

Explanatory Cover Note Draft National Mitigation Investment Strategy

_____, 2017

[Drafters Note: Although presented as one Word document for convenience, the Explanatory Cover Note and Draft National Mitigation Investment Strategy are two separate, but complementary, documents.]

What is the National Mitigation Investment Strategy?

The National Mitigation Investment Strategy (“Investment Strategy”) will provide a national approach to investments in mitigation activities and risk management across the United States for federal departments and agencies; state, territorial, tribal, and local governments (SLTTs); and private and non-profit sector entities such as businesses, philanthropies, foundations, universities, and other non-governmental organizations. The Investment Strategy will be grounded in three fundamental principles: (1) catalyze private and non-profit sector mitigation investments and innovation; (2) improve collaboration between the federal government and SLTTs, respecting local expertise in mitigation investing; and (3) make data- and risk-informed decisions that include lifetime costs and risks. **The Investment Strategy’s overarching goal is to improve the coordination and effectiveness of “mitigation investments,” defined as risk management actions taken to avoid, reduce, or transfer risks from natural hazards, including severe weather.**

To achieve this goal, and consistent with the fundamental principles, the Investment Strategy will provide recommendations, organized by the following six outcomes:

1. Coordination of risk mitigation and management improves between and among public, private, and non-profit sector entities.
2. The private and non-profit sectors increase their investments in and innovations related to mitigation.
3. SLTTs increasingly empowered to lead risk reduction activities and share responsibility and accountability with the federal government.
4. Public, private, and non-profit sector entities develop and share more of the data and tools needed to make risk-informed mitigation investments.
5. Public, private, and non-profit sector entities improve risk communication, leading to more risk-informed mitigation investments by individuals and communities.
6. The built environment — whether grey or nature-based infrastructure, and including lifeline infrastructure, buildings, and homes — becomes more resilient.

1 If followed, it is hoped these recommendations will benefit the Nation in numerous ways,
2 including:

- 3
- 4 • reducing loss of life and injuries, damage to property, and negative impacts on the
5 economy and the environment;
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- 7 • coordinating mitigation investment activities nationwide;
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- 9 • lowering overall costs for responding to and recovering from natural disasters, and
10 reducing taxpayer burden;
- 11
- 12 • improving public-private collaboration and unlocking private and non-profit sector
13 capital, innovation, and expertise, thus driving job creation and economic growth;
- 14
- 15 • empowering SLTTs with greater autonomy while reducing the federal cost share for
16 mitigation, supporting more equitable cost-sharing for mitigation investments between
17 the federal government and other entities, and increasing overall accountability;
- 18
- 19 • simplifying the navigation of federal mitigation programs and assistance;
- 20
- 21 • strengthening the resilience of U.S. infrastructure;
- 22
- 23 • integrating mitigation planning in comprehensive community and regional planning
24 activities and improving mitigation decision-making by individuals, business owners, and
25 policymakers;
- 26
- 27 • improving human health and social cohesion;
- 28
- 29 • helping improve financial outcomes for individuals, families, and businesses and speed
30 financial recovery; and
- 31
- 32 • empowering more communities to mitigate natural hazards and improve resilience.
- 33

34 **What is the *Draft National Mitigation Investment Strategy*?**

35

36 The “Draft Investment Strategy” is an initial set of proposed recommendations and illustrative
37 case studies to improve the coordination and effectiveness of mitigation investments across the
38 nation. The recommendations are made with the expectation that they are “workable” and
39 straightforward. The Draft Investment Strategy explicitly avoids making recommendations that
40 would require fundamental structural changes, new legislation, or funding increases by the
41 federal government. The Draft Investment Strategy recommendations are intended to outline
42 plausible steps that, if taken more broadly, may improve coordination and increase the
43 effectiveness of national mitigation investments.

44

45 The Draft Investment Strategy is an important milestone in the development of a nationally
46 applicable approach to mitigation investments, but it should not be mistaken for a final or

1 binding product. Draft Investment Strategy recommendations generally are expected to be
2 adjusted in response to the expressed needs of communities and other stakeholders, and the
3 expectations of how those needs will change over time.

4
5 The Draft Investment Strategy will be used to provoke thought, discussion, and feedback from
6 the private and non-profit sectors, federal departments and agencies, and SLTTs. While the
7 Draft Investment Strategy was developed by the federal government through the Mitigation
8 Framework Leadership Group (MitFLG),¹ a *national* approach to a mitigation investment
9 strategy requires public, private, and non-profit sector input. The Draft Investment Strategy
10 provides an opportunity to spark engagement by distributing a document to which all
11 stakeholders can react.

12
13 Throughout the remainder of 2017 and into 2018, the MitFLG will continue to conduct research
14 in support of the Investment Strategy and solicit stakeholders' feedback which will shape how
15 the Investment Strategy continues to develop. The MitFLG intends to collect leading practices
16 and lessons learned that promote mitigation investments, as well as to disseminate knowledge
17 around what makes mitigation investments more (and less) effective and coordinated across
18 public, private, and non-profit sectors. Through its stakeholder engagement process, the MitFLG
19 will seek comments on the Draft Investment Strategy itself, including but not limited to the
20 "workability" or viability of these initial recommendations; the extent to which the
21 recommendations could (and should) be made bolder; whether or how structural changes may be
22 needed to improve the effectiveness of national mitigation investments; whether the
23 recommendations sufficiently address access and functional needs; and/or how to make the next
24 version of the Investment Strategy more refined and effective. Additional questions for which
25 MitFLG will be seeking responses include:

- 26
27 1. What incentives are used or should be used to encourage resilient investments by states,
28 territories, tribes, local jurisdictions, businesses, non-governmental organizations,
29 homeowners, and other individuals and organizations?
- 30
31 2. What tools, guidance, or strategies do stakeholders use, or would like to use, to
32 communicate risk and which are the most effective?
- 33
34 3. How are stakeholders catalyzing investments to make their communities more resilient
35 through mitigation activities?
- 36
37 4. What challenges and barriers have stakeholders encountered as they designed and
38 implemented strategies to mitigate natural hazard risk and improve their communities'
39 resiliency?
- 40
41 5. How do different levels of government streamline interactions in order to facilitate
42 resilience investments? What steps can each level of government take to streamline and
43 facilitate investments to support mitigation activities?

¹ The interagency MitFLG provides a coordinating structure for mitigation across the Federal government, and nationally. The MitFLG is focused on creating a national culture shift that encourages and incentivizes risk management and long-term resilience in national planning, decision making, and development.

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6. How can governments more effectively engage private businesses and citizens in sharing responsibility for disaster risk reduction, including activities to mitigate risk and build resilience?
 7. How effective are these recommendations? What should be added, modified, or deleted from the list of recommendations?
 8. What is the most effective way for the public, private, and non-profit sectors to implement the recommendations in the Investment Strategy?

DRAFT NATIONAL MITIGATION INVESTMENT STRATEGY

January 11, 2018

Mitigation Framework Leadership Group

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Executive Summary

What is the National Mitigation Investment Strategy? The U.S. Department of Homeland Security tasked the Mitigation Framework Leadership Group (MitFLG) with developing a National Mitigation Investment Strategy (Investment Strategy) to address the lack of mitigation investment coordination. The public, private, and non-profit sectors annually spend billions of dollars to fund mitigation planning and activities that avoid, reduce, or transfer these natural hazard risks. Studies have shown that such mitigation investments can be effective and cost-efficient. The costs and dangers posed by natural hazards, along with the importance of mitigation, should drive the United States towards a more coordinated, integrated approach to mitigation investments. As a result, mitigation investments made by the federal government, state, local, territorial and tribal entities (SLTTs), as well as by private and non-profit sector entities (such as businesses, philanthropies, foundations, universities, and other non-governmental organizations), would be more effective and efficient.

By focusing on increased coordination between and among the federal government, SLTTs, private sector, and non-profit entities and more effective use of governmental resources in supporting mitigation activities, the Investment Strategy provides a national approach to mitigation investments. Specifically, the Investment Strategy is grounded in three fundamental principles that inform its national approach: (1) catalyze private and non-profit sector mitigation investments and innovation; (2) improve collaboration between the federal government and SLTTs, respecting local expertise in mitigation investing; and (3) make data- and risk-informed decisions that include lifetime costs and risks.

Investment Strategy Outcomes and Recommendations. The Investment Strategy makes a series of recommendations, organized by six desired outcomes which – if met – could result in a Nation better equipped for, and less vulnerable to, natural disasters.

Outcome 1: Coordination of risk mitigation and management improves between and among federal, public, private, and non-profit sector entities.

- Develop common vocabulary for understanding risk and mitigation
- Develop common metrics for evaluating mitigation and resilience
- Adopt complementary processes for applying for mitigation, preparedness, and recovery funds
- Modify federal processes to promote holistic approaches to risk management and mitigation planning
- Improve coordination between mitigation and other national preparedness mission areas and allow community-based adaptations
- Incorporate evaluation of mitigation issues into continuous improvement processes

Outcome 2: Private and non-profit sector entities increase their investments in and innovations related to mitigation.

- Support financial products that reduce natural hazard risks and costs
- Encourage investments in innovative mitigation-related tools and technologies

- Promote non-traditional models for financing mitigation activities
- Increase insurance coverage of individuals, businesses, and communities for natural hazard risk

Outcome 3: SLTTs increasingly empowered to lead risk reduction activities and share responsibility and accountability with the federal government.

- Identify community-based mitigation training needs and deliver more targeted training to communities
- Create consumer assistance programs that incentivize mitigation
- Align financial incentives and cost sharing for mitigation projects

Outcome 4: Public, private and non-profit sector entities develop and share more of the data and tools needed to make risk-informed mitigation investments.

- Enhance the availability and usability of federal data
- Identify and share leading practices and case studies demonstrating the value of mitigation investments

Outcome 5: Public, private, and non-profit sector entities improve risk communication, leading to more risk-informed mitigation investments by individuals and communities.

- Develop measurement tools to help communities evaluate their resilience
- Increase and improve mitigation education and outreach to meet access and functional needs
- Apply the science of risk communication to enhance individual and community mitigation efforts

Outcome 6: The built environment — whether grey or nature-based infrastructure, and including lifeline infrastructure, buildings and homes — becomes more resilient and promotes community resilience.

- Encourage the passage and enforcement of up-to-date model building codes
- Encourage the use of nature-based solutions for mitigation
- Focus post-disaster on rebuilding better as well as rebuilding quickly
- Encourage local and regional investment that enhance the security and resilience of infrastructure through design standards and coordinated capital improvement

Anticipated Benefits of Coordinated Mitigation Investments. If followed, these recommendations should help develop an integrated, national approach to mitigation investments that: reduces loss of life and injuries, damage to property, and negative impacts on the economy and the environment; coordinates mitigation investment activities nationwide; lowers overall costs for responding to natural hazards and recovering from disasters, and reduces taxpayer burden; improves public-private collaboration and unlocks private and non-profit sector capital, innovation, and expertise, thus driving job creation and economic growth; empowers SLTTs with greater autonomy while reducing the federal cost share for mitigation, supporting more equitable

Draft National Mitigation Investment Strategy for Public Comment

1 cost-sharing for mitigation investments between the federal government and other entities, and
2 increasing overall accountability; simplifies the navigation of federal mitigation programs and
3 assistance; strengthens the resilience of U.S. infrastructure; integrates mitigation planning into
4 comprehensive community and regional planning activities and improves decision-making by
5 individuals, policymakers, and business owners; improves human health and social cohesion;
6 helps improve financial outcomes for individuals, families and businesses and speed financial
7 recovery; and empowers whole communities to mitigate natural hazards and improve resilience.

I. Introduction

The National Mitigation Investment Strategy (Investment Strategy) provides a national approach to investments in mitigation activities and risk management across the United States for federal departments and agencies; for state, local, territorial, and tribal governments (SLTTs); and for private and non-profit sector entities such as businesses, philanthropies, foundations, and other non-governmental organizations (NGOs). The Investment Strategy's goal is to improve the coordination and effectiveness of "mitigation investments," defined as risk management actions taken to avoid, reduce or transfer natural hazard risks.¹ To achieve this goal, the Investment Strategy describes six desired outcomes, and proposes recommendations to advance those outcomes, as detailed below.

Section I(A) explains the need for a National Mitigation Investment Strategy, while Section I(B) describes the strategy's purpose, potential benefits, and the underlying principles that informed the strategy's development. Next, Section I(C) explains how the Investment Strategy has been developed, and expectations for its implementation. Section I(D) outlines the strategy's structure, organized around six desired outcomes, noting the challenges ahead. Section II proposes a path for achieving these outcomes by pairing each outcome with a set of recommendations directed at public, private, and/or non-profit entities.² Section III concludes with next steps, and requests stakeholder feedback.

A. The Need for a National Mitigation Investment Strategy

Natural hazards, including severe weather events, are dangerous and costly. In 2016, 458 people were killed and an additional 1,276 people were injured by severe weather events.³ Beyond causing death and injury, such natural hazards are extremely expensive. Between 1980 and 2017, the United States sustained 217 weather-related disasters that caused at least \$1 billion in damage each, collectively resulting in over \$1.2 trillion of damage.⁴ Moreover, natural hazards have a significant effect on our social and economic fabric. Minimizing the damage and costs associated with natural hazards is therefore an essential ingredient to security and prosperity in every region of the United States.

¹ See GAO, *Report to Congressional Requestors: Hurricane Sandy - An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, No. GAO-15-515 (July 2015), available at <http://gao.gov/assets/680/671796.pdf> (recommending such a strategy).

² Although these recommendations, if followed, ultimately will benefit and/or influence the behavior of individuals and communities, they are directed solely at the institutions whose decisions will affect such individuals and communities rather than the individuals or communities themselves.

³ National Oceanic and Atmospheric Administration (NOAA), *Summary of Natural Hazard Statistics for 2016 in the United States* (May 11, 2017), available at <http://www.nws.noaa.gov/om/hazstats/sum16.pdf>.

⁴ NOAA National Centers for Environmental Information, *Billion Dollar Weather and Climate Disasters: Overview* (October 2017), available at <https://www.ncdc.noaa.gov/billions/>. This figure does not account for the billions of dollars of additional damage caused by less costly weather events. Nor does this total include the costs for Hurricanes Harvey, Irma, and Maria.

Mitigation investments support actions that can improve economic prosperity, health, and safety by reducing the risks posed by natural hazards. They can include:

- providing funds (e.g., grants and loans),
- conducting construction (e.g., infrastructure projects),
- sharing technical expertise and advice (e.g., personnel, planning, and leading practices), as well as vulnerability and capability assessments, and/or
- providing hazard risk information (e.g., data).

Mitigation investments can kick-start new projects and infrastructure or support ongoing mitigation efforts by communities, individuals, and businesses. They can support projects whose sole purpose is mitigation (e.g. a seawall) or projects where mitigating natural hazard risk is a secondary purpose or benefit (e.g., building a new bridge higher). Such investments also can support ongoing and annual planning activities in states, tribes, and communities. Mitigation investments are fundamentally cost-effective, representing a good use of taxpayer funds: a landmark 2005 study by the National Institute of Building Safety (NIBS) and the Federal Emergency Management Agency (FEMA) found that every dollar spent on hazard mitigation saves the Nation an average of four dollars.⁵

Defining Hazard Mitigation and Resilience

In the Investment Strategy, “mitigation” is defined as “*risk management action taken to avoid, reduce, or transfer natural hazard risks.*”⁶

Mitigation actions can help lead to a state of greater resilience. The Investment Strategy defines “resilience” as “*the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions [including] the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.*”⁷

While this Investment Strategy defines mitigation investments as expenditure of resources to engage in risk management and reduce natural hazard risk, federal departments and agencies — as well as the broader mitigation community — may have different policies about what is considered a mitigation investment.

Mitigation investments take place at all levels of government, as well as within the private and non-profit sectors. The federal government annually spends billions of dollars on mitigation

⁵ NIBS Multihazard Mitigation Council, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, vol. 1 (2005), available at https://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/MMC/hms_vol1.pdf. NIBS is currently updating this study, with preliminary findings expected in 2017. See, e.g., NIBS Multihazard Mitigation Council, *Projects* (visited on June 23, 2017), available at http://www.nibs.org/?page=mmc_projects (describing, among other things, the activities of the *Mitigation Saves* Version 2.0 Committee).

⁶ See FEMA, *National Mitigation Framework* (last updated Apr. 27, 2017), available at <http://www.fema.gov/national-mitigation-framework>.

⁷ See *Presidential Policy Directive/PPD-21 — Critical Infrastructure Security and Resilience* (Feb. 12, 2013), available at <https://www.whitehouse.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil>.

1 through hundreds of grants, programs, and projects across multiple federal departments and
2 agencies; some funding goes directly to projects, and some is distributed through SLTTs for use
3 and/or further distribution to local entities or individuals. SLTTs also use their own state and
4 local taxpayer funds to support community and individual mitigation measures. The private and
5 non-profit sectors invest in mitigation too, for their own property, for financial and technological
6 products, and for philanthropic support to help others conduct mitigation projects.

7
8 In a 2015 report, the U.S. Government Accountability Office (GAO) found these various streams
9 of mitigation investments were not coordinated, even among the departments and agencies of the
10 federal government, thus undermining the investments' overall effectiveness. In its report, the
11 GAO recommended that the Mitigation Framework Leadership Group (MitFLG) establish an
12 investment strategy to identify and guide federal investments in disaster resilience and
13 mitigation-related activities, and make recommendations to the President and Congress on how
14 the nation should collaborate on future disaster resilience investments.⁸ This Investment
15 Strategy responds to the GAO's recommendation.

16 17 **B. Investment Strategy Purpose, Benefits, and Fundamental Principles**

18
19 **Purpose.** The Investment Strategy aims to improve the coordination and effectiveness of
20 mitigation investments in the United States, and increase the Nation's resilience to natural
21 hazards, by providing a single national strategy for such investments. The Investment Strategy
22 should serve as a common guide to mitigate and manage natural hazard risks in a coordinated
23 way rather than reactively address – often expensively – the consequences of disasters. In other
24 words, the Investment Strategy aims to help the entire Nation, including vulnerable communities
25 in both rural and urban areas, become safer and more resilient in the face of the many natural
26 hazards, including severe weather, in the United States.⁹ Fundamentally, the Investment
27 Strategy's goal is to improve the coordination and effectiveness of mitigation investments
28 nationwide.

29
30 **Benefits.** More specifically, the Investment Strategy sets forth a series of recommendations
31 that, if followed, should have numerous benefits, including:

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33 • reducing loss of life and injuries, damage to property, and negative impacts on the
34 economy and the environment;
- 35
36 • coordinating mitigation investment activities nationwide;
- 37
38 • lowering overall costs for responding to and recovering from natural disasters, and
39 reducing taxpayer burden;
- 40

⁸ See GAO, *Report to Congressional Requestors: Hurricane Sandy - An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, No. GAO-15-515 (July 2015), available at <http://gao.gov/assets/680/671796.pdf>.

⁹ At this time, the Investment Strategy does not address resilience to man-made risks such as crime, terrorism, and/or cyber attacks.

- improving public-private collaboration and unlocking private and non-profit sector capital, innovation, and expertise, thus driving job creation and economic growth;
- empowering SLTTs with greater autonomy while reducing the federal cost share for mitigation, supporting more equitable cost-sharing for mitigation investments between the federal government and other entities and increasing overall accountability;
- simplifying the navigation of federal mitigation programs and assistance;
- strengthening the resilience of U.S. infrastructure;
- integrating mitigation planning in comprehensive community and regional planning activities and improving mitigation decision-making by individuals, business owners, and policymakers;
- improving human health and social cohesion;
- helping improve financial outcomes for individuals, families, and businesses and speed financial recovery; and
- empowering more communities to mitigate natural hazards and improve resilience.

Fundamental Principles. The Investment Strategy rests upon three fundamental principles that provide a foundation for the development and implementation of the Investment Strategy.

Fundamental Principle 1: Catalyze private and non-profit sector mitigation investments and innovation.

The Investment Strategy supports the use of public funds — from federal, state, local, tribal or territorial sources — to catalyze private and non-profit sector investments, as well as to develop sustainable funding mechanisms for mitigation that are not wholly dependent on taxpayers. The Investment Strategy recognizes that not all resilience projects are attractive for private sector investment and may require slower, “patient capital” — with longer return periods than traditional investments — and therefore may need relatively more public support than other projects. (Philanthropies and other NGOs also may help with longer-term resilience projects.) While taxpayer dollars need to be carefully stewarded, not every investment made will lead to a successful outcome. The Investment Strategy should allow for experimentation, should encourage collaboration and fair sharing of risks and benefits by public, private, and non-profit sector entities, and should be tolerant of residual risk and rare, occasional failures.

Fundamental Principle 2: Improve collaboration between the federal government and SLTTs, respecting local expertise in mitigation investing.

The Investment Strategy supports increased and improved collaboration between the federal government and SLTTs, with federal respect for local and regional expertise to drive mitigation decisions and investments. This ground-up approach to mitigation investing will provide SLTTs with greater autonomy to address local and regional risks, increase fiscal accountability, and ultimately will lessen federal costs while reducing the total, long-term costs of natural hazards.

Fundamental Principle 3: Make data- and risk-informed decisions that include lifetime costs and risks.

The Investment Strategy supports the continued development and use of data- and risk-informed standards and metrics to create effective financial incentives for mitigation, measure success, educate the public about risk and mitigation, simplify policy and funding decisions, and develop common goals across the public, private, and non-profit sectors. Data and risk-informed analysis for mitigation investment requires a long-term perspective, looking at assets' costs and expected future risks associated with assets across the assets' full lifetime (or life cycle).¹⁰ The Investment Strategy also supports improving the ability of families, businesses, and federal government and SLTT leaders to understand risk and make risk-based decisions through use of incentives or choice architecture to steer decision-makers toward optimal outcomes for the public good.

C. Investment Strategy Development, Implementation, and Measurement

Development. Largely relying upon the expertise of its members, the MitFLG has formulated this version of the Investment Strategy with the express purpose of provoking thought, discussion, and feedback from the private and non-profit sectors, federal departments and agencies, and SLTTs.

The next version of the Investment Strategy will be the result of collaboration between public, private, and non-profit sector entities and reflect feedback from these groups. This combination of perspectives and expertise is critical to Investment Strategy development, because all categories of actors will have a role in implementing a *national* approach to mitigation investments. The MitFLG has charged a Stakeholder Engagement Sub-Committee (SESC) with ensuring that the Investment Strategy is developed following an inclusive approach that reflects a variety of perspectives from across the Nation. The SESC is developing and implementing a stakeholder engagement plan to involve a broad range of stakeholders, including but not limited to partners from SLTT governments, federal agencies, private sector, academia, and non-profit and professional organizations.

¹⁰ Recent studies suggest that long-time ownership of an asset may create an environment conducive for incentivizing such owners to engage in mitigation activities, as opposed to short-time ownership by investors who have fewer reasons to invest in mitigation. See, e.g., Urban Land Institute Center for Sustainability, *Returns on Resilience: The Business Case* (2015), available at <http://uli.org/wp-content/uploads/ULI-Documents/Returns-on-Resilience-The-Business-Case.pdf>.

The MitFLG and the National Mitigation Framework

The Mitigation Framework Leadership Group (MitFLG) is a national coordinating structure group established to coordinate mitigation efforts across the federal government. In particular, the MitFLG focuses on integrating federal efforts to deliver the mitigation core capabilities in the National Mitigation Framework. The MitFLG also assesses the effectiveness of mitigation capabilities as they are developed and deployed across the nation. The U.S. Department of Homeland Security (DHS) requested that the MitFLG reassess the federal approach to mitigation investment, with this Investment Strategy as the result.¹¹

Generally, the Investment Strategy complements and should be considered as a subcomponent of the National Mitigation Framework, which “establishes a common platform and forum for coordinating and addressing how the Nation manages risk using hazard mitigation capabilities and describes hazard mitigation roles across the whole community.”¹² The National Mitigation Framework is part of a broader national effort to improve preparedness, as set forth in Presidential Policy Directive 8: National Preparedness (PPD-8) within the National Preparedness Goal: “A secure and resilient Nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk.”¹³ As a contributor to this overall goal and strategy, the Investment Strategy will ensure that the nation is receiving the most beneficial return on its mitigation and resilience funding activities in a way that has equitable, social, environmental, and community co-benefits.

It is anticipated that the Investment Strategy will be an iterative document, and the recommendations identified in the strategy likely will change over time as the needs of communities and the Nation evolve.¹⁴

¹¹ FEMA, *Mitigation Framework Leadership Group (MitFLG)* (last updated Apr. 28, 2017), available at <https://www.fema.gov/media-library/assets/documents/116787>.

¹² DHS, *National Mitigation Framework* (2d ed. Jun. 2016), available at http://www.fema.gov/media-library-data/1466014166147-11a14dee807e1ebc67cd9b74c6c64bb3/National_Mitigation_Framework2nd.pdf.

¹³ DHS, *National Preparedness Goal* (2d ed. Sep. 2015), available at https://www.fema.gov/media-library-data/1443799615171-2aae90be55041740f97e8532fc680d40/National_Preparedness_Goal_2nd_Edition.pdf. PPD-8 directed the Secretary of Homeland Security to develop a National Preparedness Goal — through a coordinated effort with other Executive Branch departments and agencies and consultation with local, state, tribal, and territorial governments; the private and non-profit sectors; and the public — to define “the core capabilities necessary to prepare for the specific types of incidents that pose the greatest risk to the security of the Nation” and a series of National Planning Frameworks to coordinate efforts to deliver the capabilities defined in the Goal. The National Mitigation Framework is one of five frameworks developed to achieve the goal of a secure and resilient Nation with the capabilities required to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk across the whole community. The National Mitigation Framework addresses how the Nation will develop, employ, and coordinate core mitigation capabilities to reduce loss of life and property by lessening the impact of disasters.

¹⁴ It is hoped that appendices in the next version of the Investment Strategy will provide additional information related to mitigation investments, such mitigation-related resources and examples of leading practice case studies, ideas for pilot programs and projects that can be used as a way of testing its recommendations.

Implementation. The Investment Strategy is voluntary. Its implementation will occur incrementally as opportunities present themselves to various public, private, and non-profit sector entities. Immediate implementation by federal departments and agencies and SLTTs (to the extent permissible by current statutes, regulations, and policies) is highly encouraged. However, it is important to note that implementation not only is voluntary, but also is not intended to result in additional reporting requirements or other administrative burdens. The Investment Strategy explicitly avoids making recommendations that would require funding increases by the federal government.

Measurement. To avoid additional preparedness-related reporting requirements, the National Preparedness Report can be used to measure the success of the Investment Strategy (pending data availability). Each year the National Preparedness Report provides a snapshot of how well the Nation is prepared, including gaps, and successes.¹⁵ The National Preparedness Report focuses on recent-to-ongoing events and can show where mitigation activities reduce the consequence of natural hazard risk. For example, previous National Preparedness Reports have highlighted the recovery from Super Storm Sandy (five years after the disaster) and examined the recovery from Hurricane Katrina (ten years after the disaster). These retrospective analyses ensure that long-term mitigation efforts can be accounted with little-to-no additional administrative burden to report. The National Preparedness Report has proven itself successful in capturing public sector preparedness actions by the federal government and SLTTs, and the inclusion of private and non-profit sector efforts should demonstrate a more complete assessment of the national level of preparedness. Therefore, gaps in preparedness which can be addressed through the Investment Strategy's recommendations should also be highlighted in the National Preparedness Report.

D. Investment Strategy Outcomes and Recommendations

Outcomes. The Investment Strategy provides a series of recommendations organized around six outcomes, all of which are grounded in the Investment Strategy's fundamental principles. The outcomes represent desired end states potentially achieved by making mitigation investments more coordinated and effective:

Outcome 1: Coordination of risk mitigation and management improves between and among federal, public, private, and non-profit sector entities.

Outcome 2: Private and non-profit sector entities increase their investments in and innovations related to mitigation.

Outcome 3: SLTTs increasingly empowered to lead risk reduction activities and share responsibility and accountability with the federal government.

Outcome 4: Public, private, and non-profit sector entities develop and share more of the data and tools needed to make risk-informed mitigation investments.

¹⁵ See, e.g., FEMA, 2016 National Preparedness Report, available at <https://www.fema.gov/media-library/assets/documents/116951>.

Outcome 5: Public, private, and non-profit sector entities improve risk communication, leading to more risk-informed mitigation investments by individuals and communities.

Outcome 6: The built environment — whether grey or nature-based infrastructure, and including lifeline infrastructure, buildings and homes — becomes more resilient and promotes community resilience.

Although presented separately for purposes of organization, the intersection of the six outcomes — and the recommendations associated with each of them — is important to the overall Investment Strategy. For instance, improving coordination of risk mitigation and management between federal, SLTTs, and private and non-profit entities (Outcome 1) and increasing private and non-profit sector investments and innovations in resilience and mitigation (Outcome 2) can both help effectively and efficiently make the built environment more resilient (Outcome 6).

Recommendations. For each outcome, the Investment Strategy identifies recommendations — with analysis and illustrations where applicable — that will help achieve these outcomes. Appendix I lists all of the recommendations and the outcomes each supports. The criteria used to select these recommendations are described in Appendix II. Although each Investment Strategy recommendation is designed to stand on its own, the Investment Strategy is intended to be assessed as a whole.

Investment Strategy recommendations propose workable changes to the current national approach to mitigation investments that do not require either fundamental changes to law or increasing funding at the federal level. Although fragmented overall, national mitigation investments already include successful programs at every level of government and in the private and non-profit sectors. For example, although FEMA’s Pre-Disaster Mitigation (PDM) grant program is cost-effective by providing SLTTs funds *before* a natural hazard causes damage, it is limited in its scope, and dwarfed in size by *post*-disaster mitigation grants.¹⁶ However, it is not the place for the Investment Strategy to recommend that specific Federal programs like PDM be expanded or better funded.¹⁷ Instead, the Investment Strategy shares successful public, private, and non-profit sector programs, investments, and funding mechanisms, including PDM grants, to illustrate recommendations and provide examples for implementation of those recommendations.

Challenges. Achieving the outcomes through adoption and implementation of the recommendations included in the Investment Strategy will not be without challenges. For example, uniform standards and metrics which help simplify mitigation investment decisions

¹⁶ GAO, *Report to Congressional Requestors: Hurricane Sandy - An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, No. GAO-15-515 (July 2015), available at <http://gao.gov/assets/680/671796.pdf> (noting that PDM spending was only a fraction of spending on post-disaster mitigation grants: approximately \$222 million versus \$3.2 billion between 2011 and 2014).

¹⁷ Some federal departments and agencies are independently exploring ways of increasing the national focus on investment in mitigation through actions including partnerships, education and financial and non-financial incentives. For example, FEMA’s Federal Insurance and Mitigation Administration is pursuing a goal of increasing national mitigation investment by a factor of four over the next five years, focusing on incentive pilots and programs, technical assistance, and community and private sector awareness campaigns.

might not properly account for regionally-specific risks and related issues. In addition, at the federal level, differences in roles, rules, processes, and funding streams among departments and agencies mean that even if all relevant departments and agencies implement an Investment Strategy recommendation, such implementation likely will not be uniform without close communication and coordination. Finally, decision-makers implementing the Investment Strategy will face challenges in appropriately balancing equities, such as when deciding how to allocate resources to urban versus rural areas, or determining appropriate cost shares between federal and SLTT entities.

II. Recommendations

Investment Strategy recommendations are grouped, loosely, under the outcome which they best advance. Many, if not all, of the recommendations advance more than one outcome, and the recommendations should be read collectively. These recommendations — should they be followed — will help move the needle on improving coordination, effectiveness, and cost-sharing between and among federal, public, private, and non-profit sector entities with regard to mitigation investments, as well as meeting the Investment Strategy outcomes.

All of the following recommendations are limited to what is allowed by law.

Draft Investment Strategy Reminder: This initial set of recommendations, part of the Draft Investment Strategy, is an important milestone in the development of a truly national approach to mitigation investments, but it should not be mistaken for a finished product. These Draft Investment Strategy recommendations are expected to provoke thought, discussion, and feedback from private and non-profit sector stakeholders, and public sector representatives from all levels of government. This feedback will shape how the Investment Strategy continues to develop, as will additional research and analysis on the feasibility and effectiveness of the recommendations identified below.

Outcome 1 - Coordination of risk mitigation and management improves between and among public, private, and non-profit sector entities.

Public, private, and/or non-profit entities should:

- *Develop common vocabulary for understanding risk and mitigation*
- *Develop common metrics for evaluating mitigation and resilience*
- *Adopt complementary processes for applying for mitigation, preparedness, and recovery funds*
- *Modify federal processes to promote holistic approaches to risk management and mitigation planning*
- *Improve coordination between mitigation and other preparedness mission areas and allow community-based adaptations*
- *Incorporate evaluation of mitigation issues into continuous improvement processes*

Achieving comprehensive mitigation requires significant coordination on many fronts. Not only should entities on the same level — such as federal departments and agencies — align mitigation investments, but also public, private, and non-profit sector entities across levels and sectors should work together. While each entity may tackle mitigation programs differently — an entirely appropriate approach given the differences between communities across the Nation — the strategies should be coordinated and complementary to allow public, private, and non-profit sector entities to each perform their ideal role. Such coordination is not limited to these entities, as mitigation investments must be nuanced enough to work across temporal periods, geographical regions, disaster phases, and even ideologies.

Developing a common vocabulary of mitigation and resilience (Recommendation 1.1) and common resilience metrics and/or indices (Recommendation 1.2) should be done through public-private coordination, bringing together the expertise and experiences of public, private, and non-profit sector professionals. Further, to encourage coordination both before and after disasters, as well as simplify the grant process for all applicants, grant timelines and criteria among public departments and agencies should be aligned (Recommendation 1.3), prioritizing grants that promote cross-sector resilience planning and coordination (Recommendation 1.4). At all levels, there should be increased coordination between those who mitigate before disasters and those who respond to help communities prepare for, respond to, and recover from disasters, since mitigation should be incorporated into preparedness, response, and recovery (Recommendation 1.5), and continuously improved (Recommendation 1.6).

Recommendation 1.1: Public, private, and non-profit sector entities should, in a coordinated manner, develop and use a shared understanding of mitigation-related terms.

A fundamental challenge of mitigation is that individuals are often not speaking the same language, nor do they use the same analytical tools to measure the effect of a mitigation measure. The development and use of common vocabulary and common metrics would increase the public, private, and non-profit sectors' mitigation or resilience investments. For instance, a grant to improve healthcare outcomes may not be perceived as mitigation, even though healthy people are more likely to survive a natural disaster. In order to better coordinate mitigation investments,

a common understanding of exactly what is meant by relevant terms is needed between various stakeholders, including those from the public, private, and non-profit sectors. In these cases, the translation of terms can be an effective strategy, helping to identify common interests and goals. This shared understanding can provide a baseline for entities to collaborate and coordinate efforts. Without a common understanding of terms — such as mitigation, adaptation, and resilience — each entity will use its own definition, assuming that others share the same understanding. Misinterpretation of terms can lead to gaps, misunderstandings, and missed opportunities for collaboration. While it is likely a stretch to align all institutionalized definitions of mitigation across the public and private sectors, it is critical to ensure that definitions are aligned among mitigation investment stakeholders. This ensures that all involved entities are “working off the same sheet of music,” while allowing flexibility for different sectors and regions to meet their own needs.

It is not currently clear exactly what “counts” as a mitigation investment. Even calculating a federal baseline for mitigation investments is a difficult task, with estimates varying widely. Sharing a clear, common understanding of mitigation-related vocabulary can help to encourage investments by better promoting mitigation opportunities.

Recommendation 1.2: Public, private, and non-profit sector entities should, in a coordinated manner, develop and use common sets of metrics and indices for identifying and evaluating mitigation measures and overall resilience.

Common metrics and indices to define and measure mitigation and resilience — as to structures, infrastructure or communities — are rare.¹⁸ Such metrics and/or indices could be used in numerous ways by the public, private, and non-profit sectors, including: to assess and prioritize projects for public funding; to help identify the most cost-effective means to improve resilience; to contribute to the rating of risks associated with structures, projects, or communities; to rate bonds associated with communities; and to help homebuyers compare the resilience of homes.

Common metrics have been useful in other contexts — for example, EnergyStar and WaterSense have long helped consumers purchase products that are energy or water efficient. Developing a common agreement among one or more metrics and/or indices, so that the federal government, and public, private and non-profit sector entities rely on the same set of metrics or indices, could likewise help consumers as well as create cost simplification of, for example, federal cost-benefit requirements and processes. As with the development of a common vocabulary, reliance on a public-private partnership to develop such metrics and/or indices will engage expertise from both sectors and make common usage far more likely. Further, a variety of perspectives and contributions increases the likelihood that the mitigation and resilience metrics and/or indices would be holistic in nature, taking account of all aspects of natural hazard risk, mitigation, and resilience, including benefits of mitigation not directly related to property (e.g., decreasing social and economic vulnerability and improving human health and well-being).

¹⁸ One exception is the National Flood Insurance Program (NFIP)’s Community Rating System, which provides a system to rate the flood mitigation measures taken by communities that are members of the NFIP. See, generally, FEMA, *National Flood Insurance Program Community Rating System* (last updated Jun. 7, 2017), available at <https://www.fema.gov/national-flood-insurance-program-community-rating-system>. See also discussion of Recommendation 5.1.

The public, private and non-profit sectors should consider using existing assessment, tracking, reporting and communications tools and frameworks for building the business case to invest resources in resilience, even if they are still being developed and in their infancy. While resilience is a complicated area, rather than developing new tools and procedures for quantifying the performance and benefits of resiliency projects, entities could consider leveraging common or emerging data measures for evaluating progress and changes in a community's resilience, including common baselines, planning scenarios, durations and other financial and non-financial metrics. Without these measures it will be hard for resilience experts, communities and investors to evaluate the benefits of investing in one project over another and it will be hard for investors to justify making investments of any kind.

Recommendation 1.3: Public sector entities at the federal and SLTT levels should adopt, to the extent possible, complementary timelines, criteria, and streamlined application processes for different types of mitigation, preparedness, and recovery funds.

Aligning criteria and timelines of government funds and programs can be challenging due to funding source limitations, and barriers to implementation such as the appropriation language itself. Nevertheless, actions can be taken at both a federal and state level to make greater progress toward complementary eligibility criteria and processes. These efforts could help to ensure that jurisdictions are able to implement more holistic mitigation solutions, and simplify the process for public, private, and non-profit sector entities to apply for government funds. Developing state-federal eligibility criteria also could help to ensure that funding opportunities are as beneficial and tailored towards local needs as possible.

Complementary grant eligibility criteria may also potentially lessen the burden on applicants. One example of this from the preparedness domain is the cooperative agreement between two federal agencies which had distinct hospital preparedness programs and grant opportunities, but shared the goal of increasing health preparedness and community resilience.¹⁹ Their cooperative agreement aligned grant criteria and health preparedness goals among two distinct sets of grantees — allowing jurisdictions to implement holistic solutions across grantee audiences while simultaneously being less burdened by individual applications. Ideally, alignment of eligibility criteria would be done through coordination and consultation with partners at all levels of government to ensure the funding meets community needs.

Not all criteria for all mitigation grants could or should be identical, however. While some criteria (such as economic development and consideration of life cycle costs/savings) could be more universal, grant diversity is beneficial. For example, the U.S. Department of Housing and Urban Development (HUD)'s Community Development Block Grants (CDBG) often provide funding for projects that would not otherwise be covered under other mitigation grants like FEMA's Hazard Mitigation Grant Program.

¹⁹ The cooperative agreement between the U.S. Department of Health and Human Services and the Centers for Disease Control was signed in FY12, and renewed in FY17. More information on the FY17 agreement is available at <https://www.grants.gov/web/grants/view-opportunity.html?oppId=290860>.

1 In addition to potentially better aligning existing funding opportunities, complementary
2 procedures and guidance could lessen the burden on grant applicants, which could in turn help
3 eliminate barriers to mitigation activities by SLTTs. After Hurricane Sandy, 12 out of the 13
4 cities and states who responded to a federal survey reported that “navigating the multiple funding
5 streams and various regulations is a challenge that affected their ability to maximize disaster
6 resilience opportunities.”²⁰ While many federal programs help SLTTs navigate their individual
7 grants,²¹ the current burden is largely on SLTTs to understand all of the available funding
8 options. SLTTs understand their community needs best, and should be easily able to compare
9 available options to determine the best fit.

10
11 One potential mechanism for implementing this recommendation is by repurposing existing
12 federal resources to launch a mitigation web portal and an online “wizard,” i.e., an automated
13 interface. While Grants.gov provides a single portal for multiple grants, it does not provide an
14 easy-to-navigate tool for exploring funding opportunities. During and after disasters, a
15 streamlined wizard could reduce the burden on those seeking assistance at the entity level. For
16 example, the “Find Assistance” feature on DisasterAssistance.gov asks users to answer nine
17 questions to determine a personalized list of possible assistance geared towards individuals. A
18 similar tool could be configured to help SLTT officials and relevant private and non-profit sector
19 participants navigate mitigation funding opportunities for their communities or organizations: an
20 automated wizard associated with Grants.gov could ask users guided questions and then provide
21 a list of applicable funding and/or more references or other resources. To maximize efficiency,
22 the mitigation portal could share login information with Grants.gov, and serve as a “common
23 application” that auto-populated fields in different applications based on stored user data.

24
25 Additionally, a Grants.gov wizard could incorporate a benefit-cost analysis (BCA) resilience
26 planning tool that would be accepted by federal grant programs and which would reduce the risk
27 that one project would have different BCA calculations for different grant proposals. Smaller
28 SLTTs often do not have the resources to dedicate to an intricate BCA. After Hurricane Sandy,
29 11 of 13 states and cities responding to a federal survey reported that “local applicants may have
30 difficulty collecting the information required to complete FEMA’s Benefit Cost Analysis Tool or
31 their [grant program] . . . applications.”²² The wizard could, among other things, give guidance
32 on: (a) how to calculate losses avoided (e.g., lost economic productivity when rebuilding after
33 disaster), (b) how to address return on investment, (c) how to do a life-cycle analysis, including
34 an evaluation of the benefits that accrue over long timeframes, (d) how to consider and account
35 for access and functional needs, (e) the costs of potential system failures, and (f) other non-

²⁰ GAO, *Report to Congressional Requestors: Hurricane Sandy - An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, No. GAO-15-515, at p. 37 (July 2015), available at <http://gao.gov/assets/680/671796.pdf>.

²¹ For example, for communities with water and wastewater utilities, the Environmental Protection Agency developed the tool, Federal Funding for Utilities -Water/Wastewater - for National Disasters, to help these utilities find the most applicable disaster and mitigation funding from many federal agencies. See <https://www.epa.gov/fedfunds>.

²² GAO, *Report to Congressional Requestors: Hurricane Sandy - An Investment Strategy Could Help the Federal Government Enhance National Resilience for Future Disasters*, No. GAO-15-515, at p. 42 (July 2015), available at <http://gao.gov/assets/680/671796.pdf>.

mitigation benefits. This BCA resilience planning tool could either link to or incorporate the National Institute of Standards and Technology (NIST)’s Economic Decision Guide, which offers an approach to conducting the economic analysis related to, for example, mitigation activities, and a guided full examination of return on investment.²³

Recommendation 1.4: Federal departments and agencies should promote mitigation and resilience planning and coordination across sectors to build a more complete view of risk and resilience that includes socio-economic, health, and environmental factors.

Mitigation begins with a comprehensive understanding of risk based on a community’s vulnerabilities, threats, hazards, and capabilities. Comprehensive risk assessment and coordinated mitigation actions require a multi-sector approach addressing socio-economic, health, and natural and built environment factors. As the National Mitigation Framework states: *“Building and sustaining a culture of preparedness and a mitigation-mindset will make the Nation more socially, ecologically, and economically resilient before, during, and after an incident. Resilience in communities and the Nation depends on the whole community working together.”*²⁴

Federal departments and agencies are in a strong position to promote a more complete view of risk through an array of grant and contract mechanisms. As effective mitigation activities aim to improve community functioning for everyday — as well as extreme — events, grant and contract mechanisms relevant to mitigation exist in many mission spaces. The modification of grant application and procurement criteria and processes can benefit overall resilience, safety, and economic prosperity by prioritizing awards that include comprehensive risk identification (i.e. socio-economic, health, and environmental factors); cross-sector coordination of governmental and whole-community partners; and integrated planning. For example, HUD’s National Disaster Resilience Competition — while appropriately focused on meeting unmet needs from past disasters in a way that reduced harm during future disasters — provided a flexible platform for applicants to innovate and propose multi-sector projects that maximized community benefit (e.g., those that addressed issues from affordable housing, to health and public services, to environmental benefits, while meeting resilient recovery needs).

²³ Stanley W. Gilbert et al., *Community Resilience Economic Decision Guide for Buildings and Infrastructure Systems*, NIST Special Publication 1197 (Dec. 2015), available at <http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1197.pdf>. The NIST guide considers costs of a project, losses avoided, and other economic benefits that accrue from the investment. NIST has developed a tool to implement the approach, and is preparing to pilot test the tool with some communities before a full public release. See also NIST, *The Community Resilience Economic Decision Guide* (updated Apr. 5, 2017), available at <https://www.nist.gov/topics/community-resilience/community-resilience-economic-decision-guide>.

²⁴ DHS, *National Mitigation Framework*, at p. i (2d ed. June 2016), available at: http://www.fema.gov/media-library-data/1466014166147-11a14dee807e1ebc67cd9b74c6c64bb3/National_Mitigation_Framework2nd.pdf.

Recommendation 1.5: Public, private, and non-profit sector entities should improve coordination between mitigation and other national preparedness mission areas, to allow community-based adaptations to strengthen all aspects of affected communities and mitigate future natural hazards during the recovery period.

The National Disaster Recovery Framework asserts that “resilient and sustainable recovery encompasses more than the restoration of a community’s physical structures to pre-disaster conditions.” Mitigation approaches, and the expertise of mitigation professionals, can provide communities with the tools and strategies to “build back better” following extreme events such as natural disasters, as well as human-caused disasters and health emergencies. Strengthening the professional relationships between national preparedness mission area stakeholders and incorporating mitigation and preparedness considerations within recovery planning and practices can provide a solid framework for evidence-informed, community-led recovery and community-based mitigation actions during restoration and rebuilding. Coordination approaches — for example mitigation liaison positions for disaster recovery assistance or cross-sector mitigation teams — should base actions on local priorities and needs and make full use of community knowledge and capabilities.

Improvements in coordination between mitigation, preparedness, and recovery should extend to fiscal and programmatic mechanisms. The federal government and SLTTs should maximize flexibilities (as allowable) in preparedness and recovery funding and programs to address mitigation efforts. Ideally, such mitigation efforts should promote preparedness, resilient recovery and design, strengthen health, and improve social cohesion in order to mitigate adverse effects of future emergency events.

Programs beyond grants can improve mitigation, such as the U.S. Army Corps of Engineers (USACE) Silver Jackets Program. The objective of the national USACE Silver Jackets Program is to support state-led teams in collaboratively, comprehensively, and sustainably managing flood risk in the country. The program’s overarching goal is to facilitate strategic life-cycle flood risk management. Teams integrate the ongoing diverse flood-related programs and authorities of FEMA, USACE, other federal agencies, state agencies, and when appropriate, regional and local agencies.²⁵

Though funding is always helpful, the federal government should provide leadership and coordination, such as convening key stakeholders, sharing leading practices and lessons learned, raising awareness and conducting training, and developing business cases for investment.

Recommendation 1.6: Public sector entities should ensure that continuous improvement processes are put into place and that they incorporate mitigation strengths, innovations, and areas for improvement.

Identifying strengths and areas for improvement through continuous improvement processes help members of the whole community validate risk assessments and capability requirements; update plans based on documented gaps; determine and prioritize resource needs; and shape training and

²⁵ See *Silver Jackets: Many Agencies, One Solution*, available at <https://silverjackets.nfrmp.us/>.

exercise planning based on targeted needs and recent policy changes. This ongoing monitoring enables emergency managers to identify recurring areas for improvement, institutionalize and share lessons learned and best practices, and enhance decision-making to improve outcomes for survivors and communities. In short, such continuous improvement processes maximize the effectiveness of investments across all mission areas. While emergency management continuous improvement processes often focus on response and recovery operations, these processes should also identify lessons regarding mitigation and the resilience of both the built environment and the community as a whole.

FEMA provides several examples of how mitigation can be included in continuous improvement processes. For example, FEMA examined its implementation of the National Flood Insurance Program (NFIP) after Hurricane Matthew in 2016, in light of legislative changes and lessons learned since Hurricane Sandy. The after-action review team identified key findings and developed recommendations to improve process, data integration, and staffing. FEMA also conducted a Losses Avoided Study on North Carolina, which reviewed 2,240 of the 6,000 mitigated properties in North Carolina and estimated that these mitigation activities avoid losses of \$206 million to \$234 million. In particular, the Losses Avoided Study revealed the benefits of previous mitigation projects, such as the acquisition of Severe Repetitive Loss properties by FEMA that moved people and structures out of areas that likely would be impacted by future flooding; by removing these structures and maintaining the areas as open space, places like Lenoir County managed to decrease the losses experienced during Hurricane Matthew. In 2017, the NFIP Sandy Claims Review Division used a continuous improvement process on its claims review procedures which developed specific and actionable recommendations to help the Division improve branch-specific training and to develop processes, policies, and metrics across the entire division.

Outcome 2 - Private and non-profit sector entities increase their investments in and innovations related to resilience and mitigation.

Public, private, and/or non-profit entities should:

- *Support financial products that reduce natural hazard risks or costs*
- *Encourage investments in innovative mitigation-related tools and technologies*
- *Promote non-traditional models for financing mitigation activities*
- *Increase insurance coverage of individuals, businesses, and communities for natural hazard risks*

Mitigation is a national responsibility, one which requires expertise and resources from not just the federal government, but also SLTTs and, importantly, the private and non-profit sectors. Funding mitigation activities — whether by strengthening homes, improving public structures, protecting and promoting health, or making whole communities or regions more resilient via large-scale infrastructure projects or comprehensive, risk-informed planning — is the responsibility of *all* sectors. In fact, the private and non-profit sectors, with assistance from the public sector, can unlock capital in innovative ways to help fund a more resilient Nation. Foundations and other non-profit entities can advocate for “patient capital” that is willing and able to accept either lower returns or is not subject to earnings and short-term timing pressures, as well as help identify and calculate additional non-financial returns accruing from resiliency,

environmental and social benefits. All stakeholders can contribute to “blended finance” transactions, which allow investors to tie returns to their expectations and timing requirements.

The federal government and SLTTs can help the private and non-profit sectors increase investments and innovation related to mitigation by removing barriers and otherwise supporting financial products (Recommendation 2.1) and other technological innovations (Recommendation 2.2) related to risk and mitigation, or by using nontraditional funding mechanisms to encourage innovation and identify leading practices (Recommendation 2.3) as well as increasing insurance coverage (Recommendation 2.4). By following these recommendations, the public sector can maximize the effectiveness of its investments and further harness the private and non-profit sectors as a national engine for mitigation.

Recommendation 2.1: Federal departments and agencies, and SLTTs, should remove barriers for, and otherwise support development of, financial products that reduce natural hazard risks and/or the costs of recovering from natural disasters.

Working with private and non-profit sector partners, federal and SLTTs can develop and mobilize strategies to attract private and non-profit capital to mitigation activities through financial products that yield returns when those activities succeed in delivering results. Such financial products — which provide capital or risk transfer tools for the individual, business, or community *and* a return on investment for the financial institution and/or investors — include insurance, resilience bonds, impact bonds, and insurance-linked securities such as catastrophe bonds.²⁶ In some instances, governmental bodies can use these financial products to support the financial and physical resilience of public infrastructure and lands. In other instances, the federal government and SLTTs can help remove barriers for the development of financial products that fund resilience and reduce the costs of responding to and recovering from natural disasters. In either case, government support for innovative financial products focused on mitigation can attract the fiscal interest of new sources of capital, providing private and non-profit sector funding for private and public projects that increase national resilience to a variety of natural hazards. Moreover, this recommendation requires public-private collaboration and will help spur private and non-profit sector investment in resilience projects that benefit communities and the Nation as a whole.

For example, following Superstorm Sandy, New York City’s Metropolitan Transportation Authority (M.T.A.) issued \$200 million of catastrophe bonds, a structured debt instrument that transferred catastrophic risk from M.T.A to the capital markets,²⁷ to protect against storm

²⁶ “Resilience bonds” are instruments which evaluate the impact of a resilience project on the investor’s expected loss. These are currently under development and are an intriguing option for communities seeking to fund resilience-specific projects.

²⁷ See Federal Insurance Office, U.S. Department of the Treasury, *The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States*, at p. 39 (Dec. 2014), available at <https://www.treasury.gov/initiatives/fio/reports-and-notice/Documents/FIO%20-Reinsurance%20Report.pdf> (defining catastrophe bonds and other alternative reinsurance instruments).

1 surge.²⁸ If Sandy-level storm surge occurred anytime in a three year period, the investors would
2 help shoulder the cost of rebuilding; if it did not occur, investors would get back their principal
3 plus 4.5 percent annually above Treasury rates.²⁹ Catastrophe bonds have also been used to
4 transfer risks presented by earthquakes³⁰ and wind.³¹ For instance, the California Earthquake
5 Authority successfully brought a \$925 million catastrophe bond to market in May 2017.³²
6

7 The Forest Resilience Bond illustrates another possibility for public-private partnerships to
8 develop and use innovative financial products that promote resilience. The Forest Resilience
9 Bond, which deploys private capital to fund forest restoration treatments, was developed by Blue
10 Forest Conservation in partnership with the World Resources Institute, Encourage Capital, and
11 the American Forest Foundation with support from a 2016 Conservation Innovation Grant from
12 the National Resources Conservation Service. In this pay-for-success approach, beneficiaries
13 (such as private landowners, public agencies, utilities) repay private investors over time for
14 forest treatments that yield desired benefits such as water quality protection, increased water
15 yield, and regulated water flow.³³ Working with Blue Forest Conservation, and in coordination
16 with other stakeholders including academia, NGOs, and state experts, the U.S. Forest Service is
17 exploring use of the Forest Resilience Bond model for restoration on public and private forest
18 lands, including identifying strategies for overcoming barriers and implementing the model
19 within the bounds of federal laws such as the National Environmental Policy Act and federal
20 appropriations law.
21

22 Similar models for public-private partnership to enhance community resilience can be seen in
23 urban areas. For example, in partnership with DC Water, Quantified Ventures, a pay-for-success
24 broker, closed the Nation's first Environmental Impact Bond (EIB) in September 2016. This
25 new, highly-replicable financing mechanism allowed DC Water to shift the performance risk of
26 their infrastructure project to EIB investors. Through an iterative process of outcomes research,
27 analysis and collaboration across disciplines (e.g. finance, engineering, legal), the result was the
28 Nation's first EIB, a \$25 million tax-exempt bond sold in a private placement. As a result, DC

²⁸ Georgia Levenson Keohane, "Preparing for Disaster by Betting Against It," *New York Times* (Feb. 12, 2014), available at <https://opinionator.blogs.nytimes.com/2014/02/12/preparing-for-disaster-by-betting-against-it/>.

²⁹ *Id.*

³⁰ Artemis, *Catastrophe Bond and Insurance-Linked Securities Deal Directory: Embarcadero Re Ltd. (Series 2012-2)*, available at http://www.artemis.bm/deal_directory/embarcadero-re-ltd-series-2012-2/.

³¹ Artemis, *Catastrophe Bond and Insurance-Linked Securities Deal Directory: Calypso Capital II Ltd. (Series 2013-1)*, available at http://www.artemis.bm/deal_directory/calypso-capital-ii-ltd-series-2013-1/.

³² Matthew Lerner, "California Earthquake Authority's \$925 million cat bond is one of the largest ever," *Business Insurance* (May 23, 2017), available at <http://www.businessinsurance.com/article/20170523/NEWS06/912313540/California-Earthquake-Authority-catastrophe-bond-Swiss-RE>.

³³ Todd Gartner & Chad Reed, "The Forest Resilience Bond: Leveraging Innovative Finance, Science, and Partnerships to Fight Drought and Wildfire," *World Resources Institute Blog* (Nov. 3, 2016), available at <http://www.wri.org/blog/2016/11/forest-resilience-bond-leveraging-innovative-finance-science-and-partnerships-fight>.

Water will pay for outcomes rather than paying for a project and hope the desired outcomes will follow.³⁴

Recommendation 2.2: Public, private, and non-profit sector entities should encourage investments in developing and deploying new and improved tools and technologies related to mitigation.

Innovation in support of mitigation goes well beyond financial products, and also includes new mitigation-related tools and technologies. In order to encourage investments in mitigation technologies, public, private and non-profit sector entities alike should use all available avenues to support, fund, and increase awareness of such tools and technologies and to improve modeling, testing, and prototyping of new resiliency materials to improve performance and service life. In particular, the federal government and SLTTs should consider the ways that their grants, contracts, design competitions,³⁵ and technology incubations programs can help foster the development of such tools and technologies.

The possibilities for mitigation technology innovation are near limitless. Examples of technologies that could help homeowners mitigate natural hazard risk directly include, but are not limited to, impact-resistant glass that can minimize or avoid exploding or imploding windows and doors from flying debris and high winds during hurricanes, tornados, and tropical storms.³⁶ Technologies that provide data to measure and improve mitigation — including but not limited to weather-smart equipment and technologies such as “smart homes” and sensors that detect changes in pressure and temperature in materials — also support economic development and national resilience. For example, the Delaware Department of Transportation is developing a weather and flood monitoring system which would build and test new, low-cost (under \$200/unit) flood sensors throughout the state. Also, the Environmental Protection Agency developed an on-line tool, Hazard Mitigation for Natural Disasters: A Starter Guide for Water and Wastewater Utilities to help these utilities participate in the FEMA mitigation process and provide ideas for mitigation technologies and strategies.³⁷ Such programs provide opportunities for public-private collaboration and partnership and job growth.

³⁴ Quantified Ventures, *DC Water's Green Infrastructure Environmental Impact Bond Overview*, available at <https://static1.squarespace.com/static/558071a0e4b00a2971965f06/t/58d90f7a86e6c087a943a51b/1490620284529/DC+Water+EIB+Overview.pdf>.

³⁵ Design competitions are discussed in greater detail in connection with Recommendation 2.3.

³⁶ Urban Land Institute Center for Sustainability, *Returns on Resilience: The Business Case*, at 5 (2015), <http://uli.org/wp-content/uploads/ULI-Documents/Returns-on-Resilience-The-Business-Case.pdf>.

³⁷ See <https://www.epa.gov/waterutilityresponse/hazard-mitigation-natural-disasters-starter-guide-water-and-wastewater>.

Recommendation 2.3: Public, private, and non-profit sector entities (in public-private partnerships, where feasible) should identify, evaluate, pilot, and promote non-traditional models for financing mitigation activities that promote leading practices and provide additional benefits to the funding resources.

All sectors should explore and promote mitigation financing mechanisms beyond traditional models. Funding models could be designed to promote collaborative, cross departmental and regional planning; leverage partner efforts and resources; and remove barriers to the adoption of new technologies and processes that can help make communities more resilient. New models might help early adopters overcome financial barriers such as the cost of legal and policy reforms. Innovative financing may deliver important side benefits that extend beyond those who receive funding: for example, financing through a competitive process can change the way *all* competition participants engage in mitigation planning, ultimately enhancing their ability to bounce back in the face of disaster even if they are not awarded funds through the competition itself. Such funding mechanism alternatives are not limited to federal programs; they can also be used by or in partnership with public, private and non-profit sector entities.

Integrating innovative approaches as one tool in a toolbox of public and private funding mechanisms can help to strengthen the Nation’s approach to mitigation, but these innovative funding mechanisms cannot and should not supplant traditional funding processes completely. On-the-ground conditions should inform which funding mechanism or combination of funding mechanisms are appropriate and viable, and the approach taken by the funder. The assessments referenced in the National Disaster Recovery Framework could provide a model for assessing which types of funding mechanisms may be appropriate in a given circumstance.³⁸

HUD’s National Disaster Resilience Competition is one example of an innovative funding mechanism supplementing existing allocation processes. The Disaster Relief Appropriations Act (P.L. 113-2) included disaster recovery funds from presidentially declared disasters in 2011, 2012 and 2013. About \$14 billion of this appropriation was allocated through the usual processes and formulas, based on federal agency data for all eligible jurisdictions. HUD determined, however, that the data did not adequately represent the remaining unmet need, and decided to make approximately \$1 billion in funds available through a competitive process designed to foster evidence-based, collaborative approaches to resilience.³⁹ In order to help eligible applicants adapt to this new competitive model and generate innovative projects without violating federal law, the Rockefeller Foundation served as a coach and resource to grantees. Rockefeller engaged nearly 350 resilience experts from varied disciplines, and hosted a series of “resilience academies” to help applicants formulate their proposals, pushing proposal teams to think beyond traditional solutions to those that would help address social, economic and environmental issues within their communities while also bolstering resilience. In addition to

³⁸ DHS, *National Disaster Recovery Framework, Second Edition* (2d ed. Jun. 2016), available at https://www.fema.gov/media-library-data/1466014998123-4bec8550930f774269e0c5968b120ba2/National_Disaster_Recovery_Framework2nd.pdf.

³⁹ HUD, *Community Planning and Development: National Resilience Disaster Recovery Phase TWO* (Jun. 2015), available at <https://portal.hud.gov/hudportal/documents/huddoc?id=2014ndrc2-nofa.pdf>.

1 informing competition proposals, these academies also taught skills that allowed the 50
2 participating SLTTs to strengthen their approaches to resilience overall, benefitting communities
3 whether or not they submitted a winning proposal.⁴⁰ Proposals were reviewed by interagency
4 federal panels, and ultimately HUD selected 13 winning proposals from across the country.

5
6 Washington State's Floodplains by Design partnership is another powerful example of public
7 and private financial collaboration that is inclusive of public, private, and non-profit funding.⁴¹
8 Washington State's floodplain serves a broad range of community economic, natural and cultural
9 needs, yet floodplain management, particularly around Puget Sound, has not kept pace with
10 growth. Homes and businesses are increasingly at risk from flooding, water quality has declined,
11 and habitat critical to restoring salmon populations is disappearing. The Floodplains by Design
12 public-private partnership is now implementing projects that meet broad community resilience
13 needs, including flood protection, habitat restoration, water quality improvement, and enhanced
14 outdoor recreation. By combining various forms of public and private funding to promote
15 adaptation and resiliency, and integrating flood risk reduction with habitat protection and
16 restoration, Washington State is addressing diverse floodplain management and ecosystem
17 recovery goals while ensuring public dollars are well spent.

18
19 Non-traditional financing mechanisms can also help individuals mitigate their homes against
20 natural hazard risk. The North Carolina Insurance Underwriting Association (also called the
21 Coastal Property Insurance Pool), a non-profit association created by the North Carolina General
22 Assembly to provide a residual insurance market for high-risk properties, began a pilot program
23 in 2017 to help its policyholders pay for improving their roofs. Through this program, Coastal
24 Property Insurance Pool policyholders in certain territories of North Carolina received a no cost
25 endorsement to their homeowners' policy under which they could, if they suffered a covered
26 cause of loss resulting in more than 50 percent damage to the roof during a prescribed time
27 period, upgrade their roof to an industry approved standard at no additional cost.⁴² Following the
28 upgrade, the policyholders will received a mitigation credit of approximately 7 percent against
29 the price of their policy.

30
31 As federal, public, private and non-profit sector entities identify, evaluate, pilot, and promote
32 non-traditional models for financing resilience, many potential solutions could be better explored
33 and expanded. Proven solutions to consider include repayments, increases in user fees, storm
34 water fee rebates for replacing impervious sites, bundling utility fees for increased use of
35 renewables and implementation of efficiency gains.

36
37 **Recommendation 2.4: Public and private sector entities should coordinate to**
38 **increase insurance coverage by individuals, businesses, and communities for natural**
39 **hazard risk.**
40

⁴⁰ Rockefeller Foundation, *National Disaster Resilience Competition*, available at <https://www.rockefellerfoundation.org/our-work/initiatives/national-disaster-resilience-competition/>.

⁴¹ See www.floodplainsbydesign.org.

⁴² The standard used by the Coastal Property Insurance Pool is the Insurance Institute for Business & Home Safety (IBHS) FORTIFIED Home – Hurricane Bronze Level. The FORTIFIED Home program is discussed in further detail in Recommendation 6.3.

Insurance that protects against the risk of natural hazards, whether through homeowner policies or disaster-specific policies for floods or earthquakes, provides policyholders with immediate resources for post-disaster recovery and, in doing so, protects governments, individuals, communities and businesses from unanticipated and costly outlays from disasters. However, a coverage gap exists: many people, businesses, and communities around the Nation are un- or under-insured with regard to natural hazard risk. The federal government should work with SLTTs and the private sector to create incentives for individuals, businesses, and communities to purchase insurance; in turn, insurers should continue to provide incentives, through pricing signals and other mechanisms, for policy holders to reduce their risk exposure through mitigation.

For example, flood insurance — whether it is purchased from the National Flood Insurance Program (NFIP) or through private carriers — enables insured survivors to recover more fully after flood event. The NFIP makes flood insurance available for homeowners, renters, and businesses in 22,235 NFIP-participating communities in all 50 states and six territories, helping customers manage flood risk and reducing the financial burden when floods occur. The NFIP currently provides a total of \$1.25 trillion in coverage for approximately five million policyholders. FEMA is working to double the nation’s flood insurance coverage — whether public or private — by 2023. To meet this ambitious goal, both the NFIP and an expanded private market will need to markedly increase flood insurance coverage across the Nation.

Outcome 3 – SLTTs increasingly empowered to lead risk reduction activities and share responsibility and accountability with the federal government.

Public, private, and/or non-profit entities should:

- *Identify community-based mitigation training needs and deliver more targeted training to communities*
- *Create consumer assistance programs that incentivize mitigation*
- *Align financial incentives and cost-sharing for mitigation projects*

While the federal government can and should play a role in national mitigation, the vast majority of mitigation activities should come from SLTTs who are in the best position to understand local and regional risks, and how best to mitigate those risks. Training therefore should be targeted to community-based mitigation and resilience needs to further empower SLTTs’ efforts (Recommendation 3.1). SLTTs are also in the best position to incentivize their residents to take action by creating programs that encourage individuals to reduce their vulnerabilities (Recommendation 3.2), and to target financial incentives to mitigation efforts (Recommendation 3.3).

Recommendation 3.1: Public, private, and non-profit sector entities should coordinate to identify community-based mitigation and resilience training needs in order to develop and deliver more targeted training for communities and/or regions.

Effective mitigation training should be based on local risks, needs, and knowledge gaps. Mitigation training development and delivery is an area which would benefit from increased coordination between public, private and non-profit sector partners, resource sharing,

1 technological innovation, and whole community inclusion. For example, partners can co-host
2 workshops that bring together government officials, project sponsors, funding agencies,
3 community advocates, academia, and other stakeholders to create regional approaches to
4 mitigation. Notably, technology such as web-based training and engagement mechanisms can
5 reach far wider audiences than in-person training. Community-centered training, such as is done
6 in the Rockefeller Foundation’s 100 Resilient Cities Network, can bring together diverse
7 stakeholders and allow for cross-sector education and a more holistic view of risk that
8 encompasses socio-economic, health, and natural and built environment concerns.

9
10 Partnering with the private and non-profit sectors can help the federal government deliver
11 training in a more nimble format. For example, WoodWorks, an initiative of the Wood Products
12 Council, provides free, one-on-one technical support to architects and engineers on wood
13 building design. Through partnerships with the U.S. Forest Service, major North American
14 wood associations, and other organizations, WoodWorks promotes the construction of wood
15 buildings and provides technical expertise on a wide range of building types including schools,
16 mid-rise/multi-family, commercial, corporate, franchise, retail, public, institutional and more.
17 Building with wood provides a resilient construction material. Not only are mass timber
18 technologies, such as cross-laminated timber slow to burn during fire events, but they are
19 resilient to earthquake and other extreme events.⁴³ This characteristic allows communities to be
20 resilient in the face of natural disasters and also allows for a faster rebuild, as has occurred in
21 Italy and New Zealand after seismic events.⁴⁴ WoodWorks hosts yearly conferences across the
22 country and provides workshops and training opportunities on a range of topics to expose
23 architects and engineers to wood design. To encourage further advancement, WoodWorks hosts
24 a series of awards, known as the Wood Design Awards. These awards acknowledge excellence
25 in wood design, engineering and construction, and highlight innovative projects that demonstrate
26 qualities such as sustainability, strength, versatility, cost effectiveness and beauty.

27
28 **Recommendation 3.2: Public sector entities should create consumer assistance or**
29 **other similar programs to incentivize mitigation.**
30

31 Consumer assistance programs have shown promising results at the state level to provide
32 individuals with assistance in reducing their vulnerabilities. Providing incentives at the
33 individual level can help to encourage mitigation activities. One example is California’s Capital
34 Access Program’s Seismic Safety Loan Program, which authorizes the state to provide financial
35 incentives to private lenders to finance seismic retrofits.

36 SLTTs can also work in concert with federal programs to incentivize individual mitigation
37 activities. For example, Harris County, Texas combined local funding and FEMA Hazard
38 Mitigation Grant Program funding to create a program that allows homeowners who had
39 experienced repetitive flood losses to sell their homes to the county at market value. The county
40 turned the underlying land into open space, and prohibited any future construction in the area.
41 Had this program not existed prior to the 2015 Memorial Day floods, Harris County would have
42 had a projected 550 additional homes flooded, and approximately \$12.4 million in additional
43 losses.

⁴³ See <http://www.rethinkwood.com/>.

⁴⁴ See, e.g., David Killick, “Timber has huge potential for rebuild,” *The Press* (May 14, 2014), available at <http://www.stuff.co.nz/the-press/opinion/perspective/10041501/Timber-has-huge-potential-for-rebuild>.

1
2 A potential limitation to this recommendation is the reality of limited funding. Public sector
3 entities face resource constraints and competing priorities. However, creative cost-effective
4 methods to reduce vulnerabilities and increase resilience in certain jurisdictions could be
5 modified and used to benefit other jurisdictions. Sharing promising practices between public
6 sector entities could help to save time and effort, potentially encouraging creative solution
7 adoption. Public, private, and non-profit sector entities should consider ways to identify and
8 disseminate such practices.

9
10 **Recommendation 3.3: Public, private, and non-profit sector entities should align**
11 **financial incentives and cost sharing for mitigation projects.**
12

13 Continuing to replace buildings and infrastructure without accounting for future conditions,
14 while implicitly relying on the federal government to fund any future recovery costs, is
15 unsustainable. Targeted incentives to encourage mitigation and the consideration of future
16 conditions either during new construction or during recovery, can lead to reduced losses when
17 disasters do occur. Further, targeted investments in mitigation measures that improve the
18 ultimate resilience of a new structure or infrastructure project should be considered as a way for
19 public sector funds to assist private and non-profit sector projects. These incentives should be
20 directed both at individuals contemplating improvements to their homes or businesses and public
21 sector entities contemplating physical mitigation projects (e.g., infrastructure) or systemic
22 mitigation (e.g., passing and enacting building codes).

23
24 Currently, programs exist at the federal government and SLTT levels, as well as within the
25 private and non-profit sectors, that provide financial incentives to support mitigation activities.
26 For example, some state and/or local governments, such as South Carolina, provide tax
27 incentives for retrofits that increase a building's structural resistance to hurricane, winds, and
28 floods.⁴⁵ Certain localities in Alabama also provide incentives through building permit rebates.⁴⁶
29 And some states require insurers to provide set premium discounts for policyholders that meet
30 home construction and retrofit standards and programs like the IBHS FORTIFIED program.⁴⁷ In
31 the private and non-profit sectors, even when insurers do not offer explicit discounts, premiums
32 reflect risk so improved resilience can result in lowered premiums. The same holds true for
33 insurance sold through the NFIP, managed by FEMA. The NFIP also offers policyholders
34 community-wide discounts when communities take certain mitigation measures through the
35 Community Rating System.⁴⁸ At the federal level, incentives could also include removing
36 barriers that prevent federal funds from being used to support resilient design (including

⁴⁵ South Carolina Department of Insurance, *State Income Tax Credits for Fortification Measure*, available at <http://www.doi.sc.gov/593/State-Income-Tax-Credit-for-Fortificatio>.

⁴⁶ City of Orange Beach, Alabama, Ordinance No. 2012-1145 (2012), available at http://www.cityoforangebeach.com/pages_2011/pdfs/ordinances/2012/2012-1145_Building_Codes_2012_Adopted.pdf.

⁴⁷ See IBHS, *Build Strong. Build FORTIFIED. The National Standard for Resilient Construction*, available at <https://disastersafety.org/fortified/>.

⁴⁸ FEMA, *Community Rating System* (last updated Mar. 7, 2017), available at <https://www.fema.gov/community-rating-system>. See also discussion of Recommendation 5.1.

recovery funding) or encouraging the integration of resilience and mitigation measures in agency grants, technical assistance, and other programs.

A post-Katrina storm mitigation incentive program enacted by the State of Louisiana exemplifies how public funds can create a financial incentive for individuals to invest in mitigation. The program is open to any homeowner in Louisiana and covers either retrofit of an existing home or construction of a new residence that meets the program requirements. The state requires an inspection certification by a building code enforcement officer, registered architect or engineer, or registered third-party provider authorized by the Louisiana State Uniform Construction Code Council. Homeowners can receive a tax deduction of up to 50% of the cost paid for the retrofit, less the value of any other state, municipal, or federally-sponsored initiative. The taxpayer must claim the homestead exemption for the home being retrofitted and the home cannot be a rental property. The tax deduction is capped at \$5,000 per structure and is claimed on the tax return for the year the work is completed.⁴⁹ The California Earthquake Authority provides another example: the Earthquake Brace + Bolt initiative was developed to help homeowners lessen the potential for damage to their houses during an earthquake.⁵⁰

As decision- and policy-makers in the public, private and non-profit sectors consider the use of such incentives as a lever to improve community and individual resilience, they should coordinate to align those incentives and communicate that alignment to the greatest extent possible. In particular, making the availability of aligned incentives better known could increase private and non-profit sector investment in projects that increase community and individual resilience, spur job growth among those providing resilience-related products and services, or encourage individuals to invest in mitigation measures for their own homes and property. Potential barriers to incentives include funding limitations and the possibility of diverting funding from other opportunities. However, the economic and community rewards for engaging in mitigation activities could help to overcome these barriers.

Outcome 4 – Public, private and non-profit sector entities develop and share more of the data and tools needed to make risk-informed mitigation investments.

Public, private, and/or non-profit entities should:

- *Enhance the availability and usability of federal data*
- *Identify and share leading practices and case studies demonstrating the value of mitigation investments*

Data lies at the heart of informed decision-making, and risk-informed mitigation investments, in particular, require risk and resilience data. The federal government makes significant investments on behalf of taxpayers in collecting, organizing, and maintaining data related to natural hazards. For example, FEMA’s Risk MAP program invests in flood mapping and flood

⁴⁹ Louisiana Department of Insurance, *Storm Mitigation Incentives FAQs*, available at <https://www.lidi.la.gov/docs/default-source/documents/propertycasualty/storm-mitigation-faq.pdf?sfvrsn=18>

⁵⁰ See <https://www.earthquakebracebolt.com/>.

1 risk analysis, and participates in the Federal Government’s 3D Elevation Program to obtain
2 better land surface elevation data through new technologies such as light detection and ranging
3 (LiDAR). SLTTs also collect such information, as do private sector and non-profit sector
4 entities, such as infrastructure companies any universities.

5
6 Subject to relevant laws and commercial considerations, all entities with access to natural hazard
7 data and information should improve how they share natural hazard data. Making data and tools
8 more readily available and usable should improve investment decision-making by public,
9 private, and non-profit sector entities and, ultimately, national resilience.

10
11 In particular, federal departments and agencies should enhance the usability of federal data by
12 adopting open source, standardized formats for risk and resilience data that is readily available
13 through a single website (Recommendation 4.1). In addition, federal, SLTT, private sector, and
14 non-profit sector entities should better coordinate with regard to the dissemination of leading
15 practices for mitigation, so that communities can make better informed resilience investment
16 decisions (Recommendation 4.2).

17
18 **Recommendation 4.1: Federal departments and agencies should enhance the**
19 **availability and usability of federal risk and resilience data.**

20
21 The federal government already is committed to providing easy access to unclassified data.⁵¹
22 Through user-centered design and customized approaches, federal departments and agencies can
23 and should include their efforts toward easy access to data increasing the availability and
24 usability of data needed by federal, public, private, and non-profit sector entities to make the
25 most effective, risk-informed mitigation investments possible.

26
27 As a first step, federal departments and agencies should assess exactly which of their risk and
28 resilience data is the most relevant for improving resilience investments. Further discussions
29 with consumers, communities, and NGOs should help identify which financial, economic,
30 engineering, stream gage/hydrologic, health, and other data related to natural hazard risk and
31 resilience is most useful to them. For example, the Hurricane Sandy Task Force identified a
32 need for aggregated, personally identifiable information-scrubbed data about disaster-affected
33 populations.⁵² When assessing data needs, it should be recognized that the same data can be used
34 for different purposes, only some of which may be relevant for improved mitigation.

35
36 Federal departments and agencies should also consider repurposing existing resources and
37 personnel to have designated “resilience data stewards” who could serve as “point persons” for

⁵¹ See, e.g., Office of Management and Budget, Memorandum for the Heads of Executive Departments and Agencies, No. M-13-13 (May 9, 2013), *available at* <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-13.pdf> (requiring federal agencies “to collect or create information in a way that supports downstream information processing and dissemination activities. This includes using machine-readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts.”).

⁵² Hurricane Sandy Rebuilding Task Force, *Hurricane Sandy Rebuilding Strategy*, at 145 (Aug. 2013), *available at* <https://portal.hud.gov/hudportal/documents/huddoc?id=HSRebuildingStrategy.pdf>.

1 identifying their departments or agency’s existing data sets relating to natural hazard risk
2 management and mitigation. The stewards could spotlight significant data limitations whether
3 with respect to sharing data outside their agencies (such as data created for official use only,
4 privacy requirements and/or costs to prepare data for public release) or with respect to the data
5 itself (for example, aggregation issues). The identified data need not necessarily be gathered for
6 the purpose of improving mitigation, so long as it bears upon risk mitigation as determined
7 through discussions with end-users. Nor need the data be exclusively federal, so long as it is
8 within the federal government’s authority to distribute that data.⁵³

9
10 Next, federal departments and agencies should evaluate how they can provide the desired data in
11 usable formats that best meets the needs of its “customers”: taxpayers (including businesses,
12 individual consumers, and non-profits) and SLTTs. Federal departments and agencies should
13 consult with SLTTs and private, and non-profit sector entities about how they currently collect
14 risk- and resilience-related data, and whether there are any improvements they can make to the
15 collection and reporting of nationwide data.

16
17 Gathering data is important, but equally important is the ability to transfer data in a format that is
18 available and accessible to others. As the cost of technology drops and the granularity of data
19 collected increases, this includes the need to identify leading practices in sharing data and
20 information that is too data-intensive to share across traditional distribution technologies. To the
21 greatest extent possible consistent with their information technology capabilities and information
22 security practices, federal departments and agencies should use “open source” software for
23 which the original source code is made freely available and may be redistributed or modified as
24 needed.⁵⁴

25 Finally, risk- and resilience-related data should be available through a single website, whether it
26 is directly downloadable from that site or through links to other websites. Federal departments’
27 and agencies’ resilience data stewards could help ensure that the single risk and resilience
28 website includes links to relevant data sets within their agencies.⁵⁵ The proposed website could
29 be a modification of existing tool, such as www.data.gov, that highlights natural hazard risk and
30 mitigation. Alternately, a specific new website could be created, modeled on
31 www.healthdata.gov, a “site dedicated to making high value health data more accessible to

⁵³ For example, the U.S. Geological Survey’s stream gaging network is currently funded in partnership with over 850 federal government and SLTTs. See U.S. Geological Survey, *USGS Federal Priority Streamgages (FPS)* (page last modified Feb. 10, 2017), available at <https://water.usgs.gov/nsip/>.

⁵⁴ Pending legislation would “expand the Government’s use and administration of data to facilitate transparency, effective governance, and innovation” including the use of an “open format” for any “Government data asset.” See S. 760 – OPEN Government Data Act. This legislation has been endorsed by a number of businesses, industry groups, civil society organizations, and transparency advocates. See Letters to Senate Committee on Homeland Security and Governmental Affairs and House Committee on Oversight and Government Reform (Apr. 5, 2017), available at <https://www.datacoalition.org/wp-content/uploads/2017/04/2017-OPEN-gov-data-act-support-letter-full.pdf>.

⁵⁵ They also could serve as points of contact for resilience-related data requests, as well as coordinate with their agencies’ privacy officials and Chief Information Officers. See, e.g. Hurricane Sandy Rebuilding Task Force, *Hurricane Sandy Rebuilding Strategy*, at pp. 147-48 (Aug. 2013), available at <https://portal.hud.gov/hudportal/documents/huddoc?id=HSRebuildingStrategy.pdf>.

entrepreneurs, researchers, and policy makers in the hopes of better health outcomes for all.”⁵⁶ This website has been praised as “a useful example of a publicly available data website that is comprehensive, secure, and easy to navigate”⁵⁷ — attributes which any risk and resilience data website should share.

In short, the federal government needs to ask — and answer — whether there are better means to define, share, integrate, and convey its data to better communicate risk.

Recommendation 4.2: Public, private, and non-profit sector entities should bolster existing efforts to disseminate leading practices, including an inventory of programs and case studies demonstrating the value of, and “business case” for, mitigation investments.

In addition to facilitating access to risk and resilience data, federal departments and agencies must translate that data into knowledge and actions in order to maximize the data’s effective. The translation of such data into knowledge and action can empower communities to tailor mitigation investments – including infrastructure improvements – to meet their local needs.

Federal departments and agencies already have taken several steps to provide the necessary “know-how” for translating words into action, and more efforts are underway which should be supported and expanded as needed. Currently, the National Oceanic and Atmospheric Administration (NOAA) hosts an interagency, online toolkit which includes a “steps to resilience” framework; case studies; science-based tools; easy-to-understand topic narratives; and links to authoritative reports, regional experts, and training courses.⁵⁸ NOAA plans to expand the Toolkit to include structured “Learning Progressions” to build users’ knowledge, skill, and capacity to use science-based data products and decision-support tools, as well as StoryMap-based “Guided Explorations” to facilitate users’ explorations of where and how their valued assets are exposed to various hazards. In addition, the NIST-funded Community Resilience Panel is developing a Resilience Knowledge Base, organized around the six-step process in the NIST Community Resilience Guide, to direct users to relevant tools, guidance, and other resources to assist in planning processes. The Panel is currently reviewing materials for inclusion in the Knowledge Base and will be making the site active soon.⁵⁹

Each federal department and agency should ensure that its online mitigation resources provide links to the resources provided by other federal departments and agencies, including the website referenced in Recommendation 4.1. All federal hosts should consider expanding their websites to include more forward-looking risk analysis, predictive modeling, decision support tools, management practices, best available science, and case studies for mitigation investments, to the extent they do not already do so. All federal departments and agencies also should periodically update their websites based on feedback from end-users.

⁵⁶ See <https://www.healthdata.gov/>.

⁵⁷ Hurricane Sandy Rebuilding Task Force, *Hurricane Sandy Rebuilding Strategy*, at p. 145 (Aug. 2013), available at <https://portal.hud.gov/hudportal/documents/huddoc?id=HSRebuildingStrategy.pdf>.

⁵⁸ See <https://toolkit.climate.gov/>.

⁵⁹ See Community Resilience Panel for Buildings and Infrastructure Systems, <https://crpanel.nist.gov/>.

1
2 SLTTs, private and non-profit sector entities, also play a significant role in identifying and
3 disseminating best practices for improving resilience. For example, the New Jersey Sea Grant
4 Consortium piloted two tools that might assist other communities: (1) the Coastal Community
5 Vulnerability Assessment Protocol, a Geographic Information Systems-based methodology to
6 assist land use planners, mitigation planners, emergency managers, and other local decision-
7 makers in the identification of their communities' vulnerabilities through virtual mapping, and
8 (2) "Getting to Resilience," a questionnaire developed as a non-regulatory tool to help coastal
9 communities build their resilience capacity.⁶⁰ In the private and non-profit sectors, numerous
10 initiatives are helping to mitigate communities and promote resilience, such as SBP, a national
11 organization whose mission is to shrink the time between disaster and recovery through five
12 interventions: Rebuild, Share, Prepare, Advise, and Advocate,⁶¹ and Rebuild by Design which
13 describes itself as convening "a mix of sectors – including government, business, non-profit, and
14 community organizations – to gain a better understanding of how overlapping environmental and
15 human-made vulnerabilities leave cities and regions at risk. Through a partnership with 100
16 Resilient Cities, Rebuild's collaborative research and design approach is helping cities around
17 the globe achieve resilience."⁶²

⁶⁰ NJ Sea Grant Consortium, *New Jersey Coastal Community Resilience Demonstration Project*, at p. 6 (Dec. 2010), available at <http://njseagrant.org/wp-content/uploads/2014/03/ccvap-pilot-final.pdf>.

⁶¹ SBP, *About Us*, available at <http://sbpusa.org/about-us>.

⁶² Rebuild by Design, *What is Rebuild by Design?* available at <http://www.rebuildbydesign.org/about#comp456>.

Outcome 5 – Public, private, and non-profit sector entities improve risk communication, leading to more risk-informed mitigation investments by individuals and communities.

Public, private, and/or non-profit entities should:

- *Develop measurement tools to help communities evaluate their resilience*
- *Increase and improve mitigation education and outreach to meet access and functional needs*
- *Apply the science of risk communication to enhance individual and community mitigation efforts*

Risk communication is essential for well-informed, *risk*-informed mitigation investments. “Risk communication” means finding ways to help people understand potential hazards to themselves, their property, and their community, so that they can put the risk in perspective and make more informed decisions.¹ A national mitigation investment strategy requires communication and engagement nationwide, with participation at all levels of the public, private, and non-profit sectors.

Federal and private sector programs already offer various forms of risk communication, employing numerous tools, ranging from price signals (such as charging lower premiums for insurance in less hazardous areas) to grassroots outreach campaigns (like Preparethon). This Outcome recognizes, however, that given the critical role of risk communication, improvements to, and expansion of, existing efforts can and should be made. In particular, community-based hazard-mitigation efforts may require a more concerted effort to develop and adopt criteria and tools that help communities better identify the risks they face, the means to mitigate those risks, and how to become more resilient (Recommendation 5.1). Such efforts should involve public, private, and non-profit sector entities in order to reach the broadest possible audience. In addition, more hazard-mitigation education and outreach should be targeted to meet the access and functional needs of those who are less able to withstand or recover from disasters without outside assistance (Recommendation 5.2). Outreach efforts may be more successful when they are grounded in behavioral economics which address decision-making challenges and maximize the effectiveness of risk communications (Recommendation 5.3).

Recommendation 5.1: Public, private, and non-profit sector entities should encourage the development and adoption of evaluative criteria and measurement tools that help communities evaluate, assess, and improve their economic, environmental, and social performance, becoming healthier, stronger, and more resilient.

Input, expertise, and leadership from public, private, and non-profit sector entities are needed to demonstrate how risk and mitigation communication efforts benefit individuals and communities, and inspire other communities to adopt leading practices that relate to their

¹ See David Ropeik, confirmed in June 29, 2017 email to Nicholas A. Shufro, FEMA/DHS; see also U.S. Environmental Protection Agency (EPA), *Risk Communication* (last updated Sep. 23, 2016), available at <https://www.epa.gov/risk/risk-communication>.

1 localized risks. The application of evaluative criteria and other performance measurement tools
2 for mitigation can help enhance communities' quality of life, overall health, and public safety by
3 allowing communities to determine whether and to what extent mitigation efforts are successful.

4
5 If some communities become “early adopters” of risk assessment/communication frameworks
6 and evaluative tools *and* the benefits of such ideas are clearly articulated on a regional or
7 national scale, it is possible that other communities will adopt them as well. For example, the
8 Rockefeller Foundation’s 100 Resilient Cities initiative has developed the City Resilience
9 Framework (Framework), which provides a lens to understand and communicate the complexity
10 of cities and the drivers that contribute to their resilience. The Framework is built on four
11 essential dimensions of urban resilience: Health & Well-being; Economy & Society;
12 Infrastructure & Environment; and Leadership & Strategy. Each dimension contains three
13 “drivers,” which reflect the actions cities can take to improve their resilience. As an example,
14 one driver of the Economy & Society dimension calls for cities and governments to “ensure the
15 availability of funding and a vibrant economy as a result of diverse revenue streams, the ability
16 to attract business investment, and contingency plans. This involves good governance,
17 integration with the regional and global economy and measures to attract investment.” The
18 driver further points out that important economic factors include contingency planning, sound
19 management of city finances, the ability to attract business investment, a diverse economic
20 profile and wide linkages to the economy and society.²

21 Domestically, the NFIP’s Community Rating System (CRS) is a voluntary mitigation incentive
22 program that rewards community floodplain management activities exceeding the NFIP’s
23 minimum standards. Under the CRS, flood insurance premium rates are discounted to reward
24 community actions that meet the three goals of the CRS, which are: (1) reduce flood damage to
25 insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3)
26 encourage a comprehensive approach to floodplain management. The CRS uses a Class rating
27 system that is similar to fire insurance rating to determine flood insurance premium reductions
28 for residents.³

29
30 Another domestic example is the Building Code Effectiveness Grading Schedule which assesses
31 the building codes in effect in a particular community and how the community enforces its
32 building codes, with special emphasis on mitigation of losses from natural hazards. The concept
33 is simple: municipalities with well-enforced, up-to-date codes should demonstrate better loss
34 experience, and insurance rates can reflect that. The prospect of lessening catastrophe-related
35 damage and ultimately lowering insurance costs provides an incentive for communities to
36 enforce their building codes rigorously especially as they relate to windstorm damage. The
37 anticipated upshot: safer buildings, less damage, and lower insured losses from catastrophes.

² See 100 Resilient Cities, *The City Resilience Framework*, available at
<http://www.100resilientcities.org/resilience#/-/> (last visited Jun. 20, 2017).

³ FEMA, *National Flood Insurance Program Community Rating System*, <https://www.fema.gov/national-flood-insurance-program-community-rating-system> (last updated Jun. 7, 2017).

Recommendation 5.2: Public, private, and non-profit sector entities should target more (and better) mitigation education and outreach to meet access and functional needs.

By providing equal access to acquire and use the necessary knowledge and skills, this Investment Strategy is intended to benefit the whole community, including low-income individuals and those who may have access and functional needs.⁴ Vulnerable populations with access and functional needs often live in areas that are particularly high-risk for natural hazards. Despite the increased risks faced by such populations with access and functional needs, they are often hard to reach or overlooked and may need tailored risk communication and mitigation education strategies.

Community organizations, such as social service providers and religious, civic, professional and cultural groups, can help the federal government and SLTTs identify and target populations with access and functional needs for outreach and education regarding risks and mitigation. For example, the City of New York focused a resiliency planning initiative in a vulnerable neighborhood which developed a “stakeholder engagement plan” for broad-based input into project deliverables, including a fully funded infrastructure project and a feasibility study.⁵ Similarly, an initiative in New Jersey is developing a set of web-based tools and techniques to help planners engage communities to prepare for and recover from disasters. These tools and processes could be used by planners in the context of an overall community plan update, as part of special purpose plans, or in developing a stand-alone community resilience plan and implementation strategy.⁶

Another technological resource for reaching populations with access and functional needs is STEW-MAP, a publicly available, online stewardship database and map of civic organizations that work to conserve, manage, monitor, transform, advocate for, and/or educate the public about their local environments. The project adds a social layer of information to biophysical information on ‘natural infrastructure’ in metropolitan areas. By having a thorough understanding of who is working in natural resource stewardship, municipalities and others can more effectively activate relevant civic organizations to aid in mitigation activities. Findings from STEW-MAP have also demonstrated the importance of stewardship (i.e., the act of coming together, working side-by-side, and creating change) to mitigation and community resilience.

⁴ Access and functional needs refers to persons who may have additional needs before, during and after an incident in functional areas, including but not limited to: maintaining health, independence, communication, transportation, support, services, self-determination, and medical care. Individuals in need of additional response assistance may include those who have disabilities; live in institutionalized settings; are older adults; are children; are from diverse cultures; have limited English proficiency or are non-English speaking; or are transportation disadvantaged.

⁵ The City of New York, *A Stronger, More Resilient New York* (2013), available at http://s-media.nyc.gov/agencies/sirr/SIRR_singles_Lo_res.pdf. See also New York City Mayor’s Office of Recovery and Resiliency, *Related Programs and Initiatives*, available at <http://www.nyc.gov/html/planyc/html/resiliency/resiliency.shtml>.

⁶ New Jersey Coastal Community Resilience Demonstration Project, *Pilot Communities: Cape May Point, Little Silver, Oceanpoint* (Dec. 2010), available at <http://njseagrant.org/wp-content/uploads/2014/03/ccvap-pilot-final.pdf>.

1 STEW-MAP has also been deployed in Baltimore, the Chicago region, Seattle, Los Angeles,
2 Philadelphia, and San Juan, Puerto Rico, as well as several international locations.⁷

3
4 Public, private, and non-profit sector entities also should consider modifying existing programs,
5 or creating new consumer assistance and/or financial education programs that incentivize
6 mitigation.

7 **Recommendation 5.3: Public, private, and non-profit sector entities should apply**
8 **evidence and best practices from the science of risk communication in order to**
9 **enhance community and individual mitigation efforts.**

10
11 Evidence from social, behavior, economic, and decision sciences may provide useful tools to
12 improve risk and mitigation communications. For example, behavioral economics “looks at how
13 psychology affects economic decision-making – how our thoughts and emotions may affect how
14 we make decisions about money. . . . Behavioral economists try to develop models which
15 account for the fact that we are impatient, procrastinate, and do not always make the best choice
16 when decisions are hard – sometimes we even completely avoid making a decision.”⁸ Other
17 fields, from psychology to management, also study the way individuals understand and process
18 risk, and make decisions.

19
20 Academic institutions, in partnerships with private sector and government entities have been
21 studying how science-based risk communication can encourage individuals to address their risk
22 and resilience needs and develop a better understanding of what they need to do to mitigate
23 natural hazard risk.⁹ One study, for example, combined a literature review with interviews of
24 government officials (including federal, state and local public health agency representatives) to
25 examine how “behavioral economic-inspired interventions that have proved effective in other
26 related contexts” could be applied to emergency/disaster management. The study suggested
27 application of potentially low-cost, high-impact interventions, including interventions to
28 overcome decision-making biases (such as present bias, statistics-related bias, and identifiable
29 bias) that are relevant to disaster preparedness and obtain a more effective response.

30
31 Encouraging people to act in a way that will aid in their personal mitigation and preparedness
32 efforts in turn can improve their communities’ resilience. Outreach efforts may be more
33 successful when they are grounded in science in order to address decision-making challenges and
34 maximize the effectiveness of risk communications. The Risk Management and Decision
35 Process Center at the Wharton School of the University of Pennsylvania works with the private

⁷ Forest Service, U.S. Department of Agriculture, *Urban Natural Resources Stewardship – STEW-MAP* (last modified May 26, 2017), available at <https://www.nrs.fs.fed.us/urban/monitoring/stew-map/>.

⁸ “Behavioral Economics – Definition and Meaning,” *Market Business News*, available at <http://marketbusinessnews.com/financial-glossary/behavioral-economics/>.

⁹ See, e.g., Sebastian Linnemayr et al., “Using Insights from Behavioral Economics to Strengthen Disaster Preparedness and Response,” *Disaster Medicine and Public Health Preparedness*, Vol. 10, Issue 5, at pp. 768-774 (Oct. 2016), abstract available at <https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/article/using-insights-from-behavioral-economics-to-strengthen-disaster-preparedness-and-response/08ABFE535DA7FE2B8FFB003FA7B7A230>.

sector, government, and international partners to research and provide recommendations including critical infrastructure and flood resilience. The Center’s Flood Resilience Research Collaboration is a partnership with, among others, the Zurich Insurance Group to study what motivates individuals and communities to take flood preparedness actions. The program has also looked at why people have not purchased flood insurance, discussing the need to do more effective outreach and risk communication to populations with access and functional needs.¹⁰

Overall, the science of risk communication shows promise as a means to improve risk communications and influence decision-making regarding mitigation. Academic institutions, the private sector, and the public sector should increase partnerships to cost effectively way test different ways to create more effective risk communications.

Outcome 6 - The built environment — whether grey or nature-based infrastructure, and including lifeline infrastructure, buildings and homes — becomes more resilient and promotes community resilience.

Public, private, and/or non-profit entities should:

- *Encourage the passage and enforcement of up-to-date model building codes*
- *Encourage the use of nature-based solutions for mitigation*
- *Focus post-disaster on rebuilding better as well as rebuilding quickly*
- *Encourage local and regional investment that enhance the security and resilience of infrastructure through design standards and coordinated capital improvement*

Social and economic activity in our communities depends on the built environment: we live and work in buildings, and depend on infrastructure systems to deliver power, water and wastewater service, communications, and transportation to facilitate the movement of people and goods. When the functions of the built environment are disrupted, the impacts extend to the social, public health, and economic dimensions and the indirect losses can significantly surpass the direct losses to building and infrastructure.

Mitigation activities, conducted gradually over time, can help make the built environment more resilient in the face of natural hazards. These activities can include the adoption and enforcement of modern model building codes (Recommendation 6.1). They can also extend beyond man-made “grey” materials like concrete and include more nature-based solutions (Recommendation 6.2). Further, when damaging hazard events do occur and resources become available from insurance, federal aid, and other sources to support rebuilding, there is an opportunity to build back better, reducing the risk of damage and disruption from future hazard occurrences (Recommendation 6.3). And critical infrastructure needs particular attention, especially at the local and regional level (Recommendation 6.4). Taken together, these steps can help reach a desired end state of a more resilient built environment across the Nation.

¹⁰ Risk Management and Decision Processes Center, Wharton, University of Pennsylvania, *Flood Resilience Research – Collaboration with Zurich Insurance*, available at <https://riskcenter.wharton.upenn.edu/flood-resilience-research-collaboration-zurich-insurance/>.

Recommendation 6.1: Federal departments and agencies should ensure up-to-date building standards are used for federal building projects and could incentivize SLTTs receiving federal aid for building projects to adopt and enforce, at a minimum, the most current version of model building codes.

In the United States, model building codes — such as the International Building Code (IBC) and the International Residential Code (IRC) — are developed by the International Code Council with input from FEMA and NIST.¹¹ The IBC and IRC, which govern construction of buildings and residential structures and incorporate standards based on the latest available science and provide the design criteria for buildings to be able to resist common natural hazards, are updated on a three-year cycle.

Nearly all fifty states have adopted some version of the IBC and IRC as the basis for their building codes, but some states leave adoption to local authorities while others do not have codes that reflect the latest IBC and IRC. Further, state or local authorities may amend codes, resulting in local or state-wide codes which are inconsistent with the model building codes.

Adoption and effective enforcement of current codes leads to improvements in the performance of buildings over time as building stock is replaced. Following Hurricane Charley, which struck Florida in 2004, a study found that modern building codes reduced the severity of losses by 42 percent and the loss frequency by 60 percent.¹²

The federal government already requires higher standards for certain mitigation projects. For example, based on IBHS FORTIFIED standards,¹³ FEMA has developed a publication with the standard for residential wind retrofits required as a condition of Hazard Mitigation Assistance grant funding for residential wind retrofit projects.¹⁴ Most of these standards are consistent with international model disaster building codes and their referenced American Society of Civil Engineers standards.

More widespread adoption and enforcement of model building codes is not without challenges. Effective code enforcement requires trained inspectors to review plans and inspect projects at various stages of construction, as well as contractors who are familiar with and can build in accordance with the code. Not all areas currently may have sufficient numbers of inspectors and contractors. Such challenges may argue for a longer timetable for implementation – but not abandonment of the higher standards reflected in the latest IBC and IRC building codes.

¹¹ See International Code Council, *ICC Home*, available at <https://www.iccsafe.org/>.

¹² See IBHS, *Modern, Enforced Building Codes Critical to Reducing Storm-Related Damages, Says IBHS*, available at <https://disastersafety.org/ibhs-news-releases/modern-enforced-building-codes-critical-to-reducing-storm-related-damage-says-ibhs-2/> (citing joint study by IBHS, the University of Florida, and the FEMA Mitigation Assessment Team).

¹³ The IBHS FORTIFIED standard is discussed further in connection with Recommendation 6.3, below.

¹⁴ FEMA, *FEMA P-804, Wind Retrofit Guide for Residential Buildings (2010)* (last updated Jul. 14, 2014), available at <https://www.fema.gov/media-library/assets/documents/21082>.

1 Nevertheless, federal departments and agencies could use federal funding of building projects to
2 incentivize SLTTs to adopt and enforce the most recent building codes which could reduce
3 long-term costs associated with natural hazards.

4
5 **Recommendation 6.2: Public sector entities should encourage nature-based**
6 **solutions for mitigation and resilient infrastructure investments.**
7

8 While not abandoning traditional “grey” infrastructure with its known track record, public sector
9 entities should consider nature-based solutions where feasible to reduce the impact of natural
10 hazards. Examples of nature-based solutions include dunes, coastal marshes, and other natural
11 features that reduce the impact of storm surge and tidal flooding. In areas prone to riverine
12 flooding, nature-based solutions can include limiting development in flood-prone areas and
13 providing amenities such as greenways and parks that provide recreational, transportation and
14 economic benefits during normal times, and during floods protect developed areas and reduce
15 runoff into rivers, further reducing flood risk. Communities can help mitigate concerns about
16 limiting development in flood-prone areas through programs and policies that encourage
17 development activity in more appropriate and less vulnerable areas.

18
19 Nature-based solutions can provide direct and indirect benefits to the community. For example,
20 they can improve water quality and quantity by reducing storm water runoff and treating it at its
21 source; reduce pollutant loads discharged in combined sewer overflows; reduce flood risk; and
22 provide water for outdoor irrigation or recharging groundwater. Storm water management using
23 nature-based solutions can also result in lower capital costs for developers. Nature-based
24 solutions can also provide benefits to the community beyond mitigation itself. Increasing
25 demand for nature-based solutions can promote economic growth and create jobs in construction
26 and maintenance of these features. Nature-based solutions also create open space and parks that
27 encourage physical activity, preventing some types of diseases. Values of properties located
28 close to green spaces can increase, benefiting developers and homeowners.¹⁵ Nature-based
29 solutions can also provide important habitat for fish and wildlife species, which in turn can
30 provide benefits from commercial and recreational fisheries, as well as well wildlife-based
31 recreation opportunities. In addition, nature-based features in coastal areas can reduce the extent
32 of flooding from storm surge during hurricanes and other coastal storms. Natural features, such
33 as wetlands, barrier islands, and reefs, can help reduce the destructive impacts of storm surges
34 and waves by attenuating wave velocity and strength.

35
36 Nature-based solutions have been used to reduce risk in communities around the United States.
37 For example, St. Louis metropolitan region launched an effort to use rivers and floodplains to
38 make the region a clean, green, connected place to live. The Clean Water, Safe Parks, and
39 Community Trails Initiative aims to create a “River Ring”, which will create 1200 square miles
40 of connected greenways, parks and trails along the multiple rivers in the region. The River Ring
41 creates multiple benefits area beyond recreational use, such as increasing property values and
42 providing alternate transportation routes. It also has the potential to mitigate the impacts of

¹⁵ EPA, *Benefits of Green Infrastructure* (last updated Mar. 22, 2017), available at <https://www.epa.gov/green-infrastructure/benefits-green-infrastructure>.

1 flooding, as the forests along the greenways reduce runoff rates and floodplain soils can store
2 water, reducing flow into streams and rivers. Other examples of nature-based solutions include
3 the use of dunes to protect roadways;¹⁶ creating living shorelines along roadways;¹⁷ and
4 floodplain restoration to reduce future flood risk.¹⁸

5
6 Like the state-revolving fund at EPA – which encourages states to use grant funding for projects
7 to address green infrastructure, water or energy efficiency improvements, or other
8 environmentally innovative activities – other federal departments and agencies, as well as
9 SLTTs, should consider directing specific percentages of resources toward nature-based
10 infrastructure within authorities and for appropriate hazards.

11
12 **Recommendation 6.3: Public sector entities should focus more on rebuilding better**
13 **as well as rebuilding quickly following damage caused by natural disasters.**
14

15 Recovery from a natural disaster or severe weather event presents communities with an
16 opportunity to build back better, increasing the likelihood that they will better withstand the next
17 storm or disaster. Advance recovery planning by the federal government and SLTTs, based on
18 the best available science, current model building codes, and mitigation goals, can facilitate
19 efficient and resilient reconstruction while reducing the cost of future natural disaster.

20
21 Rebuilding quickly and rebuilding better do not need to be mutually exclusive. For example, the
22 RAPIDO program was implemented in South Texas as a pilot project to demonstrate an
23 approach to rapidly rebuilding homes after disasters. The concept consists of building a core unit
24 — including a kitchen, bathroom, living and sleeping units — that can be built in six days. The
25 concept allows homeowners to quickly return to their homes post-disaster. Further, the houses
26 can be expanded over time to meet the homeowner’s requirements. Following Hurricane Dolly,
27 a pilot project consisting of 20 homes was constructed in the Rio Grande Valley to demonstrate
28 the concept. RAPIDO homes built in the Rio Grande Valley cost approximately \$15,000 – far
29 less than the cost of \$60,000-70,000 for trailers. In addition to post-disaster recovery, RAPIDO
30 homes can help to meet the need for affordable housing for low-income families. The program
31 is being expanded to use the basic concept developed for temporary-to-permanent housing
32 following a disaster to providing safe, affordable housing solutions to low-income areas.¹⁹
33

¹⁶ See Federal Highway Administration, U.S. Department of Transportation, *Highways in the Coastal Environment*, Pub. No. FHWA-NHI-07-096 (2d ed. Jun. 2008), available at <https://www.fhwa.dot.gov/engineering/hydraulics/pubs/07096/07096.pdf>.

¹⁷ See Federal Highway Administration, U.S. Department of Transportation, *Living Shoreline Along Coastal Roadways Exposed to Sea Level Rise: Shore Road in Brookhaven, New York*, No. FHWA-HEP-17-016 (Sep. 2016), available at https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/teacr/ny_shore_road/index.cfm.

¹⁸ Naturally Resilient Communities, *Otter Creek Floodplain, Middlebury, Vermont*, available at <http://nrcsolutions.org/otter-creek-floodplain-middlebury-vt/>.

¹⁹ See <http://www.rapidorecovery.org/>.

A federal tool to assist SLTTs in building back better are flexible Community Development Block Grants for Disaster Recovery (CDBG-DR) administered by HUD, which help cities, counties, and states recover from Presidentially-declared disasters, especially affected low-income areas, and subject to the availability of supplemental appropriations. CDBG-DR funds can be used rebuild affected areas and provide seed money to start the recovery process for a broad range of recovery activities.²⁰

A private sector tool for building back better comes from the IBHS Fortified Home Program,²¹ which provides a series of leading practices to strengthen homes to withstand hail, high winds, and hurricanes and reduce the incidence of loss. There are three designation levels in the program:

- Bronze – The Bronze level addresses the roof systems and reduces wind and water intrusion to the attic through the roof covering and vents.
- Silver – The Silver level addresses windows, doors, and attached structures in addition to the roof system addressed in the Bronze level.
- Gold – In addition to the upgrades in the Bronze and Silver levels, the Gold level adds upgrades to tie the house together by connecting the roof, walls, floors, and foundation so that the house acts as one system.

Recommendation 6.4: The public and private sectors should encourage local and regional investment that enhance the security and resilience of infrastructure by supporting resilient design standards, and the planning and implementation of cross-jurisdictional and cross-sector capital improvement and other plans that address multiple and evolving human, technological, and natural threats and hazards.

Protecting the nation’s lifeline infrastructure assets, networks, and systems poses a number of challenges from an investment decision-making perspective. These challenges include creating and implementing design standards and upfront investment in the building of such infrastructure to higher protection standards; plans for improving design at key opportunities prior to and following disasters; partnerships focused on understanding system interdependencies to plan for and prevent cascading failures; and supporting good capital improvement and regional planning among the different owners, operators, and policy makers.

Critical community services and economic well-being depend on maintaining the security and resilience of infrastructure assets, networks, and systems that are owned and operated by both the public and private sector at different local and regional scales. Resilience requires decision-makers at all levels of government and the private sector to increasingly incorporate resilient design into pre-disaster and post-disaster recovery infrastructure policies, plans, financing, and

²⁰ HUD, *Community Development Block Grant Disaster Recovery Program*, available at <https://www.hudexchange.info/programs/cdbg-dr/>.

²¹ IBHS, *FORTIFIED HOME*, available at <https://disastersafety.org/fortified/fortified-home/>.

recovery decisions. To the extent possible, critical infrastructure being built should be held to a higher standard (e.g., lower risk tolerance) and be designed to avoid catastrophic failure when different portions of a system fail. Design should also be flexible for modification in future states to address evolved threats. Further, because utilities and many lifeline sectors function as systems — with ramifications upstream and downstream of their geographic location and system function — it is imperative that communities and private sector owners of lifeline infrastructure work together on a regional basis to coordinate mitigation strategies with others in the footprint of their infrastructure systems. Federal funds can supplement SLTT and private sector investment in capital improvement programs and bonding authorities.

For example, the Department of Homeland Security Office of Infrastructure Protection manages the Regional Resiliency Assessment Program (RRAP) and is developing the Critical Infrastructure Resilience Toolkit (CIRT). The RRAP is a cooperative assessment of competitively selected critical infrastructure within a designated geographic area, along with a regional analysis of the surrounding infrastructure, to address a range of infrastructure resilience issues that could have regionally and nationally significant consequences. CIRT provide tools and resources to local and regional comprehensive and mitigation planners to self-assess infrastructure vulnerabilities and risks and prioritize critical infrastructure investments. For RRAP and other initiatives to advance the resilience of the nation’s infrastructure to be successful, public and private partners must continue to work together at the SLTT, regional, and federal levels to resolve infrastructure security and resilience knowledge and implementation gaps, which includes ongoing research and analysis of systems, and also innovative financing to support this work.

III. Conclusion and Next Steps

The Draft Investment Strategy represents the beginning of a nationwide discussion about how to most effectively and efficiently leverage federal government mitigation investments to better protect lives, communities, and properties across the country from natural hazards. The MitFLG welcomes feedback to make the next version of the Investment Strategy more refined and effective.

More specifically, the MitFLG’s intends to collect leading practices and lessons learned that promote mitigation investments, as well as to disseminate knowledge around what makes mitigation investments more (and less) effective and coordinated across public, private, and non-profit sectors. The MitFLG also welcomes any and all comments on the Draft Investment Strategy itself, including but not limited to the “workability” or viability of these initial recommendations; the extent to which the recommendations could (and should) be made bolder; whether or how structural changes may be needed to improve the effectiveness of national mitigation investments; and whether the recommendations sufficiently address the needs of vulnerable populations with access and functional needs. More broadly, MitFLG would like to know:

1. What incentives are used or should be used to encourage resilient investments by states, territories, tribes, local jurisdictions, businesses, NGOs, homeowners, and other individuals and organizations?

2. What tools, guidance, or strategies do various stakeholders use, or would like to use, to communicate risk, and which are the most effective?
3. How are stakeholders catalyzing investments to make their communities more resilient through mitigation activities?
4. What challenges and barriers have stakeholders encountered as they designed and implemented strategies to mitigate natural hazard risk and improve their communities' resiliency?
5. How do different levels of government streamline interactions in order to facilitate resilience investments? What steps can each level of government take to streamline and facilitate investments to support mitigation activities?
6. How can governments more effectively engage private businesses and citizens in sharing responsibility for disaster risk reduction, including activities to mitigate risk and build resilience?
7. How effective are these recommendations? What should be added, modified, or deleted from the list of recommendations?
8. What is the most effective way for the federal government, SLTTs, and the private and non-profit sectors to implement the recommendations in the Investment Strategy?

Feedback can be provided through email to fema-nmis@fema.dhs.gov or through the FEMA IdeaScale forum, "Mitigation Investment for the Nation" (<http://fema.ideascale.com/a/ideas/recent/campaign-filter/byids/campaigns/60968>).

Appendix I: Summary List of Outcomes and Recommendations

Outcomes

Outcome 1(O-1) - Coordination of risk mitigation and management improves between and among federal, public, and private and non-profit sector entities.

Outcome 2 (O-2) - Private and non-profit sector entities increase their investments in and innovations related to resilience and mitigation.

Outcome 3 (O-3) - SLTTs increasingly empowered to lead risk reduction activities and share responsibility and accountability with the federal government.

Outcome 4 (O-4) - Public, private, and non-profit sector entities develop and share more of the data and tools needed to make risk-informed mitigation investments.

Outcome 5 (O-5) – Public, private, and non-profit sector entities improve risk communication, leading to more risk-informed mitigation investments by individuals and communities.

Outcome 6 (O-6) - The built environment — whether grey or nature-based infrastructure, and including lifeline infrastructure, buildings and homes — becomes more resilient and promotes community resilience.

Recommendations

Recc. No.	Advances Outcome No(s):	Recommendation
1.1	O-1, O-2, O-3, O-4, O-5	Public, private, and non-profit sector entities should, in a coordinated manner, develop and use a shared understanding of mitigation-related terms.
1.2	O-1, O-2, O-3, O-4, O-5	Public, private, and non-profit sector entities should, in a coordinated manner, develop and use common sets of metrics and indices for identifying and evaluating mitigation measures and overall resilience.
1.3	O-1, O-3, O-4, O-5	Public sector entities at the federal and SLTT levels should adopt, to the extent possible, complementary timelines, criteria, and streamlined application processes for different types of mitigation, preparedness, and recovery funds.
1.4	O-1, O-2, O-3, O-6	Federal departments and agencies should promote mitigation and resilience planning and coordination across sectors to build a more complete view of risk and resilience that includes socio-economic, health, and environmental factors.

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Recc. No.	Advances Outcome No(s):	Recommendation
1.5	O-1	Public, private, and non-profit sector entities should improve coordination between mitigation and other preparedness mission areas to allow community-based adaptations to strengthen all aspects of affected communities and mitigate future natural disasters during the recovery period.
1.6	O-1	Public sector entities should ensure that continuous improvement processes are put into place and that they incorporate mitigation strengths, innovations, and areas for improvement.
2.1	O-2, O-3, O-6	Federal departments and agencies, and SLTTs, should remove barriers for, and otherwise support development of, financial products that reduce natural hazard risks and/or the costs of recovering from natural disasters.
2.2	O-2, O-4, O-5, O-6	Public, private, and non-profit sector entities should encourage investments in developing and deploying new and improved tools and technologies related to mitigation.
2.3	O-2, O-1, O-3, O-6	Public, private, and non-profit sector entities (in public-private partnerships, where feasible) should identify, evaluate, pilot, and promote non-traditional models for financing mitigation activities that promote leading practices and provide additional benefits to the funding resources.
2.4	O-2	Public and private sector entities should coordinate to increase insurance coverage by individuals, businesses, and communities for natural hazard risk.
3.1	O-3, O-1	Public, private, and non-profit sector entities should coordinate to identify community-based mitigation and resilience training needs in order to develop and deliver more targeted training for communities and/or regions.
3.2	O-3	Public sector entities should create consumer assistance or other similar programs to incentivize mitigation.
3.3	O-3, O-1	Public, private and non-profit sector entities should align financial incentives and cost sharing for mitigation projects.
4.1	O-4, O-5	Federal departments and agencies should enhance the availability and usability of federal risk and resilience data.
4.2	O-4, O-5	Public, private, and non-profit sector entities should bolster existing efforts to disseminate leading practices, including an inventory of programs and case studies demonstrating the value of, and “business case” for, mitigation investments.

Recc. No.	Advances Outcome No(s):	Recommendation
5.1	O-5	Public, private, and non-profit sector entities should encourage the development and adoption of evaluative criteria and measurement tools that help communities evaluate, assess, and improve their economic, environmental, and social performance, becoming healthier, stronger, and more resilient.
5.2	O-5	Public, private, and non-profit sector entities should target more (and better) mitigation education and outreach to meet access and functional needs.
5.3	O-5	Public, private, and non-profit sector entities should apply evidence and best practices from the science of risk communication in order to enhance community and individual mitigation efforts.
6.1	O-6, O-3	Federal departments and agencies should ensure up-to-date building standards are used by their programs and could incentivize SLTTs receiving federal aid for building projects to adopt and enforce, at a minimum, the most current version of model building codes.
6.2	O-6	Public sector entities should encourage nature-based solutions for mitigation and resilient infrastructure investments.
6.3	O-6, O-3	Public sector entities should focus more on rebuilding better as well as rebuilding quickly following damage caused by natural disasters.
6.4	O-6	The public and private sectors should encourage local and regional investment that enhances the security and resilience of infrastructure by supporting resilient design standards, and the planning and implementation of cross-jurisdictional and cross-sector capital improvement and other plans that address multiple and evolving human, technological, and natural threats and hazards.

Appendix II: Investment Strategy Criteria

The Investment Strategy used two sets of criteria – mandatory and prioritization criteria – to identify and choose initial recommendations that are consistent with at least one of the six Investment Strategy outcomes. Through stakeholder engagement and further analysis, recommendations may be eliminated later if it is determined that, in fact, they do not satisfy the criteria described below.

Mandatory Criteria

A recommendation must satisfy five “mandatory criteria” to be included in the Investment Strategy:

- 1) **Actionable.** A recommendation must be feasible and detailed enough to be actionable.
- 2) **Targeted.** A recommendation must be appropriately targeted: not so high-level that entities could reasonably argue the recommendation is already satisfied, but not so narrowly focused that it is only relevant for a particular agency or project.
- 3) **Clear Benefits.** A recommendation must have clear benefits to the Nation. In other words, it must either provide a demonstrable return on investment (e.g., positive return on investment or ROI) by reducing overall loss or catalyzing additional mitigation investments, or meet other public policy goals and provide benefits in addition to mitigation.
- 4) **Trackable.** The MitFLG or some other body must be able to gauge whether a recommendation has been implemented and, if appropriate, track or measure the progress of the recommendation and its effect on the Nation.
- 5) **Within Existing Authorities.** A recommendation must not require legislative action by Congress or a state legislature — it must work within the existing legal authorities of federal and SLTT departments and agencies. However, this criterion does not foreclose the possibility of the implementation of a recommendation via federal rule-making or guidance, or similar action by SLTTs, as appropriate.

Prioritization Criteria

In addition to the mandatory criteria, the selection of Investment Strategy recommendations also relies on a set of ten “prioritization criterion.” Although each of these prioritization criteria is not required for a recommendation to be included in the Investment Strategy, they helped guide the process of selecting recommendations. No one prioritization criterion is weighted over another, it is understood that each proposed project may not meet all of the proposed prioritization criteria, and the criteria are not presented in a particular order. For example, recommendations were considered that did *not* meet the prioritization criteria because, for instance, they applied to a single hazard or a single economic sector.

The following ten prioritization criteria informed the Investment Strategy and the selection of its recommendations:

- 1) **Coordinated Funding.** A recommendation should promote coordinated funding or action by federal, SLTT, and/or private and non-profit sector entities.
- 2) **Supported by Research.** A recommendation should not require additional research or data development.
- 3) **No New Appropriations.** A recommendation should not require Congress to appropriate new funds.
- 4) **Favoring Multi-Hazard.** A recommendation should be applicable across multiple hazards where possible.
- 5) **Favoring Multi-Sector.** A recommendation should apply across multiple geographic regions and sectors of the economy where possible.
- 6) **Proactivity.** A recommendation should encourage proactive, pre-disaster investments that help communities prepare for, rather than simply respond to and recover from natural disasters.
- 7) **Risk-Informed Decision-Making.** A recommendation should encourage the use of risk-informed decisions, supported by robust and commonly understood science-based estimates and scenarios.
- 8) **Leading Practices.** A recommendation should encourage compliance with leading practices, such as contemporary risk management standards.
- 9) **Vulnerable Population.** A recommendation should support investments that decrease social and economic vulnerability along with vulnerability to natural hazards, and encourage projects that benefit socially- and economically-vulnerable populations. In the Investment Strategy, “vulnerable populations” are described as persons with “access and functional needs,” i.e., persons who may have additional needs before, during and after an incident in functional areas, including but not limited to: maintaining health, independence, communication, transportation, support, services, self-determination, and medical care. Individuals in need of additional response assistance may include those who have disabilities; live in institutionalized settings; are older adults; are children; are from diverse cultures; have limited English proficiency or are non-English speaking; or are transportation disadvantaged.
- 10) **Public-Private Partnerships.** A recommendation should encourage the development of public-private partnerships related to mitigation.

Appendix III: Abbreviations

BCA	Benefit Cost Analysis
CDBG-DR	Community Development Block Grants for disaster recovery administered by HUD
CIRT	Critical Infrastructure Resilience Toolkit being developed by RRAP
CRS	NFIP Community Rating System
DHS	U.S. Department of Homeland Security
EIB	Environmental Impact Bond
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GAO	U.S. Government Accountability Office
HUD	U.S. Department of Housing and Urban Development
IBC	International Building Code
IBHS	Insurance Institute for Business & Home Safety
Investment Strategy	National Mitigation Investment Strategy
IRC	International Residential Code
LiDAR	Light Detection and Ranging
MitFLG	Mitigation Framework Leadership Group
M.T.A.	New York City's Metropolitan Transportation Authority
NFIP	National Flood Insurance Program
NGOs	Non-governmental organization
NIBS	National Institute of Building Safety
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
PDM	FEMA's Pre-Disaster Mitigation Grant Program
PPD-8	Presidential Policy Directive 8: National Preparedness
Private and non-profit sectors	All non-governmental actors, including individuals, business owners, companies, philanthropies, foundations, universities and other academic institutions, and other NGOs
Public Sector	Federal, state, territorial, tribal, and local governments
RRAP	DHS's Regional Resiliency Assessment Program

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BCA	Benefit Cost Analysis
SLTT	State, local, tribal and territorial governments
USACE	U.S. Army Corps of Engineers

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