be model based and include the ability to readily obtain flood elevation information. With advances over the past decade in automated technologies to map flood hazards and risk, <u>and</u> with high quality topographic data, the ability exists to map large geographic areas using such methods. This mapping would be done at a cheaper cost and the quality would be much improved over maps produced 30+ years ago. While FEMA has correctly identified the flood hazard area, communities and citizens need flood elevation data for important things like insurance rating, assessing actual flood risk and making development decisions and to plan for resilient community growth in order to truly manage the flood risk at the local level.

Assumption #4: Up to date detailed elevation data (LIDAR or other topographic maps) are needed anywhere flood mapping and data are to be generated. The accuracy of elevation data has an enormous impact on the accuracy of flood maps Having accurate topographic data for floodplain mapping is especially critical in regions with low relief, such as coastal areas – these are the very areas that are seeing the most significant population growth and development.

Assumption #5: Residual Risk is being defined in this cost model as risk associated with levees and inundation/failure areas below dams; however other residual risk areas should be identified. There is a new mandate in the law that residual risk areas be identified. It is important that re-established TMAC work to help further define the term and criteria.

Assumption #6: The flood map inventory must be continuously updated. Flood map data is not static, it changes over time. Drivers of this change include: 1) Change in hydrology, i.e. updated rainfall records and changing storm patterns, 2) Changes in land use such as population growth or hardening of watersheds causing changes in runoff, 3) Need for detailed flood studies as new areas develop, 4)

Update of data based on new models, and 5) Technological advancements that allow for more dynamic analyses and presentation of flood risk. While the initial mapping effort for the nation must be completed, there too is an annual maintenance cost for the entire flood map and data inventory. The federal government's investment in the development of flood hazard data is considerable and must not be allowed to decay as happened in the mid-1980s and 1990s (see chart on Historical Funding for FEMA Flood Mapping).

The Cost

Program Element	Lower Range	Upper Range
Topographic Data Development with QA/QC	$ 877,500,000	$ 1,171,200,000
Mapping (Risk Identification and Assessment)		
Discovery, Scoping, Risk Communication & Outreach	$51,609,830	$ 73,034,759
Riverine Flood Study	$ 2,941,056,518	$ 4,949,637,440
Coastal Flood Study	$ 7,733,725	$ 48,647,625
Levee Mapping	$ 53,746,875	$ 358,312,500
Dam Failure Inundation	$ 289,464,800	$ 289,464,800
DFIRM Production with QA/QC	$ 170,888,850	$ 392,162,595
Non-Regulatory Flood Risk Products	$ 67,846,631	$ 188,741,513
Total	**$ 4,459,847,229**	**$ 7,471,201,232**

The national mapping program shown above has been broken down into major elements and there is also a low and high cost associated with each. The basis for these costs are the assumptions explained in the preceding section and actual cost information obtained from FEMA and states completing mapping projects under the Cooperating Technical Partners Program. Due to its complexity, the data behind these estimates is not included in this report, but is available from ASFPM upon request.

The most significant source of variability between the high and low range is due to assumptions made related to level of riverine flood studies for a given geographic area. While good cost data is available currently, it is important to note that changing technology as well as an assumption of nation-wide LIDAR could result in reduced costs. There is a high degree of uncertainty, though, of the extent of such cost savings. The upper range also includes mapping flood hazard areas on all Federal lands. As an area becomes more developed (and thus more at-risk) there is an increased need for higher levels of detail in flood studies. There is also significant variability for levee studies reflecting the relative uncertainty as to the number of levee miles and the needed level of analysis.

Program Element	Lower Range	Upper Range
Steady-State Map Maintenance (Annual)	$ 116,180,416	$ 275,204,714
Total	**$ 116,180,416**	**$ 275,204,714**

In terms of map maintenance, the largest variable has to do with assumptions of map decay – or the accuracy of the map over time. Flood maps and risk will change over time due to several factors including changes in topography in the watershed, changes in development and growth, and also changes in precipitation, additional stream gage data, and changes in water levels in lakes and oceans. In areas where all of these are changing rapidly, maps need to be updated much more frequently than in some rural areas that have little growth and development. Also, accelerated sea level rise and climate change could result in higher decay rates than are presented in this cost estimate. All flood maps need updated periodically, but some more frequently than others.

Standard Operations and Fee Income

The resources needed to annually operate the nation's flood mapping program varies from year to year, but in recent years is generally estimated to vary from $85 - $105 million. Standard operations include staffing, program management, intaking / processing / issuing Letters of Map Change, and data management and dissemination. *These critical functions are not identified in above costs to map the nation, nor are they included in the steady-state maintenance costs.*

FEMA collects a Federal Policy Fee on all policies and a portion of it is dedicated for flood mapping purposes. In 2011 the Federal Policy Fee generated approximately $170 million; however, this revenue is used to support not only flood mapping activities, but floodplain management activities and other FEMA costs to run the NFIP. The amount used for floodplain mapping has recently been in the $100-$115 million range. From these data, based on current fee allocation and amount, standard operations costs largely offset the fee income. In order for fee income to support additional flood mapping, there would need to be a fee increase.

Cost Savings

The cost model developed by ASFPM includes estimates based on available information from states and FEMA, and is also based on today's technology and methods of providing flood map data, as well as the assumptions stated earlier. ASFPM believes that there are ways to achieve cost savings by leveraging funding, advances in technology and other approaches. A few of these are presented below.

1. *Efficiencies in mapping using better technology.* Throughout the FEMA Map Modernization program and in Risk MAP, FEMA has been successful in driving program efficiencies. This is also a result of changing and improving technologies.
2. *Leveraging state and locally collected elevation data.* Some states do routinely collect and maintain statewide, high quality LIDAR data that can be used for flood mapping. This may reduce the initial cost to collect and maintain the necessary topographic information needed for flood mapping. ASFPM has also identified potential cost savings related to conducting flood studies by having a nationwide LIDAR dataset due to economies of scale.
3. *Incenting better cost sharing overall.* Currently there is no required cost share for flood mapping. Whether through incentives or requirements, cost-sharing can drive down the Federal outlays for flood mapping and may be especially appropriate in rapidly developing areas.
4. *Streamlining the geospatial processes and management of data for flood mapping.* To be clear, there are still some communities in the country that continue to rely on paper flood maps. This

issue can be addressed by developing means to provide paper maps, when a community indicates a need--at a much lower cost than the added processing steps that are now necessary in order to always produce a paper map for every community.

5. *Increasing the flood insurance policy fee to provide additional funds for flood mapping.* In addition to direct appropriations, FEMA is authorized to use some of the fees collected from policyholders for mapping activities. Congress could direct FEMA to increase these offsetting fees. For example, a $15 increase in the fee (on average, this would only increase the cost of a policy by 1-2%) would eventually generate about $75 million per year. An alternative to the whole dollar amount charged would be to convert the fee to a percentage of the premium such that additional funding would be generated.

Conclusion

Flooding is a predictable risk in the sense that we can identify where in the nation flooding will occur. It is a manageable risk – there are established actions that individuals, businesses and communities can take to reduce potential damage – provided the flood risk areas are identified. Flooding continues to be the nation's costliest hazard, with average annual losses now averaging over $10 billion. Yet losses continue to climb – our nation has a flooding problem.

Investments in the nation's flood mapping program over the past 40 years have been impressive. Over one million miles of streams, rivers, and shorelines have been mapped at a total cost of over $4 billion. Yet we still have areas that have no flood maps, areas that have outdated flood maps that haven't been updated, and areas with older engineering studies that need to be updated. And there are other flood hazards that need to be identified. Based on the data presented in this report, over half of the needed investment has been made. Why continue?

A recent report on the NFIP identified that the lack of understanding of the national flood risk, the inadequate communication of that risk, and diminished capabilities in flood risk management due to inaccurate or out-of-date flood hazard maps is a current major weakness in the program. However, it also concluded that reliable flood risk data, including updated flood maps, and educating residents about flood risk, contribute to mitigating future flood losses (Congressional Research Service, 2011). A comprehensive, updated national flood map inventory can drive down the costs – and impacts – of flooding on our nation and its citizens.

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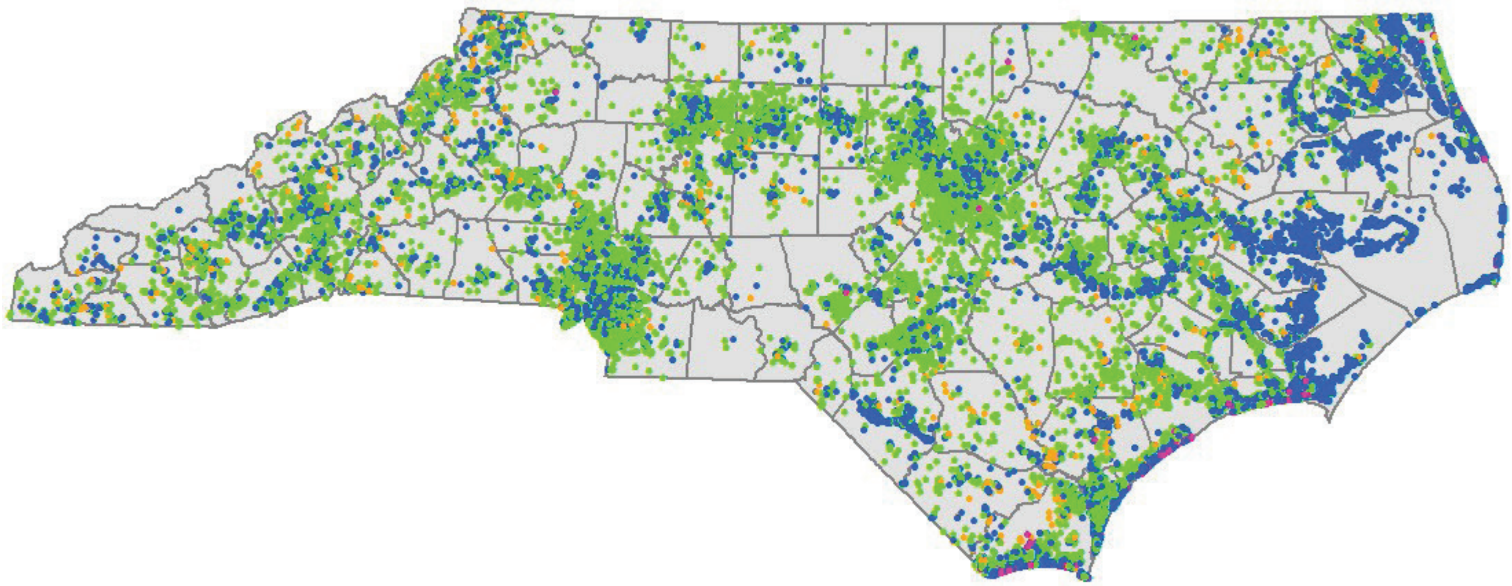

National Flood Insurance Program Premiums in North Carolina

Case Study on Data Availability, Modeling and Analysis

Supporting Premium and Affordability Discussions

Prepared by:

North Carolina Floodplain Mapping Program

North Carolina Emergency Management

EMERGENCY MANAGEMENT NORTH CAROLINA

November 2015

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Acronyms

AAL	Annualized Average Loss
CRS	Community Rating System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
NCFMP	North Carolina Floodplain Mapping Program
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
PRP	Preferred Risk Policy
SFHA	Special Flood Hazard Area

Definitions

Community Rating System (CRS)
A voluntary program that provides reductions to flood insurance premiums for policy holders for communities that exceed minimum NFIP standards.

Grandfathered NFIP Policy
Policy premium calculated based on prior building floodzone and/or BFE.

Mapped Floodplain
Includes all mapped/shaded areas of the floodplain (i.e. SFHA and Shaded X).

Negative Elevation Rated Policy
Policy with floor elevation below BFE.

NFIP Contract
Insurance agreement at building level (may contain one or more policies).

NFIP Policy
Insurance agreement at individual dwelling level (i.e. unit, condo).

NFIP Risk-Based Rate
Policy premium calculated based on current building floodzone and BFE.

Preferred Risk Policy (PRP)
A lower-cost policy based on fixed combinations of coverages amounts available for properties in low risk zones (e.g. B, C and X) that meet eligibility requirements.

PreFIRM
A building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial Flood Insurance Rate Map (FIRM).

PreFIRM NFIP Policy
A subsidized policy option for structures built before community's initial flood maps (or before 1975). Generally the PreFIRM rate is lower than NFIP risk-rated rates for structures that are below the BFE.

PostFIRM
A building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of an initial Flood Insurance Rate Map (FIRM), whichever is later.

Special Flood Hazard Area (SFHA)
The land area inundated by the 1% chance storm event where floodplain management regulations must be enforced and where rules for mandatory purchase of flood insurance apply.

Shaded X
Area of moderate flood hazard (typically 0.2% annual chance or future conditions) that is mapped but not considered part of SFHA.

1.0 Introduction

This report summarizes the findings and conclusions of a flood insurance case study on the availability of related data, methodologies and models capable of establishing premiums, and affordability analysis. This report also provides the methodology and findings of a number of conceptual alternative rate methodologies to support the discussion of flood insurance affordability. This case study was performed by the State of North Carolina Floodplain Mapping Program (NCFMP) in consultation with the National Research Council–Committee on Affordability of National Flood Insurance Program (NFIP) Premiums.

1.1 Background

The NCFMP was established by the State of North Carolina following Hurricane Floyd in 1999. This flood event revealed significant deficiencies in the availability, age, accuracy, and process for updating Flood Insurance Rate Maps (FIRMs) available at that time. Based on this finding, the State of North Carolina petitioned FEMA to delegate the authority and responsibility for the update and maintenance of all data, hydrology and hydraulic (H&H) models, and maps associated with special flood hazard areas to North Carolina. FEMA, through its Cooperating Technical Partner program, designated the State of North Carolina as a Cooperating Technical State and delegated the update and maintenance to the State.

From this designation, the State of North Carolina established the NCFMP to update, disseminate, and maintain current and accurate data, H&H models, and maps associated with flood hazard identification and risk assessment statewide. The State of North Carolina has supported the statewide update and program through: one-time large project appropriations; financial partnerships with common interest stakeholders; and a dedicated, recurring fee receipt. Since 2000, approximately $218.5M has been dedicated by the State of North Carolina (46%) and FEMA (54%).

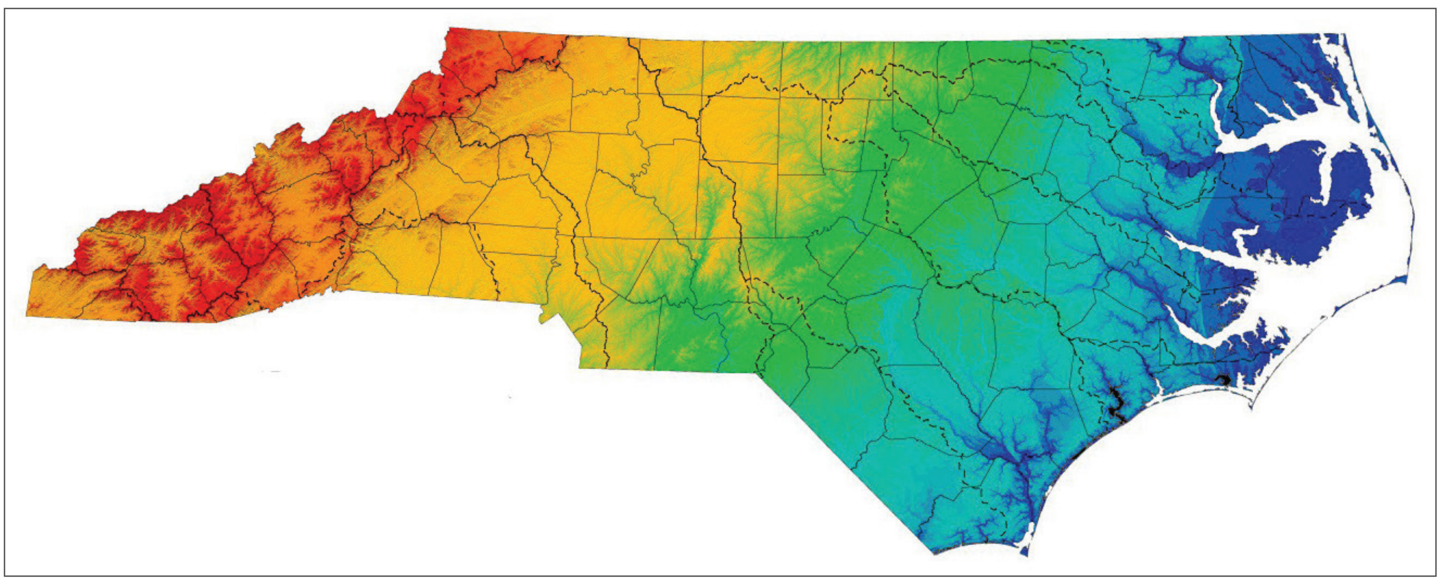


Figure 1. North Carolina Statewide LiDAR

Based on this directive, between 2000 and 2008, NCFMP (1) acquired statewide, high-resolution, LiDAR-derived topography and imagery (Figure 1); and, (2) performed hydrologic and hydraulic engineering studies for 28,778 linear stream and coastal miles (Figure 2). Leveraging these endeavors, NCFMP has generated updated statewide seamless digital data, models, and FIRMs (10,003) as well as over 300,000 base flood elevations (BFEs) associated with special flood hazard areas. NCFMP has also constructed and published a GIS-enabled website for displaying all data, models, and information associated with special flood hazards and risk (http://fris.nc.gov/fris/). Since 2008, NCFMP has implemented a number of progressive initiatives aimed to support the identification and dissemination of event specific, structure-based risk information allowing public officials and citizens to better prepare for, respond to, and mitigate against flooding and other hazards in the State.

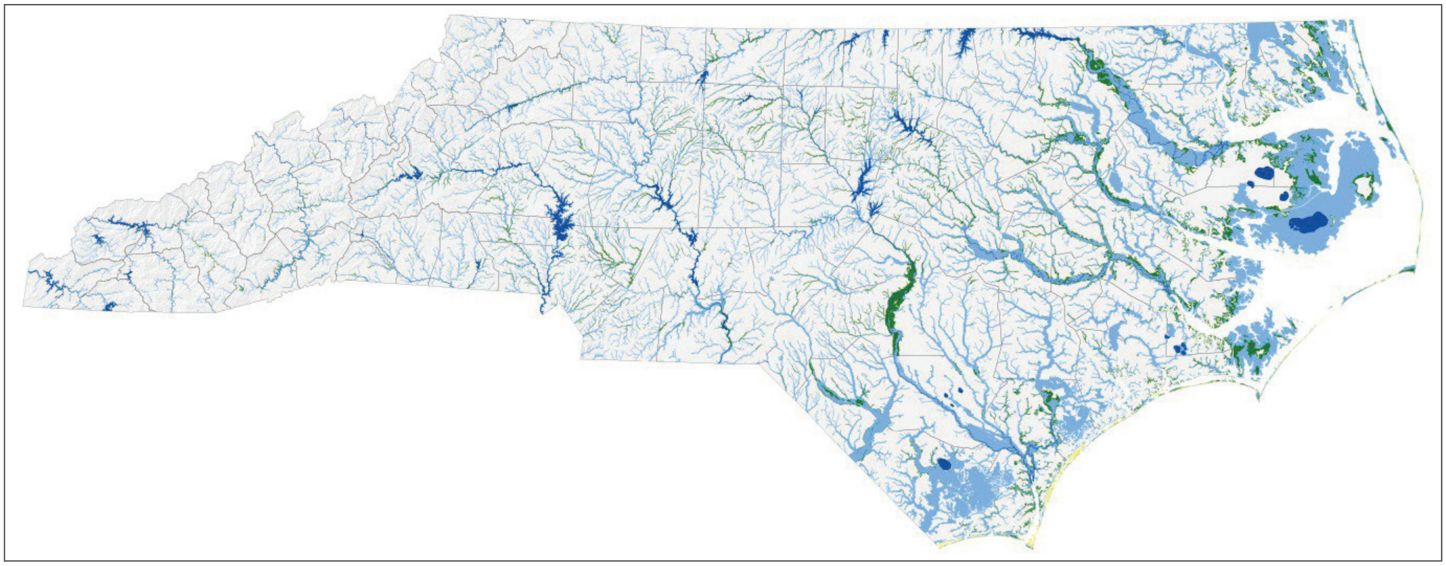


Figure 2. North Carolina Statewide Floodplains

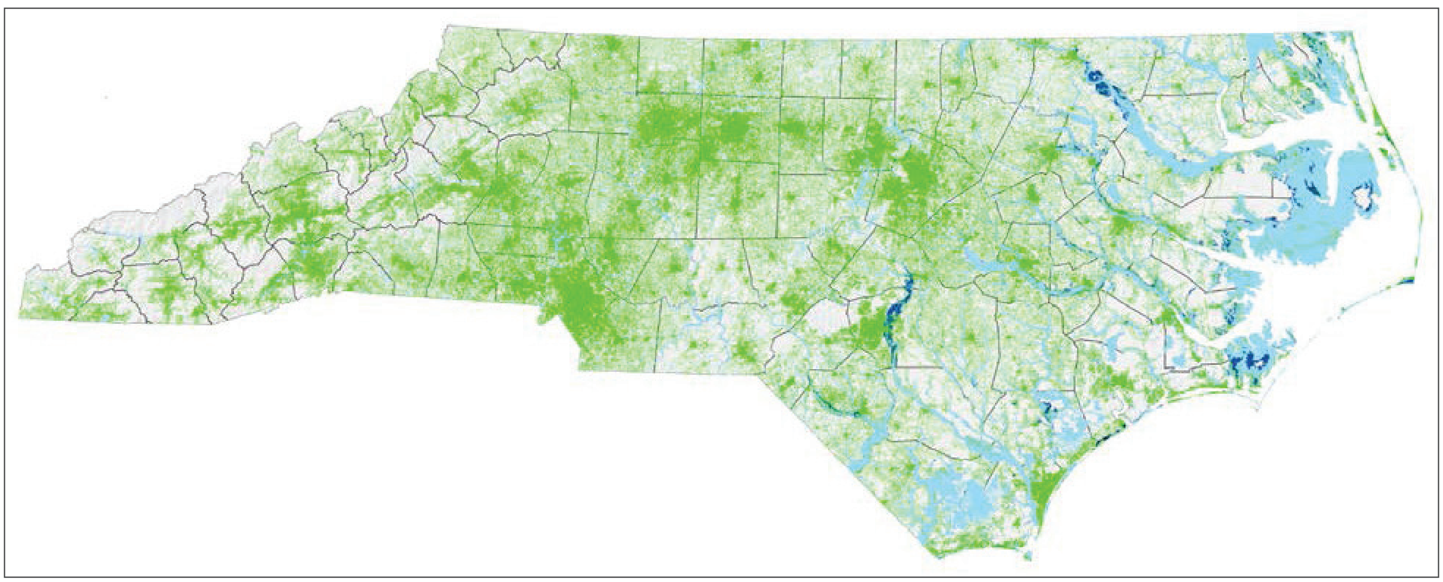


Figure 3. North Carolina Statewide Building Footprints

NCFMP has acquired and developed advanced datasets and tools to support its on-going and planned initiatives. Examples of specialized datasets include building footprints (Figure 3) attributed with detailed physical building and property information, seamless floodplain mapping, and flood elevation rasters (Figure 4). Examples of tools include those for calculating building-level flood damages, mitigation costs, and insurance premiums. NCFMP uses these sophisticated datasets and tools to support management of all regulatory and non-regulatory flood hazards and other risk management data in a database-derived, digital display environment.

Figure 4. Building Footprints Attributed with Detailed Information

2.0 Case Study - Objectives

The objectives of the case study were:

- Identify and summarize flood risks and vulnerabilities in North Carolina and assess how those expected flood damages might be reflected in NFIP risk-based flood insurance premiums,
- Establish and test conceptual logic and computational methods to simulate and assess potential impacts on premium affordability for alternative affordability policy actions ; and,
- Identify data/information needs and gaps to perform affordability analyses at a nationwide level.

To accomplish the objectives of the case study, the following three general tasks were performed: (1) data compilation and integration of relevant data; (2) establishment of a baseline profile of flood insurance in North Carolina; and, (3) evaluation of a limited number of NFIP affordability policy scenarios.

3.0 North Carolina Profile

North Carolina is a diverse state in the Mid-Atlantic area of the country that covers multiple physiographic regions, has a diverse demographic and economic composition, and is subject to significant flooding from both coastal and riverine sources. The State has a total population of just under 10 million and land area of nearly 53,000 square miles (sq. mi.) making it the 9th most populated state. The subsections below provide a more detailed profile of the State with regards to flood hazards, risks/vulnerabilities, and insurance.

3.1 Profile - Flood Hazards

Mapped special flood hazard areas (floodplains) cover approximately 21% of the total land area in North Carolina. NCFMP maintains an advanced enterprise database that stores floodplain mapping and other related information to support the State's management of information in an all-digital environment. Effective floodplain boundaries (in the form of vector polygon files) and corresponding BFE information (in the form of a 10-ft cell raster) were extracted from the database for the entire State. The floodplain boundary information was used to identify the flood zone (i.e. AE, VE, X, A, etc.) for buildings and insurance policies, and the BFE raster was used to assign the BFE to buildings within the Special Flood Hazard Area (SFHA) (i.e. 1% annual chance floodplain). The table below provides selected summary metrics for floodplains in North Carolina based on the NCFMP floodplain dataset.

Flood Zone	Mapped Stream Miles	% Total Miles	Area (Sq. MI)	% Total Area
A	239	0.9%	525	4.7%
AE	27,368	98.0%	7,811	69.5%
AH	1.8	0.0%	0.6	0.0%
AO	0.5	0.0%	1.9	0.0%
VE	258	0.9%	600	5.3%
Shaded X	48	0.2%	585	5.2%
Open Water	10	0.0%	1,719	15.3%
Total	**27,925**	**100%**	**11,243**	**100%**

Table 1. Floodplain Overview Metrics

Having BFE information associated with buildings is essential to the assessment of flood risk/vulnerability as described in the next subsection. As shown in the table above, the large majority of floodplain areas in the State correspond to zones that have BFEs (e.g. AE, VE), with Zone AE (Riverine and Coastal) being the predominant zone.

3.2 Profile - Flood Vulnerability

3.2.1 Individual Building Information

NCFMP has acquired and maintains a statewide layer of building footprints within the enterprise database. This dataset, which contains over 5.2 million footprints, was initially captured from aerial imagery in a major data acquisition effort in 2007 and 2008. NCFMP, through a county by county phased approach, conflates relevant data and attributes to each structure. These data and attributes include, but are not limited to: surveyed first floor elevation; heated square footage; foundation type; occupancy classification; tax assessment (e.g. building values, occupancy type, etc.); and flood risk/vulnerability (e.g. annualized flood damages) information. Approximately 80% of all structures in North Carolina have been conflated with supplemental data.

Leveraging the conflation work described above, there are approximately 302,000 buildings (6% of all buildings) in the State that are within the mapped floodplains. Of those buildings in the mapped floodplains, the estimated total value is approximately $87 billion. Only about 30% of the buildings in the floodplain have a flood insurance policy. A comparison of these buildings' first floor elevations (FFEs) with BFEs indicates that over 75% of the buildings in the floodplain are at or above the BFE. The tables below provide select summary metrics for buildings in North Carolina based on the NCFMP building dataset followed by a graphic showing (1) the breakdown of FFE/BFE for buildings in the floodplain, and (2) the percent of buildings in the floodplain without a policy. As shown in the tables below, the large majority of buildings within the mapped floodplain are single family residences.

Buildings by Floodzone		Estimate Value ($Billions)
A	2%	$1.3
AE, AH, AO	64%	$58.3
Shaded X	27%	$20.9
VE	7%	$6.4

Buildings by Occupancy Type		Estimated Value ($Billions)
Single Family	75%	$34.7
2-4 Family	3%	$1.5
Other Residential	4%	$4.0
Non-Residential	18%	$46.7

Table 2. Buildings in Mapped Floodplain Overview Metrics

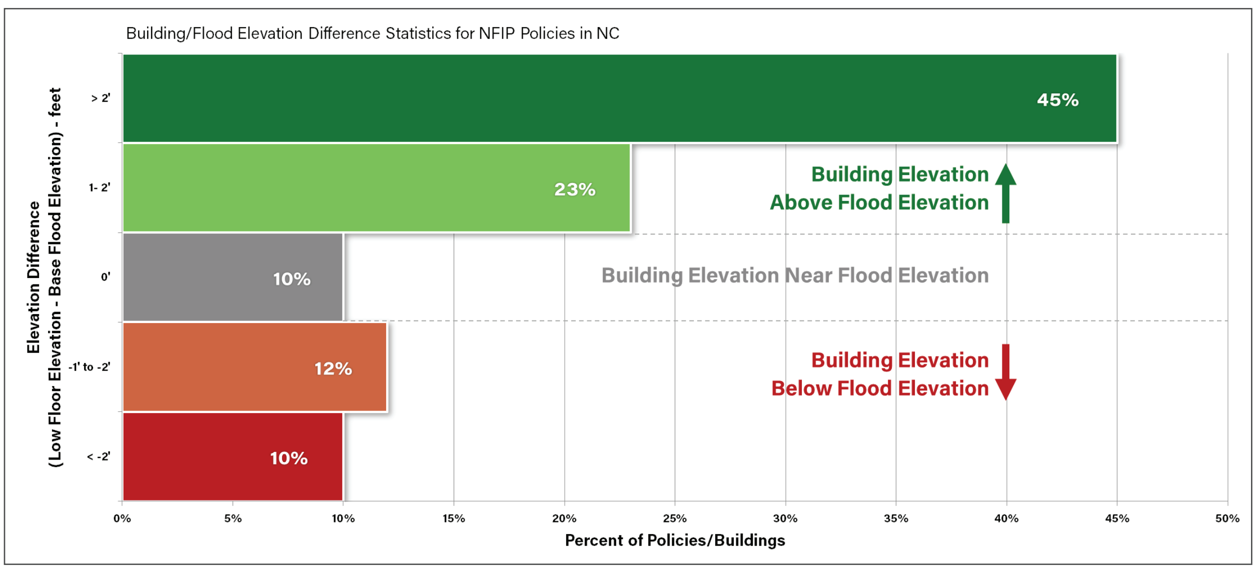


Figure 5. Building/Flood Elevation Difference for NC NFIP Policies

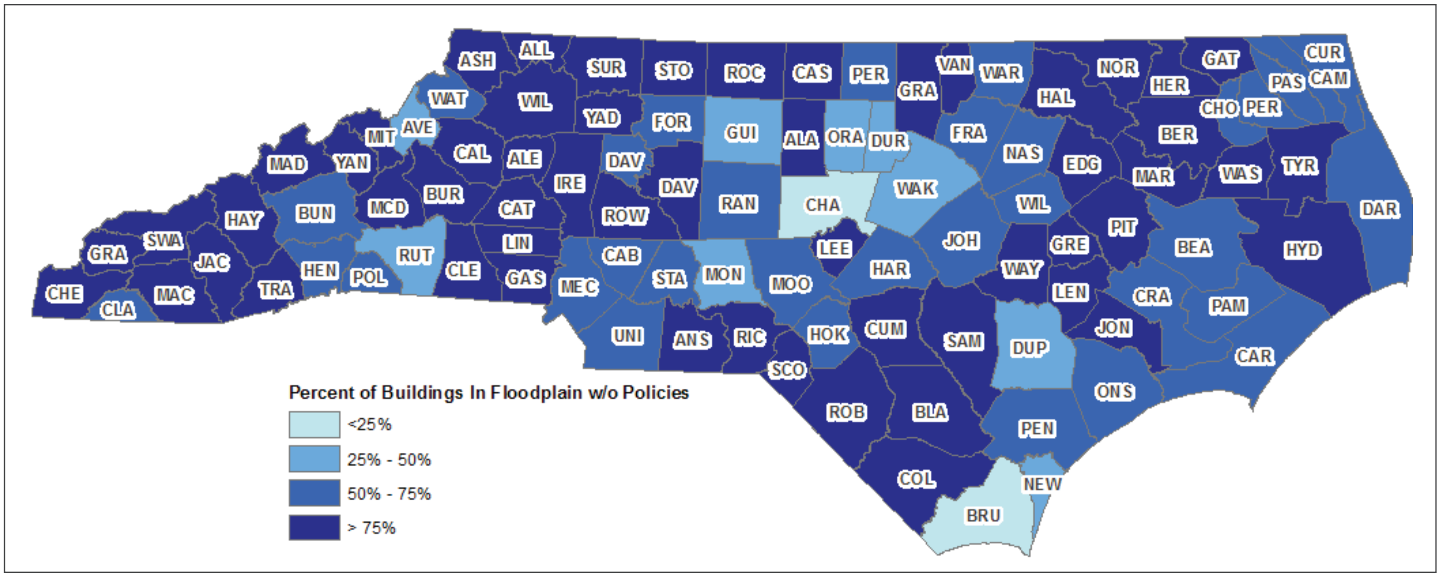


Figure 6. Buildings in Floodplain without Policies

3.2.2 Demographic Information by Census Unit

Existing demographic information was utilized in the study to identify the characteristics of the areas that may be most impacted by potential flood insurance rate changes. Demographic data for this study was compiled from a combination of census related datasets including HAZUS, American Community Survey, and decennial census data. In general, the most refined level of demographic data is at the census block level which can vary significantly in size based on the level of urbanization, but is typically in the 5-200 acre range. Certain data, such as income and age data, was only available at the census block group level. Census block groups are considerably larger than census blocks, having a typical size of 1-10 square miles. In these cases, block group data was allocated to the block level. The tables below provide selected summary metrics for demographics in North Carolina based on the integrated census block datasets. However, no socio-economic data were available at the level of the individual policy holder or property owner.

Population and Housing	Statewide	Containing Mapped Floodplain	% in Floodplain
Total Number of Census Block Groups	6,155	5,440	88%
Total Number of Census Blocks	286,395	99,423	35%
Populated Census Blocks	185,219	51,457	28%
Total Housing Units	3,745,155	168,532	5%
Total Population	**9,535,483**	**586,738**	**6%**

Age and Minority Status	Statewide
Median Age	38.8
Percent School Age Population (Less than 16 years)	23.9%
Percent Working Age Population (16 to 65 years)	63.1%
Percent Retired Age Population (Over 65 years)	12.9%
Percent Minority Population	34.7%

Financial	Statewide
Median Household Income	$50,934
Percent Owner Occupied Houses	58.7%
Percent Households with Mortgage	39.6%
Percent Households below Poverty Level	16.2%

Table 3. Demographic Overview Metrics

3.3 Insurance Information for Buildings

3.3.1 National Perspective

Nationwide, North Carolina ranks eighth in the number of NFIP policies and ninth in the number of claims to date. The State accounts for approximately 2% of the 5.2M current nationwide policies and $51B claims payments to date. The combined graphic below shows the relative distribution of NFIP policies nationwide followed by a table listing policy counts and claims for the top ten states.

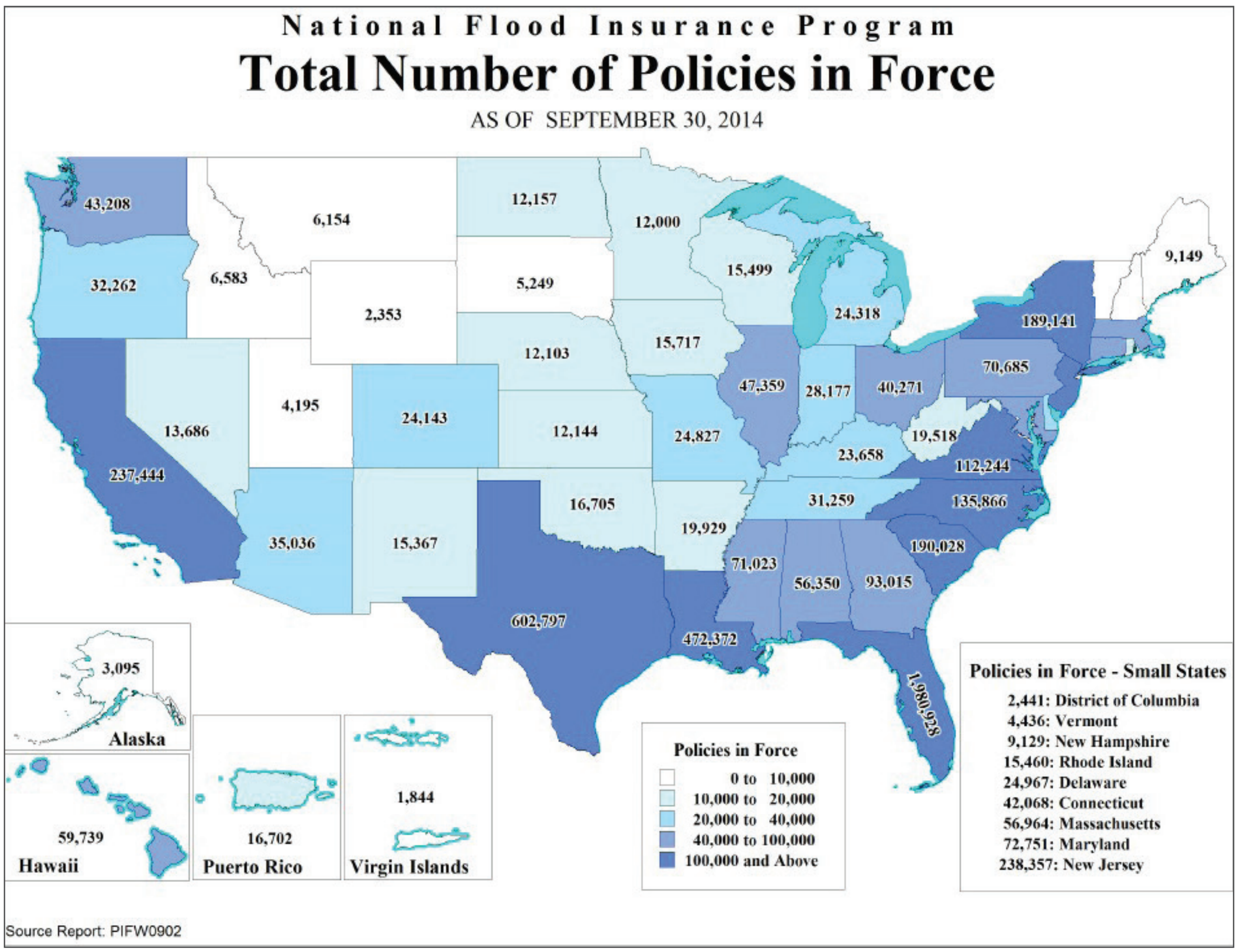


Figure 7. NFIP Nationwide Policies in Force as of September 30, 2014

State	Policies in Force (as of Dec 2014)	Policy Rank	Total Claims	Claims Rank
Florida	1,947,504	1	$3,863,325,738	5
Texas	600,610	2	$5,612,063,866	3
Louisiana	472,542	3	$16,702,283,056	1
New Jersey	237,358	4	$5,647,974,936	2
California	234,308	5	$514,376,726	12
South Carolina	190,470	6	$441,553,065	15
New York	188,872	7	$5,150,687,452	4
North Carolina	135,511	8	$1,004,825,714	9
Virginia	112,156	9	$632,511,372	11
Georgia	92,745	10	$316,041,577	18

Table 4. Policies Counts and Claims for Top 10 States

3.3.2 Policy Information

Flood insurance data was used to characterize current insurance policy metrics such that the potential impact of insurance reform changes could be assessed. NCFMP, as the NFIP Coordinator Office for North Carolina, obtained NFIP policy information for all North Carolina policies (as of June 2014) from FEMA. The policy information was provided in tabular (.csv) format as an export from the NFIP database and included 116 data fields (i.e. table columns). Descriptions of data fields were not provided, so NCFMP analyzed the data to ascertain meanings for key fields. Upon review of the policy data, it was noted that the data appeared to contain numerous records with incomplete, inconsistent, and/or inaccurate information. Examples of apparent data issues included lacking address and spatial coordinates (e.g., latitude/longitude), questionable floodplain information (e.g., BFEs and zone designation), unreliable fields for insurance classifications (e.g., grandfathering and PreFIRM), and duplicate records. NCFMP leveraged existing in-house data and information to generate metrics where insurance policy data was questionable and to geocode (i.e. spatially locate) the large majority of contracts to the building/property level. The figure below shows the statewide insurance policies, classified by flood zone, based on NCFMP analysis and geocoding.

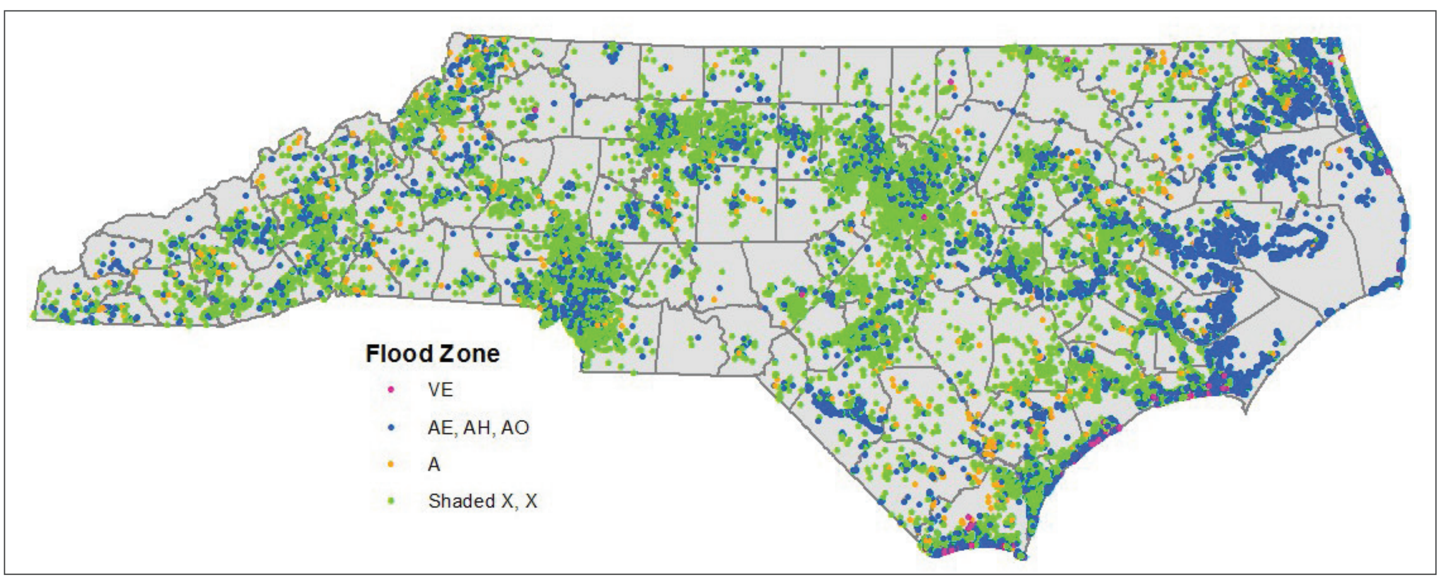


Figure 8. Insurance Policies by Flood Zone

Approximately 123,000 records were received from the NFIP dataset. Each of these records was considered a contract. Because some contracts, such as those for condos, contain several policies, data for a total of about 138,000 policies was contained in the NFIP dataset. It is estimated that approximately 75% of contracts are within FEMA mapped floodplains, whereas the remaining 25% are outside of FEMA mapped floodplains. There are several ways policies can be rated. One objective of this study was to break down current policy coverage and premiums based on rating categories. Certain data fields suggested that this data was known; however, upon review they were determined to be unreliable. Since this data could not be determined solely based on field codes within the NFIP database, NCFMP conducted data analyses to estimate these metrics using a combination of spatial and tabular data. The methods shown in the table below were used to estimate each policy type:

Policy Type Category	Subsidized or Discounted Rate?	Description	Determination Methodologies
Preferred Risk Policy	No	Low-Cost policy available for most structures in moderate to low risk zones without previous claims. Premiums are primarily based on amount of coverage.	Defined by attribute selection based on "Rate Method" value
Grandfathered	Yes	Lower-Cost policy option for structures affected by map changes that allows structures built in compliance to maintain rates based on original flood zones and BFEs.	Estimated by combination of spatial/ tabular evaluation of rate: More favorable zone than actual zone **OR** Same zone but more favorable BFE **OR** Coded as "PRP Extension"
PreFIRM	Yes	Lower-Cost policy option for structures built before Community's initial flood maps (or before 1975).	Estimated by combination of attribute selection of "PreFIRM" value **AND** Verification of actual being consistent with PreFIRM rate tables
Grandfathered and PreFIRM	Yes	Lower-Cost policy where PreFIRM structure is grandfathered to original flood zone.	Combination of Grandfathered and PreFIRM methodologies above
Specific Rate	Unknown	Structures paying a non- standard rate. Premiums for these structures are significantly lower than standard rates for most structures in NC.	Attribute selection based on "Rate Method" value
NFIP Risk-Based	No	Full-Rate policies for structures where premium is based on actuarially determined rates.	Any policy not falling into categories listed above.

Table 5. Policy Type Description and Determination

NFIP risk-based premiums are calculated based on a single storm frequency flood elevation (i.e., 1% annual chance BFE). A large percentage of floodplains in North Carolina have multi-storm frequency flood elevation information, which NCFMP uses to derive the average annualized loss (AAL) building damages. The AAL can be considered an estimate of potential future claims, thus it could be used to supplement the calculation of premiums. Nationwide, multi-storm frequency event data is only available for a limited number of areas; however, as floodplains are updated through FEMA's Risk MAP program, the availability of multi-frequency flood hazard information is increasing.

The table below (Table 6) provides selected summary metrics for insurance contracts in North Carolina based on June 2014 NFIP data. As the table shows, the NFIP generates approximately $110 million in revenue from premiums in North Carolina. The premiums cover approximately $33 billion in assets which results in a ratio of $300 coverage for every dollar of premium. Over one-third of the contracts/policies are not NFIP risk-based.

Category	Number of Contracts	% Total Contracts	Annual Premium	% Total Premium	Average Premium	Total Coverage	% Building	% Content
NFIP Risk-Based	39,389	32%	$36.0 M	33%	$915	$10.3 B	86%	14%
Preferred Risk	36,978	30%	$16.2 M	15%	$439	$10.7 B	71%	29%
Specific Rate	7,435	6%	$13.0 M	12%	$1,754	$2.3 B	86%	14%
PreFIRM and/or Grandfathered	39,809	32%	$45.3 M	41%	$1,138	$9.7 B	85%	15%
Totals	**123,611**	**100%**	**$110.6 M**	**100%**	**$895**	**$33.0 B**	**81%**	**19%**

Table 6. Insurance Overview Metrics

While the above table shows statewide flood insurance policy metrics, Table 7 below provides a further breakdown of policy data in FEMA mapped floodplains. Approximately 75% of policies are located within the floodplain, but those policies make up 85% of statewide generated revenue.

Policy Breakdown		Total Premiums (Revenues)	Average Premium (Affordability)
Policy Type	*Number of Contracts*	*Existing*	*Existing*
NFIP Risk-Based/PRP	47,135	$38.6 M	$818
Grandfathered	23,482	$18.3 M	$779
Subsidized	8,702	$15.3 M	$1,756
Grandfathered & Subsidized	6,501	$11.0 M	$1,685
Specific Rate	7,350	$13.3 M	$1,814
Total	93,170	$96.4 M	$1,035
Outside Floodplain	30,440	$14.2 M	$466

Table 7. Existing Policy Summary for Mapped Floodplain

As shown above, there are an estimated 93,000+ contracts in the floodplain. However, as noted previously, there are an estimated 300,000± buildings in the mapped floodplain, indicating significant under coverage in North Carolina. The majority (75%+) of these buildings are located in high-risk flood zones (e.g., Zone AE and VE) that can be rated under NFIP risk-based, grandfathered, or PreFIRM subsidized rates. The remaining buildings are located in low risk zones (i.e., Shaded X) and would likely be eligible for the Preferred Risk Policy (PRP) option.

As public record, flood insurance policies can be written either (1) directly from the NFIP, or (2) through private insurance companies in the "Write Your Own" (WYO) Program. There are over 30 WYO companies that write flood insurance contracts in North Carolina. The following figure shows a breakdown of the insurance contracts by type of insurance company. As can be seen, almost 90% of contracts are written by a WYO company and do not come directly from an NFIP insurance agent. Of the 30+ WYO companies, 75% of all contracts/policies are written by six companies.

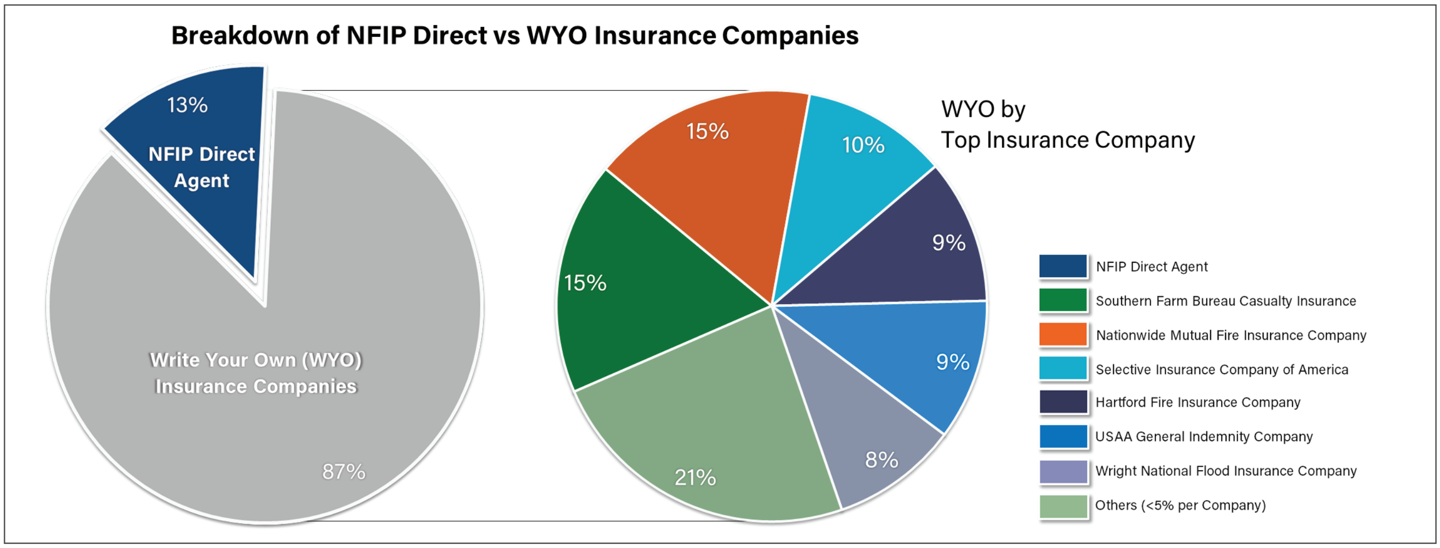


Figure 9. Flood Insurance Policies in North Carolina by NFIP/WYO and WYO Company

3.3.3 Claims Information

NCFMP obtained claims information from FEMA. To estimate both existing costs associated with claims and potential claim costs associated with the alternative scenarios, claims information was summarized at the county and state level. Based on information obtained from FEMA and other public websites, North Carolina has had just under 74,000 claims with a total of approximately $970 million in payouts since 1978 (an approximate 37-year period). The number of contracts/policies fluctuates from year to year but averages out to approximately 77,800 per year since 1978. Summary metrics associated with historic claims data are provided below.

Total Number of Claims Since 1978	73,900
Total Claim Payout Since 1978	$970 M
Average Claim Amount	$13,100
Average Total Claims per Year	$25.5 M
Estimated Average Claim Cost per Policy per Year	$320
Estimated Average Premium Revenue per Policy per Year	$500
Estimated Average Program Surplus/Deficit per Policy per Year	+$180 surplus

Table 8. North Carolina Statewide Claims Data

As shown in the summary metrics above, North Carolina typically operates on a net surplus, otherwise known as a "giving-State". These results are the consequences of the premiums paid and flood losses over the period of record. If there had been a different pattern of storms, which was a realistic possibility given the likelihood of different storm events, the net surplus might have been greater or might have been negative. While these net surplus numbers may be of some interest, they are not indicative of nationwide program statistics, and could change with claims from future storm events. Thus, caution should be applied when using these numbers in assessment of long-term financial solvency of the NFIP.

Since 1978, it appears that, on average, revenues generated from premiums are approximately 1.5 times more than program costs associated with paid claims. The figures below (Figure 10) show total claims by county and historic annual contract counts, premiums, and claims since 1978. The cumulative funding deficit from 1996-2006, shown in Figure 11 on the following page (red hatched area), is largely due to claims from Hurricanes Fran and Floyd in 1996 and 1999, respectively.

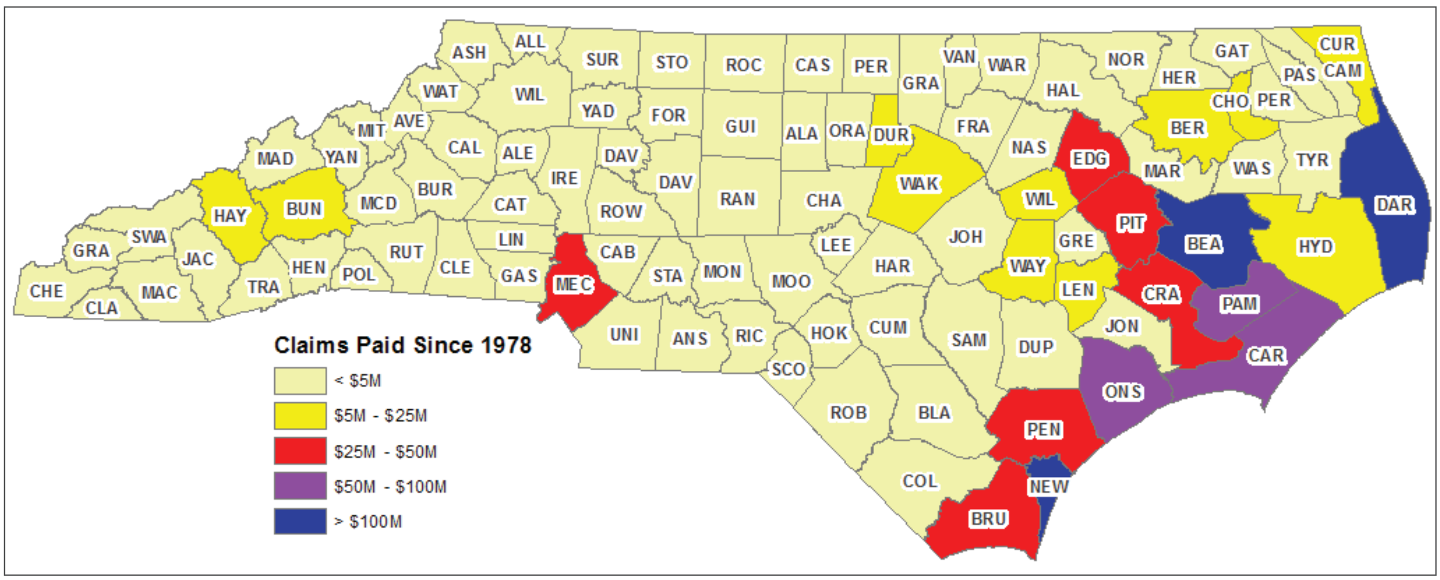


Figure 10. Claims Paid Since 1978 by County

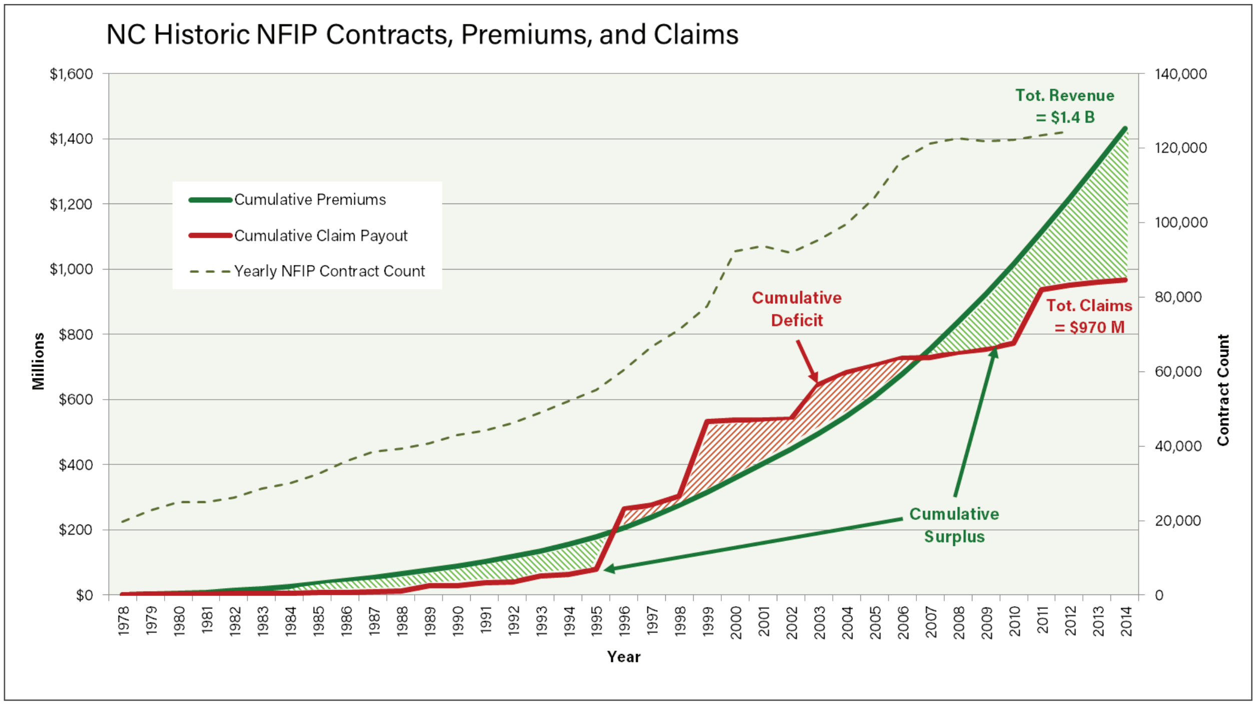


Figure 11. Policy Revenue since 1978

As indicated in the previous subsection, AAL data can be used as an estimate of future claims. A statewide estimate of AAL for North Carolina is not available at the time of this report as AAL computations are still being developed on a county-by-county basis.

3.4 Integrated Data Metrics

The data sources for this study, discussed in further detail in the following sections, were integrated through a combination of spatial and tabular operations. Section 3.3.2 above provides a summary of integrated statewide metrics (policy premiums as they currently exist). This integrated data was also used for a comparative analysis of alternative rate scenarios that will be discussed in the following sections.

4.0 Data Requirements

The previous section provided summaries and metrics of flood hazard, flood risk/vulnerability, and flood insurance data for North Carolina. Data compilation from multiple sources was necessary to develop the resulting summaries and metrics. This section provides more specific detail on data requirements, sources, and integration necessary to support the study.

4.1 Data Requirements - Overview and Workflow

For purposes of this study, data sources were grouped into four general categories: insurance, floodplain, building, and demographic. As discussed previously, NCFMP maintains several sophisticated spatial databases to manage flood and risk information statewide. The two primary databases are referred to as NC FLOOD and NC RISK. As the name suggests, NC FLOOD stores all information required to create regulatory Flood Insurance Rate Maps (FIRM), as well as non-regulatory information such as flood and depth rasters. NC RISK stores vulnerable assets such as building footprints and supporting tables and tools to calculate flood and other natural hazard risks. These NCFMP datasets were combined with NFIP insurance data and demographic data to compile the integrated metrics provided in the previous section. The graphic below (Figure 12) shows a generalized overview of data processing workflows to support this study. The data is grouped by the major data category and shows data sources (cylinder shapes), processes (hexagon shapes), and inputs (squares).

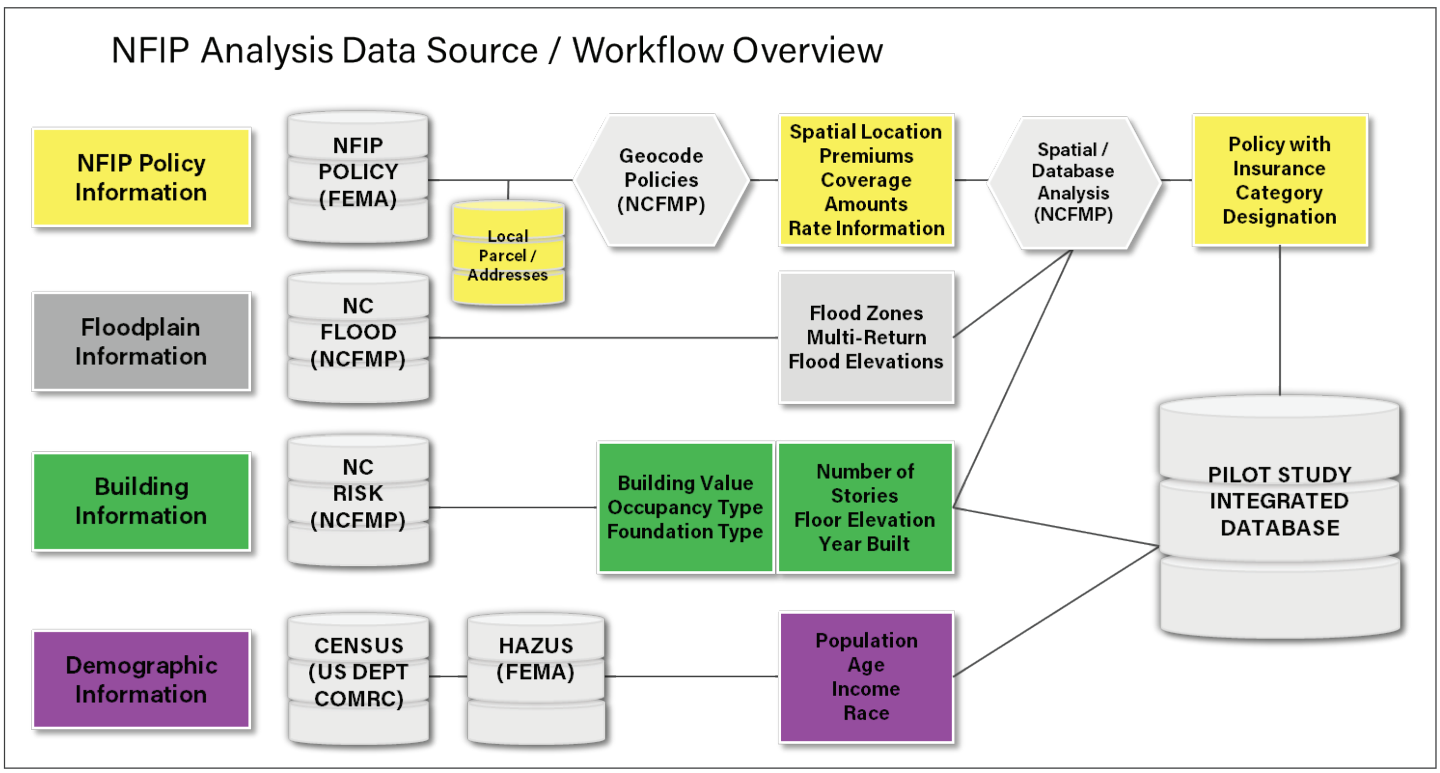


Figure 12. Data Source and Processing Workflow Overview

4.2 Data Requirements - Data Elements

As part of the study, certain pieces of key information were needed to compile existing metrics and assess potential impacts to insurance policy premiums/rates discussed in Section 5. The table below provides additional information about each of these required data elements.

Data Category	Data Element	Source	Notes
Policy Information	Building Coverage	NFIP	Used in application of rate table.
	Contents Coverage		
	Deductible		
	Lowest Floor Elevation (LFE)	NFIP	Used for structures with elevation-rated policies.
Floodplain Information	Base Flood Elevation (BFE)	NC FLOOD Database	Obtained from statewide BFE raster. Used for elevation-rated policies.
	Flood Zone		Determined from statewide floodplain layer. Used in determination of rate table.
	CID		Used to identify year of communities first flood map and participation in Community Rating System (CRS).
Building Information	Year Built	NC RISK Database	Used to determine PreFIRM eligibility by comparing with year on community's first flood map.
	Lowest Floor Elevation (LFE)		Used to assess elevation-based rates for non-elevation rated policies.
	Number of Stories		Used in application of rate table.
	Occupancy Type		
	Foundation Type		
Demographic Information	Population	Census / HAZUS	Secondary information that might be used to assess demographic characteristics of areas where policy holders were located. Because this is only available at the block or block group level, it cannot be used for assessment of cost burden (premium relative to income, for example) for individual policy holders.
	Income		
	Age		
	Race		
Claims Data	Claims Paid	NFIP	Historical claims information by year and individual structure was not available. However, such data would not be used for this analysis because the analysis depends on estimating future losses and claims which will differ from historical losses.

Table 9. Data Element Sources

Having accurate BFE and LFE data is imperative when calculating accurate policy premiums. While the above table describes where the data comes from, Table 10 below gives further insight into how the data was used and compiled. The table also provides context on the scalability of the data should other states want to perform similar analyses and highlights some of the limitations of each type of information. The observed range of cost is based on the level of effort required to obtain similar data in North Carolina.

Data Category	Study Compilation Comments	Scalability Considerations	Approximate Cost (range)
Policy Information	NCFMP geocoded policies to building/parcel level using custom geocoding services generated from combination of local address point/ parcel data and NCFMP building footprints. Due to apparent quality/integrity issues, mostly related to classifying discounted policies, NCFMP expended significant effort in developing alternative means to estimate key metrics relying mainly on having digital floodplain information (including BFEs) as well as accurate geocoding.	FEMA may have preliminary geocoding for policies. Policies could be geocoded using standard available (Google, ESRI, etc.) geocoding services at a reasonable level. Continuous BFE information would need to be generated and/or estimated.	$0.75 - $2.00 per policy
Floodplain Information	Majority of flood zones in North Carolina have BFEs.	Floodplain mapping for most of the country is available through the NFHL or DFIRM databases from FEMA. Many areas in the country still have Zone A mapping with no BFE. Many new Zone A areas being included RiskMAP studies are model backed and have a non- regulatory elevation that could be used.	WSE Raster for areas with NFHL with BFE: $40-$70 per mile
Building Information	NCFMPs statewide building footprint layer populated with structure information based on survey and conflation of parcel and HAZUS data.	Development of this dataset was a significant undertaking which may not be practical at the nationwide level. The HAZUS dataset provides estimates of building information summarized at the block level which could be used. However, it is noted that comparisons with HAZUS data to NCFMP specific data have shown to yield wide variations.	$20 - $40 / Building FFE $25 - $50 / Building Capture and Attribution

Data Category	Study Compilation Comments	Scalability Considerations	Approximate Cost (range)
Demographic Information	Data available was at census block or block group level.	Demographic data is available nationwide. Data cannot be attributed to specific building or policy holder level. Data would be more meaningful if available at the individual building level.	Nominal if use Census / HAZUS information

Table 10. Data Compilation and Scalability

4.3 NCFMP Tools

In addition to the characterization of existing insurance information, a main objective of the study was to establish and assess the ability to calculate potential impacts to NFIP premiums based on potential policy rate changes. NCFMP developed algorithms and associated tools (collectively referred to as the NCFMP Insurance Rate Calculator) to calculate flood insurance premiums based on building, property, and flood zone information present in existing NCFMP and NFIP datasets described above.

The NCFMP Insurance Rate Calculator was built in a SQL Server database that stores NFIP rate tables, community information, and tools that calculate premiums based on required data elements. Using these tools, NCFMP investigated the impacts from a number of alternative NFIP rate calculation scenarios, which are discussed in Section 5.

4.4 Tool Verification

As part of the algorithm/tool development, premiums calculated with the tool were compared to actual premiums for policies in the mapped floodplain. Two comparisons were performed. The first comparison used premiums that were calculated using required data (e.g., occupancy type, floor elevation, and flood elevation) from NCFMP datasets, which, in general, are the datasets intended for use with the tool. This data was compared to actual premiums. In the second comparison, premiums were calculated using required data extracted from the NFIP database. These values were then compared to actual premiums. The intent of the second comparison was to test the consistency of calculations assuming most NCFMP input data is the same as policy data. Results of the comparisons are presented below.

4.4.1 Comparison 1: NCFMP Data Based Rate Comparisons

Comparison of premiums using NCFMP data to actual premiums, in general, showed significant discrepancies/variations. Approximately 35% of calculated premiums were within 20% of actual premiums, and over 50% of samples were more than 30% different than actual premiums. There are significant deviations in both the above/below actual premiums; however, as a whole, the premiums calculated in the tool using NCFMP data are higher than actual premiums.

The following observations are offered that may explain the discrepancies:

- It is estimated that over 35% of policies in the floodplain are grandfathered or use a non-standard rate table. When using NCFMP data, it is not known what BFE elevation is used for grandfathering, so the tool uses the BFE assigned to the building (likely the Effective BFE) and produces higher premiums for those policies.
- Review of NCFMP data samples showed discrepancies in flood elevation, floor elevation, and flood zone when compared to NFIP data. Since all of this information is used to run the tool, variations in data can have a significant impact on the calculated premium.
- The algorithms/tools use general assumptions for certain policy specific details such as content location, appropriate flood venting, and location of utilities.

A graphical comparison of NCFMP computed to actual NFIP premiums are shown in the following figure.

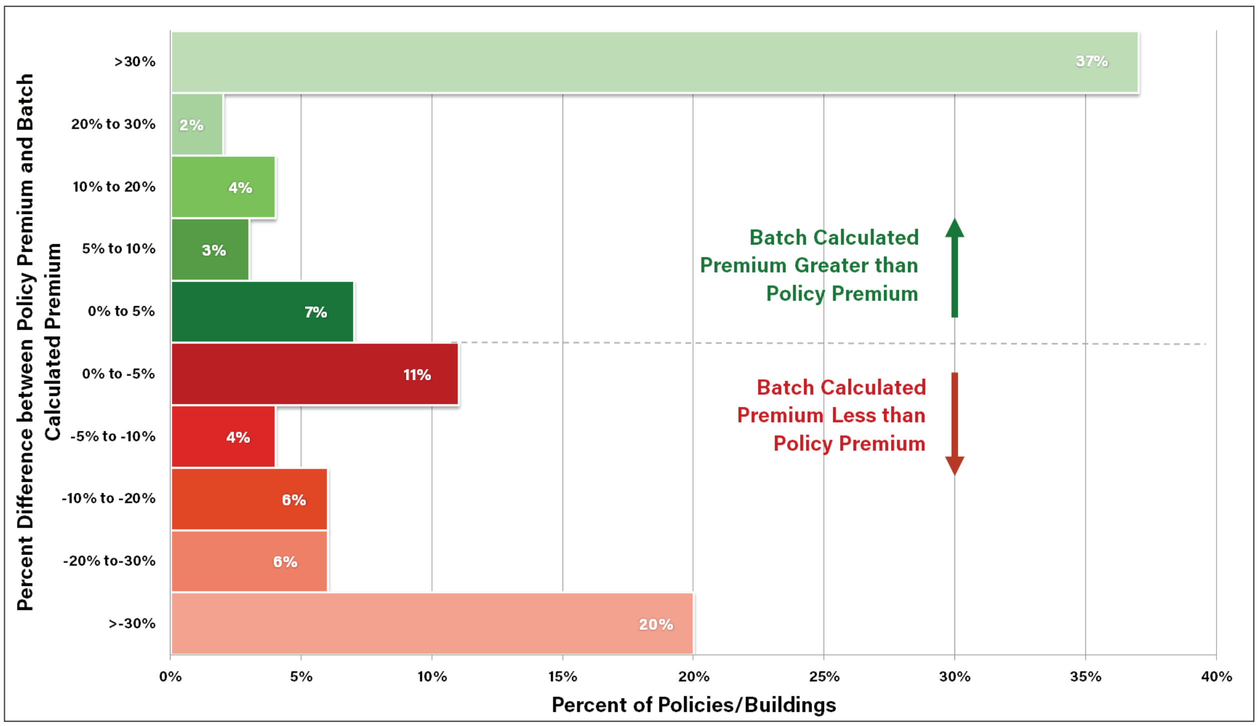


Figure 13. Comparison of Calculated Premiums vs. Policy Premiums using NCFMP data

4.4.2 Comparison 2: NFIP Data Based Rate Comparisons

Comparison of premiums using NFIP data to actual premiums, in general, showed much better correlation than Comparison 1. Approximately 75% of calculated premiums were within 20% of actual premiums, and slightly more than 50% of samples were within 5% of actual premiums. There is a near 60/40 split of calculated premiums that are above and below actual premiums. However, as a whole, the premiums calculated in the tool using NFIP data are still higher than actual premiums. In a detailed review of the numbers, it was identified that the policies that use non-standard rates, in general, are dramatically lower than standard rates. It is estimated that nearly 10% of policies in the floodplain use non-standard rates, which is believed to be separate from subsidies and/or grandfathering. These non-standard rate policies were removed from the comparison. If not removed, however, the percent of policies that are over 30% higher would be much more noticeable (almost 20% of policies). A graphical comparison of computed to actual NFIP premiums is shown in the following graph.

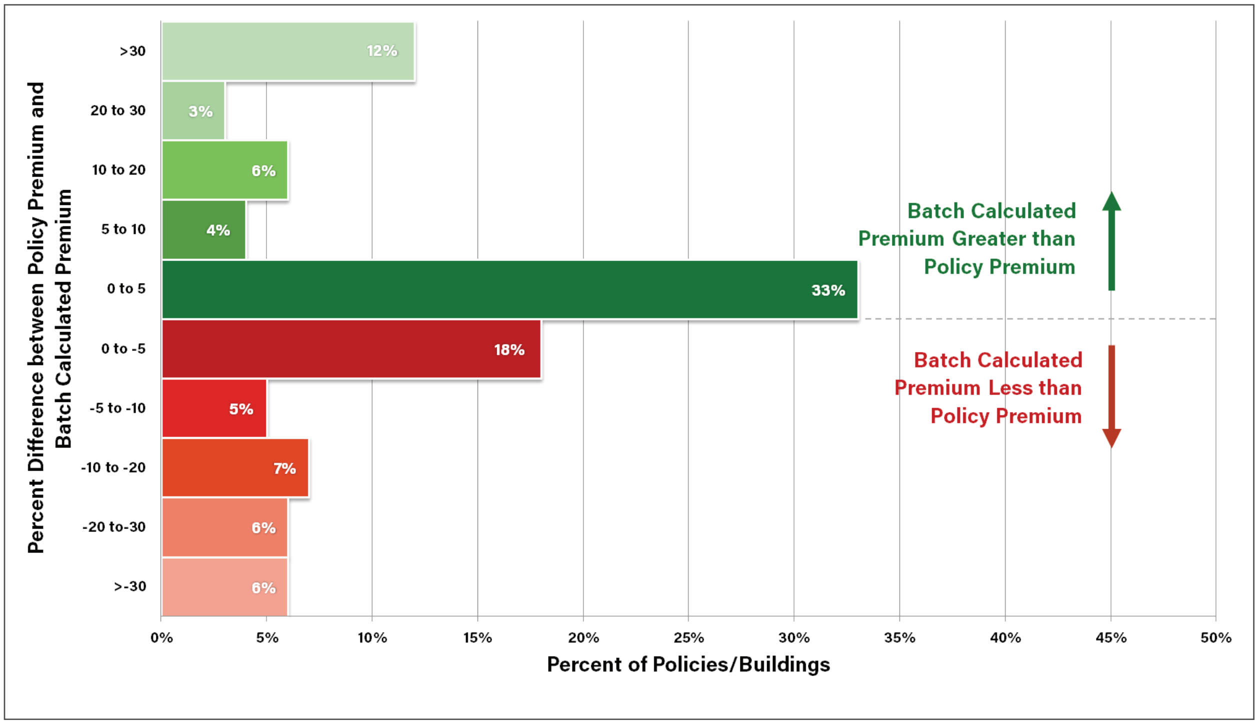


Figure 14. Comparison of Calculated Premiums vs. Policy Premiums using NFIP data

5.0 Scenario Analyses

Prior to assessing alternative scenarios, a baseline scenario was developed from which alternative scenarios were compared. The baseline scenario considers moving all policies to NFIP risk-based except those considered Preferred Risk Policies (PRP) and Specific Rate policies. Alternate scenario 1 reinstates all PreFIRM and grandfathered rates, while alternate scenario 2 considers instituting a premium cap as a measure of cost-burden for any current grandfathered or PreFIRM policies. Finally, alternate scenario 3 considers mitigating those households that are less than 2-feet above the BFE, are currently grandfathered or PreFIRM policies, and meet the cost-burdened threshold. Each scenario below includes the data requirements for that scenario and findings as well as general observations, impacts to affordability, impacts to financial solvency, and data gaps/needs. To assess the impacts to affordability, each policy was assigned a "Premium Relative to Total Coverage" percentage which was calculated by dividing the policy premium by the total coverage for that policy. A percentage greater than 1% was used as an indicator to identify policies that are more likely to be impacted by affordability. Further details about the baseline scenario and alternate scenarios 1-3 are given below. These scenarios were developed solely for the purpose of testing the computational logic of the analysis. They were not chosen to represent and were not intended to be proposed affordability policy options.

5.1 Baseline Scenario: Immediate NFIP Risk-Based Rates

Description: Scenario assumes all existing policies in the mapped floodplain move to elevation-rated NFIP risk-based rates, with the exception of PRP and specific rate policies. PreFIRM and grandfathered rates which are subsidized or discounted were removed.

Objective: Assess the impact of completely removing all subsidies or discounts except CRS discount. This scenario represents "maximum change" scenario.

Data Requirements:

Data Element	Source	Level of Availability
Flood Zone	NC FLOOD Database	Statewide
Year Built	N/A	Set all to PostFIRM (2015)
CID	NC FLOOD Database	Statewide
Number of Stories	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Occupancy Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Foundation Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Base Flood Elevation (BFE)	NC FLOOD Database	Statewide within SFHA
Lowest Floor Elevation (LFE)	NFIP (where elevation rated) NCFMP (where non-elevation rated)	Elevation rated policies. Buildings in floodplain in 58 Counties
Building Coverage	NFIP	Statewide structures with policies
Contents Coverage	NFIP	Statewide structures with policies
Deductible	NFIP	Statewide structures with policies

Findings:

Policy Breakdown		Total Premiums (Revenues)	Average Premium (Affordability)
Policy Type	*Number of Contracts*	*Baseline Scenario*	*Baseline Scenario*
NFIP Risk-Based/PRP	47,135	$38.6 M	$818
Grandfathered	23,482	$53.2 M	$2,264
Subsidized	8,702	$23.0 M	$2,645
Grandfathered & Subsidized	6,501	$29.5 M	$4,544
Specific Rate*	7,350	$13.3 M	$1,814
Total	**93,170**	**$157.6 M**	**$1,692**

*If Specific Rate policies move to NFIP risk-based rates, their revenue would increase to $67.8 M, and total revenue would increase to $212 M

General Observations:

- Approximately 38,685 (~40%) polices are affected by the scenario.
- The impact is greatest for those policies coded as grandfathered.
- The Baseline Scenario Integrated Data Matrix provides detailed breakdowns of metrics by flood zone and occupancy type.

Impacts to Affordability:

Premium Relative to Total Coverage (%)	Baseline	
	# of Policies	% of Policies
0-1	74,722	80.2%
1-2	8,232	8.8%
2-5	7,620	8.2%
>5	2,596	2.8%
Total	**93,170**	**100%**

Impacts to Financial Solvency:

- This scenario would increase revenue by approximately $60 M (63%) through increases in premiums.
- Impacts to the financial solvency of the NFIP (program revenues vs. claims and operating expenditures) could not be evaluated with this study due to insufficient historical claims data.

Data Gaps/Needs:

- Not all building data is conflated (e.g., missing BFE and Occupancy Type).
- BFE not populated for buildings outside of SFHA but still within floodplain.
- Geospatially located NFIP Claims data.

Baseline Scenario: Integrated Data Matrix

		Flood Zone	High Risk Riverine (A, AE, AH, AO)				High Risk Coastal (VE)				Low Risk (Shaded X)			
		Occupancy	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential
POLICY METRICS	Risk-Based Rate	# Policies	29,227	789	422	1,543	3,324	254	131	45	972	186	55	185
		$ Annual Premium	$16.3 M	$0.5 M	$0.8 M	$2.3 M	$11.2 M	$0.8 M	$0.7 M	$0.1 M	$0.7 M	$0.1 M	$0.1 M	$0.3 M
		$ Average Premium	$557	$661	$1,825	$1,502	$3,370	$3,306	N/A	$3,110	$670	$696	$2,701	$1,674
		$ Building Coverage	$5932 M	$195 M	$307 M	$445 M	$753 M	$80 M	$86 M	$14 M	$189 M	$49 M	$107 M	$53 M
	Preferred Risk Rate	# Policies	2,734	40	29	40	234	12	5	1	6,569	195	37	106
		$ Annual Premium	$1.2 M	$0.0 M	$0.0 M	$0.1 M	$0.1 M	$0.0 M	$0.0 M	$0.0 M	$2.9 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$436	$398	$256	$1,586	$466	$473	N/A	$54	$441	$411	$301	$1,791
		$ Building Coverage	$592.8 M	$7.6 M	$1.6 M	$8.8 M	$55.0 M	$2.9 M	$0.8 M	$0.1 M	$1417.6 M	$35.5 M	$3.7 M	$30.7 M
	Grandfathered Rates	# Policies	13,444	655	359	823	6,267	414	105	89	1,129	77	10	110
		$ Annual Premium	$11.2 M	$0.4 M	$0.9 M	$2.3 M	$32.0 M	$2.6 M	$1.6 M	$1.1 M	$0.8 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$836	$649	$2,458	$2,804	$5,101	$6,309	$14,978	$11,860	$749	$960	$1,368	$1,548
		$ Building Coverage	$2833 M	$177 M	$317 M	$261 M	$1469 M	$139 M	$105 M	$31 M	$237 M	$24 M	$3 M	$33 M
	PreFIRM Rates	# Policies	6,156	302	181	952	695	61	16	29	212	26	15	57
		$ Annual Premium	$9.7 M	$0.9 M	$0.5 M	$5.3 M	$4.9 M	$0.7 M	$0.4 M	$0.5 M	$0.1 M	$0.0 M	$0.0 M	$0.1 M
		$ Average Premium	$1,572	$2,862	$2,518	$5,605	$7,030	$11,512	$22,604	$16,885	$600	$721	$3,004	$904
		$ Building Coverage	$80957 M	$5230 M	$4533 M	$18410 M	$11769 M	$1250 M	$1128 M	$760 M	$2858 M	$475 M	$1765 M	$1273 M
	Grandfathered and Subsidized Rates	# Policies	3,581	217	71	511	1,595	172	30	68	196	6	15	39
		$ Annual Premium	$7.0 M	$0.9 M	$0.6 M	$2.6 M	$14.0 M	$2.4 M	$0.7 M	$1.2 M	$0.1 M	$0.0 M	$0.0 M	$0.1 M
		$ Average Premium	$1,956	$4,318	$7,929	$5,125	$8,751	$14,121	$21,979	$17,565	$478	$1,310	$1,132	$1,411
		$ Building Coverage	$511 M	$38 M	$42 M	$96 M	$314 M	$38 M	$32 M	$17 M	$24 M	$1 M	$2 M	$7 M
	Specific Rate (Method 2)	# Policies	5,113	200	159	136	1,461	110	62	23	74	6	2	4
		$ Annual Premium	$4.4 M	$0.3 M	$0.7 M	$0.7 M	$5.2 M	$0.4 M	$1.3 M	$0.2 M	$0.1 M	$11.4 k	$5.3 k	$3.3 k
		$ Average Premium	$4,376	$6,626	$20,934	$8,488	$19,451	$24,092	$125,948	$26,688	$890	$777	$3,137	$66
		$ Building Coverage	$110211 M	$6028 M	$21859 M	$3292 M	$34329 M	$3482 M	$9630 M	$794 M	$1654 M	$153 M	$139 M	$3 M
BUILDING METRICS		# Buildings	145,211	5,201	39,081	5372	18691	1282	1923	3942	62276	2592	14402	2523
		# Buildings with Policies	57,574	1,922	3,732	1,179	13,805	570	122	349	8,792	420	500	200
		$ Total Floodplain Building Value	$22.5 B	$0.9 B	$33.6 B	$2.1 B	$5.7 B	$0.3 B	$0.2 B	$1.3 B	$9.0 B	$0.4 B	$10.0 B	$0.9 B
		% Buildings without Policies	60%	63%	90%	78%	26%	56%	94%	91%	86%	84%	97%	92%
		$ Building Coverage Overage/Deficit	-$16.6 B	-$0.7 B	-$33.3 B	-$1.7 B	-$5.0 B	-$0.3 B	-$0.2 B	-$1.3 B	-$8.9 B	-$0.3 B	-$9.9 B	-$0.8 B

5.2 Alternative Scenario 1: Reinstatement of PreFIRM Subsidized and Grandfathered Rates

Description: Scenario reinstates PreFIRM subsidies and grandfathering for eligible properties. Assumes that all other policies are at NFIP risk-based rates, excluding PRP and specific rate policies.

Objective: Provides assistance to policies with buildings built before current floodplain regulations and policies with buildings built in compliance with floodplain regulations at the time of construction.

Data Requirements:

Data Element	Source	Level of Availability
Flood Zone	NFIP	Where policies exist
Year Built	NFIP	Where policies exist
CID	NFIP	Where policies exist
Number of Stories	NFIP	Where policies exist
Occupancy Type	NFIP	Where policies exist
Foundation Type	NFIP	Where policies exist
Base Flood Elevation (BFE)	NFIP	Where policies exist
Lowest Floor Elevation (LFE)	NFIP	Where policies exist
Building Coverage	NFIP	Where policies exist
Contents Coverage	NFIP	Where policies exist
Deductible	NFIP	Where policies exist

Findings:

Policy Breakdown		Total Premiums (Revenues)			Average Premium (Affordability)	
Policy Type	*Number of Contracts*	*Baseline Scenario*	*Alternative Scenario 1*	*% Change*	*Baseline Scenario*	*Alternative Scenario 1*
NFIP Risk-Based/PRP	47,135	$38.6 M	$38.6 M	0%	$818	$818
Grandfathered	23,482	$53.2 M	$18.3 M	-65%	$2,264	$779
Subsidized	8,702	$23.0 M	$15.3 M	-33%	$2,645	$1,756
Grandfathered & Subsidized	6,501	$29.5 M	$11.0 M	-63%	$4,544	$1,685
Specific Rate	7,350	$13.3 M	$13.3 M	0%	$1,814	$1,814
Total	**93,170**	**$157.6 M**	**$96.4 M**	**-39%**	**$1,692**	**$1,035**

*If specific rate policies move to NFIP risk-based rates, their revenue would increase to $67.8 M, and total revenue for this scenario would increase to $150.9 M

General Observations:

- Approximately 38,685 (~40%) polices are affected by the scenario.
- The impact is greatest for those policies coded as grandfathered with revenue generated from those policies decreasing by 65%.
- Overall revenue would decrease by almost 40%.
- Over 85% of policies would pay 1% of their total coverage or less.
- Alternative Scenario 1 Integrated Data Matrix provides detailed breakdowns of metrics by flood zone and occupancy type.

Impacts to Affordability:

Premium Relative to Total Coverage (%)	Baseline		Alternative Scenario 1	
	# of Policies	*% of Policies*	*# of Policies*	*% of Policies*
0-1	74,722	80.2%	82,062	88.1%
1-2	8,232	8.8%	8,894	9.5%
2-5	7,620	8.2%	2,005	2.2%
>5	2,596	2.8%	209	0.2%
Total	**93,170**	**100%**	**93,170**	**100%**

Impacts to Financial Solvency:

- This scenario would decrease revenue generated by $61 M (40%).
- Impacts to the financial solvency of the NFIP (program revenues vs. claims and operating expenditures) could not be evaluated with this study due to insufficient historical claims data.

Data Gaps/Needs:

- Not all building data is conflated (e.g., missing BFE and Occupancy Type).
- BFE not populated for buildings outside of SFHA but still within floodplain.
- Geospatially located NFIP Claims data.

Alternative Scenario 1: Integrated Data Matrix

		Flood Zone	High Risk Riverine (A, AE, AH, AO)				High Risk Coastal (VE)				Low Risk (Shaded X)			
		Occupancy	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential
POLICY METRICS	Risk-Based Rate	# Policies	29,227	789	422	1,543	3,324	254	131	45	972	186	55	185
		$ Annual Premium	$16.3 M	$0.5 M	$0.8 M	$2.3 M	$11.2 M	$0.8 M	$0.7 M	$0.1 M	$0.7 M	$0.1 M	$0.1 M	$0.3 M
		$ Average Premium	$557	$661	$1,825	$1,502	$3,370	$3,306	N/A	$3,110	$670	$696	$2,701	$1,674
		$ Building Coverage	$5932 M	$195 M	$307 M	$445 M	$753 M	$80 M	$86 M	$14 M	$189 M	$49 M	$107 M	$53 M
	Preferred Risk Rate	# Policies	2,734	40	29	40	234	12	5	1	6,569	195	37	106
		$ Annual Premium	$1.2 M	$0.0 M	$0.0 M	$0.1 M	$0.1 M	$0.0 M	$0.0 M	$0.0 M	$2.9 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$436	$398	$256	$1,586	$466	$473	N/A	$54	$441	$411	$301	$1,791
		$ Building Coverage	$592.8 M	$7.6 M	$1.6 M	$8.8 M	$55.0 M	$2.9 M	$0.8 M	$0.1 M	$1417.6 M	$35.5 M	$3.7 M	$30.7 M
	Grandfathered Rates	# Policies	13,444	655	359	823	6,267	414	105	89	1,129	77	10	110
		$ Annual Premium	$8.8 M	$0.4 M	$0.5 M	$1.3 M	$5.4 M	$0.7 M	$0.2 M	$0.2 M	$0.6 M	$0.1 M	$0.0 M	$0.1 M
		$ Average Premium	$658	$574	$1,530	$1,536	$865	$1,591	N/A	$2,327	$544	$1,021	$878	$929
		$ Building Coverage	$2833 M	$177 M	$317 M	$261 M	$1469 M	$139 M	$105 M	$31 M	$237 M	$24 M	$3 M	$33 M
	PreFIRM Rates	# Policies	6,156	302	181	952	695	61	16	29	212	26	15	57
		$ Annual Premium	$8.1 M	$0.5 M	$0.4 M	$2.8 M	$2.5 M	$0.2 M	$0.1 M	$0.2 M	$0.2 M	$0.0 M	$0.1 M	$0.1 M
		$ Average Premium	$1,322	$1,526	$2,001	$2,966	$3,636	$3,844	N/A	$7,087	$1,118	$1,017	$5,120	$2,189
		$ Building Coverage	$80957 M	$5230 M	$4533 M	$18410 M	$11769 M	$1250 M	$1128 M	$760 M	$2858 M	$475 M	$1765 M	$1273 M
	Grandfathered and Subsidized Rates	# Policies	3,581	217	71	511	1,595	172	30	68	196	6	15	39
		$ Annual Premium	$4.6 M	$0.3 M	$0.2 M	$1.5 M	$3.3 M	$0.4 M	$0.1 M	$0.3 M	$0.2 M	$0.0 M	$0.0 M	$0.1 M
		$ Average Premium	$1,285	$1,530	$3,010	$2,858	$2,091	$2,072	N/A	$3,707	$1,061	$1,597	$1,530	$2,399
		$ Building Coverage	$511 M	$38 M	$42 M	$96 M	$314 M	$38 M	$32 M	$17 M	$24 M	$1 M	$2 M	$7 M
	Specific Rate (Method 2)	# Policies	5,113	200	159	136	1,461	110	62	23	74	6	2	4
		$ Annual Premium	$4.4 M	$0.3 M	$0.7 M	$0.7 M	$5.2 M	$0.4 M	$1.3 M	$0.2 M	$0.1 M	$0.0 M	$0.0 M	$0.0 M
		$ Average Premium	$868	$1,461	$4,463	$5,107	$3,593	$3,216	N/A	$7,567	$1,880	$1,895	$2,633	$834
		$ Building Coverage	$110210.8 M	$6027.5 M	$21859.4 M	$3292.4 M	$34328.5 M	$3482.0 M	$9630.3 M	$794.0 M	$1654.2 M	$153.3 M	$138.7 M	$3.2 M
BUILDING METRICS		# Buildings	145,211	5,201	39,081	5372	18691	1282	1923	3942	62276	2592	14402	2523
		# Buildings with Policies	57,574	1,922	3,732	1,179	13,805	570	122	349	8,792	420	500	200
		$ Total Floodplain Building Value	$22.5 B	$0.9 B	$33.6 B	$2.1 B	$5.7 B	$0.3 B	$0.2 B	$1.3 B	$9.0 B	$0.4 B	$10.0 B	$0.9 B
		% Buildings without Policies	60%	63%	90%	78%	26%	56%	94%	91%	86%	84%	97%	92%
		$ Building Coverage Overage/Deficit	-$16.6 B	-$0.7 B	-$33.3 B	-$1.7 B	-$5.0 B	-$0.3 B	-$0.2 B	-$1.3 B	-$8.9 B	-$0.3 B	-$9.9 B	-$0.8 B

5.3 Alternative Scenario 2: Immediate NFIP Risk-Based Rates with Capped Premium for PreFIRM Subsidized and Grandfathering

Description: Scenario assumes all existing policies in the mapped floodplain move to elevation-rated NFIP risk-based rates, excluding PRP and specific rates, but premiums are limited to 1% of coverage to those who meet the following two eligibility criteria: (1) NFIP risk-based premium exceeds 1% of total coverage, and (2) received PreFIRM subsidized and/or grandfathered rates before.

Objective: Assess the impact of completely removing all subsidies or discounts except CRS discount while still providing assistance to those policies with buildings built before current floodplain regulations and policies with buildings built in compliance with floodplain regulations at the time of construction.

Data Requirements:

Data Element	Source	Level of Availability
Flood Zone	NFIP	Statewide structures with policies
Year Built	NFIP	Statewide structures with policies
CID	NC FLOOD Database	Statewide
Number of Stories	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Occupancy Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Foundation Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Base Flood Elevation (BFE)	NFIP	Statewide structures with policies
Lowest Floor Elevation (LFE)	NFIP (where elevation rated) NCFMP (where non-elev. rated)	Elevation rated policies Buildings in floodplain in 58 Counties
Building Coverage	NFIP	Statewide structures with policies
Contents Coverage	NFIP	Statewide structures with policies
Deductible	NFIP	Statewide structures with policies

Findings:

Policy Breakdown		Total Premiums (Revenues)			Average Premium (Affordability)	
Policy Type	*Number of Contracts*	*Baseline Scenario*	*Alternative Scenario 2*	*% Change*	*Baseline Scenario*	*Alternative Scenario 2*
NFIP Risk-Based/PRP	47,135	$38.6 M	$38.6 M	0%	$818	$818
Grandfathered	23,482	$53.2 M	$34.2 M	-36%	$2,264	$1,455
Subsidized	8,702	$23.0 M	$9.3 M	-60%	$2,645	$1,068
Grandfathered & Subsidized	6,501	$29.5 M	$9.7 M	-67%	$4,544	$1,490
Specific Rate	7,350	$13.3 M	$13.3 M	0%	$1,814	$1,814
Total	**93,170**	**$157.6 M**	**$105 M**	**-33%**	**$1,692**	**$1,127**

*If specific rate policies move to NFIP risk-based rates, their revenue would increase to $67.8 M, and total revenue for this scenario would increase to $159.5 M.

General Observations:

- Approximately 13,700 (~15%) of policies would have premiums limited to 1% of total coverage for this scenario.
- The impact is greatest for those policies coded as grandfathered and subsidized where limiting the premium to 1% of total coverage decreases revenue by nearly $20 M.
- Over 90% of policies would pay 1% of their total coverage or less.
- Alternative Scenario 2 Integrated Data Matrix provides detailed breakdowns of metrics by flood zone and occupancy type.

Impacts to Affordability:

Premium Relative to Total Coverage (%)	Baseline		Alternative Scenario 2	
	# of Policies	*% of Policies*	*# of Policies*	*% of Policies*
0-1	74,722	80.2%	87,480	93.9%
1-2	8,232	8.8%	3,591	3.9%
2-5	7,620	8.2%	1,843	2.0%
>5	2,596	2.8%	256	0.3%
Total	**93,170**	**100%**	**93,170**	**100%**

Impacts to Financial Solvency:

- This scenario would decrease revenue generated by the baseline scenario by almost $53 M (33%).
- Impacts to the financial solvency of the NFIP (program revenues vs. claims and operating expenditures) could not be evaluated with this study due to insufficient historical claims data.

Data Gaps/Needs:

- Not all building data is conflated (e.g., missing BFE and Occupancy Type).
- BFE not populated for buildings outside of SFHA but still within floodplain.
- Geospatially located NFIP Claims data.

Alternative Scenario 2: Integrated Data Matrix

		Flood Zone	High Risk Riverine (A, AE, AH, AO)				High Risk Coastal (VE)				Low Risk (Shaded X)			
		Occupancy	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential
POLICY METRICS	Risk-Based Rate	# Policies	29,227	789	422	1,543	3,324	254	131	45	972	186	55	185
		$ Annual Premium	$16.3 M	$0.5 M	$0.8 M	$2.3 M	$11.2 M	$0.8 M	$0.7 M	$0.1 M	$0.7 M	$0.1 M	$0.1 M	$0.3 M
		$ Average Premium	$557	$661	$1,825	$1,502	$3,370	$3,306	N/A	$3,110	$670	$696	$2,701	$1,674
		$ Building Coverage	$5932 M	$195 M	$307 M	$445 M	$753 M	$80 M	$86 M	$14 M	$189 M	$49 M	$107 M	$53 M
	Preferred Risk Rate	# Policies	2,734	40	29	40	234	12	5	1	6,569	195	37	106
		$ Annual Premium	$1.2 M	$0.0 M	$0.0 M	$0.1 M	$0.1 M	$0.0 M	$0.0 M	$0.0 M	$2.9 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$436	$398	$256	$1,586	$466	$473	N/A	$54	$441	$411	$301	$1,791
		$ Building Coverage	$592.8 M	$7.6 M	$1.6 M	$8.8 M	$55.0 M	$2.9 M	$0.8 M	$0.1 M	$1417.6 M	$35.5 M	$3.7 M	$30.7 M
	Grandfathered Rates	# Policies	13,444	655	359	823	6,267	414	105	89	1,129	77	10	110
		$ Annual Premium	$9.5 M	$0.4 M	$0.8 M	$1.5 M	$17.6 M	$1.5 M	$1.1 M	$0.4 M	$1.0 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$706	$637	$2,349	$1,870	$2,802	$3,615	$10,131	$5,032	$890	$1,143	$1,622	$1,838
		$ Building Coverage	$2833 M	$177 M	$317 M	$261 M	$1469 M	$139 M	$105 M	$31 M	$237 M	$24 M	$3 M	$33 M
	PreFIRM Rates	# Policies	6,156	302	181	952	695	61	16	29	212	26	15	57
		$ Annual Premium	$5.1 M	$0.4 M	$0.2 M	$1.7 M	$1.3 M	$0.1 M	$0.1 M	$0.1 M	$0.1 M	$0.0 M	$0.1 M	$0.1 M
		$ Average Premium	$832	$1,209	$1,059	$1,784	$1,889	$2,272	$6,550	$2,724	$705	$851	$3,533	$1,050
		$ Building Coverage	$80957 M	$5230 M	$4533 M	$18410 M	$11769 M	$1250 M	$1128 M	$760 M	$2858 M	$475 M	$1765 M	$1273 M
	Grandfathered and Subsidized Rates	# Policies	3,581	217	71	511	1,595	172	30	68	196	6	15	39
		$ Annual Premium	$3.4 M	$0.3 M	$0.3 M	$0.9 M	$3.6 M	$0.4 M	$0.4 M	$0.2 M	$0.1 M	$0.0 M	$0.0 M	$0.1 M
		$ Average Premium	$957	$1,507	$3,889	$1,753	$2,230	$2,580	$11,719	$3,010	$560	$1,559	$1,334	$1,656
		$ Building Coverage	$511 M	$38 M	$42 M	$96 M	$314 M	$38 M	$32 M	$17 M	$24 M	$1 M	$2 M	$7 M
	Specific Rate (Method 2)	# Policies	5,113	200	159	136	1,461	110	62	23	74	6	2	4
		$ Annual Premium	$4.4 M	$0.3 M	$0.7 M	$0.7 M	$5.2 M	$0.4 M	$1.3 M	$0.2 M	$0.1 M	$11.4 k	$5.3 k	$3.3 k
		$ Average Premium	$868	$1,461	$4,463	$5,107	$3,593	$3,216	$20,376	$7,567	$1,880	$1,895	$2,633	$834
		$ Building Coverage	$110211 M	$6028 M	$21859 M	$3292 M	$34329 M	$3482 M	$9630 M	$794 M	$1654 M	$153 M	$139 M	$3 M
BUILDING METRICS		# Buildings	145,211	5,201	39,081	5372	18691	1282	1923	3942	62276	2592	14402	2523
		# Buildings with Policies	57,574	1,922	3,732	1,179	13,805	570	122	349	8,792	420	500	200
		$ Total Floodplain Building Value	$22.5 B	$0.9 B	$33.6 B	$2.1 B	$5.7 B	$0.3 B	$0.2 B	$1.3 B	$9.0 B	$0.4 B	$10.0 B	$0.9 B
		% Buildings without Policies	60%	63%	90%	78%	26%	56%	94%	91%	86%	84%	97%	92%
		$ Building Coverage Overage/Deficit	-$16.6 B	-$0.7 B	-$33.3 B	-$1.7 B	-$5.0 B	-$0.3 B	-$0.2 B	-$1.3 B	-$8.9 B	-$0.3 B	-$9.9 B	-$0.8 B

5.4 Alternative Scenario 3: Mitigation Assistance for Policies Meeting Certain Criteria

Description: Scenario assumes all existing policies in the mapped floodplain move to elevation-rated NFIP risk-based rates, excluding PRP and specific rates, but provides mitigation assistance grant for the elevating the building to BFE plus two feet to those who meet the following two eligibility criteria: (1) NFIP risk-based premium exceeds 1% of total coverage, and (2) received PreFIRM subsidized and/or grandfathered rates before.

Objective: Assess the impact of completely removing all subsidies or discounts except CRS discount while trying to prevent future loss for those policies with buildings built before current floodplain regulations and policies with buildings built in compliance with floodplain regulations at the time of construction.

Data Requirements:

Data Element	Source	Level of Availability
Flood Zone	NFIP	Statewide structures with policies
Year Built	NFIP	Statewide structures with policies
CID	NC FLOOD Database	Statewide
Number of Stories	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Occupancy Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Foundation Type	NC RISK Database	Approx. 42 Counties (where conflated building data exists)
Base Flood Elevation (BFE)	NFIP	Statewide structures with policies
Lowest Floor Elevation (LFE)	NFIP (where elevation rated) NCFMP (where non-elev. rated)	Elevation rated policies Buildings in floodplain in 58 Counties
Building Coverage	NFIP	Statewide structures with policies
Contents Coverage	NFIP	Statewide structures with policies
Deductible	NFIP	Statewide structures with policies

Findings:

Policy Breakdown		Total Premiums (Revenues)			Average Premium (Affordability)	
Policy Type	*Number of Contracts*	*Baseline Scenario*	*Alternative Scenario 3*	*% Change*	*Baseline Scenario*	*Alternative Scenario 3*
NFIP Risk-Based/PRP	47,135	$38.6 M	$38.6 M	0%	$818	$818
Grandfathered	23,482	$53.2 M	$43.2 M	-19%	$2,264	$1,839
Subsidized	8,702	$23.0 M	$9.2 M	-60%	$2,645	$1,055
Grandfathered & Subsidized	6,501	$29.5 M	$10.8 M	-63%	$4,544	$1,656
Specific Rate	7,350	$13.3 M	$13.3 M	0%	$1,814	$1,814
Total	**93,170**	**$157.6 M**	**$115.0 M**	**-27%**	**$2,276**	**$1,235**

*If specific rate policies move to NFIP risk-based rates, their revenue would increase to $67.8 M, and total revenue would increase to $169.5 M.

Overall Benefit/Cost Estimate:

Total Policies	Costs			Benefits	Benefit / Cost Metrics	
	Mitigation Costs (Present Value)	*Mitigation Costs (Annual)*	*Lost Revenue (Annual)*	*Avoided Flood Damages (Annual)**	*Annual Change in Revenue*	*Annual Benefit/Cost Ratio*
11,483	$1.3 B	$95.5 M	$42.6 M	$80.6 M	-$57.5 M	0.5

*Average annualized loss data was not available for all policies, so avoided flood damages were extrapolated based on available data.

General Observations:

- Approximately 11,490 (~10%) policies would receive a mitigation assistance grant.
- The impact is greatest for those policies coded as grandfathered and subsidized where raising the buildings to 2 ft. above BFE would decreases revenue by nearly $20 M.
- Over 85% of policies would pay 1% of their total coverage or less.
- Alternative Scenario 3 Integrated Data Matrix provides detailed breakdowns of metrics by flood zone and occupancy type.

Impacts to Affordability:

Premium Relative to Total Coverage (%)	Baseline		Alternative Scenario 3	
	# of Policies	*% of Policies*	*# of Policies*	*% of Policies*
0-1	74,722	80.2%	79,803	85.6%
1-2	8,232	8.8%	10,206	11%
2-5	7,620	8.2%	2,768	3%
>5	2,596	2.8%	393	0.4%
Total	**93,170**	**100%**	**93,170**	**100%**

Impacts to Financial Solvency:

- With the additional annual cost to provide mitigation, the annual change in revenue would be a decrease of $57.5 M.
- Impacts to the financial solvency of the NFIP (program revenues vs. claims and operating expenditures) could not be evaluated with this study due to insufficient historical claims data.

Data Gaps/Needs:

- Not all building data is conflated (e.g., missing BFE and Occupancy Type).
- BFE not populated for buildings outside of SFHA but still within floodplain.
- Geospatially located NFIP Claims data.

Alternative Scenario 3: Integrated Data Matrix

		Flood Zone	High Risk Riverine (A, AE, AH, AO)				High Risk Coastal (VE)				Low Risk (Shaded X)			
		Occupancy	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential	Single Family	2-4 Family Residential	Other Residential	Non-Residential
POLICY METRICS	Risk-Based Rate	# Policies	29,227	789	422	1,543	3,324	254	131	45	972	186	55	185
		$ Annual Premium	$16.3 M	$0.5 M	$0.8 M	$2.3 M	$11.2 M	$0.8 M	$0.7 M	$0.1 M	$0.7 M	$0.1 M	$0.1 M	$0.3 M
		$ Average Premium	$557	$661	$1,825	$1,502	$3,370	$3,306	N/A	$3,110	$670	$696	$2,701	$1,674
		$ Building Coverage	$5932 M	$195 M	$307 M	$445 M	$753 M	$80 M	$86 M	$14 M	$189 M	$49 M	$107 M	$53 M
	Preferred Risk Rate	# Policies	2,734	40	29	40	234	12	5	1	6,569	195	37	106
		$ Annual Premium	$1.2 M	$0.0 M	$0.0 M	$0.1 M	$0.1 M	$0.0 M	$0.0 M	$0.0 M	$2.9 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$436	$398	$256	$1,586	$466	$473	N/A	$54	$441	$411	$301	$1,791
		$ Building Coverage	$592.8 M	$7.6 M	$1.6 M	$8.8 M	$55.0 M	$2.9 M	$0.8 M	$0.1 M	$1417.6 M	$35.5 M	$3.7 M	$30.7 M
	Grandfathered Rates	# Policies	13,444	655	359	823	6,267	414	105	89	1,129	77	10	110
		$ Annual Premium	$9.6 M	$0.4 M	$0.8 M	$1.6 M	$25.5 M	$2.0 M	$1.4 M	$0.6 M	$1.0 M	$0.1 M	$0.0 M	$0.2 M
		$ Average Premium	$713	$572	$2,166	$1,963	$4,071	$4,845	$12,979	$7,140	$891	$1,143	$1,628	$1,846
		$ Building Coverage	$2833 M	$177 M	$317 M	$261 M	$1469 M	$139 M	$105 M	$31 M	$237 M	$24 M	$3 M	$33 M
	PreFIRM Rates	# Policies	6,156	302	181	952	695	61	16	29	212	26	15	57
		$ Annual Premium	$4.2 M	$0.3 M	$0.2 M	$1.8 M	$1.8 M	$0.2 M	$0.2 M	$0.1 M	$0.2 M	$0.0 M	$0.1 M	$0.1 M
		$ Average Premium	$682	$908	$1,120	$1,933	$2,592	$3,260	$14,961	$4,699	$714	$858	$3,576	$1,077
		$ Building Coverage	$80957 M	$5230 M	$4533 M	$18410 M	$11769 M	$1250 M	$1128 M	$760 M	$2858 M	$475 M	$1765 M	$1273 M
	Grandfathered and Subsidized Rates	# Policies	3,581	217	71	511	1,595	172	30	68	196	6	15	39
		$ Annual Premium	$2.7 M	$0.2 M	$0.3 M	$1.0 M	$4.9 M	$0.6 M	$0.5 M	$0.3 M	$0.1 M	$0.0 M	$0.0 M	$0.1 M
		$ Average Premium	$767	$1,151	$3,562	$1,877	$3,043	$3,721	$17,712	$4,774	$568	$1,559	$1,359	$1,680
		$ Building Coverage	$511 M	$38 M	$42 M	$96 M	$314 M	$38 M	$32 M	$17 M	$24 M	$1 M	$2 M	$7 M
	Specific Rate (Method 2)	# Policies	5,113	200	159	136	1,461	110	62	23	74	6	2	4
		$ Annual Premium	$4.4 M	$0.3 M	$0.7 M	$0.7 M	$5.2 M	$0.4 M	$1.3 M	$0.2 M	$0.1 M	$11.4 k	$5.3 k	$3.3 k
		$ Average Premium	$868	$1,461	$4,463	$5,107	$3,593	$3,216	$20,376	$7,567	$1,880	$1,895	$2,633	$834
		$ Building Coverage	$110211 M	$6028 M	$21859 M	$3292 M	$34329 M	$3482 M	$9630 M	$794 M	$1654 M	$153 M	$139 M	$3 M
BUILDING METRICS		# Buildings	145,211	5,201	39,081	5372	18691	1282	1923	3942	62276	2592	14402	2523
		# Buildings with Policies	57,574	1,922	3,732	1,179	13,805	570	122	349	8,792	420	500	200
		$ Total Floodplain Building Value	$22.5 B	$0.9 B	$33.6 B	$2.1 B	$5.7 B	$0.3 B	$0.2 B	$1.3 B	$9.0 B	$0.4 B	$10.0 B	$0.9 B
		% Buildings without Policies	60%	63%	90%	78%	26%	56%	94%	91%	86%	84%	97%	92%
		$ Building Coverage Overage/Deficit	-$16.6 B	-$0.7 B	-$33.3 B	-$1.7 B	-$5.0 B	-$0.3 B	-$0.2 B	-$1.3 B	-$8.9 B	-$0.3 B	-$9.9 B	-$0.8 B

6.0 Conclusions and Next Steps

The State of North Carolina Floodplain Mapping Program embarked on a case study to characterize flood hazard and NFIP policy information and to identify and evaluate conceptual alternative rate methodologies to support discussions of flood insurance affordability. The study leveraged NFIP data and a number of North Carolina specific data sets, as well as national datasets, to compile and integrate flood insurance, flood hazard, flood risk/vulnerability, and demographic data. The objectives of this study were to characterize flood vulnerabilities in North Carolina, develop and test methodologies to assess the affordability impacts of alternative policy option scenarios, and identify data/information needs to scale the study nationwide.

North Carolina contains a variety of flood hazards, ranging from coastal to mountainous, with mapped floodplains covering over 20% of the total land area. There are approximately 300,000 buildings in mapped floodplain areas, however, only an estimated 30% have flood insurance.

This study illustrated how to estimate some of the potential impacts of converting premiums to risk-based rates based on recent flood insurance reform using enhanced North Carolina datasets and tools. The study then illustrated how to assess three potential alternative policy option scenarios for reducing the cost burden of increased premiums.

This North Carolina statewide study was possible, in large part, due to advanced datasets (e.g., conflated buildings, and geocoded policies) that NCFMP has developed to support its program initiatives. These datasets are robust, however, data gaps exist. Data gaps identified in the study included areas without conflated building information (e.g., BFE, FFE, and Occupancy Type), NFIP policies that could not be located to the building/parcel level, limited AAL information, and lack of demographic data at the individual property owner level.

In reference to expanding a similar study to the nationwide level, one key challenge is having a reliable means to estimate the elevation difference for all buildings in the floodplain. Elevation difference is defined as the building floor elevation minus the flood elevation and is a key variable in the calculation of risk-based premiums. Nationwide, building floor elevation information is not generally available in a comprehensive data source. In addition, well over 50% of floodplain mapping in the nation is based on approximate studies (i.e. Zone A) without published flood elevation. Other challenges in fully assessing impacts from different rate scenarios include not having demographic, AAL, policy, and claim information at the building/property level; and more complete/reliable information in the NFIP database with supporting documentation.

NFIP Rate Methods

NATIONAL ASSOCIATION of REALTORS®

NAR Brief
MILLIMAN FLOOD INSURANCE STUDY

Top Line Summary

- Independent actuaries studied National Flood Insurance Program (NFIP) rates in 5 counties.
- The study finds that many property owners are overcharged while others are undercharged.
- NAR recommends several changes to better align NFIP rates to the property-specific risk.

Key Study Findings

- NFIP rates are currently not well aligned with risk.
- NFIP rates do not track with other risk factors such as distance to coast/river.
- Doing so could increase NFIP participation and strengthen solvency.
- "A Zones" (high risk areas): NFIP uses one rate table to charge most high risk properties across the U.S.
    - As a result, two property owners facing different risks could pay the same premium rate.
        - For example, storm surge flooding in coastal areas causes more damage than riverine flooding – yet in the A zone, rates do not reflect this difference.
    - Also, because 20% of properties are subsidized, adjacent properties with identical risk profiles could pay dramatically different rates.
- "X Zones" (low risk): While the A zone table accounts for the relative elevation of the property, the X zone table does not; many will not voluntarily opt in as long as the average rate is so high.
    - Thus some low risk properties pay more than high risk properties that are elevated.

Recommendations

- Divide the A zone into coastal and inland subzones and calculate a rate table for each.
- Incorporate risk factors such as distance to river/coast, in addition to property elevation.
- Develop an X zone table that accounts for property elevation and other appropriate risk factors.

Methodology

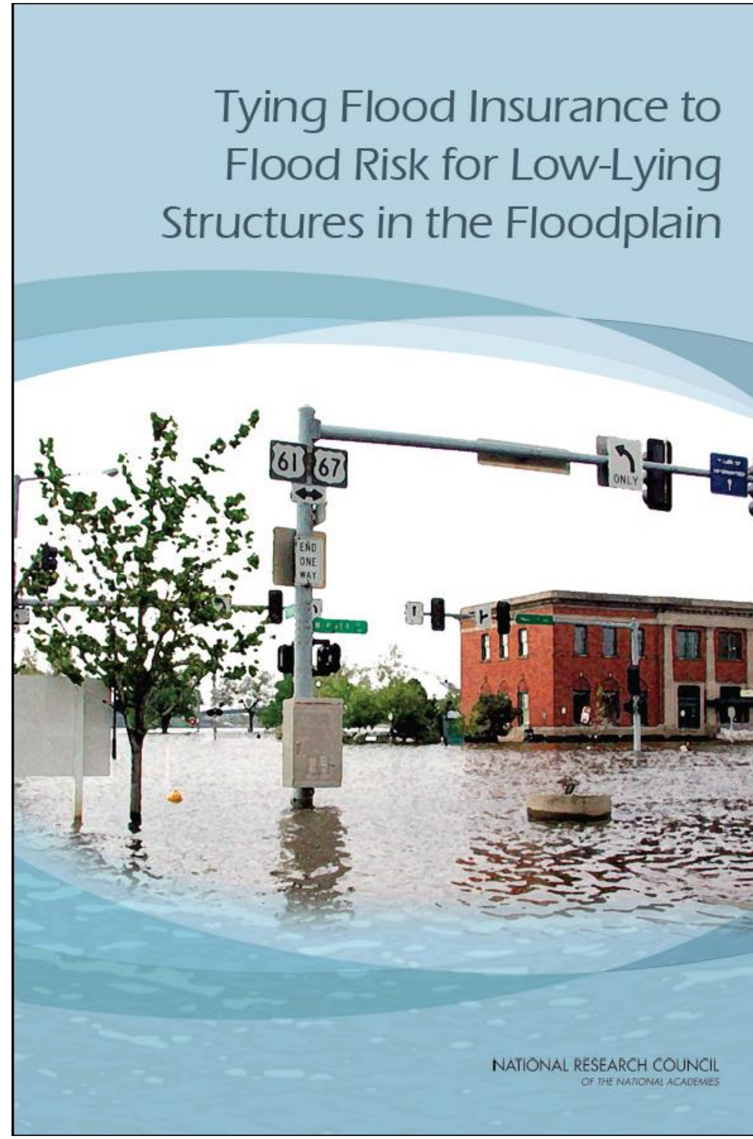
- This is a case study, not a full actuarial study of FEMA's rate-making process.
- Selected 5 counties: Pinellas, FL; Harris, TX; Ocean, NJ; Merced, CA; and Hancock, Ohio.
- Identified a typical high risk property for each county (e.g., 1-story $175,000 masonry structure built in 1970) then varied one attribute (e.g., built in 1995 instead of 1970).
- Assumed that all properties in the county reflect these characteristics so only the location and elevation of the property would vary.
- Calculated the rate two ways: first as NFIP would then as a private insurance company would, and compared the results.
- Evaluated how the rates change with other risk factors including the distance to coast/river.

Complete Study & Results: Available upon Request

For more information: please contact Austin Perez, 202-383-1046 or aperez@realtors.org, at the National Association of REALTORS.

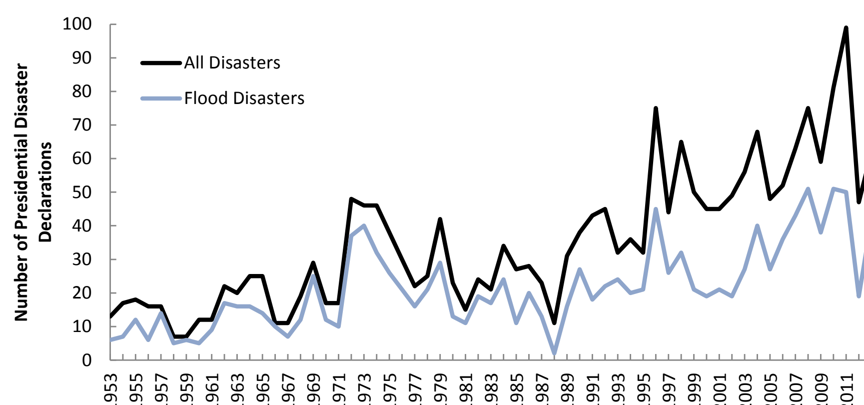
NATIONAL ASSOCIATION of REALTORS®

Tying Flood Insurance to Flood Risk for Low-Lying Structures in the Floodplain



Floods take a heavy toll on society

- Floods affect more people and are more costly than any other natural disaster
  - 2/3rds of presidential disaster declarations are flood related
- NFIP was established to reduce flood risk to individuals and their reliance on federal disaster relief



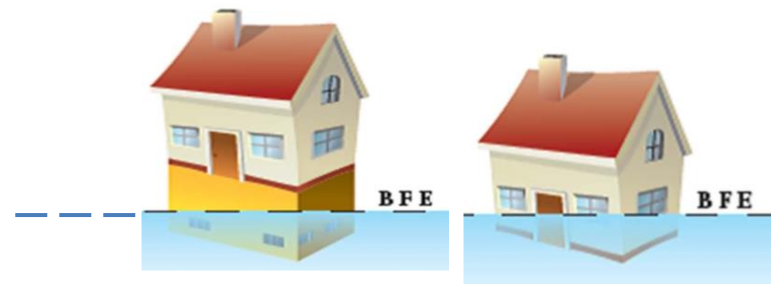
The National Academies of SCIENCES · ENGINEERING · MEDICINE

NFIP Flood insurance Rates

- Two types of flood insurance rates
  - Risk-based (4.5 million policies): premiums reflect actual risk (cost) of flooding
  - Subsidized (1 million policies): premiums set low for older (pre-flood map) structures
- Biggert-Waters Flood Insurance Reform Act (BW 2012) and Homeowner Flood Insurance Affordability Act (HFIAA 2014) are phasing out subsidized rates
  - Shift to risk-based rates → increase premiums
  - Most subsidized structures low lying and at high risk of flooding → substantial premium increases to cover losses

What is a Low-Lying Structure?

Low-lying structure = elevation of the lowest floor is lower than NFIP benchmark



Low-lying structure

Structure built to NFIP standards

NFIP benchmark for construction standards, floodplain management, and rate setting = water surface elevation with a 1 in 100 chance of being exceeded annually (BFE)

What is the concern?

Low lying = high flood risk

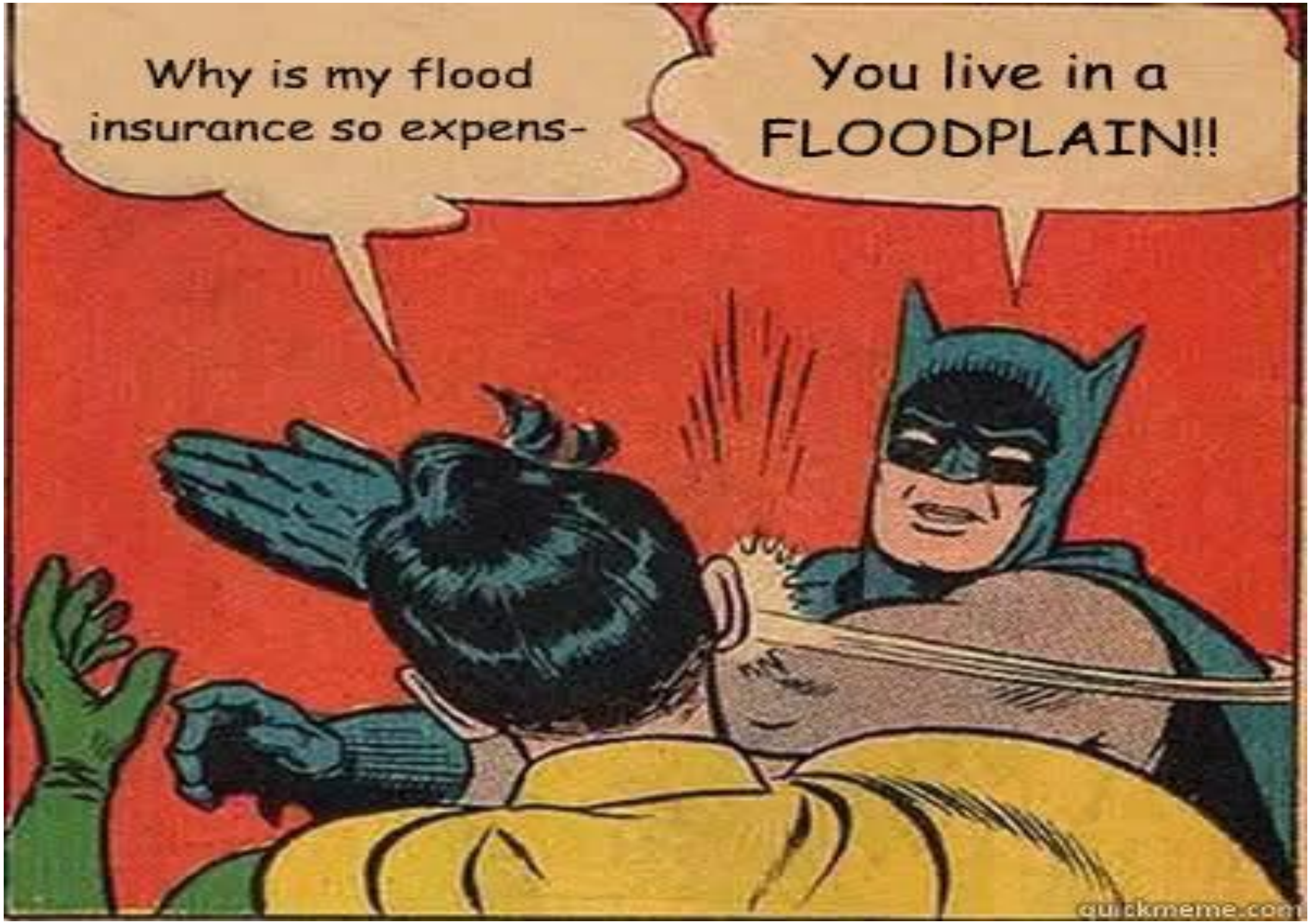
- flood more frequently
- flood deeper
- flood for longer periods
- suffer a higher proportion of damage from small flood events

Low-lying structure

Structure built to NFIP standards

Up to 1 million low-lying structures in NFIP portfolio

NFIP wants to ensure rates are fair and accurate



HOLY BFE Batman-- You're right!

NRC Report

- This report examines methods for calculating risk-based rates for low-lying structures
  - Examine current NFIP methods and possible changes to those methods
  - Identify data and analysis needs
  - Discuss issues of feasibility and cost for implementing risk-based rates for low-lying structures
- Focus is on methods, <u>not</u> on what those rates or premiums should be

Committee Members

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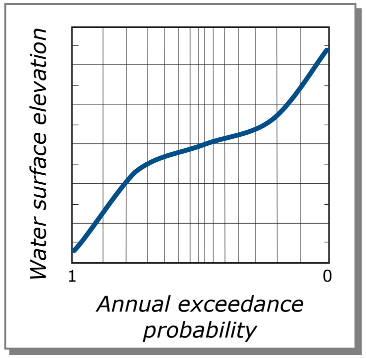
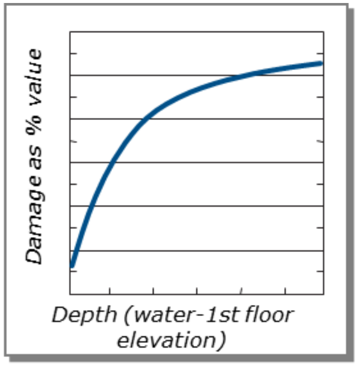
Current NFIP Methods
Step 1: Flood Risk Assessment

- Flood hazard = probability and magnitude of flooding
- Effectiveness of flood protection and mitigation measures (e.g., levees)
- Exposure and vulnerability = relationship between flood hazard and damage to the asset





Flood risk: combine the results to calculate the average annual loss to a structure being insured

Step 2: Rate Setting

- Take the average annual loss from the flood risk analysis
- Convert to an insurance rate by adjusting for
  - expenses
  - amount of underinsurance
  - portion of the claim that will not be covered because of the deductible
  - other factors

Conclusions About Current Methods

- Assessment does not fully capture flood hazard and vulnerability conditions that affect low-lying structures
  - very frequent flooding, damage from longer duration of flooding and from small flood events
- Some NFIP data and analysis methods are dated
- These problems can be addressed by incremental changes to current methods or new approaches

Key Incremental Changes

- Enhance flood hazard assessment
  - Account for frequent flooding, which causes significant portion of potential losses
  - Localize flood hazard description, rather than using averages
- Expand exposure and vulnerability assessment
  - Determine the extent to which structure damage is caused by factors other than inundation depth
- Account for effectiveness of levees
  - Assess the protection of non-accredited levees against frequent floods
- Change underinsurance adjustment
  - Tie to replacement cost of the structure, rather than average building values

New Approach: Comprehensive Risk Assessment

- Describe risk over the entire range of flood hazard conditions and flood events (small to catastrophic)
  - Determine flood hazard for individual structures by modeling watershed characteristics at fine spatial resolution
  - Describe the varying levels of protection offered by all flood protection and mitigation measures using probabilistic models
- Explicitly and systematically account for all uncertainties through the risk analysis

Key Data Issues

- Collect structure elevation data for all low-lying structures
  - Can't determine risk-based rates without it
  - Variety of sources
- Data quality improvements needed to increase accuracy of flood loss estimates
  - Consistent estimates of structure replacement costs
  - Better quality control and review of NFIP claims data

Feasibility, Implementation, and Cost

- Most analysis approaches are being carried out by other organizations, and so are feasible
- Incremental changes to current NFIP methods could be implemented quickly and at low or moderate cost
- Comprehensive risk assessment would provide greater improvements in flood loss estimates, but would take longer and cost more to implement
  - Implementation could be done in stages and leverage work from other agencies
  - NFIP will have to balance costs and benefits

Bottom Line

- Subsidized rates are being replaced by risk-based rates → premiums will go up significantly for low-lying structures
- NFIP cannot develop fair and accurate rates for these structures without
  - structure elevation and consistent replacement cost data
  - changes to NFIP methods
- NFIP could make incremental changes now while working toward a comprehensive risk assessment
  - NFIP will have to do a cost-benefit analysis to determine which changes to implement

Homeowner Advocacy

NATIONAL ASSOCIATION of REALTORS®

CAROLINA FLOOD SOLUTIONS LLC

Innovative Solutions for Complex Issues

NFIP Policy Rating Analysis: Summary of Findings and Recommendations for Improvements

CONSULTANT REPORT

March 3, 2016

Carolina Flood Solutions LLC

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None of the information in this document is to be considered quote or an offer of coverage, but an estimate or observations for research and informational purposes only. Examples use the NFIP Manual in effect during the policy period their cases were presented for resolution by the insured.

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About Carolina Flood Solutions LLC

Carolina Flood Solutions LLC is a private consulting firm that assists clients with a variety of flood insurance and floodplain related concerns, including determining if their flood insurance policy is properly rated, resolving any discrepancies which resulted in misrating or rating adjustments, and offering mitigation options to insured's who desire to lower their flood insurance premiums. This case study discusses ten policies or quotes that we selected to support recommendations for improvements to the NFIP operational structure, to "shore up" the NFIP before rate increases are expanded, thus making sure that those who are affected are rated properly.

About the Author

Lisa Sharrard (Jones) founded Carolina Flood Solutions LLC in 2013. She is the former Chair of the Association of State Floodplain Managers and a recognized leader in her profession. Her successful work as an advocate for her clients prompted the National Association of REALTORS® to request Congress to create the Office of the Flood Insurance Advocate within the Federal Emergency Management Agency, modeled after her advocacy example.

Lisa has over 28 years in the public and private sectors having served as the State Coordinator in South Carolina, overseeing the implementation of Risk Map, federal regulatory compliance at the state and local levels, and flood mitigation and response. Lisa has had the pleasure to serve FEMA in numerous task forces over her career including FEMA's CRS Task Force. After leaving public service, Lisa worked as a trainer for the NFIP Direct. She is one of the few individuals, across the country, which has direct experience in all aspects of the NFIP. Lisa is the former National Chairperson of the Association of State Floodplain Managers (ASFPM). She currently serves the Association of State Floodplain Managers as Co-Chair of the Regulations Committee and as a member of the Certified Floodplain Manager-Certification Board of Regents. Lisa is a licensed Property & Casualty Producer in both NC and SC.

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NFIP Policy Rating Analysis: Summary of Findings and Recommendations for Improvements

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Background

The ***Biggert-Waters Flood Insurance Reform Act*** and the subsequent ***Homeowners Flood Insurance Affordability Act*** (HFIAA) of 2014 continue to have major impacts on the cost of flood insurance. Unfortunately, the acts failed to resolve major factors contributing to what policyholders pay for federally backed flood insurance, administered under the umbrella of the National Flood Insurance Program (NFIP).

The NFIP is a complicated program for the consumer. Insureds have very little control over how their policies are written and interpreted (underwritten). They rely on licensed professionals, as "trusted advisors," to fill out the application correctly and to notify them of program changes that may benefit them.

In the legal system, you are innocent until proven guilty; however, in most cases, the current NFIP policies or procedures consider you guilty until you prove your innocence. Often times, an underwriter makes a judgement, resulting in the insured being billed for more premium money, with little or no explanation offered to the insured and no direction to further assistance. In some cases, the mortgage company, which escrows the premium, pays the increased premium amount thus raising the insured's monthly mortgage payment. Agents have little knowledge of what transpired, as they are notified when the insured is. There is no appeal process, or clear help line, like there is with the Internal Revenue Service. The timing of the re-underwriting of a policy also seems random and/or arbitrary to the insured.

Summary

Since the *Biggert-Waters Flood Insurance Reform Act of 2012* and the subsequent *Homeowner's Flood Insurance Affordability Act of 2014,* much attention has been paid to proper rating of flood insurance policies, much of it at the expense of policy holders and the equitability and fairness that Congress envisioned. This report highlights cases in which insurance agents, Write Your Own (WYO) companies, or the Bureau and Statistical Agent failed to provide adequate customer service or due diligence, causing policy holders to be given higher or excessive quotes or premiums for flood insurance policies or to pay too little or too much for their respective flood insurance policies. Mortgagees or lenders also play a major role in the process with their enforcement of the mandatory purchase act. This report also highlights how the NFIP's processes appear one-sided, favoring the program, WYO companies, and the insurance agency—not the policy holders.

Let's begin by looking at the roles of the four major players: the Federal Emergency Management Agency, Write-Your-Own companies, mortgage companies, and insureds.

The Federal Emergency Management Agency and the National Flood Insurance Program

The National Flood Insurance Program was created by Congress in 1968 to make flood insurance more generally available and affordable for widespread purchase. The program was originally administered by Housing and Urban Development (HUD) until President Carter created the Federal Emergency Management Agency (FEMA) on April 1, 1979. At that time, the program was transferred to FEMA and has remained there ever since.

Both the *Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) and the subsequent Homeowner's Flood Insurance Affordability Act of 2014 (HFIAA 2014)* directed FEMA to make big changes in the insurance, mapping, and mitigation programs that support the NFIP. However, FEMA got off to a slow start in making those reforms. For instance, there were key leadership changes within FEMA, specifically, with Roy E. Wright being named the agency's Deputy Associate Administrator for Insurance and Mitigation in 2015. In addition, there were delays in implementing some of the reform directives, such as the startup of the Office of the Flood Insurance Advocate in 2014 (HFIAA 2014), led by David Stearrett, which were intended to nurture a greater understanding of the issues and need for internal changes.

I have worked with the Office of the Flood Insurance Advocate to help resolve some of my clients' issues that otherwise could not have been resolved so expeditiously. While I think we are off to a better start now, FEMA and the NFIP still have a long way to go in terms of internal reform, customer service, support, and the necessary revisions to the NFIP, for both the direct (federal) and private markets.

The Write Your Own (WYO) Program

Background

The Write Your Own (WYO) Program began in 1983 and is a cooperative undertaking of the insurance industry and FEMA. The WYO Program allows participating property and casualty insurance companies to write and service the Standard Flood Insurance Policy in their own names. The companies receive an expense allowance for policies written and claims processed while the Federal Government retains responsibility for underwriting losses. The WYO Program operates as part of the NFIP, and is subject to its rules and regulations. The goals of the WYO Program are to increase the NFIP policy base and the geographic distribution of policies, improve service to NFIP policyholders through the infusion of insurance industry knowledge, and provide the insurance industry with direct operating experience with flood insurance. [1]

Currently, there are 78 companies enrolled in the WYO Program. The majority of the 78 WYO participating companies outsource the administration of the NFIP to seven processing companies.

[1] FEMA website https://www.fema.gov/what-write-your-own-program

WYO Expense Allowance & Agent Compensation

WYO companies are paid an expense allowance[2] of approximately 31.3% through their contractual relationship with FEMA/NFIP. These funds are used for servicing the flood insurance policies (writing, endorsing, etc.) and processing claims. This includes providing training to their agents writing the policies as well as to customer service and underwriting staff.

Under the current compensation package offered by the NFIP, WYO companies pay their captive or independent insurance agents writing flood polices a commission based on the percentage of the premium. These commissions vary widely, from 15 percent (NFIP Direct) up to 23-25 percent. Once a policy is in-force, agents are required to do little else in terms of updating or maintaining the accuracy of the policy for an insured building. Most changes or endorsements (such as name changes or increases in coverage), regardless of their impact on rating, are initiated by the insured or their mortgage company, not the agent.

Agents typically do not review or revisit the insured property unless requested to do so by the WYO or the insured. Mistakes aren't typically caught unless there is an underwriting review. One example would be in a post-disaster environment in which the WYO insurance claims adjuster discovers inconsistency between actual conditions and the flood policy declarations page or application (e.g., building description, flood zone, etc.). Unfortunately, as a result of the South Carolina floods in October 2015, I have first-hand knowledge that this cross-check is not being done.

Agents typically write both the homeowners and flood policies. Most insurance companies require the agent to update the policies every 3-5 years by making sure there have been no changes to the insured structure, updating the replacement cost value (done annually) and providing new photographs. While the insurance companies require this level of attention and maintenance of homeowner's policies, neither FEMA's NFIP or the WYOs require this level of attention to detail for flood insurance policies. This leads to insureds paying too much or not enough premium for the coverage they have or to being under- or over-insured.

Since there is no penalty or consequences for doing a poor job, inaccurately completing the application, or making any other egregious mistakes that affect rating and because there is no requirement to update the application periodically, the agent and WYO are the source of higher premiums or underrated policies which drive the costs of the program up. The current compensation structure is a disincentive for agents and WYOs to provide the necessary customer service or servicing of the policy that helps insureds reduce their flood insurance premium rates and help FEMA/NFIP keep premiums lower. This report does not intend to portray agents, insurance companies, WYOs, or others in an unflattering light nor does it assign blame to them. This report merely points out some shortcomings and loopholes that the NFIP's current structure and business practices allow.

[2] http://bsa.nfipstat.fema.gov/manuals/accounting_manuals/WYO_Accounting_Procedure_Manual_04302015.pdf

WYO and the New Private Market

Some WYOs are entering into the private market while still servicing NFIP policies. One of the case studies that follow shows the conflict the agent faces and the possible conflicts of interest that affect the extent to which the insured receives the best product.

WYO Case Studies

The following nine case studies illustrate some of the deficiencies in the WYO Program, particularly as they relate to agent practices in rating analysis and assignment and how these practices affect policyholder premium rates.

Overview of V-Zone Rating

Because several of these case studies relate to V-Zone ratings, let's first look at the complexity of the how insurance rates affect premiums in Coastal Zones. Insurance rates are based on a number of factors. A primary factor is the flood zone in which the structure is located. However, V-Zone ratings are more complicated to rate as they take into account more factors, including:

1. Date of Construction
2. Size of Enclosures (300 sq. ft. or greater)
3. Replacement Cost Value (RCV)
4. Mechanical equipment below Base Flood Elevation (BFE)
5. Foundation Type

The size of enclosures and RCV (items 2 and 3 above) play a big role in V-Zone rating. Let's look at them individually.

1. Size of Enclosures (300 sq. ft. or greater)
2. Replacement Cost Value/Ratio (Rate Pages 22-23)

Agents assign a replacement cost value to the structure on the application, and no supporting documentation is required to sustain the figure. This value is only used in determining the insurance to value ratio for Post-FIRM (***Flood Insurance Rating Map***)buildings located in the V, V1–V30, and VE zones using Tables 3E or 3F, or the Specific Rating Guidelines for rating. The estimated building ***replacement cost***[3] is used in conjunction with the amount of the building insurance desired to determine the insurance-to-replacement cost ratio. The NFIP Agent Manual instructs the underwriter not to take into account or include any excess lines coverage (available through the private market) in place when determining the amount of coverage purchased. The underwriter can only include building coverage purchased through the NFIP. FEMA does not require agents to substantiate with documentation the RCV on the application for any policy type other than Residential Condominium Building Association Policies (RCBAP). RCBAP polices must submit new RCV documentation every three years.

[3] This term and others appearing in boldface italicized type are defined in the Glossary at the end of this report.

Rating illustration 1: RCV is $200,000; the lender required the maximum amount of insurance available of $200,000 building coverage, resulting in a replacement cost ratio of 100%.

$$\frac{\$200{,}000}{\$200{,}000} = 1$$

Rating illustration 2: In this example, the insured purchases the maximum amount of insurance available ($250,000), and the agent assigns the RCV at $600,000, resulting in a replacement cost ratio of 41%.

$$\frac{\$250{,}000}{\$600{,}000} = 0.41$$

Both structures are two feet above the Base Flood Elevation on piles with no enclosure. Now let's look at the NFIP Rate Table that applies.

TABLE 3E. REGULAR PROGRAM – POST-FIRM CONSTRUCTION RATES

ANNUAL RATES PER $100 OF COVERAGE

ELEVATION OF THE LOWEST FLOOR ABOVE OR BELOW BFE ADJUSTED FOR WAVE HEIGHT[2]	1981 POST-FIRM V1–V30, VE ZONE RATES[1]				
	ELEVATED BUILDINGS FREE OF OBSTRUCTION[3]				
	CONTENTS		BUILDING		
	Residential	Non-Residential	Replacement Cost Ratio .75 or More[4]	Replacement Cost Ratio .50 to .74[4]	Replacement Cost Ratio Under .50[4]
+4 or more	0.54	0.54	0.90	1.19	1.83
+3	0.57	0.57	1.03	1.41	2.11
+2	0.85	Illustration 1	1.42	Illustration 2	2.86
+1	1.19	1.24	2.06	2.71	3.79
0	1.62	1.74	2.70	3.48	4.82
-1	2.32	2.39	3.58	4.62	6.37
-2	3.32	3.50	4.80	6.19	8.39
-3	4.34	4.60	5.58	7.09	9.27
-4 or below	***	***	***	***	***

As you can see from the rate table above, the rate or cost of insurance coverage per $100 increases, as the insurance coverage to replacement cost value ratio declines.

Example 1: V-Zone Policy Misrated, Resulting in Lower Premium in Error

Our first example is a single-family structure located in a V17 (VE) Flood Zone.

As shown in Figure 1 below, RCV on the homeowner's policy is $551,616, while the NFIP Declarations Page in Figure 2 below shows a RCV for the flood policy to be $250,000. This is inconsistent; the two RCVs should match.

Figure 1: Homeowner's Policy Coverage and RCV

POLICY COVERAGES:

	LIMIT OF LIABILITY:
SECTION I - PROPERTY	
A. DWELLING	$ 551,616

Figure 2: Rating Information - NFIP Policy Declaration Page

Rating Information

Building Occupancy: Single Family	[redacted]
Primary Residence: Y	
Number of Floors: Two Floors	
Building Indicator: Elevated	Program Status: Regular Grandfathered: No
Basement/Enclosure/Crawlspace:	Flood Risk/Rated Zone: V13
No Enclosure or Crawlspace	
Condo Type: N/A	
Replacement Cost Value: 250,000	Elevation Difference: 5

Discoveries:

The current premium of $2,790 plus policy fees and surcharges (NFIP Manual, June 2014), as shown in Figure 3, is based on 100% insured-to-replacement cost value. If we compare the RCV of the homeowner's policy (which is required by the carriers to be adjusted annually) to the NFIP Policy building coverage, we calculate the following ratio:

$$\mathbf{250,000 \div 551,616 = 0.45}$$

Figure 3: NFIP Policy Declaration Page

Coverage		Deductible	Premium
BUILDING	$250,000	$1,250	$2,250.00
CONTENTS	$100,000	$1,250	$540.00
		ANNUAL SUBTOTAL:	$2,790.00

Based on this ratio, rather than using the "Replacement Cost Ratio of .75 or More" value, the agent and WYO company should have used "Replacement Cost Ratio under .50" value (Table 3E below, from the NFIP Manual, June 2014). Because the agent placed the RCV at 100% ($0.90 per $100 of coverage), the insured is paying a significantly lower premium than he should be paying. The proper rate should have been $1.83 per $100 of coverage for building coverage. Under this scenario, the insured should have paid **$5,115** plus policy fees and surcharges, for the flood insurance premium. This almost doubled the current rate the insured is paying.

TABLE 3E. REGULAR PROGRAM – POST-FIRM CONSTRUCTION RATES

ANNUAL RATES PER $100 OF COVERAGE

ELEVATION OF THE LOWEST FLOOR ABOVE OR BELOW BFE ADJUSTED FOR WAVE HEIGHT[2]	1981 POST-FIRM V1-V30, VE ZONE RATES[1] — ELEVATED BUILDINGS FREE OF OBSTRUCTION[3]				
	CONTENTS		BUILDING		
	Residential	Non-Residential	Replacement Cost Ratio .75 or More[4]	Replacement Cost Ratio .50 to .74[4]	Replacement Cost Ratio Under .50[4]
+4 or more	0.54	[illegible]	0.90	[illegible]	1.83
+3	0.57	0.57	1.03	1.41	2.11
+2	0.85	0.91	1.42	1.89	2.86
+1	1.19	1.24	2.06	2.71	3.79
0	1.62	1.74	2.70	3.48	4.82
-1	2.32	2.39	3.58	4.62	6.37
-2	3.32	3.50	4.80	6.19	8.39
-3	4.34	4.60	5.58	7.09	9.27
-4 or below	***	***	***	***	***

To complicate matters, the structure has an enclosure greater than 300 square feet. Per the NFIP Manual, this means that Table 3F (shown on the next page)—and not Table 3E—should have been used to calculate the premium. Table 3F indicates that the rate of $4.29 per $100 for building coverage and $1.01 per $100 for contents coverage should have been used. The actual premium calculated for building and contents coverages under this scenario (actual conditions) is **$11,735** plus policy fees and surcharges. As recommended, the client is reducing the enclosure to less than 300 square feet and addressing the discrepancy between the two different RCVs with his insurance agent.

TABLE 3F. REGULAR PROGRAM – POST-FIRM CONSTRUCTION RATES

ANNUAL RATES PER $100 OF COVERAGE

1981 POST-FIRM V1-V30, VE ZONE RATES[1,2]

ELEVATION OF THE LOWEST FLOOR ABOVE OR BELOW BFE ADJUSTED FOR WAVE HEIGHT[3]	ELEVATED BUILDINGS WITH OBSTRUCTION[4]				
	CONTENTS		BUILDING		
	Residential	Non-Residential	Replacement Cost Ratio .75 or More[5]	Replacement Cost Ratio .50 to .74[5]	Replacement Cost Ratio Under .50[5]
+4 or more	.70	.70	1.95	2.59	3.84
+3	.75	.75	2.09	2.75	3.97
+2	1.01	1.01	2.31	[illegible]	4.29
+1	1.27	1.33	2.68	3.47	4.93
0	1.75	1.84	3.26	4.23	5.93
-1[6]	2.39	2.53	4.15	5.37	7.47
-2[6]	3.41	3.65	5.46	7.05	9.64
-3[6]	4.46	4.73	6.18	7.87	10.38
-4 or below[6]	***	***	***	***	***

Example 2: Grandfathering Not Applied, Resulting in Higher Premiums and Higher Agent Commissions and Jeopardizing Real Estate Transactions

A Realtor contacted me for assistance regarding a quote for a federally backed flood insurance premium of $30,233 (annual) for $250,000 building coverage only, with a $5,000 deductible. The structure is post-FIRM located currently in a VE Zone. A subsequent quote (Figure 4) was obtained, lowering both the annual premium ($10,044, as compared to the previous $30,233) and deductible ($3,000 as compared to the previous $5000) for the same level of building coverage ($250,000).

Figure 4: Quote 2

COVERAGE/PREMIUM INFORMATION				
Coverage	**Limits**	**Deductible**	**RPH Basic**	**RPH Additional**
Building	$250,000.00	$3,000.00	4.73	4.15
Discount/Surcharge				$1,233.00
1 Year Premium				$10,044.00

Discoveries:

The structure is a two-story townhome with enclosure built in 1986. The FIRM used as the basis for the quote was dated in 2007 and placed the structure in a VE Flood Zone with a 15-foot BFE. The elevation certificate (Figure 5) clearly indicated in the comments section that the structure was eligible for grandfathering for Flood Zone A10 and a BFE of 12 feet. With a little research, we were able to verify that the structure was built in compliance with a prior FIRM.

Figure 5: Elevation Certificate Comments

The structure was built around 1986 and at that time it was in Flood Zone A10 with a BFE of 12'.

In addition, while the structure was originally constructed in an A flood zone with a BFE of 12, it did not have openings in the enclosed area in accordance with 44CFR§60.3¶(b)5. While this requirement was enacted on October 1, 1987, after the structure had been built, the NFIP Manual requires that these openings be installed in order to qualify for the "built in compliance" grandfathering provision.

Had the insurance agent or underwriter read and understood the documentation that was submitted to them, they clearly would have done things differently, as we advised our client.

We advised the seller to install three Smart Vents (two words), manufactured in South Carolina by an American-owned company, Smart Vents, Inc. Smart Vents are ICC-ES Certified engineered openings that provide 200 square feet of flood protection each. Three Smart Vents were installed at a cost of $1,100. Once the Smart Vents were installed and the grandfathering applied, a new flood policy (Figure 6) was obtained for $449 that provides $250,000 building coverage and $100,000 contents coverage, each with a $2,000 deductible. The sale of the townhome went through, and the new owner is fully insured.

With a few hours of work to install the Smart Vents and applying the NFIP rules, flood insurance was made affordable. All the tools were pre-existing. It did not take an act of Congress or FEMA intervention; all it took to make the difference was someone knowledgeable on the program basics. Had the client been left with the first two flood insurance quotes, the real estate transaction would have failed to go through and the buyer would have walked away.

Figure 6: Grandfathered Quote

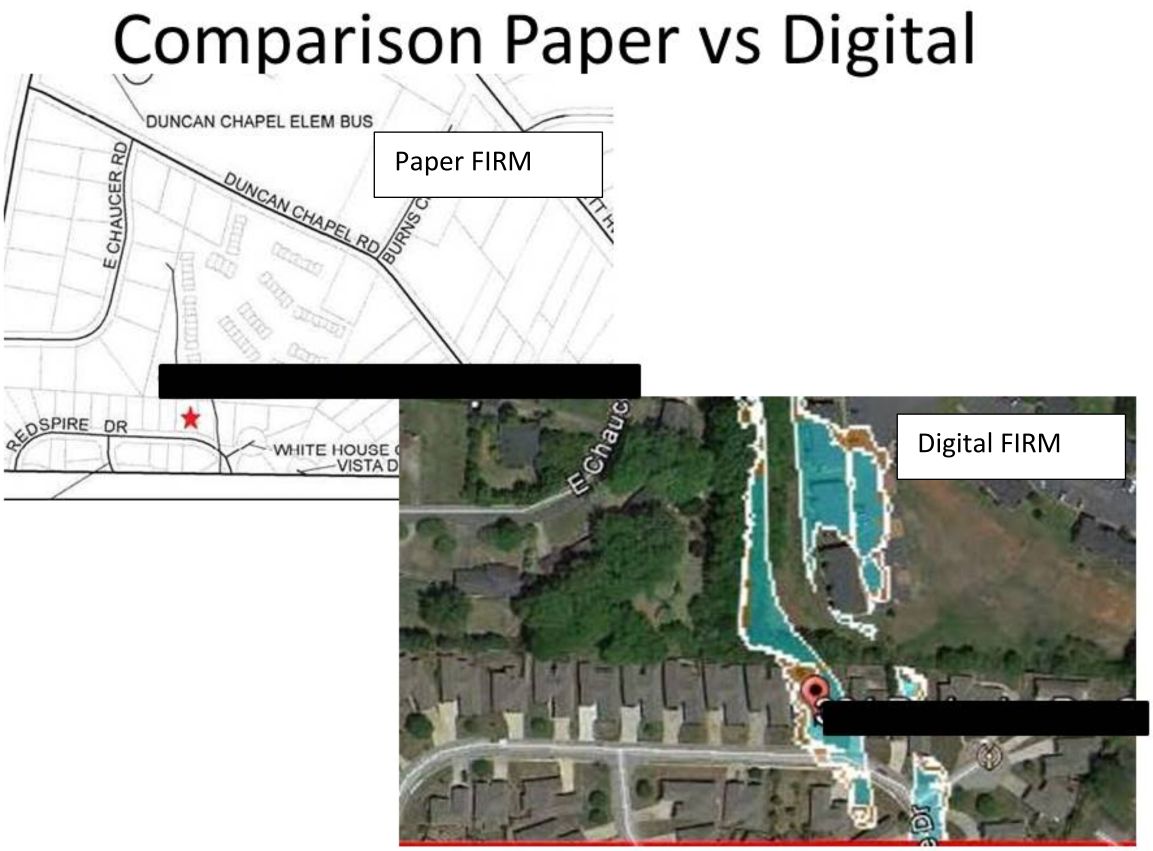
ANNUAL SUBTOTAL:		*$450.00*
INCREASED COST OF COMPLIANCE:		$4.00
COMMUNITY RATING DISCOUNT:	15%	($68.00)
RESERVE FUND ASSESSMENT:	5.0%	$19.00
PROBATION SURCHARGE:		$0.00
ANNUAL PREMIUM:		*$405.00*
FEDERAL POLICY SERVICE FEE:		$44.00
TOTAL:		$449.00

Example 3: Incorrect FEMA Digital Flood Maps Leave Senior Citizen with No Place to Turn

A client contacted me regarding her mortgagee's insistence that she buy a flood insurance policy even though her house was located in Flood Zone X. The client is an unemployed senior citizen, living on a fixed income. The mortgagee had sent her a letter, requiring her to purchase a flood insurance policy under the Mandatory Purchase Act or they would force place the policy for her.

Our investigation revealed that the paper FIRM and the digital FIRM were different (Figure 7). While both are published by FEMA, the paper FIRM is the official map. We immediately contacted the community and FEMA's contractor who produced the map. They agreed that an erroneous version had been uploaded instead of the final version and have reported the error to FEMA. With the widespread use of GIS, we found the erroneous digital layer on Google Earth and on FEMA's website. Furthermore, FEMA had provided the digital layer to the county for their website.

Figure 7: Both FEMA FIRMs



The client purchased a ***preferred risk policy*** at a cost of $334 for $125,000 building and $50,000 contents coverage. On behalf of the client, we appealed the decision of mortgagee, one of the largest in the nation, by providing the official paper FIRM to them on two separate occasions. The mortgagee's response was that they have determined that the flood hazard area is an AE flood zone and that the mandatory purchase requirements apply. Additionally, the mortgagee sent a letter instructing our client to increase coverage by $10,100 within 45 days or they would "force place" the policy for her. The preferred risk building/contents coverages are prescriptive; therefore, the insurance agent and client would have to "over insure" to comply with the mortgagee's request for additional coverage, which means obtaining the next level of combined $150,000 building/$60,000 contents coverage and paying the difference in premium of $22. Let's look at the costs to date for a structure that is not located in a flood zone per the FEMA paper map and errantly placed in a flood zone by FEMA on the digital flood map.

$$flood\ insurance\ Premium\ \ \$344 + additional\ coverage\ \$22 = \$356$$

+ Consulting fees $900 = **$1,266.**

This is a clear example of where Section 18 of the HFIAA (Reimbursement to Homeowners for Successful Map Appeals) should apply. First, this is a FEMA/FEMA Contractor error to the digital flood map layer that was uncovered by and has negatively affected the client with the unnecessary expenditure of funds. Further, based on this error, the mortgagee is holding the property owner at gunpoint with the threat of force placing a flood policy. The cost of a forced placed policy is an exorbitant premium of approximately $6,755 for building-only coverage.

Additionally, we appealed to the map determination company with the argument that the paper map is the "official map." The mapping company argued that their conversations with FEMA indicate that both the paper *and* the digital versions are "official" maps, although the digital map does not go through the same review process as the paper map. One assumes that the maps would match, but in this case, they did not.

In attempting to resolve this issue, we have applied for a ***Letter of Map Amendment*** "as shown," which could take up to 45 days for FEMA to respond.

Example 4: Flood Policy Held Hostage

On October 30, 2013, while the Biggert-Waters Flood Insurance Reform Act of 2012 was in effect, a buyer made a cash purchase of an improved property located in the floodplain. The buyer purchased the property with cash to avoid the lender's mandatory purchase of flood insurance, as the flood insurance premium quote was $37,180. By comparison, for the policy term in effect at the time of the sale, the seller's flood insurance premium was $834 and grandfathered

Additionally, the buyer was informed by the seller's insurance agent that they would only allow the assignment, and not a transfer, of the seller's NFIP policy to the buyer's own insurance agent. Further, this assignment was contingent upon the seller's agent being allowed to write all buyer's insurance needs related to that property address. In essence, the seller's agent was holding the NFIP policy, backed by the federal government, hostage for all the buyer's insurance needs.

At the time, it made no difference whether the buyer bought the policy then or later, so he decided to shop around. In March 2014, Congress passed the Homeowners Flood Insurance Affordability Act (HFIAA). HFIAA repealed Section 205 (g) (2) of the Biggert-Waters Act, which imposed the huge premium increases that negatively affected by real estate transactions. However, buyers who did not purchase a policy at the exorbitant premiums were left out. To this day, this class is still impacted by high premiums or quotes, as Congress did not repeal or offer relief to Section 205 (g) (1), which states *"any property not insured by the flood insurance program as of the date of enactment of the Biggert-Waters Flood Insurance Reform Act of 2012…"*

There was no advertised relief for this affected class, being those who purchased a house after July 6, 2012, but not an NFIP policy, due to affordability. Therefore, people who sought to purchase a flood insurance policy after July 6, 2012 but could not afford the exorbitant annual flood insurance premiums to this day may remain uninsured and may end up qualifying for disaster assistance, of some sort, in the future.

Example 5: Policyholder Punished for Possible 15-Year-Old Record Keeping Error and Grandfathering Unfairly Removed After 15 Years as a Loyal NFIP Customer

The insured purchased the house in 2005 with an existing flood insurance policy in effect that the seller assigned to buyer. The seller had maintained continuous coverage since the NFIP policy originated in 1999. The structure is Pre-FIRM. The assigned policy had been "grandfathered for continuous coverage" since 1999, in an A13 flood zone. In 1995, the FIRM map changes placed the subject property in a VE Zone. The grandfathered policy renewed in September 2013 with a premium of $1,818.

In 2014, the insured added a home equity loan. The WYO company re-underwrote the policy, requesting the insured to provide proof of the existing flood insurance policy prior to 1999, when the insured did not own the structure, in order to prove eligibility for continuous coverage. Again, the insured did not own the structure until 2005. The insured's premium jumped to $4,219 for the 2014-2015 policy term. The monthly escrow payment more than doubled, from $151.50 to $351.58, related solely to the removal of the grandfathering provision.

Since the insured did not own the structure from 1995 to 1998, how could he prove the existence of a flood insurance policy? The NFIP recognized this grandfathered status for nearly 15 years, and the insured feels that it is inherently unfair to have to prove something that was never questioned when the policy was assigned to him.

To offer a corollary of another federal agency, the Internal Revenue Service only audits taxpayers' records for the last five years. The IRS also does not require the burden of proof to meet today's standards for something that was deemed to meet the burden of proof in prior years. Even FEMA changed their refund polices in November 2015 to five years instead of six, citing federal records retention regulations. Yet FEMA's rules require insureds go beyond their policy ownership to justify eligibility for grandfathering. This is inherently unfair to insureds who, in good faith, have paid a premium.

Another example is an insured who purchased a house and was provided a quote of $700 the day before the closing, after initially being told the structure was not in a flood hazard area and that flood insurance was not required. Thirty days after closing, the insured learned that the premium is now roughly $2,200 a year. Had he known this before the closing, he would have never bought the house, as the high premium was a major factor in affordability to him and his young family, and a key factor in his decision-making process. Agents and WYOs are using quotes to hook insureds with low premiums until the policy is completely underwritten and a final premium is disclosed down the road. Since quotes are not binding, by the time the actually premium is disclosed, the insured is stuck and has no recourse to undo the purchase or go against an agent for errors or omissions claims.

As of the date of this report, I am currently working with six clients with similar situations to see if we can restore the prior rating with documentation. In all cases, the lack of documentation to support grandfathering goes back more than six years and all involve assigned policies (policies that transfer ownership from seller to buyer at the time of closing). In one case, clearly the agent made an error years ago, and while he recently discovered the mistake during the claims process, he creatively found a way to conceal the misrating from the insured and the NFIP. The sharp homeowner saw something amiss and asked me to track it down for fear of losing his affordable flood insurance all together. In these situations where the agent cleverly conceals an application error, FEMA should turn it over for investigation of fraud charges against agents, agencies, or WYOs and assist insureds with errors and omissions claims against the parties involved. The names of these individuals and agencies should also be turned over to the State Department of Insurance to investigate possible violation of state laws.

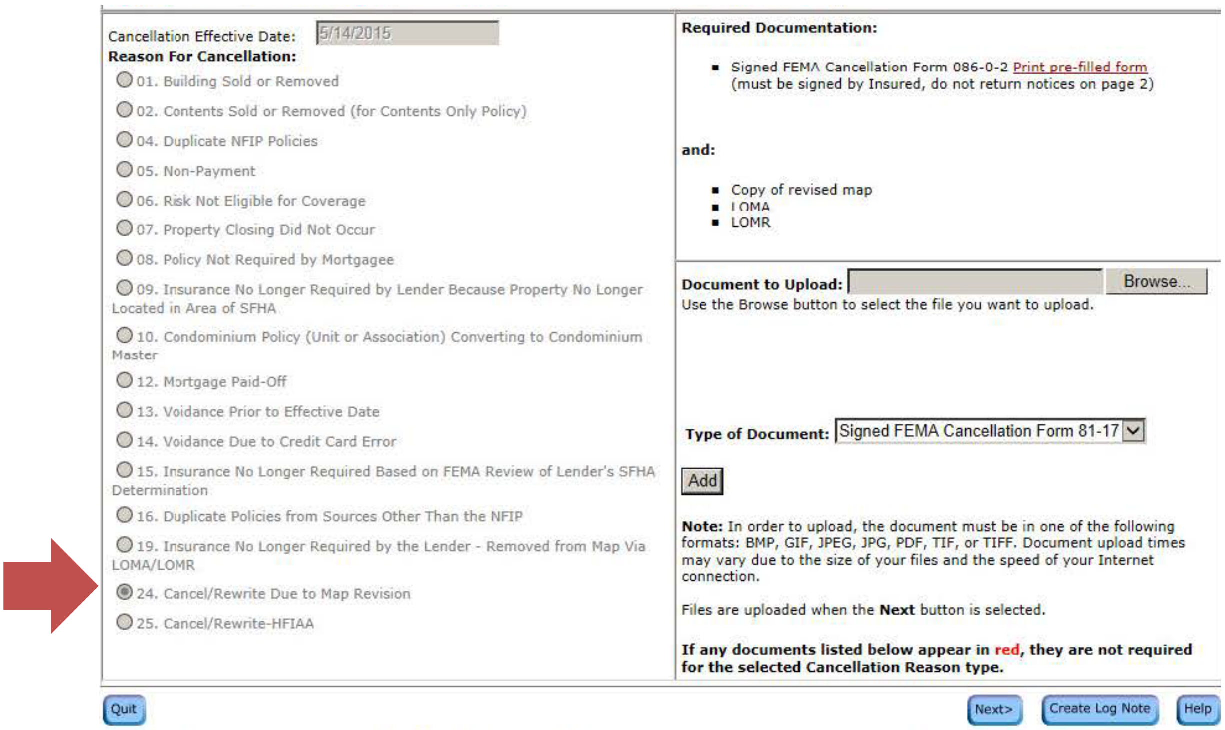
Example 6: Agent Limitations Would Not Allow Conversion of Standard "X" Policy to Preferred Risk Policy, Resulting in the Insured Paying Higher Premiums

The insured purchased a standard flood insurance policy in 1999 for a property that was located in the low-risk X Zone. At that time, the policy was written as a standard policy rated in an X Zone because the insured's property is and always has been in Zone X. The insured has never had a claim. The insured's agent never made the policyholder aware of the Preferred Risk Policy (PRP) program or her potential eligibility.

In 2015, at the insured's request, the insured's agent tried to convert the policy from a standard policy to a low-cost PRP. The agent's system has limited cancellation reason codes, so when calling the company for assistance, the agent was instructed to use cancellation Reason Code 24 (Cancel/Rewrite Due to Map Revision, LOMA, or LOMR), as shown in Figure 8. A Letter of Map Amendment (LOMA), was not issued or submitted as documentation to support Reason Code 24. The insured's property is and always has been in Zone X. Because the agent followed the instructions of the WYO company representative, the WYO's underwriter processed the request for Reason Code 24, converting a standard X Zone policy to a standard X Zone policy, and sent the insured a bill for additional premium—the exact opposite of what the policyholder expected.

Instead, the agent should have been instructed to use cancellation Reason Code 22, which converts the standard policy to PRP and provides for a refund of the current term only. Upon further investigation, and after conversing with the agent, the agent sent me a screenshot from their WYO system (see Figure 8), showing that Reason 22 is not one of the options that agents can select.

Figure 8: Screenshot of Agent's View



I requested the agent upload a paper PRP application, and I sent the documentation for this case to the newly established Flood Advocates Office within FEMA.

In this case, the WYO intentionally limits the options available to agents to service policies. The way their system is set up deters agents from submitting requests to convert eligible policies to lower cost policies (e.g., conversion of standard rate policies to PRP policies). If the agent is in error, the WYO underwriter could deny the conversion.

Additionally, if the property is and always has been in an X Zone and since no claim has ever been filed or paid, why would it not be converted to the cheaper policy and the insured refunded the overpaid premium for the last six years? In this case, a PRP was not an option at the time the policy was written, nor was the cheaper policy ever offered to the insured.

As this report was finalized, FEMA changed its refund procedures and has approved a multi-year refund to this insured.

Example 7: NFIP Changes and New NFIP Products Do Not Automatically Equate to Insured Savings

The NFIP created the Preferred Risk Policy (PRP) Program in 1989. The PRP policy insures structures located in low-risk flood zones (flood zones B, C, X). Example 6 is a clear example. While some insureds may have been sent a letter or seen TV advertisements regarding the availability of the product (policy), they did not understand the product and its benefits. Insureds' policies should have been pre-screened, eligibility determined, and the options presented to the insured to sign an endorsement converting the policy to the cheaper premium by their agents and the WYOs. To this day there are many people with standard flood insurance policies that are eligible for the PRP policy, but they are not aware of this fact. This is costing insureds hundreds and sometimes thousands of dollars in additional premium annually.

Example 8: WYO Use of Default Values Results in Insureds Paying Too Much or Too Little Flood Insurance Premiums

Too Little Premium Being Collected

The insured's policy transferred ownership (from buyer to seller) as a subsidized pre-FIRM policy, with "0000, suffix A" as the flood panel number and Flood Zone A11. Flood Map Panel "0000, suffix A" is a default value and, as such, is not an accurate portrayal of the flood zone determination. Neither the WYO or the insurance agent questioned the accuracy of the map when the policy was assigned or reissued. In this instance, the client is currently rated as plus three feet above the base flood elevation on the assigned current policy (see Figure 9). After I obtained the appropriate map information, I found the local government had found the structure to be substantially damaged by Hurricane Hugo. In addition, there is no evidence to support the plus three feet above BFE rating. The structure is currently in a VE flood zone with a 16 foot BFE. The evidence I found supports post-FIRM rating of an A8 zone with a 14 foot BFE, resulting in a plus one foot rating for flood insurance.

Figure 9: Default flood map panel as shown on Declarations page

Primary Residence: N
Premium Payor: 1st Mortgagee
Flood Risk/Rated Zone: A13 **Current Zone:** VE
Community Number: 0000 A
Community Name:
Grandfathered: Yes
Pre-Firm Construction
Program Type: Regular

Elev Diff: 3
Elevated Building: N
Includes Addition(s) and Extension(s)
Replacement Cost:
Number of Units: 1

Type	Coverage	Rates	Deduct	Discount	Sub Total
Building:	250,000	.250 / .080	1,250	6-	296.00
Contents:	83,300	.380 / .120	1,250	3-	162.00
Contents Location:	Lowest Floor Above Ground Level and Higher Floors				

Premium Calculation	
Premium Subtotal:	458.00
ICC Premium:	4.00
CRS Discount:	92.00
Reserve Fund Assmt:	19.00
HFIAA Surcharge:	.00
Federal Policy Fee:	44.00
Probation Surcharge:	.00
Endorsement Amount:	.00
Total Premium Paid:	433.00

Coverage Limitations May Apply. See Your Policy Form for Details.

Too Much Premium Being Collected

The insured began questioning why her flood insurance premium was significantly more than her neighbor's premium. After reading an article on BankRate.com in which I was quoted, she contacted me for a review. After seeing the default flood panel indicator applied, I researched the flood maps and verified the flood zone. I was easily able to locate the correct flood map panel from FEMA's website (historic map panels). I noticed that the policy indicated the insured's property was located in V03 flood zone (see Figure 10), while the map showed the structure to be located in an A0 flood zone. The insured obtained an updated elevation certificate which indicated she was above the threshold and therefore could be rated in an AO Zone with an elevation certificate. The insured has had this policy for many years and is now entitled to a multi-year refund, which is estimated to be in excess of $17,000. Once the corrections were applied in September 2015, the insured's new premium was $490.

Figure 10: Default flood map panel as shown on Declarations page

Primary Residence: N
Premium Payor: Insured
Flood Risk/Rated Zone: V03 **Current Zone:**
Community Number: 0000 A
Community Name:
Grandfathered: No
Pre-Firm Construction
Program Type: Regular

Elev Diff: N/A
Elevated Building: N
Includes Addition(s) and Extension(s)
Replacement Cost: $106,700
Number of Units: 1

Type	Coverage	Rates	Deduct	Discount	Sub Total
Building:	250,000	1.480 / 2.540	2,000		5,714.00
Contents:	17,100	1.840 / 4.340	2,000		315.00
Contents Location:	Lowest Floor Above Ground Level and Higher Floors				

Coverage Limitations May Apply. See Your Policy Form for Details.

Premium Calculation	
Premium Subtotal:	6,029.00
ICC Premium:	55.00
CRS Discount:	.00
Reserve Fund Assmt:	304.00
Federal Policy Fee:	44.00
Probation Surcharge:	.00
Endorsement Amount:	.00
Total Premium Paid:	6,432.00

We submitted all the documentation to support the correction of the misrated policy in June 2015. The insured received two refund checks: one in September and another in October. Per the NFIP Manual, the WYO only has the authority to issue a refund check for the immediate two policy terms (current term and one prior term). Now the wait begins for the multi-year refund check to be issued, as the Bureau and Statistical Agent must approve the remaining four years. For reasons unknown to me, this leg of the process takes years for refunds to be issued to insureds, regardless of the amount of the refund. I know that FEMA is aware of the issue, examining the refund procedures and trying to improve the process.

Example 9: Rather than Identifying a Misrating, Agent Recommends Private Market Policy

October 2015 presented Columbia, South Carolina with torrential rains and multiple dam failures. While working with clients to determine their mitigation options, I had to calculate the return on their investment to elevate the house thus mitigating future flood losses. The insured has full coverage, ($250,000 building, $100,000 contents) with a $5,000 deductible, paying a $6,450 premium. Just prior to the flood, the insured increased the deductible to $10,000 which lowered the premium to $3,638. When the insured sent the elevation certificate to the agent and asked the agent what the premium would be if he elevated his flood damaged home 2 feet and 4 feet above the BFE, the agent responded.

> ***"Per our discussion regarding flood insurance pricing if you were to make your house flood compliant, I found out the following: You would have to completely fill in your basement with concrete or dirt and elevate your house by 4 feet in the front and 6 feet in the back. This is probably not a realistic solution.***

However, there are some new flood insurance markets competing with the National Flood Insurance Program (NFIP) that we could quote for you at your next renewal. If you have had no more than one flood loss in the past five years then we have a market in the range of $2,425 for $250,000 Building coverage, $100,000 Contents coverage and a $5,000 deductible on each.

Please confirm the number of flood losses you have had in the past five years and we will pend our file 60 days prior to your next renewal to quote some other markets, if possible."

Based on the agent's response in comparing the structure and ground elevations, it clear to me that the agent or the agent's advisor saw the elevation certificate. For this example, we will compare the full coverage using the original $5,000 deductible. Had the agent used the elevation certificate to calculate the full-risk rate premium, she would have informed the insured that using the elevation certificate would result in a premium of $3,589—a $2861 annual savings over the pre-FIRM subsidized rate he is currently paying. A subsequent quote from another WYO yielded that the insured would be paying $571 for 2 feet above and $490 for 4 feet above annually.

The biggest surprise to me is that had the agent even looked at the elevation certificate, she should have realized that the policy was misrated. The structure has a subgrade crawlspace (0.9 feet below the outside grade of the structure), not a basement. As a result of the misrating, the agent has been over-charging the insured premium for years. Additionally, because she did not discover the error prior to November 1, 2015, the insured is only entitled to a five-year refund, not six as had been the policy up until that time. Effective November 1, 2015, FEMA changed their refund procedures.

I immediately notified FEMA on October 31, 2015 of the error, hoping that the insured would be able to obtain the six-year refund as the agent did not discover the error in her response to the insured on October 30, 2015. I had hoped that the error would be discovered by the flood claim adjuster, who is supposed to confirm that the building description matches the actual construction. If it doesn't, the adjuster is to refer the building description to underwriting for correction. This check-and-balance test that FEMA put in place failed miserably, as the flood adjuster did not note any discrepancy.

Once the agent submitted the request for a multi-year refund, it was quickly denied by the WYO lead underwriter based on a misinterpretation of the NFIP Manual. The underwriter was only going to approve a one-year refund based on his interpretation of the refund procedures. I had to get FEMA underwriters involved to get the WYO to approve the multi-year refund. Even after the underwriter received an email from FEMA directing the multi-year refund, the WYO lead underwriter requested the eligibility and FEMA's interpretation. FEMA has directed the WYO to honor the six-year refund. This leaves me to question as to why the underwriter did not know or comprehend the correct refund policies and how many prior requests for refunds were denied based on this misinterpretation. I doubt the WYO company will do an internal audit to determine how many refund requests were wrongly denied and seek to refund the insureds the money they are entitles to.

Had the insured blindly followed the agent into the purchase of a private market policy and the private market company later decided not to allow him to renew, he would not be eligible to come back to the NFIP with a subsidized or grandfathered rate. Agents are not required to disclose the consequences of dropping an NFIP policy (loss of grandfathering or subsidized rate) to an NFIP insured.

A major defect in the NFIP reform and the surge of interest in the private market flood insurance policies is that the rules governing the program do not require FEMA to recognize private market as continuous coverage and protect insureds by disclosure of any differences (or consequences) between the NFIP and the private market policies. These loopholes may be a big black hole for some insureds in the future who get caught between the need for flood insurance and affordability.

Mortgage Companies

Mortgage companies are trying to do a better job in compiling with the mandatory purchase requirements. I am beginning to hear of some cases from insurance agents in which the mortgage companies are requiring policies that are legitimately eligible for grandfathering by rating with the current zone rather than the zone that provides the more favorable insurance premium for the insured. Apparently they are entitled to do so under the rules and regulation of the NFIP.

Example 10: Mortgage Company Requires More than the Value of the House

In the event of a claim on the flood insurance policy, the most that an insured can receive is the replacement of value or the face value of the policy, whichever is less. Some mortgage companies, including the U.S. Department of Veterans Affairs (VA), require an appraisal prior to sale, but they do not necessarily require the appraiser to establish separate values attributed to the land and structure. Keep in mind that the NFIP does not insure land, only structures. However, when you purchase an improved property, there is the value of the land and the value of the improvement (structure).

In this case, the buyer purchased waterfront property on the intercostal waterway for $285,000 and subsequently was required to purchase flood insurance for the maximum amount of $250,000 building coverage. The county property assessor's office assessed a tax value of the land at $100,000. A review of the appraisal completed for the VA loan revealed that the appraiser attributed 100 percent of the sale price to the structure and zero percent of the sale price to land value. The insured was required to carry the full $250,000 of building coverage, with no recourse to appeal to the mortgagee. These erroneous assumptions result in policyholders being over insured, paying a higher premium, and paying higher escrow payments—all a result of the mortgagee's standard of practice which holds that land has no value.

Review Findings & Programmatic Issues

As a result of my investigation and client experiences, there are areas in which some of the current NFIP policies could be revisited and hopefully improved, as discussed below.

Refund Process

FEMA's and the WYO companies' process for refunding insured parties for agent and WYO mistakes is "broken." In a case mentioned in my last report, the agent initiated a multi-year refund request in June 2013. The insured has received the refund for the current policy term and prior term for $6,010. The four additional years of refunds—totaling less than $400—were not approved until December 2015. Numerous inquiries were made to the WYO. It was only after querying FEMA's Office of the Flood Insurance Advocate and constant follow-up inquiries that the insured received the refund of $352 in December 2015.

Perhaps FEMA should consult the Internal Revenue Services (IRS) on their refund process. If you receive a refund you are not entitled to, then the IRS will recoup those funds. Two or more years is simply an unacceptable amount of time for FEMA or any agency to withhold refunds due to insureds who have been over charged, in some cases, far beyond the allowable recoupment period. I have two pending refunds in excess of $10,000: one initiated in July 2015, the other in January 2016. In both cases, the most recent two terms were processed by the WYOs immediately; however, the breakdown seems to occur when the refund requests for the remaining three to four years are sent to the Bureau and Statistical Agent (FEMA) for approval and processing.

Policy Accuracy and Completeness

One inherent observation is that many policies that were grandfathered use a default panel number "0000." For example, there are a lot of panel 0000 policies out there, and many people who have standard X Zone policies who have not been qualified for PRPs. The perception is that FEMA is quick to apply ratings that increase premiums, but slow to apply ratings that lower premiums. This is only one of many identified issues that lead to policy errors and misrating.

Agent Limitations

In my opinion, there is a ***serious programmatic issue*** if agents are not allowed to choose the appropriate cancellation/rewrite code in accordance with the NFIP Manual, which favors the agent and the WYO rather than the insured. FEMA should ensure that WYOs properly and expediently institute changes that are within program guidelines and are in the best interest of the insured when it comes to policy conversions.

Accountability

FEMA should start holding WYOs more accountable for training their agents and disseminating new product and procedural information to them, as required under their contracts. Furthermore, WYO audit performance should be public information. This will drive competition, as well as accuracy and accountability among WYOs. Congress should direct FEMA to make WYO audit findings public information. The major difference between annual tax returns and insurance policy renewals is the insured relies on a trained professional to fill out the tax return or application correctly and assumes that the professional completing the work know the rules of the program, similar to tax preparers. Tax preparers are not required to be licensed by the state; however, they have some liability if they are wrong or do the wrong thing. On the flip side, the only accountability by the NFIP for insurance agents who do the wrong thing is "sometimes" an adjustment to their agent commission.

NFIP Direct vs. Private Market Policies

In the growing interest for private market policies, we should keep in mind that the private market policy is not going to be a fit for everyone. There is room and a purpose for both public and private sector policies.

Recommendations:

Some of the following recommendations could be implemented by FEMA and NFIP participants without congressional authorization.

Require Agent & WYO Policy Maintenance

- ***Obtain and validate the Replacement Cost Value of insured structures.*** The NFIP should require agents to update the RCV for all policies, except PRP, once every three years at renewal. WYO underwriters should question RCVs that are out of line. There are various sources to obtain estimated RCVs. This could be accomplished simply with submitting a copy of hazards policy (homeowners) declarations page, which indicates the RCV.
- ***Provide or update invalid or default data.*** Agents should be required to verify or ascertain grandfathering eligibility for all post-FIRM and pre-FIRM qualified structures. Where the panel number on the declarations page is “0000,” the WYO should be required to ascertain the correct panel number.
- ***Photos:*** Insureds should provide updated photos every three to five years so that their agent can validate the insurance building description and other factors, assuring that premiums are still valid.
- ***Institute training for agents and adjusters on their roles in the validation process.***

Re-examine the NFIP Refund Process

The process needs to be not only examined to see what sweeping changes need to be implemented, but retooled to expedite insureds’ refunds of overpaid premiums, even if the WYO refunds the money while FEMA completes their review.

Change the FEMA/NFIP Application

We recommend that the application be changed to ensure more accurate rating. Rather than requesting the square footage, a more accurate method would be to ask for the dimensions of the enclosure. An adjuster or agent could easily verify the enclosure size. Most people guess the square footage when asked.

Allow Reimbursement of Property Owner's Expenses for FEMA Mapping Errors

When mapping errors occur that are not appealable due to FEMA's inadequate quality control procedures, FEMA should reimburse affected property owners for expenses related to those errors. If FEMA or its contractors lack the quality control procedures necessary to ensure that the paper and digital maps match, then affected citizens should be allowed to be reimbursed under the HFIAA Section 18.

Make FEMA Internal Training Mandatory

All employees providing flood insurance advice or information should be required to attend annual formal training on flood insurance in an attempt to make sure that responses and knowledge are up-to-date to prevent misinformation from being provided to insureds and the general public. Of the many FEMA regional and core insurance employees who are providing insurance advice to insureds, I can think of only one who is actually trained as an insurance professional.

Institute Customer Service and Outreach to Insureds

FEMA should institute procedures to train staff on customer service techniques and set staff expectations of customer service goals. The Office of the Flood Insurance Advocate within FEMA should also institute a tracking system to log and follow-up with insureds who call asking for assistance. Currently, there is no tracking system to ensure customers were help or became frustrated and gave up. Additionally, FEMA should extend the deadline from April 1, 2016 for those who fell thru the cracks between the Biggert-Waters Reform Act of 2012 and today and utilize their TV marketing and advertising dollars to invite potential insureds back to the NFIP or at a minimum make them aware of their options.

Offer Insureds the Benefit of Rating Class Changes

As NFIP policies and procedures change, FEMA should require WYOs and agents to identify insureds who will benefit from rating class changes and offer the benefits of these changes to them.

- ***FEMA should require WYOs to offer PRP policies, at renewal, to all eligible standard rated policies that have not had a claim and disclose any lower premium they may be eligible for.*** At a minimum, WYOs should make the offer to the insureds and instruct them on what steps they could take to obtain the lower premium. If WPOs do not make this offer, then the insureds should be eligible for a multi-year refund.
- ***FEMA should require WYOs to offer the newly mapped procedure to all current or newly insured policyholders who qualify.*** If they don't, then the insured should be eligible for a multi-year refund.
- ***FEMA should use their marketing funds to bridge the gap of those people who were given quotes between the two reform acts but did not purchase a policy***. Beginning April 2016, FEMA implements penalties for those who did not purchase a policy. FEMA has done nothing to get the word out of the impending doom homeowners face if they do not have a NFIP policy in place.

- ***Recognize excess lines coverage***. In the calculation of the insurance-to-value ratio for post-FIRM V-Zone rated structures, FEMA should allow credit for excess lines coverage available through the private market.

Allow for the Portability of Private and NFIP Flood Policy Coverage

Like health insurance, flood insurance coverage should be portable as long as you can prove continuous coverage. Insureds should be allowed to move from the NFIP to the private market, and to return to the NFIP as needed without losing their grandfathering status or subsidies, which in essence penalizes them for being good consumers.

Update the *Mandatory Purchase of Flood Insurance Guidelines*

FEMA and the U.S. Department of the Treasury should jointly update the *Mandatory Purchase of Flood Insurance Guidelines* that FEMA rescinded. This publication clearly explained what the requirements are for mortgagees, mortgagors, and the lay person seeking clarity or information.

Give Notice to Lenders about Mandatory Participation in the Letter of Determination Review Process

FEMA has underutilized process by which mortgagors (borrowers) can appeal the interpretation of the mandatory purchase of flood insurance determination of their mortgagee for a small fee of $80. Currently, the lender must agree to participate and the request for a ***Letter of Determination Review*** (LODR) must be submitted within 45 days of the notice from the lender that flood insurance is required. If the LODR is granted in favor of the borrower, then the lender is relieved of their obligation to comply with the mandatory purchase requirements. The lender could still require a less expensive flood insurance, a preferred risk policy, if they so choose.

This process is much faster and cheaper when there is some confusion of when the mandatory purchase requirements apply. This should not be confused with the Letter of Map Amendment (LOMA) process, which removes structures from the flood hazard area based on the submission of additional data. It is my opinion that the insured should be informed of their right to appeal the lender's decision through the LODR process. I am aware of several instances where insureds would have saved a great deal of time and money had they been aware of and been allowed to request a review through that process.

Conclusion

The errors or omissions of flood insurance policies identified in this report offer a road map for reforms. Long-term solutions for the sustainably of the National Flood Insurance Program are not found in fixing or tweaking subsidies. Rather, solutions lie in identifying and implementing mitigation measures for individual structures (risk reduction), thus resulting in lower premiums for insureds and providing stability in the real estate and mortgage markets.

The solvency of the NFIP is dependent on the system working in tandem with interpreting the rating rules the same way. The current system involves insurance agents, insurance companies, WYOs and FEMA—all of whom must interpret the NFIP Manual. The difficulty is that they are not all interpreting it the same way. Each company has its own software, own underwriters, and own internal training. We know that WYO companies support their agents, but how much training do the WYOs provide their agents on the NFIP?

The current system, as it is set up now, is not inherently fair to insureds. In the case of rating errors, the system does not explain to the insured why rates are suddenly raised after years of lower premiums, nor does it explain how they could or what information could be offered to appeal a decision. The same fervor is not applied when policy changes (such as map changes and BFE information) benefit an insured in the form of lower premiums.

It is clearly understood that the refund process needs a major evaluation and overall. FEMA needs to delegate more authority and accountability to the WYO's and/or determine where the in-house, procedural breakdown is occurring in order to make some major changes. These procedural changes related to refunds apply to both whether the refund applies to the current policy term or multi-year and the length of time it takes for a multi-year refund to be processed.

Major inconsistencies exist in the system across the board. The involved parties must take the time to develop a plan to correct those years of the inconsistencies that is fair to the insured and provides implementation of accurate rating. This is in the long-term best interest of the program and it solvency.

We need a holistic approach and recommendations from all sectors. This could be accomplished through the formation of a bi-partisan commission on NFIP reform with all sectors represented.

Glossary

Base Flood Elevation (BFE)	The elevation of the projected height of the flood having a one percent chance of being equalled or exceeded in any given year.
Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12)	A major reform Act of the NFIP passed by Congress and effective on July 6, 2012.
Federal Emergency Management Agency (FEMA)	The agency within the Department of Homeland Security that oversees the implementation of the NFIP.
Flood Insurance Rate Map (FIRM) [i]	An official map of a community, on which the Federal Insurance Administrator has delineated both the special hazard areas and the risk premium zones applicable to the community. A FIRM that has been made available digitally is called a Digital Flood Insurance Rate Map (DFIRM).
Homeowners Flood Insurance Affordability Act of 2014 (HFIAA)	A major reform Act of the NFIP passed by Congress and effective March 21, 2014, which rolled back some of the costly provisions if the Biggert-Waters Flood Insurance Reform Act of 2012.
Letter of Determination Review (LODR)	A process in which borrowers can appeal their mortgage companies interpretation of policies that determine if mandatory purchase of flood insurance is required.
Letter of Map Amendment (LOMA)	A process which removes structures from the flood hazard area based on submission of additional data.
National Flood Insurance Program (NFIP)	The flood insurance program created by Congress in 1968, and backed by the federal government, to make the sale of flood insurance more readily affordable and available for purchase.
Preferred Risk Policy (PRP)[ii]	A lower-cost Standard Flood Insurance Policy (SFIP), written under the Dwelling Form or General Property Form. It offers fixed combinations of building/contents coverage limits or contents-only coverage. The PRP is available for property located in B, C, and X Zones in Regular Program communities that meets eligibility requirements based on the property's flood loss history. It is also available for buildings that are eligible under the PRP Eligibility Extension.
Replacement Cost & Replacement Cost Value (RCV)	The amount of money required to replace or repair the insured building in the event of loss or damage, without a deduction for depreciation.
V-Zone Rating	Rating which applies in V-Zones as mapped by FEMA as shown on the FIRM. This is an area of special flood hazard extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources.

[i] 44 CFR Part 59 https://www.gpo.gov/fdsys/pkg/CFR-2010-title44-vol1/pdf/CFR-2010-title44-vol1-sec59-1.pdf
[ii] NFIP Agents Manual, FEMA, April 2015

FEMA

DECEMBER **2015**

The Annual Report of the Flood Insurance Advocate

OFFICE OF THE FLOOD INSURANCE ADVOCATE

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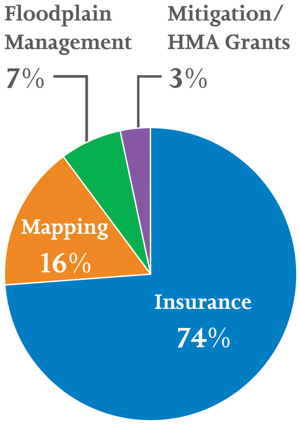
On December 22, 2014, the Federal Emergency Management Agency (FEMA) designated the Flood Insurance Advocate.

Message from the Advocate

On December 22, 2014, the Federal Emergency Management Agency (FEMA) established the Office of the Flood Insurance Advocate (OFIA) on an interim basis and I was selected as the Acting Flood Insurance Advocate. In June 2015, the OFIA was permanently established and I was formally designated as the Flood Insurance Advocate by FEMA's Administrator. Since then, my priority has been to staff the office with experts in National Flood Insurance Program (NFIP) flood insurance, flood hazard mapping, floodplain management and Hazard Mitigation Assistance (HMA) grants; the OFIA's four primary focus areas. At the release of this report, our staff has grown to five (5) with a goal of nine (9) staff total.

In our first year, my staff and I carried out our mission to advocate for the fair treatment of policyholders and property owners by providing education and guidance on all aspects of the NFIP, identifying trends affecting the public and making recommendations for program improvements to FEMA leadership.

CY2015 INQUIRY CATEGORIES



THE OFIA's FIRST YEAR

During our first calendar year (CY) of operations, the OFIA received a few hundred of email inquiries at insurance-advocate@fema.dhs.gov, spanning the four focus areas of the office — flood insurance (74%), flood hazard mapping (16%), floodplain management (7%) and HMA grants (3%). In general, the inquiries received were from our customers (policyholders and property owners). We also received referrals from Congressional representatives, as well as FEMA and Federal Insurance and Mitigation Administration (FIMA) leadership.

Throughout the year, we took steps to foster long-term programmatic improvements through collaboration across FIMA in meetings, work groups, and task forces; worked closely with the NFIP program offices to identify opportunities to improve outreach to and communication with our customers; provided feedback and input on proposed improvements to communications; and engaged stakeholders and staff in data gathering discussions. In particular, we began broader conversations within FIMA on the need for messaging and policy consistency and we are working to ensure our customers' needs and concerns are taken into account as the NFIP evolves.

In this report, we highlight five challenges and provide recommendations for each. As we move forward, the OFIA will continue to work collaboratively with FIMA's program offices to identify issues and work together to develop tools, resources and solutions that will support the fair treatment of all policyholders and property owners.

I would like to thank my team for their hard work and dedication to our mission, FIMA leadership for their support and desire to see this office succeed, and to the dedicated staff in the program offices and regions who show us daily their desire to treat NFIP customers fairly. I submit this report on behalf of the Office of the Flood Insurance Advocate.

Sincerely,

David Stearrett
Flood Insurance Advocate

This report addresses five key issues in the OFIA's four primary areas of focus in the National Flood Insurance Program (NFIP) — flood insurance, flood hazard mapping, Hazard Mitigation Assistance (HMA) grants, and floodplain management.

Executive Summary

During its first year of operations, the Office of the Flood Insurance Advocate (OFIA) received a few hundred inquiries while working to establish the necessary approaches, processes and procedures for full office operations to meet the mandate required in section 24 of the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA). While some inquiries were straightforward, many were complex and required significant attention.

This report addresses five key issues in the OFIA's four primary areas of focus in the National Flood Insurance Program (NFIP) — flood insurance, flood hazard mapping, Hazard Mitigation Assistance (HMA) grants, and floodplain management — that emerged over the course of the year. These issues are:

- The lack of actionable and timely data available to FIMA and the OFIA.
- Barriers in receiving Increased Cost of Compliance (ICC) payment.
- Application of the HFIAA surcharge, specifically default assumptions and limitations.
- Limitations on the issuance of prior-term refunds.
- Lack of understanding of, and the availability of, floodproofing certification/credit information.

The OFIA selected these issues for this report due to the challenges each present to the broader population of NFIP customers. The recommendations enclosed in this report are based on the OFIA's understanding of the issues, the ongoing challenges policyholders and property owners have with regard to these issues, and the OFIA's understanding of how to advocate for their fair treatment.

As these challenges emerged, the OFIA worked with the NFIP program areas, and subject matter experts, to discuss, understand and identify opportunities that exist to address these issues. Each challenge is presented in three parts: the key issue affecting our customers, the background of the issue, and the OFIA's recommendations for program office consideration. Additionally, program offices were provided opportunity to respond to the OFIA's findings and recommendations. Program responses are inserted as received.

The Office of the Flood Insurance Advocate (OFIA) operated on an interim basis, and in June 2015, the OFIA was permanently established.

Background

HFIAA, Section 24 (42 U.S.C. 4033), signed into law in March 2014, directed the Federal Emergency Management Administration (FEMA) Administrator to designate a Flood Insurance Advocate to advocate for the fair treatment of policyholders and property owners under the NFIP. (Pub. Law No. 113-80, Sec. 24 (Mar. 21, 2014).) On December 22, 2014, FEMA established the OFIA on an interim basis, and in June 2015, the Administrator designated a Flood Insurance Advocate and the OFIA was permanently established.

Consistent with Section 24 of HFIAA, the duties and responsibilities of the OFIA are as follows:

- **Obtain fair treatment** for NFIP policyholders and property owners when FEMA maps Special Flood Hazard Areas (SFHAs) and designates flood risk zones.
- **Educate** property owners and policyholders under the NFIP on individual flood risks, flood mitigation, measures to reduce flood insurance rates through effective mitigation, the Flood Insurance Rate Map (FIRM) review and amendment process and any changes in the flood insurance program as a result of any newly enacted laws.
- **Assist** policyholders under the NFIP and property owners to understand the procedural requirements related to appealing preliminary FIRMs and implementing measures to mitigate evolving flood risks.
- **Assist** in the development of regional capacity to respond to individual constituent concerns about flood insurance rate map amendments and revisions.
- **Coordinate** outreach and education with local officials and community leaders in areas impacted by proposed FIRM amendments and revisions.
- **Aid** potential policy holders under the NFIP in obtaining and verifying accurate and reliable flood insurance rate information when purchasing or renewing a flood insurance policy.

In focusing on these duties and responsibilities, the OFIA seeks to take into account the advocacy-related activities already taking place across the organization, while acknowledging the limitations inherent to any organization during the early days of operations.

THE OFIA's ROLE

The OFIA reports to the FEMA Administrator and the Associate Administrator for FIMA. This structure allows the OFIA to maintain its autonomy within FEMA, enables it to raise issues and concerns to the highest levels of FEMA and work directly with FIMA program offices on behalf of policyholders and property owners to address the most challenging and complex issues.

The OFIA's role is not to implement the NFIP, nor do the job of the program offices. The OFIA gets directly involved when a policyholder believes the outcome is unfair. The OFIA's long-term objective is to be fully engaged in only the most unique cases that are not readily solved by current policies and regulations.

Operating with a small staff, the OFIA's first year focused on establishing its position within FEMA. This included identifying the skillsets needed for the Advocate team, setting operational objectives, establishing policies and procedures that govern the OFIA's activities, and developing pathways to manage inquiries received by the office. The majority of the OFIA's staff comes from FIMA programs and have subject matter expertise in flood insurance, floodplain management, flood hazard mapping and HMA grants. Staff experience spans decades of service and each staff member possesses a keen understanding of policyholders' and property owners' needs and challenges.

The OFIA finds the lack of timely (e.g., up-to-date or real-time) data to be an impediment to providing quality responses to policyholders in a timely manner.

Trends, Issues, and Recommendations

Consistent with HFIAA, Section 24, which instructs the OFIA to advocate for the fair treatment of policyholders and property owners, the OFIA considered the range of inquiries received during the calendar year and identified five issues in its four primary categories that appear to affect significant segments of NFIP customers. The recommendations presented here are the result of the OFIA's expertise and discussions with program offices.

LACK OF ACTIONABLE DATA

The OFIA finds the lack of timely (e.g., up-to-date or real-time) data to be an impediment to providing quality responses to policyholders in a timely manner. Inquiries related to the eligibility of a property for a Preferred Risk Policy (PRP), or related to the status of a building as a Repetitive Loss (RL) or Severe Repetitive Loss (SRL) property, may be inadvertently responded to incorrectly as a result of unavailable claim and/or policy information. Additionally, the current legacy data system does not provide information regarding the status of newly purchased or renewed policies in the past 60 days, nor is the premium data provided sufficient to determine the total premium and applicable fees and surcharges being placed on the policy. As a result, FIMA must take the additional time necessary to contact and await responses from the Write Your Own (WYO) insurance companies and FEMA's NFIP Direct Servicing Agent (DSA) which delays customer response time.

BACKGROUND

NFIP collects necessary policy data through a Transaction Record Reporting and Processing (TRRP) plan. NFIP insurers submit all monthly financial reporting and statistical transaction reporting in accordance with the TRRP and the financial control plan. Transactions reported under the TRRP are analyzed by the NFIP Bureau and Statistical Agent. The TRRP plan, the age of the TRRP and the platform of the existing legacy system used to administer the TRRP function have a number of limitations including providing data that is 30 days old when released to the NFIP system of record. As a result, by the time the data is refreshed on a monthly basis, it is typically 60 days old.

RECOMMENDATION(S)

The OFIA recommends that FIMA identify an interim solution to collect, analyze and disseminate data in order to enhance current business processes and decision-making. While the NFIP information technology (IT) modernization effort underway will provide online access to timely data, it is not expected to be in place for at least five years.

PROGRAM RESPONSE

There is no doubt that the NFIP legacy system and the TRRP are antiquated and do not meet the needs of an organization committed to making data-driven decisions and enhancing the customer experience. FIMA has recognized actionable, timely data as a critical component to ensuring the needs of the customer are met and has developed a new insurance analytics and policy branch to tackle the issue. The Insurance Analytics and Policy Branch is already working with its private sector partners to develop mechanisms and processes to obtain policyholder information closer to real time. The branch does not need to wait until the legacy system modernization effort is complete to begin analyzing information from the NFIP's WYO insurance companies and DSA. FIMA will work with the OFIA in developing these mechanisms and processes in the future to ensure that real-time policyholder data needs are met, as much as possible.

INCREASED COST OF COMPLIANCE (ICC)

Based on inquiries received, the OFIA finds there is confusion among community officials and State and FEMA floodplain management staff regarding what is required to successfully trigger an ICC claim. FEMA's Floodplain Management Division and Building Science Branch guidance documents are incomplete and do not accurately capture all of the necessary ICC information that should be contained in the substantial damage letter provided by the community official. Currently, many community substantial damage letters do not contain an accurate market value and cost estimate for repairs or are not clear that the substantial damage determination is based on flood. As a result, ICC claims are being denied by insurers and slowing down the mitigation efforts of policyholders.

BACKGROUND

ICC coverage was created by Congress in 1998. The purpose of ICC is to provide eligible policyholders, whose structures are substantially damaged or repetitively damaged by flooding, up to $30,000 in order to meet the requirement of bringing their structures into compliance with local floodplain management ordinance. The coverage availability and payment limits are subject to the terms of the Standard Flood Insurance Policy and maximum coverage limits, including all applicable NFIP rules and regulations. Eligible mitigation measures include floodproofing (for non-residential structures only), relocation, elevation and demolition. When properly utilized, ICC is a relatively fast and effective tool to mitigate substantially damaged structures. While $30,000 may not be enough to offset the costs to completely fund a mitigation project, it provides a substantial financial resource towards the associated expenses.

RECOMMENDATION(S)

The OFIA recommends that the Building Science Branch update FEMA P-758, *Substantial Improvement/Damage Desk Reference 2010*, used by community officials, with specific guidance and examples on what must be included in the community's substantial damage letter. It is further recommended that the Floodplain Management Division update FEMA 301, *NFIP Increased Cost of Compliance Coverage — Guidance for State and Local Officials, 2003*. Finally, the OFIA recommends that the Federal Insurance Directorate and the Mitigation Directorate work together to develop additional materials to educate customers and stakeholders about the ICC process, including how ICC can be combined with HMA grants as a cost match.

PROGRAM RESPONSE

The Floodplain Management Division has begun an effort to update and develop outreach materials that will clarify the ICC process. This effort will update brochures and course materials currently designed to educate policyholders, local officials and insurance adjusters on the ICC requirements. The current ICC brochures and fact sheets are the homeowner's initial notification that ICC may be available to help with mitigation activities. After updating, the documents will help homeowners understand how "substantial damage" is determined and how that determination establishes eligibility for ICC. The outreach materials will also identify key steps in the ICC procedure so that a policyholder can understand where a claim may be in the process. The Floodplain Management Division has also begun an update of FEMA 301, *The NFIP Increase Cost of Compliance Coverage — Guidance for State and Local Officials, 2003*. Since the initial publishing of this document, there have been changes in the ICC regulations and process, which warrants a re-write of the publication and the integration of the current guidance. In addition, an update of the FEMA 480, *National Flood Insurance Program Floodplain Management Requirements, A Study Guide and Desk Reference for Local*

Officials, 2005, will reiterate the local responsibility in determining whether structures are substantially damaged based on the local ordinance, and the impact this determination will have on policyholders receiving ICC. Furthermore, the Division is updating materials used for adjuster workshops to better educate this audience on their role in the ICC process. The Floodplain Management Division is coordinating this effort with the Federal Insurance Directorate and the Building Science Branch and is expecting a release of the outreach brochures by June 2016. The manuals and course materials will be completed by beginning of fiscal year (FY) 2017.

The Building Science Branch has noted the recommendation to update FEMA P-758 with a discussion on the specific documentation required in the community's substantial damage determination to trigger an ICC claim to be made by the insured. Upon the next revision to FEMA P-758, the publication will include information on ICC and point to the newly published outreach materials that are described above.

HFIAA SURCHARGE

Policyholders continue to express frustration regarding the $250 surcharge. This occurs primarily in the instances when:

- The owners of buildings house more than one family but it is their primary residence;
- When there are multiple buildings located on a primary residence's lot; and
- When spouses live in separate locations but cannot claim both houses as their primary residence.

Housing authorities are also concerned about the $250 surcharge. They own properties that are rented out to low income individuals. Since the housing authorities cannot claim primary residence status, they are paying thousands of dollars in new non-primary surcharges that cannot be recouped.

Additionally, policyholders are required to verify the structure is their primary residence by supplying an insurer with supporting documentation. Notification is sent to the policyholder by the insurer at least 90 days prior to the policy renewal date. If the documentation is not sent back to the insurer verifying it is a primary residence, the default assumption is that the structure is not a primary residence and the policyholder will be charged a $250 surcharge on the policy renewal invoice. This issue is exacerbated when the mortgagee pays the renewal premium for the higher amount, which causes an imbalance in the policyholder's escrow account, and may be difficult to be refunded once the policyholder submits the appropriate documentation to the insurer.

BACKGROUND

HFIAA mandated that every NFIP policy include an annual surcharge to be collected until, with limited exceptions, all subsidies are eliminated. The HFIAA surcharge is $25 for policies that cover the property in the primary residence of the policyholder as defined by the NFIP, while policies for all other buildings will include a $250 surcharge. The surcharge is not risk-based, and factors such as the flood zone do not change the surcharge. The NFIP defines a primary residence as a single-family building, condominium unit, apartment unit, or unit within a cooperative building that will be lived in by the policyholder or the policyholder's spouse for: (1) more than 50% of the 365 calendar days following the current policy effective date; or (2) 50% or less of the 365 calendar days following the current policy effective date if the policyholder has only one residence and does not lease that residence to another party or use it as rental or income property at any time during the policy term. A policyholder and the policyholder's spouse may not collectively have more than one primary residence.

RECOMMENDATION(S)

The OFIA recommends that an outreach strategy to insurance agents and other stakeholders be developed to communicate the surcharge to their customers when an application is being completed and when a policy is being renewed. Agents should accurately identify the residency of a building to ensure the appropriate surcharge is applied. Additionally, the OFIA recommends that the renewal invoice include communication to the policyholder about the surcharge amount and steps they can take if the building is a primary residence.

The OFIA also recommends consideration in exempting state and local housing authorities from being charged the non-primary residence surcharge, due to the unforeseen financial impacts for the owners of these types of buildings. In addition, the OFIA recommends consideration in the applicability of the non-residence surcharge for building owners who have spouses living in separate residences.

Finally, the OFIA recommends that additional educational materials be developed regarding the applicability of the surcharge.

PROGRAM RESPONSE

It is clear that confusion surrounding the HFIAA surcharge persists and that many policyholders object to paying the added fee, especially for non-primary residences. FEMA has communicated the changes to policyholders through the WYO insurance companies and has updated all training materials to reflect the April 1, 2015 program changes, which included the surcharge. Currently, FEMA Regional Insurance Specialists have been working closely with agents in their regions to educate them about the surcharge. Through a series of webinars hosted in late 2015, FEMA Regional Insurance Specialists have educated hundreds of agents in the program changes and that work will continue into 2016. FEMA's "HFIAA Surcharge Fact Sheet" created especially to address confusion on this issue is available online at www.fema.gov/media-library/assets/documents/105569 and other WYO insurance companies are using the Fact Sheet to directly inform their customers (www.selectiveflood.com/WebApplications/EDS/SelectiveFlood_PublicSite/client/pdf/HFIAASurchargeFactSheet.pdf). Similarly, FEMA has worked with many insurance industry publications to educate agents and carriers about the new requirements (www.insurancejournal.com/news/national/2015/04/01/362763.htm and www.iamagazine.com/markets/read/2015/03/30/brace-your-clients-for-new-flood-policy-surcharge.) FEMA will continue in 2016 to educate agents and policyholders about the requirements and the necessity of sending proof-of-primary-residence materials back to insurers in ensure the appropriate surcharge is reflected. FEMA will also discuss with WYO insurance companies ways to increase knowledge among policyholders.

PRIOR TERM REFUNDS

When a policyholder requests multi-year premium refunds, they are advised by their agent or insurer that, under current refund procedures, refunds are limited to the premium difference for the current policy term only. As a result, policyholders continue to voice frustration over what they perceive as FEMA charging them for more than their fair share of the risk and keeping it to pay back the debt for previously experienced losses.

BACKGROUND

The NFIP has limitations on its current procedures for refunding premiums for prior policy terms when policyholders request them for the following reasons, including, but not limited to:

- When a map is revised in a community and a policyholder's flood risk is reduced, but they were unaware of the change.
- When a policyholder with a building located in a B, C, or X Zone is sold a higher cost standard-rated NFIP policy when they applied for flood insurance even though they were eligible for a lower cost Preferred Risk Policy.

RECOMMENDATION(S)

The OFIA recommends Federal Insurance Directorate create additional educational materials to educate the insurance agent and other stakeholders about the process and what is to be expected in terms of rating and refunds. Additionally, the OFIA recommends the program consider authorizing multi-year refunds in the instances above, as well as taking another look at all of the refund procedures to ensure there is an element of fairness on behalf of the policyholder.

PROGRAM RESPONSE

FIMA understands a policyholder's frustration when they request multi-year refunds and are told that current refund procedures limit them to receiving the premium difference for the current policy term only. We understand their frustration with a perceived unfair practice and will continue to consider further revisions to the rules for prior term refunds to ensure equitable treatment for all NFIP policyholders.

FLOODPROOFING CERTIFICATES/CREDIT

From the inquiries received, and through discussions with FIMA's Risk Management Directorate, two issues have emerged that are the direct result of the changes made to the issuance of a new requirement for the revalidation of the floodproofing credit offered under the Standard Flood Insurance Policy.

The first, and most prevalent, issue of concern to policyholders is the limited amount of time for required documents to be submitted, reviewed and revalidated by FEMA to avoid a large increase to their annual premiums. Policyholders are notified of the need for the required floodproofing documentation 90 days prior to their policy expiring, and the renewal notice must be sent no later than 45 days prior to policy expiring. As a result, little time is being given for the process to run its course to preserve the existing floodproofing credit by the time the renewal notice is issued. Discussions with policyholders, stakeholders and program areas indicate that the time allotted for receipt, renewal and revalidation of a floodproofing certification is not sufficient.

The second issue is the outright loss of the floodproofing credit. Some policyholders have submitted all of the required paperwork only to discover that the building is no longer eligible to retain the floodproofing credit. Buildings identified as being elevated on piles, piers, post, columns or having foundation walls do not qualify for the revalidation of a previously granted floodproofing credit.

BACKGROUND

The OFIA received a number of inquiries related to the revalidation of existing floodproofing certificates, and/or the loss of the floodproofing credit. These inquiries came to the OFIA through the regional offices and, according to information obtained from FIMA's Risk Management Directorate, there are a significant quantity of these types of inquiries already being handled by the directorate.

Title 44 Code of Federal Regulations (CFR) § 60.3 (c) (4) requires that where a non-residential structure is intended to be made watertight below the base flood level, a registered professional engineer or architect must develop and/or review the structural design, specifications, and plans for the construction, and certify that the design and methods of construction are in accordance with accepted standards of practice for meeting all of the applicable provisions of the minimum floodplain management criteria. Furthermore, participating communities are required to maintain a record of such certificates, which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed.

In October 2013, FEMA made changes to its policy on the issuance or revalidation of the floodproofing credit in the NFIP Specific Rating Guidelines (SRG). These changes can be credited to the diligence of individuals in the Federal Insurance Directorate of FIMA, who identified a number of policies from Hurricane Sandy losses that were issued to buildings that received a floodproofing credit and also received large monetary settlements due to flooding. Because these losses run contrary to the expectation that floodproofed buildings are presumed substantially watertight and should be subject to little or no damage, FEMA decided to review all of the non-residential buildings issued a floodproofing credit in the past.

As a result of these changes, all new business applications seeking non-residential floodproofing credit had to be submitted to FEMA for review and approval. On or after December 1, 2013, the renewal of existing policies currently receiving non-residential floodproofing credit had to be re-underwritten, meaning policyholders had to reapply for the credit and follow the procedures that were set forth for new business applications. In total, the review and recertification affected approximately 1,500 policyholders.

While FIMA has been following the new procedures, the NFIP WYO insurance companies, insurance agents and policyholders have not fully embraced or followed the changes. In speaking with policyholders and agents, the main reason appears to be a lack of complete understanding of the new procedures, as found in Section 5, Page 2 of the SRG. Compounding this issue, FEMA publications and documents do not address the changes. Publications such as Technical Bulletin 3-93 (TB 3-93) and FEMA P-936 were written and published prior to these changes. FEMA Form 086-0-34, commonly known as the *Floodproofing Certificate,* was also developed in 2012, again prior to the changes. Finally, conducting a web search for information on this topic yields little, if any, information.

RECOMMENDATION(S)

The OFIA recommends the Federal Insurance Directorate establish a new timeframe that better reflects the time that is needed for receipt, review and revalidation of a floodproofing credit.

The OFIA recommends that the Floodplain Management Division update FEMA P-480, *National Flood Insurance Program Floodplain Management Requirements, A Study Guide and Desk Reference for Local Officials*, and all associated training modules.

The OFIA recommends that the Building Science Branch add descriptive language of the floodproofing review process in their already scheduled updating of Technical Bulletin 3-93, *Non-Residential Floodproofing — Requirements and Certification*, and FEMA P-936, *Floodproofing Non-Residential Buildings*. The OFIA also recommends the updating of the TB 3-93 publication, as this technical bulletin is the one most widely used by our stakeholders who are designing, permitting, and/or issuing approvals of compliance.

The OFIA recommends the Risk Management, Insurance, and Mitigation Directorates review all published material related to this topic, and make updates that will specify the required documentation that is needed, or author new publications that will clarify the new floodproofing credit issuance/revalidation process.

PROGRAM RESPONSE

The Building Science Branch has begun the process to update Technical Bulletin 3-93, *Non-Residential Floodproofing — Requirements and Certification*. The updated bulletin will address compliant floodproofing solutions in the context of current codes, standards, regulations and certifications. This bulletin will also point readers to current How-To Guides such as FEMA P-936 Floodproofing Non-Residential Buildings. The bulletin will also include reference to published Federal Insurance Directorate guidance on submission of documentation necessary for review of flood insurance policy applications that claim or renew a floodproofing rating and credit.

As work has begun on the updated bulletin, the Floodplain Management Division and the Federal Insurance Directorate will be included in the review and concurrence process in order to insure the effort is coordinated and any disconnects are avoided. Completion of the updated bulletin is expected in FY2017.

As the OFIA looks forward into 2016, our highest priority continues to be the establishment of a more formalized framework to advocate for the fair treatment of policyholders and property owners.

Moving Forward

As the OFIA looks forward into 2016, our highest priority continues to be the establishment of a more formalized framework to advocate for the fair treatment of policyholders and property owners. Conducting case management is only one facet of the Advocate's role. To fully implement all of the OFIA's planned functions, the office needs to obtain sufficient staff, continue putting operational support systems in place, refine and make processes more efficient and increase its engagement with the program offices in areas that are of notable concern.

Yet underlying all of this, the OFIA has a continued need for access to timely, credible data. Access to, understanding of and analysis of data are a priority for the OFIA. It is only through data analytics that a deeper understanding of the evolving issues facing FIMA's customers is made possible. In the coming months, the OFIA will be working with FIMA leadership and the program offices to identify, generate and access more timely, relevant and active data sets to gain a full understanding of how the NFIP interacts with its customers. Only through a robust data analysis effort will the OFIA be equipped to provide insight into the key issues and trends that compel NFIP customers to seek assistance.

During calendar year 2015, the OFIA staff identified a range of issues that appeared to have significant underlying impact across the inquiries submitted to the office. These include:

- **Severe Repetitive Loss Properties, or (SRL).** It has been brought to the attention of the OFIA that numerous properties have been incorrectly classified as SRL. As a result, those policyholders are being subjected to significant premium increases. The OFIA will be looking at ways to identify those properties and explore avenues to have them properly categorized.
- **Flood Insurance Agent Education.** A high percentage of inquiries submitted to the OFIA indicated that the information received by policyholders from their insurance agents was inaccurate and/or incomplete. The OFIA is statutorily responsible for aiding potential policyholders under the NFIP in obtaining and verifying accurate and reliable flood insurance rate information when purchasing or renewing flood insurance. In order to meet this mandate, the OFIA will be researching the sufficiency of current insurance agent education standards and requirements.
- **Consistency Across Regions Related to Mapping Outreach and Messaging.** Policyholders and property owners continue to struggle with understanding the impacts to their property following a map revision. As there is not a common suite of materials used to educate the public, property owners and policyholders do not receive consistent information on the insurance implications, the requirements to purchase flood insurance and the flood map review and amendment processes. The OFIA will be working with the regions to identify opportunities to drive greater consistency in messaging, materials and outreach to policyholders and property owners throughout the mapping process.

During the coming year, the OFIA will be researching these issues to understand their broader impact across policyholders and property owners, making necessary recommendations to address these impacts and working with the Directorates on identified improvements. Finally, Advocate staff will maintain insight and participate as appropriate on FIMA's efforts related to the implementation of flood insurance reforms, the ongoing customer experience initiative and NFIP's 2017 reauthorization.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