

# STRENGTHENING THE NATIONAL FLOOD INSURANCE PROGRAM

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RESILIENT

CITIES

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**As Congress takes up the hard work of reauthorizing the National Flood Insurance Program** before it expires in December 2017, 100 Resilient Cities (100RC) is developing a set of policy proposals that provide a framework for cities and their champions to advocate for a collective federal resilience agenda. In creating those broader recommendations, we realized that 100RC should weigh in on the immediate debate around flood insurance because its availability is critical to communities across the United States, and particularly to low-income families. The proposals offered here describe how Congress could create a fiscally sound **National Flood Insurance Program (NFIP)** that provides affordable and actuarially responsible flood insurance and promotes proactive city-level actions to reduce flood losses. Our aim is to provide local leaders with timely recommendations to help them advocate for reforms to the program that will better support city efforts to reduce their flood risks. At a later date, 100RC will release broader federal policy recommendations for mayors to use in support of infrastructure, housing, and economic resilience.

Cities in the 100RC network routinely cite flood risk as one of their biggest resilience challenges. Sea-level rise, changing precipitation patterns, increasing urbanization and development, and aging and undersized infrastructure are all contributing to the devastating flood impacts that are more frequently affecting our communities. Cities in the US are seeing more extreme flood events – such as the 1,000 year storm events recently experienced in Nashville and Boulder – and many cities are also facing chronic stresses from nuisance flooding and overflowing stormwater systems that are regularly flooding city streets and homes in places like Miami, Norfolk, the District of Columbia, and Chicago (and many more). The need for affordable flood insurance is not just felt by coastal cities. In fact, Tulsa, Boulder, Chicago, and El Paso join cities like Boston, New York, Miami, and San Francisco in identifying concerns with recurrent flooding. And the impacts of these flood events are increasingly straining city budgets and requiring hefty disaster recovery payouts from the federal government.

The NFIP is an important federal program that helps cities understand and mitigate their flood risks and that provides the financial resources to help property owners and businesses recover in the aftermath of a flood event. Cities rely upon a strong and solvent NFIP to support their physical and economic resilience to flooding. However, the program is also drastically in need of reform: As of July 2017, the program is more than \$24 billion in debt; rising insurance rates threaten to price many people out of coverage; outdated floodplain maps fail to adequately reflect changing flood risks; and cities don't have the funds they need to take actions to mitigate their flood risks.

**On behalf of the 100RC**, we hope mayors and other local leaders will use the following recommendations to advocate for an improved NFIP that empowers cities to enhance their flood resilience and reduces the economic costs of flooding to the US taxpayer.

**Michael Berkowitz**  
President of 100 Resilient Cities

**Otis Rolley**  
Regional Director, City and Practice  
Management, North America

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# REFORM THE NATIONAL FLOOD INSURANCE PROGRAM

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These cities have identified issues with coastal and stormwater flooding among their resilience challenges:

Atlanta  
Boulder  
Boston  
Chicago  
El Paso  
Honolulu  
Greater Miami and the Beaches  
Louisville  
Minneapolis  
Nashville  
New Orleans  
New York City  
Norfolk  
Oakland  
Pittsburgh  
San Francisco  
Seattle  
St Louis  
Tulsa  
Washington DC

## VISION

Prompt reauthorization and reform of the National Flood Insurance Program is needed to ensure a fiscally solvent program that provides affordable and actuarially responsible flood insurance for homeowners and businesses, and empowers individual and city-level actions to proactively reduce flood losses

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## WHERE WE ARE TODAY

The National Flood Insurance Program (NFIP) is vitally important to the prosperity and resilience of cities, not only because it helps cities manage their flood risks, but also because it provides insurance payments needed by individuals and businesses to recover from catastrophic flooding. City real estate markets are dependent on the NFIP, because obtaining and maintaining flood insurance is a required condition for federally-backed and many other mortgages.

The NFIP is critically important to cities in these times of growing and changing flood risks. Rising sea levels and more frequent and intense storm events are already causing negative impacts in cities across the country. It is estimated that 6 feet of sea-level rise would double the number of structures at risk of flooding to over 13 million.<sup>1</sup> Increasingly, cities are seeing flood impacts in areas outside mapped flood hazard areas, as demonstrated by recent flood events in Houston, Nashville, and Boulder.<sup>2</sup> Nuisance flooding during sunny day conditions, and rising insurance rates, are already negatively affecting homeowners and businesses in low-lying areas of cities like Norfolk and Miami.

The continued viability and solvency of the NFIP, however, is threatened by a number of challenges: the program is \$24.6 billion in debt to the U.S. Treasury and taxpayers<sup>3</sup>; insurance rates are rising; subsidized insurance rates continue to mask the real risks of flooding to properties; the program fails to adequately reward community-level actions to reduce flood risks; and the floodplain maps that serve as the basis for rates and local land-use decisions are out-of-date, and do not account for current risk, let alone future risk.

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These deficiencies in the program pose numerous challenges for cities. Out-dated floodplain maps, designed to set short-term decisions about the price of insurance, are also used to make decisions with much longer-term consequences, such as infrastructure investment and land-use decisions. Rising rates pose a socio-economic threat to cities that have a significant number of lower-income homeowners and businesses located in flood hazard areas. Rate increases will affect owners of older buildings (i.e., built before codes that require building elevation or flood proofing) who previously received insurance subsidies. For lower-income homeowners and those on a fixed income, rising rates could price people out of their homes, or force people to drop flood insurance, which might otherwise be their sole source of funds to rebuild in the event of flooding. Rising rates may also force landlords to raise rents, exacerbating housing affordability crises facing many cities.

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## FEDERAL ROLES

The NFIP was created by Congress in 1968 because private insurers were largely refusing to cover flood losses. It was created with three main purposes: to better communicate flood risks, to provide flood insurance as safety net to help homeowners and businesses rebuild after flood losses, and to encourage local governments to enact better land-use and mitigation practices to reduce flood losses. The program has four main components: (1) floodplain mapping to delineate areas at risk of flooding, (2) insurance purchase requirements, (3) minimum development standards for floodplains, and (4) incentives and funding for flood hazard mitigation measures. The Federal Emergency Management Agency (FEMA) is charged with administering the Program Congress should fund a National Academies study to identify strategies for creating a national flood mapping initiative that coordinates federal efforts, streamlines the process, and creates clear standards for developing floodplain maps.

To address the rising debt of the program, in recent reauthorization legislation (The Biggert-Waters Flood Insurance Reform Act of 2012 (BW12) and in the Homeowners Flood Insurance Affordability Act of 2014 (HFIAA)), Congress reformed the program to phase out insurance subsidies for a subset of properties including non- primary homes, commercial properties and properties that have experienced severe repetitive loss put in place when the program was created.<sup>4</sup>

The program must be reauthorized by Congress by December 2017. This provides an opportunity for city leaders to seek additional reforms to the NFIP so that it helps to create better incentives for cities to enhance flood resilience, while providing an affordable mechanism to support recovery and rebuilding for their residents and businesses.

## 1

## Maintain insurance affordability but provide accurate risk-based price signals

### CHALLENGE

Recent reforms to the NFIP require insurance premium subsidies to be phased out, possibly causing rate increases which will make insurance unaffordable for many property owners and businesses with limited or fixed incomes. Policyholders face increases in rates of up to 18 percent annually until they reach the full-risk (or 'actuarial') rate.<sup>5</sup> Rising rates threaten those with modest means or fixed incomes, who may be forced to drop coverage or be displaced if they cannot afford the added costs. Rising rates can also affect a home's resale value, which can have economic consequences for property owners whose homes are often their biggest asset and 'nest egg' for savings.

Additionally, the NFIP limits coverage for multifamily buildings (currently capped at \$500,000 for the building and \$100,000 for the contents), which leaves many structures underinsured. This is problematic for cities facing severe affordable-housing shortages, as gaps in coverage can, for example, prevent a landlord from making needed repairs after a flood loss, leading to displacement of residents. And while cities need insurance rates to send accurate price signals about the risks of building and residing in flood hazard areas, they also need affordable flood insurance options that provide adequate coverage to help homeowners, landlords and businesses get back on their feet after a disaster.

### OPPORTUNITY

In reauthorization, reforms need to be made to the NFIP to acknowledge the importance of flood insurance for the economic security of families and businesses, especially those with limited financial means. The NFIP should offer means-tested assistance to ensure that no household is displaced or forced out of coverage because of the rising costs of flood insurance. Means-tested assistance should clearly communicate the full-risk rates that are being offset, and provide support to help property owners and business reduce their flood risks with mitigation measures. The NFIP should be reformed to increase coverage or encourage private excess coverage for multifamily properties, to ensure adequate coverage based upon the size and uses of buildings.

### ACTION STEPS

#### Legislative

Congress should maintain rate increases but give FEMA explicit direction and authority to offer means-tested assistance (possibly in the form of vouchers) for low- and moderate-income property owners, with the goal of funding measures to reduce flood losses and qualify properties for lower insurance premiums. Special assistance for mixed-use, multifamily, and difficult to retrofit structures (such as attached rowhomes or historic structures) should be considered.

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Congress should explore options for expanding coverage, through both government and private sources, to increase the number of properties insured and the completeness of coverage for different types of structures and risks. For example, Congress could create incentives for owners of multifamily structures to purchase excess coverage for damages exceeding the current NFIP cap.

### Retrofitting Buildings for Flood Risk

*To address the dual challenges of increasing climate-driven flood risk and rising insurance rates, New York City commissioned studies on strategies to preserve insurance affordability for different types of buildings, including one-to-four-family buildings<sup>6</sup> and larger multifamily buildings,<sup>7</sup> through combinations of retrofits and subsidies. The city also developed a manual<sup>8</sup> providing specific guidance on the most appropriate flood-resilience retrofits for the city's most common building types, many of which cannot be protected using traditional methods, such as elevation.*

#### **Katherine Greig**

Deputy Director NYC Mayor's Office of Recovery and Resilience

#### **Executive**

FEMA should continue to take steps to send accurate risk-based price signals to property owners in flood-hazard areas. FEMA should be encouraged to communicate the full-risk insurance rates for a property (even where the rate is ultimately discounted), and provide transparent data and information on coverage and policies for multifamily and mixed-use buildings.

## 2

## Provide funding and incentives for individual and community-scale flood mitigation programs

### CHALLENGE

The NFIP currently fails to adequately incent investments or the adoption of policies that will help communities reduce their flood risks. And current programs supporting mitigation (e.g., Pre-Disaster Mitigation) are underfunded and do not prioritize community-scale flood risk reduction projects. Cities can significantly reduce flood risks by investing in flood risk reduction projects, or by installing green infrastructure broadly throughout a watershed to manage stormwater. However, the current structure of the NFIP fails to adequately reward those that make proactive investments or implement policies to better manage development in floodplains. Many cities struggle to secure funds to support proactive investments in mitigation, as most federal funds for these types of projects only flow after a disaster has already occurred.

*For our city, being resilient means more than levees holding back water and wetlands protecting us from storms. It means striking a balance between human needs and the environment that surrounds us while also combating the chronic stresses of violence, poverty, and inequality.*

**Mayor Mitch Landrieu**  
New Orleans, LA

Additionally, the only program designed to encourage communities to proactively reduce their flood risks is the Community Rating System (CRS), which poses barriers to entry for many cities, and whose benefits (flood insurance premium discounts) do not directly flow to the city that must undertake the work to join and maintain compliance with the program. Flood insurance discounts flow instead to the residents and businesses carrying flood insurance, making it

difficult for cities to capture these economic benefits.

Many individual property owners also struggle to pay for and install flood mitigation measures for their homes and businesses in ways that will qualify them for insurance premium discounts. Currently, the primary way an owner can reduce their annual premium is to elevate the insured structure above the floodline.<sup>9</sup> This is problematic for many structures that are difficult if not impossible to elevate, including attached row homes (common in cities in the Northeast and Mid-Atlantic), and multifamily, mixed use and historic structures.

Both individuals and communities need funding, or other incentives, to encourage and empower them to take a range of actions that will proactively reduce their flood risks, while reducing flood insurance claims and flood insurance premiums.

### OPPORTUNITY

Community-scale and individual investments in mitigation can significantly reduce flood losses and enhance the security and stability of cities, families and businesses. An oft-cited report commissioned by FEMA showed that for every dollar invested in mitigation \$4 were saved in avoided losses.<sup>10</sup> More studies like this should examine the return on investment from block-level and neighborhood-level investments in flood risk reduction projects, and how the return on investment from mitigation projects grows when you adequately account for increasing risks of flood losses

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### Community-scale green infrastructure

After Hurricane Katrina, the City of New Orleans has sought to reduce flood risks through a variety of approaches, including community-scale green infrastructure. The New Orleans Redevelopment Authority (NORA) is using FEMA Hazard Mitigation Grant Program funding to implement green infrastructure projects in the Pontchartrain Park and Gentilly Woods neighborhoods (known collectively as “Pontilly”), which had seen a large increase in vacant lots in the wake of Hurricane Katrina. To make the case for funding this effort, NORA designed the project to aggregate flood-risk-reduction benefits from multiple smaller-scale projects over a large area. In order to justify federal investment in the project,<sup>11</sup> the city collected extensive data of damages that could be avoided by implementing a neighborhood-scale effort.

### Shore Up Connecticut

In 2013, Connecticut launched the Shore Up program,<sup>12</sup> which uses federal disaster recovery dollars to finance flood resilience retrofits for homes and businesses. This low-interest loan program provides financing to retrofit buildings to be more resilient to flooding and extreme weather. Shore Up was designed specifically for flood resilience retrofits for property owners not eligible for federal disaster aid after Sandy. The program was capitalized with bond funding.

due to climate change and future development. Adequate funding, financing and other incentives must be provided to communities to help them construct large-scale projects that reduce flood risks at community levels. FEMA should be given authority and a mandate to investigate and prioritize funding for block- and neighborhood-level approaches, rather than mitigating structure by structure, which in many cases may not make economic sense. Where appropriate, priority should be given to natural and nature-based flood-risk-reduction projects that are often less costly and deliver multiple environmental, economic and social benefits (such as investments in green infrastructure or wetlands restoration projects that can help reduce flooding from storm surges or lack of adequate drainage or undersized stormwater management systems).

Funding, incentives and guidance should also be developed for difficult-to-retrofit structures (like multifamily, attached rowhomes and historic buildings), which often cannot be elevated. Partial premium reductions should be offered for mitigation measures (other than elevation) that demonstrably reduce flood insurance

claims for the property. Even small reductions in premiums will mean a great deal to homeowners on a budget. Funding and financing options should also be offered to help property owners make investments that will reduce their flood losses, flood claims and flood insurance rates.

## ACTION STEPS

### Legislative

Congress should provide funding and incentives to help communities make investments in large-scale projects that reduce flood risks, with priority given to natural and nature-based approaches. For example, FEMA should be required to prioritize funding larger-scale infrastructure proposals for Pre-Disaster Mitigation funds that reduce flood risks at the community scale.

The Administration or Congress’s infrastructure package should include funding or financing options to help communities make investments in infrastructure projects (both green and gray) that will reduce risks from natural hazards, including floods. Congress should also give FEMA explicit authority to reduce flood insurance premiums based upon neighborhood- or community-level investments in flood- mitigation.

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Congress should give FEMA explicit authority to encourage owners of multifamily and mixed-use structures to mitigate flood risks (such as moving mechanical systems to the top floor of buildings), with lowered insurance premiums.<sup>13</sup> Congress should appropriate funding to support mitigation measures for these types of structures, particularly for those providing affordable housing, through vouchers, grants or a low-cost or no-interest loan program that could be paid back through insurance savings.

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For example, Congress could authorize creation of and provide funding for a revolving loan program, or other financing mechanism, to provide low- or no-interest loans in support of flood resilience retrofits to homes and businesses. Congress should authorize a pilot program aimed at providing flood insurance at the community level. A community-level insurance option would allow cities to recoup the costs of their investments in flood mitigation measures through reduced flood insurance costs.<sup>14</sup>

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Congress should expand the Increased Cost of Compliance (ICC) program<sup>15</sup> and consider allowing ICC funds to be used to mitigate flood risks to properties in advance of a disaster, thus reducing potential flood claims to the NFIP. Congress could also consider creating an ICC program for municipal facilities, which would allow cities to fund community-scale measures to reduce flood risks to municipal facilities and surrounding development.

### **Executive**

FEMA should update the Community Rating System (CRS)<sup>16</sup> to provide easier pathways to entry for cities. FEMA could provide specialized training or support to help cities comply with the CRS requirements that are uniquely difficult for cities. FEMA could adjust the points it awards for mitigation activities to account for the enhanced value of resilience efforts in urban areas that often reduce flood risks for larger structures and protect more residents and insured value. To encourage innovation, FEMA could also consider awarding provisional points for large-scale resilience projects, such as green infrastructure projects, where the flood-risk-reduction benefits are difficult to quantify before the project is implemented. After the project is implemented, FEMA could reevaluate the number of points awarded based upon the actual performance of the project.

# 3

## Provide accurate, up-to-date information about flood risks and future conditions

### CHALLENGE

The cornerstone of the NFIP is the floodplain maps (“Flood Insurance Rate Maps” or FIRMs) that drive rate setting and local land-use regulations. The maps are developed for the purpose of setting insurance rates, but they are used by cities to make decisions that have much longer-term consequences, such as land-use decisions, and decisions on how to design critical facilities and infrastructure. In many cities these maps are outdated, and are developed using only historical flood data. They do not accurately reflect either the current or future flood risks that cities face.

As a result, developers and individuals are using imperfect information to make choices about where to buy and develop. Many homeowners are not adequately informed about the risk of flooding when making decisions about purchasing a home or whether to carry flood insurance after their mortgages are paid off.

Additionally, many state, local and private sector partners struggle to understand requirements for conducting the Hydrologic & Hydraulic studies needed to develop FEMA-compliant Flood Insurance Rate Maps. As a result, other sectors are not able to easily fill the gaps in the FEMA-administered mapping program. The deficiencies in current floodplain maps and mapping practices have been recognized in the literature and in recent legislation, which called for the Technical Mapping Advisory Council to be reconvened to make recommendations on how to improve the NFIP’s mapping program.<sup>17</sup> The process for developing floodplain maps is also costly and inefficient. Contractors are hired to develop maps for different jurisdictions leading to inconsistencies between floodplain maps in neighboring communities.

### OPPORTUNITY

Cities, developers, homeowners and businesses all need accurate, future-looking flood risk information to help them effectively understand flood risks, make decisions about where and how to build, and implement projects to mitigate flood risks. The floodplain mapping program should be fully funded and FEMA should be given authority to provide detailed flood hazard information, including information about future conditions and long-term flood risks to help cities make better land-use and capital-investment decisions. Options should be explored for the creation of digital platforms that provide tools to better visualize flood hazards, and allow for the integration of data from different federal agencies, and state, local and private sector partners.

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### Considering sea-level rise on floodplain maps

In October 2016, New York City and FEMA announced a partnership to develop new flood maps that account for climate change and sea-level rise, using the best-available science as informed by the New York City Panel on Climate Change and in partnership with other federal agencies including NOAA and USGS.<sup>17</sup> To protect flood insurance affordability, the city's FIRMs (which are also being revised) will continue to reflect current flood risk; but the forward-looking maps being developed through this partnership will be used for long-term planning and building purposes, and to help ensure that new investments in New York City are sited and designed with future flood risk in mind. This partnership provides one example of how cities can work with federal partners to identify and apply the best available data and science to inform climate-smart development.

### ACTION STEPS

#### Legislative

Congress should fully fund the floodplain mapping program and Congress should direct FEMA to provide more detailed flood-hazard information, including information about future conditions and long-term flood risks.

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Congress should give FEMA authority to create a facility for cost sharing that would allow FEMA to combine funding from other agencies, take in funding from private sources, and use data from other federal agencies, state and local partners, and the private sector. FEMA should coordinate with other federal partners, including USGS, NOAA, the Army Corps and others, to combine data

and resources and provide accessible digital elevation maps that help communities better understand their flood risks.

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Congress should fund a National Academies study to identify strategies for creating a national flood mapping initiative that coordinates federal efforts, streamlines the process, and creates clear standards for developing floodplain maps.

### Visualization of flood risks

The North Carolina Flood Risk Information System<sup>18</sup> provides an online portal for hosting floodplain maps, but the system also allows for additional data input by local and state governments (such as building elevation data that can be used to develop flood depth damage estimates). A similar system could be rolled out nationally to allow cities to better assess and visualize both current and future flood risks, in a way that is compliant with FEMA's mapping requirements.

#### Executive

FEMA should continue to partner with other agencies to collect high-resolution digital elevation data; FEMA should be encouraged to develop or build upon existing digital platforms for publishing and visualizing flood-risk information that would allow for inclusion of data from other partners, and that would be compliant with FEMA's mapping requirements.

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FEMA should develop clear and consistent standards for Hydrologic & Hydraulic studies for developing FEMA-compliant

floodplain maps. This would allow opportunities for more private, local, and state partnerships in developing risk-based mapping products and data.

FEMA should develop tools and support efforts to help cities effectively communicate flood risks to individuals, and to help inform their decisions about purchasing insurance or investing in loss-reduction measures, such as home elevation. For example, by simply changing their vocabulary around the “100-year flood”, FEMA could help homeowners better understand that the likelihood of a 100-year flood affecting their home is 1-in-4 over the life of a typical 30-year mortgage (not the 1-in-100 odds that is often assumed). FEMA should also support (and Congress should fund) community-based education projects that will help promote awareness about changing flood hazards, insurance purchase options, and measures that can be taken by homeowners, landlords and businesses to reduce flood losses.

## 4

## Enhance participation in the flood insurance program

### CHALLENGE

Part of the problem with the NFIP is that too few property owners in harm's way actually carry flood insurance, despite mandates that they do so if they carry a federally-backed mortgage.<sup>20</sup> Data suggests that only 75 to 80 percent of property owners in flood hazard areas who are required to carry flood insurance actually do so.<sup>21</sup> Property owners need only show they are carrying flood insurance when they close on a mortgage and, as a result of lax enforcement by mortgage lenders, they too often drop insurance afterwards. Although homeowners outside of the 100-year floodplain are not required to, they can carry flood insurance at very little cost.

*In the coming years, we know we must continue to invest in Nashville, but do so intentionally, preparing for both acute shocks, such as a flood, and long-term stresses, such as aging infrastructure and access to affordable housing.*

**Mayor Megan Barry**  
Nashville, TN

Property owners outside of mapped flood hazard areas are increasingly experiencing flood losses. Increased impervious coverage and development in floodplains, changing rainfall patterns with more frequent heavy rain in some areas, and sea-level rise are factors contributing to this increase in flooding. The challenge for cities is that many residents feel they will not be affected by flooding because their building is not in a mapped flood hazard area, and because they are not required to carry flood insurance. Yet many cities have experienced larger storms in recent years, causing damages well outside of mapped flood hazard areas, including most recently in Baton Rouge, LA; Charleston, SC; Virginia Beach, VA; and Boulder, CO.

The result of this lack of participation is that the NFIP fails to adequately diversify its risk, and property owners who fail to carry coverage often rely on taxpayer-funded disaster recovery assistance to recover after flood damage, if it is available.

### OPPORTUNITY

Adding additional insureds to the NFIP would bring in much needed funding, and would help ensure that property owners have flood insurance to support their own recovery, rather than relying on tax-payer-funded disaster assistance. Congress could expand private insurance purchase options and requirements to carry flood insurance. FEMA should also expand and reward education and outreach to encourage greater participation in the NFIP.

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## ACTION STEPS

### Legislative

Congress should authorize sale of multi-year insurance policies that lock in insurance rates for a period of years to create purchase incentives.

Congress could expand flood insurance purchase requirements for federally-backed mortgages to address increasing flood losses outside of mapped, special flood hazard areas (i.e., beyond the 100-year floodplain). Expanding flood insurance purchase requirements also increases the number of people paying into the program, and can reduce the need for disaster recovery payments to uninsured property owners. For example, Congress could extend flood insurance purchase requirements to the 500- year floodplain, to areas protected by levees (“residual risk areas”) or to properties that receive disaster recovery assistance.

### Executive

FEMA should fund and enhance education and outreach programs to educate homeowners and businesses about changing flood risks and flood insurance options.

FEMA should also reward CRS-participating communities with points for increasing participation of residents in the program (based upon actual new policies purchased).

## CONCLUSION

The NFIP dramatically affects city preparedness and the ability of city residents and businesses to recover in the aftermath of a flood event. With needed changes, the NFIP could better meet the resilience needs of cities: the floodplain maps used for decision-making could be updated and improved to provide better risk-based information for city officials as well as private decision makers; more people could be encouraged to carry flood insurance to help them rebuild after flood impacts; individuals and communities could be provided incentives to implement measures to reduce flood losses, and lower-income households and businesses could be provided with assistance to offset rising insurance rates.

*100RC would like to thank Enterprise Community Partners Inc., Georgetown Climate Center, Climate Resilience Consulting, and HR&A Advisors for their contributions to these recommendations.*

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# END NOTES

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1. Matthew Hauer, et al., *Millions projected to be at risk from sea-level rise in the continental United States*, Vol. 6 *Nature of Climate Change* (Jul. 2016) <https://www.nature.com/articles/nclimate2961.epdf>.
2. Brooks Garner, *Houston We Have a [Flood Insurance] Problem* (KHOU Houston Texas, Aug. 17, 2016), <http://www.khou.com/news/local/houston-we-have-a-flood-insurance-problem/300830099>. In 2010, Nashville, TN experienced a 1,000 year flood event that killed 26 people and caused \$2 billion in damages. NOAA, *NOAA's National Weather Service Releases Report on May 2010 Nashville Flood* (Jan. 2011), [http://www.noaanews.noaa.gov/stories2011/20110112\\_flooding.html](http://www.noaanews.noaa.gov/stories2011/20110112_flooding.html). In 2013, Boulder, CO also experienced a 1,000-year flood event when heavy precipitation over the course of a couple of days exceed monthly precipitation totals since rainfall records have been collected in this region. NOAA, *Climate.gov, Historic Rainfall and Floods in Colorado* (Sep. 2013), <http://www.climate.gov/news-features/event-tracker/historic-rainfall-and-floods-colorado>.
3. GAO, *Flood Insurance: Comprehensive Reform Could Improve Solvency and Enhance Resilience* (Apr. 2017), GAO-17-425, <https://www.gao.gov/products/GAO-17-425> (The program is in debt because of subsidized insurance rates and the recent increases in the severity and intensity of flood events starting in 2005, where claims exceeded insurance payments into the program).
4. See 42 U.S.C.A. § 4015.
5. 42 U.S.C.A. § 4015(e).
6. HR&A Advisors, *Multifamily Flood Insurance Affordability Study* (2016) available at <http://www.nyc.gov/html/planyc/downloads/pdf/publications/HR-A-Multifamily-Flood-Insurance-Affordability-Study-2016.pdf>.
7. RAND Corporation, *The Cost and Affordability of Flood Insurance in New York City* (2017), available at [http://www.rand.org/pubs/research\\_reports/RR1776.html](http://www.rand.org/pubs/research_reports/RR1776.html).
8. For more information, see Georgetown Climate Center, *Adaptation Clearinghouse, Retrofitting Buildings for Flood Risk* (New York City), <http://www.adaptationclearinghouse.org/resources/retrofitting-buildings-for-flood-risk-new-york-city.html>.
9. In order to qualify for discounted insurance, the main mitigation measure that FEMA recognizes is elevating a home about the base flood elevation, defined as the "computed elevation to which floodwater is anticipated to rise during the base flood (i.e., the 100-year or 1- percent change flood)." <https://www.fema.gov/base-flood-elevation>.
10. National Institute of Building Sciences, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities* (2005).
11. For more information, see Jeffrey Thomas and James DeWeese, Georgetown Climate Center, *Reimagining New Orleans Post-Katrina: A Case Study in Using Disaster Recovery Funds to Rebuild More Resiliently* 31-33 (Aug. 2015), available at [http://www.georgetownclimate.org/files/report/GCC-Reimagining\\_New\\_Orleans\\_Post\\_Katrina-August2015-Final.pdf](http://www.georgetownclimate.org/files/report/GCC-Reimagining_New_Orleans_Post_Katrina-August2015-Final.pdf).
12. For more information, see Georgetown Climate Center, *Adaptation Clearinghouse, Shore Up Connecticut Loan Program*, <http://www.adaptationclearinghouse.org/resources/shore-up-connecticut-loan-program.html>.
13. Although FEMA has issued technical guidance on how to mitigate these types of difficult-to-mitigate structures, they do not provide adequate partial mitigation credit to encourage property owners, with some discounts on insurance rates, to undertake these investments. FEMA P-1037, *Reducing Flood Losses to Residential Buildings that Cannot be Elevated* (2015), [https://www.fema.gov/media-library-data/1443014398612-a4dfc0f86711bc72434b82c4b100a677/revFEMA\\_HMA\\_Grants\\_4pg\\_2015\\_508.pdf](https://www.fema.gov/media-library-data/1443014398612-a4dfc0f86711bc72434b82c4b100a677/revFEMA_HMA_Grants_4pg_2015_508.pdf).
14. See e.g., National Academy of Sciences, *A Community-Based Flood Insurance Option* (July 2015).
15. The Increased Cost of Compliance (ICC) program provides insureds, when rebuilding after a flood event, with an additional \$30,000 to fund measures to reduce future flood losses. The structure must be covered by a standard flood insurance policy and qualify as a substantially damaged or repetitive flood loss property. The \$30,000 can be used to bring the structure into compliance with minimum requirements of the NFIP (i.e., elevated or floodproofed to at or above the base-flood elevation for the area). See FEMA, *Flood Insurance and Mitigation Administration, Fact Sheet: Increased Cost of Compliance Coverage*, [https://www.fema.gov/media-library-data/20130726-1447-20490-5393/increasedcostofcompliancecoverage\\_2012.pdf](https://www.fema.gov/media-library-data/20130726-1447-20490-5393/increasedcostofcompliancecoverage_2012.pdf).

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16. The CRS is a subprogram of the NFIP that rewards communities that adopt more robust floodplain management practices with reduced insurance premiums. Cities that enhance floodplain management can earn points that equate to discounted insurance premiums (up to 40 percent) for policyholders in their communities. However, many cities find it difficult to participate because older cities often have incomplete records and find it too difficult to earn points because of legacy development patterns, older building stock that cannot be elevated, and less open space to manage as floodplains. See, FEMA, *National Flood Insurance Program Community Rating System*, <https://www.fema.gov/national-flood-insurance-program-community-rating-system>.
  17. In the 2012 Biggert Waters legislation, Congress called for a second Technical Mapping Advisory Council (TMAC) to address stakeholder experience with flood maps, and the mapping program's credibility and efficiency. In its December 2015 annual report, the TMAC recommended that "FEMA should transition from identifying the 1-percent-annual-chance floodplain and associated base flood elevation as the basis for insurance rating purposes to a structure-specific flood frequency determination." These maps coupled with estimates of the damage to specific structures from floods of different magnitudes will provide the data to make the flood risk more transparent to property owners in flood prone areas. *The Annual TMAC Report* for 2015 can be found at [https://www.fema.gov/media-library-data/1454954097105-a94df962a0cce0eef5f84c0e2c814a1f/TMAC\\_2015\\_Annual\\_Report.pdf](https://www.fema.gov/media-library-data/1454954097105-a94df962a0cce0eef5f84c0e2c814a1f/TMAC_2015_Annual_Report.pdf).
  18. Federal Emergency Management Agency, *Press Release NR-007, Mayor De Blasio and FEMA Announce Plan to Revise NYC's Flood Maps*, <https://www.fema.gov/news-release/2016/10/17/mayor-de-blasio-and-fema-announce-plan-revise-nycs-flood-maps>. For more information on New York City's sea-level rise maps, see Georgetown Climate Center, Adaptation Clearinghouse, *Sea-Level Rise Tool for Hurricane Sandy Recovery*, <http://www.adaptationclearinghouse.org/resources/sea-level-rise-tool-for-hurricane-sandy-recovery.html>.
  19. For more information on North Carolina's Flood Risk Information System see see Georgetown Climate Center, Adaptation Clearinghouse, *North Carolina Flood Risk Information System*, <http://www.adaptationclearinghouse.org/resources/north-carolina-flood-risk-information-system.html>.
  20. 42 U.S.C.A. § 4012a.
  21. Dan Huber, C2ES, *Fixing A Broken National Flood Insurance Program: Risks And Potential Reforms* at 5, <https://www.c2es.org/docUploads/flood-insurance-brief.pdf>.

**About 100 Resilient Cities—Pioneered by The Rockefeller Foundation**

100 Resilient Cities - Pioneered by The Rockefeller Foundation (100RC) helps cities around the world become more resilient to the physical, social, and economic challenges that are a growing part of the 21st century. 100RC provides this assistance through: funding for a Chief Resilience Officer in each member city who will lead the resilience efforts; resources for drafting a resilience strategy; access to private sector, public sector, academic, and NGO resilience tools; and membership in a global network of peer cities to share best practices and challenges.

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