GEORGETOWN CLIMATE CENTER
A Leading Resource for State and Federal Policy

PREPARING OUR COMMUNITIES FOR CLIMATE IMPACTS

Recommendations for Federal Action

Recommendations to the State, Local and Tribal Leaders Task Force for Climate Preparedness and Resilience

AUTHORS & ACKNOWLEDGEMENTS

This report is the outgrowth of a series of workshops conducted by the Georgetown Climate Center (GCC) and previous on-the-ground work in several jurisdictions by GCC faculty, staff, and students. The participants in each of these workshops who informed this report and these recommendations are listed, along with each workshop agenda in Chapter 1. The workshops and report cover three primary areas where federal programs can be better leveraged to support state and local adaptation:

- Disaster relief programs (Chapter 2), the National Flood Insurance Program (Chapter 3), and programs administered by the Department of Housing and Urban Development (Chapter 4)
- Programs that support ecosystem restoration and flood control (Chapter 5)
- Programs that support water infrastructure (Chapter 6).

While the primary purpose was to identify opportunities to promote adapation using existing federal authority, the workshops also identified potential congressional reforms.These workshops were conducted with generous support from the Kresge Foundation and in cooperation with the White House Council on Environmental Quality.

This summary report of these convenings was written by Jessica Grannis, Adaptation Program Manager (Chapters 2, 3, 5); Aaron Ray, Institute Associate (Chapter 6); Vicki Arroyo, Executive Director of the Georgetown Climate Center (Chapter 1); and Sara Hoverter, Senior Fellow at the Harrison Institute for Public Law at Georgetown University Law Center (Chapter 4) with input from workshop participants. The authors would like to thank the additional Georgetown Law students and GCC staff whose research and writing contributed to this workshop series and report: Kate Zyla, Lissa Lynch, Annie Bennett, Bari Greenfeld, Katherine Lee, David Forscey, Kraig Ahalt, Nicole Smith, Emily Maus, Justin Clancy, and Daniel Smith. This report presents analysis by the authors and does not represent Georgetown University or any federal, state, or local agency or other participants.

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PHOTO CREDITS

Back Cover

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U.S. Environmental Protection Agency, "Managing Wet Weather with Green Infrastructure:-Municipal Handbook:Green Streets"

Chapter 5

Kara Reeve, National Wildlife Federation

Chapter 6

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CHAPTER 1

INTRODUCTION

INTRODUCTION TO THE GEORGETOWN CLIMATE CENTER WORKSHOP SERIES

State and local governments are struggling to cope with and prepare for rising seas, more severe heat waves, more intense floods, droughts, and other effects of climate change. Many have been looking to the federal government for help and guidance, only to run into challenges tapping into federal programs and resources.

The Obama Administration's 2013 Climate Action Plan directed federal agencies to support state and local efforts to adapt to climate change impacts. However, there are barriers to incorporating climate change when making investment decisions and implementing policies. In fact, through previous work in states and local communities, the Georgetown Climate Center (GCC) has identified challenges to promoting successful adaptation that result from current federal policies. Against this backdrop and to inform discussions of the White House's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience (Task Force), the Georgetown Climate Center convened three workshops in late 2013 and early 2014 with senior federal, state, and local officials, along with experts from the non-governmental and academic communities. These workshops were held in coordination with the White House Council of Environmental Quality (CEQ) and relevant federal agencies and with generous support from the Kresge Foundation. The goal was to pinpoint the barriers and challenges to the use of existing federal programs and authorities for adaptation, to determine how these barriers can be overcome, and to explore opportunities to promote adaptation at the state and local level.

The first workshop, on disaster relief and development, examined how climate change impacts could be incorporated into disaster relief programs, and other programs that affect land-use decisions in vulnerable areas. This workshop focused on programs administered by the Federal Emergency Management Agency (FEMA) and the Department of Housing and Urban Development (HUD), including the National Flood Insurance Program (NFIP), Hazard Mitigation Grant Program (HMGP), and Community Development Block Grant (CDBG) program.

The second workshop focused on opportunities to use living shorelines, wetlands, and other nature-based solutions to protect communities from storm surges, floods, and sea-level rise. It examined programs administered by the U.S. Army Corps of Engineers (Corps), U.S. Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Agriculture (USDA), and the U.S. Fish and Wildlife Service (USFWS).

The final workshop reviewed federal programs that could enable the consideration of climate impacts in the planning, design, and construction of sewers, water treatment plants, and other water infrastructure. This workshop included discussion of technical assistance, funding, and regulatory programs administered by the EPA and NOAA, among others.

To encourage a frank and open dialogue, workshop participants were assured that specific comments would not be attributed to any individual. The findings and recommendations in this report thus represent a summary by Georgetown Climate Center staff and do not necessarily reflect the views of any individual participant or agency. A list of workshop participants and the workshop agendas are included at the end of this chapter.

This process uncovered both major challenges and significant opportunities. The workshop series was organized based upon several key themes:

- State and local action are critical to the success of adaptation. Those on the front lines need additional support to prepare for and respond to the impacts of a changing climate.
- Federal programs must be leveraged to promote adaptation. While it is true that there are some limitations, barriers are often more perceived than real.
- While additional resources are certainly needed, adaptation does not require expansive new programs or legislation. Entities at all levels of government have plans, tools, and resources that can be amended, repurposed, or deployed to support adaptation.
- Where barriers to adaptation do exist, short-term workarounds are often available while working towards long-term fixes.
- Funding constraints limit opportunities for sensible investments in adaptation. The way federal agencies currently make investment decisions often appear to be "penny wise and pound foolish."

CROSS-CUTTING RECOMMENDATIONS

The workshops identified more than 30 federal programs, initiatives, and laws that can be used to support adaptation. Each chapter of this report details the recommendations that came out of group discussions. Several common recommendations emerged from the full set of workshops:

- CEQ should update guidelines to federal agencies to ensure that federal adaptation plans include consideration of the programs and policies that affect state and local adaptation.
- Federal agencies should issue guidance on what funds can be used to support adaptation.
- Federal agencies should improve interagency collaboration, seizing opportunities to coordinate funding streams, paperwork, and other regulatory requirements.
- Federal partners should provide more actionable data and tools to help inform state and local planning. The recent announcement of a Climate Data Initiative and the 2014 National Climate Assessment are important steps, but more work can be done to translate these tools and information for state and local users.
- The White House and the Office of Management and Budget (OMB) should reduce time needed to pass changes to regulations under the Administrative Procedure Act to help streamline implementation of recommended reforms.
- Cost-benefit analysis should include consideration of the value of ecosystem services and the costs of inaction.
- Regional planning for disaster recovery, floodplain management, nature-based coastal adaptation, and drought management should be promoted. Impacts of climate change and rising seas do not respect jurisdictional boundaries. Regional coordination is necessary and can be used to leverage limited resources.

- Federal agencies should support state and local efforts that promote resilience rather than administer resources in ways that maintain the status quo.

Agendas and participant lists from the workshops that led to the recommendations contained in this report follow this introduction. Each chapter in the report also provides additional context, details, and more specific recommendations for how federal agencies can leverage existing authority through the 30 programs identified in our discussions. Acronyms and abbreviations are defined throughout but also captured in Appendix A for easy reference. Recommendations by federal agency can be found in Appendix B.

Previous drafts of these workshop reports have been shared with Task Force members and CEQ to inform their efforts in real-time as well as to incorporate their comments.

The Georgetown Climate Center will continue to coordinate with CEQ and relevant federal agencies to ensure that these recommendations help shape the next phase of federal adaptation planning and action, and to foster additional dialogue with state and local entities facing climate change impacts.

WORKSHOP AGENDAS AND PARTICIPANTS

WORKSHOP 1 AGENDA: FLOODPLAIN MAPPING, DISASTER RELIEF, & LAND USE

Workshop date: Monday, November 18, 2013

Location: Hall of States, 444 N. Capitol Street, NW; Meeting Room 233

Overview: The Georgetown Climate Center (GCC) is hosting a series of workshops with senior federal, state, and local officials, and experts from the NGO and academic communities to discuss opportunities to leverage existing federal programs (regulatory, funding, and civil works) to support state and local adaptation. Specifically, this workshop will focus on how to incorporate consideration of climate change impacts into:

- floodplain maps;
- disaster relief programs; and
- other programs that affect land-use decisions in vulnerable areas (including the National Flood Insurance and Community Development Block Grant programs, among others).

These workshops are being supported by the Kresge Foundation. GCC is partnering with the Center for Clean Air Policy (CCAP) to facilitate the discussion about how to incorporate climate change projections on floodplain maps.

Goals & Objectives: The goal of GCC's workshop is to identify recommendations for integrating adaptation into key federal programs that affect state and local decision-making. The workshop objectives are to:

- Identify the federal programs that have the greatest opportunity to promote state and local adaptation efforts.
- Identify challenges to incorporating consideration of climate change into identified federal programs.
- Identify data, information, or analysis needed to overcome challenges and integrate adaptation into the administration of federal programs.

Detailed Agenda:

8:30 AM **Welcome, workshop goals and introductions**

Vicki Arroyo, GCC Executive Director

9:15 AM **Track 1: Disaster relief programs**

Challenges and opportunities for supporting adaptation through disaster relief programs (e.g., Public Assistance program, Hazard Mitigation Grant Program, Community Development Block Grants).

Recommendations and needs — For each prioritized topic: What are your recommendations for incorporating adaptation into disaster relief programs? What information, data, and analysis are needed?

11:15 AM Track 2: Floodplain mapping

Update on floodplain mapping after Biggert-Waters and Risk MAP (Doug Bellomo, FEMA)

Break-out sessions on floodplain mapping — opportunities and challenges for incorporating climate changes
(1) coastal floodplain mapping
(2) riverine floodplain mapping

12:30 PM Lunchtime conversation

Marion McFadden, Supervising Attorney at HUD and Chief Operating Officer of the Hurricane Sandy Rebuilding Task Force

1:30 PM Track 3: Mapping and FEMA programs

Report back and recommendation development — report back on discussion from floodplain mapping break-out sessions; identify data gaps and needs; and develop recommendations.

Policy links — how to make climate change maps and tools "actionable" (Prof. J. Peter Byrne); devise recommendations for ensuring that mapping and tools support decision-making.

Identify challenges and opportunities for encouraging adaptation through the National Flood Insurance Program (NFIP) and Community Rating System (CRS).

Recommendations and needs — For each prioritized topic: What are your recommendations for leveraging the NFIP and CRS to support state and local adaptation? What information, data, and analysis are needed?

1:30 PM Track 4: HUD programs

Challenges and opportunities — Identify opportunities and challenges for supporting climate adaptation with CDBG and other HUD formula and discretionary grant funding.

Recommendation development — Identify research gaps and needs; devise recommendations for increasing use of CDBG and other HUD formula and discretionary funds to support adaptation.

Coordination — explore potential to leverage discretionary grant programs to plan for and support more adaptive use of federal funds; devise recommendations for coordinating planning and implementation/formula funds for adaptation.

4:15 PM Break

4:30 PM Report back from break-out sessions and revisit recommendations

5:15 PM Concluding remarks and adjourn

Jessica Grannis, GCC Adaptation Program Manager

5:30 PM Reception

Federal Agencies

David Miller, Federal Emergency Management Agency (FEMA)

Doug Bellomo, FEMA

Mark Crowell, FEMA

John Westcott, FEMA

Paul Huang, FEMA

Kevin Bush, Department of Housing and Urban Development (HUD)

Marion McFadden, HUD and Sandy Task Force

Becky Lupes, Federal Highway Administration

Jeff Peterson, U.S. Environmental Protection Agency (EPA)

Maria Honeycutt, National Oceanic and Atmospheric Administration (NOAA)

Doug Marcy, NOAA

Adam Parris, NOAA

Adrienne Antoine, NOAA

John Haines, U.S. Geological Survey

Dr. Gideon Lukens, White House Office of Management and Budget (OMB)

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Prof. Sandra Knight, University of Maryland — Disaster Resilience Center

Carolyn Kousky, Resources for the Future

Samantha Medlock, Association of State Floodplain Managers

John Miller, New Jersey Association of Floodplain Managers

Sarah Murdock, The Nature Conservancy

Jim Schwab, American Planning Association

Ben Strauss, Climate Central

Laura Tolkoff, Regional Plan Association

Vicki Arroyo, Georgetown Climate Center

Peter Byrne, Georgetown University Law Center

Kate Zyla, Georgetown Climate Center

Jessica Grannis, Georgetown Climate Center

Aaron Ray, Georgetown Climate Center

Sara Hoverter, Harrison Institute for Public Law, Georgetown University Law Center

WORKSHOP 2 AGENDA: NATURE-BASED COASTAL PROTECTION

Workshop Date: November 22, 2013

Location: Hall of States, 444 North Capitol Street NW, Washington, DC; Meeting Room 233

Overview: The Georgetown Climate Center (GCC) is hosting a workshop to convene senior federal, state, and local officials and experts from the NGO and academic communities to discuss opportunities to leverage existing federal programs to support nature-based coastal adaptation strategies (e.g. living shorelines). Specifically, this workshop will focus on funding and regulatory programs administered by the U.S. Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Agriculture (USDA), and the Fish and Wildlife Service (USFWS).

Goals and Objectives: The goal of this workshop is to devise recommendations for leveraging federal programs to support nature-based coastal adaptation strategies. The workshop objectives are to:

- Identify the federal programs that have the greatest opportunity to support nature-based adaptation strategies.
- Identify challenges to implementing these approaches for flood control purposes.
- Identify data, information or analysis needed to overcome challenges and integrate consideration of climate change in the administration of identified federal programs.

Agenda:

12:00 PM Lunch

12:30 PM Welcome and workshop goals

12:45 PM Introductions

1:15 PM Funding programs

Opportunities and barriers for supporting adaptation through the Corps Civil Works program and aligning other federal funding programs for coastal restoration and flood control (including NOAA, EPA, FWS, USDA programs).

3:15 PM Break

3:30 PM Regulatory programs and technical support

Opportunities and challenges for supporting adaptation through the Clean Water Act regulatory program (e.g., Regional General Permits for living shorelines, Special Area Management Plans, updates to the Coastal Engineering Manual)

4:30 PM Recommendation development

Reflect on today's discussion and devise recommendations for realigning federal programs to allow for more natural and nature-based flood control solutions as a climate change adaptation strategy.

5:30 PM Adjourn

Federal Agencies

Charley Chesnutt, U.S. Army Corps of Engineers (Corps)

Jae Chung, Corps

Paul Wagner, Corps

Chris Darnell, U.S. Fish and Wildlife Service

Michael Craghan, U.S. Environmental Protection Agency (EPA)

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Congressional

Miriam Goldstein, Office of Senator Edward Markey

Rachel Silverstein, Senate Commerce Committee

Matthew Strickler, House Committee on Natural Resources

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Naomi Edelson, National Wildlife Federation (NWF)

Bruce Stein, NWF

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Nicole Faghin, Washington Sea Grant

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Niki Pace, Mississippi-Alabama Sea Grant Legal Program

Pam Rubinoff, University of Rhode Island

Alex Score, EcoAdapt

Eric Walberg, Manomet Center for Conservation Sciences

Jay Tanski, New York Sea Grant

Jessica Grannis, Georgetown Climate Center

Vicki Arroyo, Georgetown Climate Center

Bari Greenfeld, Georgetown Climate Center

Aaron Ray, Georgetown Climate Center

WORKSHOP 3 AGENDA: WATER INFRASTRUCTURE

Workshop Date: Friday, January 31, 2014

Location: Hall of States, 444 N. Capitol Street, NW, Washington, DC, Meeting Room 283

Overview: The Georgetown Climate Center (GCC) is hosting a series of workshops with senior federal, state, and local officials and experts from the NGO and academic communities to discuss opportunities to leverage existing federal programs (regulatory, funding, technical assistance, and civil works) to support state and local adaptation. This workshop will focus on how to incorporate consideration of climate change impacts into the development of water infrastructure.

Goals & Objectives: The goal of this workshop series is to identify recommendations for integrating adaptation into key federal programs that effect state and local decision-making. The objectives of this workshop are to:

- Identify opportunities for and challenges to using federal programs to support adaptation in the water sector; and
- Develop recommendations for how EPA and other federal agencies can work with water utilities and other state and local actors to incorporate climate change considerations into the development of water infrastructure.

Agenda:

8:30 AM Welcome, workshop goals, and introductions

9:15 AM **Overview: Adaptation needs and challenges in the water sector**

Jeff Peterson, EPA

9:45 AM **Session 1: Technical assistance**

How can federal agencies develop actionable science and information or enable utilities and communities to obtain this information to support adaptation in the water sector? What resources are needed to develop climate-resilient water infrastructure?

Panelists: Curt Baranowski, EPA; Nancy Beller-Simms, NOAA; Alison Adams, Tampa Bay Water

11:15 AM **Session 2: Adapting with green infrastructure**

What opportunities exist to align federal programs to encourage green infrastructure solutions – which will reduce stormwater runoff and reduce vulnerability to both water quality and urban heat impacts from climate change — while also reducing demand on municipal stormwater systems?

Panelists: Jenny Molloy, EPA; John Phillips, King County, WA

12:30 PM **Lessons from Rebuild By Design**

Scott Davis, HUD

1:30 PM Session 3: Grey infrastructure adaptations

How can federal programs be leveraged to encourage and enable utilities to consider their long-term vulnerabilities to climate change impacts, and to budget for any additional capacity they may need to respond to precipitation changes?

Panelists: Joel Scheraga, EPA; Pinar Balci, New York City Department of Environmental Protection; Maureen Holman, DC Water; Laurens van de Tak, C2HM HILL

4:00 PM Recommendation development

5:00 PM Concluding remarks and adjourn

Federal Agencies

Kirsten Anderer, EPA

Curt Baranowski, EPA

Sam Cohen, EPA

Laura Dubin, EPA

Robert Goo, EPA

Jenny Maolloy, EPA

Emily Nicasio, EPA

Jordan Page, EPA

Jeff Peterson, EPA

Mark Rupp, EPA

Joel Scheraga, EPA

Nancy Beller-Simms, National Oceanic and Atmospheric Administration (NOAA)

Scott Davis, Department of Housing and Urban Development

Chitra Kumar, White House Council on Environmental Quality (CEQ)

Shira Millar, CEQ

Susan Ruffo, CEQ

Marcus Pollock, Federal Emergency Management Agency

Paul Wagner, U.S. Army Corps of Engineers

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Graham Brannin, City of Tulsa

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Owen O'Riordan, City of Cambridge, MA

John Phillips, King County, WA

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Michael Blake, Green For All

Michael Brody, Stratus Consulting

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CHAPTER 2

DISASTER RELIEF PROGRAMS

CHAPTER INTRODUCTION

Recent storms have exposed the vulnerability of our coastal communities to extreme weather events and climate change. Over the last decade, the United States has experienced hundreds of billions of dollars in economic losses from flood events. In 2012, Superstorm Sandy devastated New York City and the New Jersey shore, causing $60 billion or more in damage. In 2011, Irene and Lee battered the eastern seaboard causing losses from North Carolina all the way to Vermont; in combination, they caused almost $8 billion in economic losses.[1] In 2005, the U.S. experienced the most devastating year for catastrophic losses in its history when hurricanes Katrina, Rita, Wilma, and Dennis combined to cause over $187 billion in damages.[2] Economic losses are escalating not only because of population growth and increased development in floodplains, but also because the climate is changing.

Scientists project that as the climate changes these types of catastrophic events will occur with more regularity. Sea levels could rise up to 6.6 feet, on average, by the end of the century under a high emissions scenario.[3] Extreme weather events like hurricanes and nor'easters are expected to occur with greater intensity.[4] Rising seas will exacerbate flood impacts in coastal communities: low-lying coastal areas will become permanently inundated; storm surges will be driven further inland; and shorelines will erode. Thus, dramatic flood events like Superstorm Sandy will quickly become the new normal.

Failure to prepare for these physical changes in our climate will have significant social and economic consequences. Five million Americans live within 4 feet of sea level.[5] Twenty-five of the 100 most populous cities in the U.S. are along the coast. These areas will become increasingly vulnerable to impacts, putting people at risk as well as extensive and valuable public and private development. Although the primary impacts are local, flooding has ripple effects across the entire economy—causing insured and uninsured losses, business interruptions, supply chain interruptions, travel delays, and power outages.

The aftermath of a disaster presents a prime opportunity for communities to rebuild to be more resilient to future climate change impacts. Public and private assets need to be rebuilt and significant funding becomes available through federal disaster relief programs. To ensure the long-term sustainability of disaster relief investments, recovery and rebuilding decisions should consider long-term climate projections.

The problem is that legal and administrative barriers often inhibit adaptive rebuilding. State and local recipients must often patch together funding from several different programs, which is a significant challenge. Disaster relief is administered through twenty or more programs and by a variety of federal agencies, each with its own rules and limitations. Additionally, federal agencies administering these funds do not coordinate their approval processes and reporting requirements. This can create unnecessary red tape, particularly for innovative projects, and can discourage communities from implementing adaptive measures during the rebuilding process.

FEMA, HUD, and other federal agencies that administer disaster relief funding have sufficient authority to allow communities to rebuild to be more resilient to future climate impacts. Federal agencies also have sufficient authority to require that rebuilding decisions account for climate change projections. Disaster relief programs provide enough flexibility for federal agencies to allow innovation and to require resilient rebuilding. However, more could be done to reduce red tape and to encourage and educate state and local grantees about the opportunities to use disaster relief programs to build long-term resilience.

A concise summary of high-level recommendations from the workshop is included here, and a detailed description of each recommendation is provided below:

Recommendations for All Disaster Relief Programs

- HUD and FEMA should align planning requirements across disaster relief programs.
- Federal agencies should encourage regional planning to inform disaster recovery efforts.
- Federal agencies should improve interagency cooperation and ensure that senior-level policy recommendations are translated to staff.
- Federal agencies should require state and local governments to consider climate change in all disaster recovery plans and should enforce those requirements.
- Federal agencies should offer incentives for communities that prepare.
- FEMA and other agencies should review and revise their methods of assessing costs and benefits.
- FEMA should amend benefit-cost-analysis worksheets to incorporate updated regional data and to provide guidance to grantees on how to account for climate change and ecosystem service benefits.
- OMB should reconsider its discount rate.
- Federal agencies should adopt minimum standards for resilient rebuilding and apply those standards to all major federal investments.
- Federal agencies should develop, publish, and act upon lessons learned from disaster recovery efforts.
- Federal agencies should consider methods for allocating disaster relief funds directly to local or regional grantees.
- Federal agencies should encourage more informed private sector decision-making and should leverage public-private investments.
- Federal agencies should better align the timing and distribution of federal disaster relief funds.
- FEMA, where it has authority, should direct more funding to pre-disaster mitigation programs.

Public Assistance Program Recommendations

- FEMA should authorize modifications and mitigation measures to support adaptation of damaged facilities with Public Assistance (PA) program funding.
- FEMA should provide guidance on how communities can use new authorities provided by the Sandy Recovery Improvement Act (SRIA), including in-lieu contributions and lump sum PA grants.
- FEMA should consider future climate change impacts when determining whether to reimburse a grantee to relocate a facility under the PA program.

- FEMA should recognize higher state and local building codes even where some degree of discretion is required to implement the standards.

Hazard Mitigation Grant Program Recommendations

- FEMA should encourage better linkage between hazard mitigation plans and post-disaster recovery plans and land-use plans.
- FEMA and other federal agencies should provide guidance to help states and communities develop funding sources to support hazard mitigation and adaptation outside the disaster relief context and should develop case studies of states and communities that have effectively developed funding sources.
- FEMA and other federal agencies should support development of economic analysis to make a case for hazard mitigation.
- FEMA and other federal agencies should offer more technical support and guidance to states and localities about what tools, models, and data to use for different purposes; and FEMA and other federal agencies should support programs that build local capacity.
- FEMA should provide guidance on how states can opt to administer their own Hazard Mitigation Grant Program (HMGP) as authorized by the Sandy Recovery Improvement Act (SRIA).

Community Development Block Grant Program Recommendations

- HUD should issue guidance on how the Community Development Block Grant (CDBG) program can be used to encourage adaptive rebuilding.
- HUD should align planning and reporting requirements with FEMA requirements to ensure that CDBG can be used to supplement HMGP and PA funding.

National Environmental Policy Act Recommendations

- Federal agencies administering disaster relief programs should integrate environmental review requirements under NEPA, where feasible.
- Federal agencies should allow for multiple projects to be considered together when conducting environmental review for disaster recovery projects.
- CEQ should adopt guidance to federal agencies on how to consider potential climate impacts to a project in environmental review documents required by NEPA.
- Federal agencies should consider funding pilot projects or issuing guidance on the use of Programmatic Environmental Impact Statements (PEISs) as a way of frontloading environmental review for adaptive rebuilding.

Recommendations for Congress

- Congress should better align the planning and environmental review requirements among disaster relief programs.
- Congress should allocate more funding for pre-disaster mitigation.

- Congress should allow disaster recovery funds to be spent over longer time frames and should align the timing and distribution of funds through the various disaster relief programs.
- Congress should allocate funding to allow for local capacity building.
- Congress should develop mechanisms to provide support to communities that receive disaster-affected populations.
- Congress should remove "pre-disaster condition" language from the Stafford Act.
- Congress could consider adding a national priority for disaster recovery to the Housing and Community Development Act to codify a CDBG disaster relief program.

FEDERAL DISASTER RELIEF PROGRAMS

This chapter focuses on the challenges and opportunities to leverage federal disaster relief programs for adaptation, with a specific focus on three programs: the Public Assistance (PA) and Hazard Mitigation Grant Programs (HMGP) administered by FEMA, and the Community Development Block Grant (CDBG) administered by HUD. This section provides general background on each of these programs and describes the challenges that states and localities have encountered in trying to use these funds to rebuild differently after a disaster. This section also describes related administrative requirements that can also pose challenges to adaptation including benefit-cost analysis (BCA) and environmental review requirements imposed by the National Environmental Policy Act (NEPA).

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) governs presidential disaster relief declarations and the administration of federal disaster relief funds.[6] A presidential declaration makes funds available to state and local governments to help them respond to and recover after a catastrophe.[7]

Funding is made available through congressional appropriations to the Disaster Relief Fund (DRF). These appropriations can be made through regular or supplemental appropriations, and often the appropriation language will include specific requirements for how the disaster relief funds are administered.[8]

Disaster relief funding is appropriated to a variety of federal programs administered by different federal agencies, and each program has its own rules and limitations. The Stafford Act created two programs for supporting the long-term recovery, the PA program and the HMGP, both administered by FEMA. Disaster relief appropriations often provide funds to other programs, such as the CDBG administered by HUD, and the State Revolving Fund (SRF) administered by EPA. This session focused on three programs that have highest likelihood for supporting adaptive rebuilding: the PA Program, HMGP, and CDBG.

As part of the most recent disaster relief appropriation bill for Hurricane Sandy relief, Congress enacted the "Sandy Recovery Improvement Act of 2013" (SRIA). The SRIA included some significant reforms to the Stafford Act that may provide FEMA with an opportunity to reduce some of the administrative barriers discussed below. Provisions in the SRIA allow FEMA to provide advance lump sum payments of PA funds to willing state and local grantees.[9] Other provisions allow for streamlined environmental

and historic preservation review[10] and allow FEMA to consider groupings of projects jointly for HMGP funding.

The basics of each disaster relief program are described here, including the challenges to leveraging these funding sources for adaptive rebuilding.

The Public Assistance Program

The primary program that reimburses states and localities for the costs of rebuilding public facilities is the Public Assistance program authorized under Section 406 of the Stafford Act. State and local grantees can be reimbursed for up to 75% of the costs to repair, restore, or replace public facilities. The primary limitation of the PA program is that only certain costs and activities are *eligible* for reimbursement.

Eligible costs are determined on a project-by-project basis. Grantees can typically only be reimbursed to restore the asset to its pre-disaster design, or to codes and specifications that were in effect at the time of the disaster. The Stafford Act authorizes a full range of *eligible activities* allowing state and local grantees to be reimbursed for the repair, restoration, reconstruction, or replacement of damaged public facilities.

This definition of eligible costs presents several challenges to adaptive rebuilding:

- Grantees can generally only be reimbursed with PA funds for the costs of rebuilding an asset to its pre-disaster design or to the building codes and specifications in effect at the time of the disaster.[11] Although the PA program does not prohibit states and local governments from "improving" rebuilt facilities, in most instances, the grantees must come up with the additional money needed to make any improvements to the structure. While the PA Program offers some exceptions, the process requires state and local grantees and FEMA staff to navigate individual exceptions on a project-by-project basis.
- The process by which grantees apply for funds also presents a challenge to adaptation. Grantees must complete a Project Worksheet (PW) documenting the location, description of damage, scope of work, and cost estimate for each PA project. FEMA uses PWs to estimate its future reimbursement obligations to grantees. Once the grantee begins or completes work, they can seek reimbursement for the costs incurred. This limits adaptation because communities cannot direct PA funds to address resilience holistically at the community scale.

However, FEMA has some flexibility to reimburse state and local grantees for improvements to a facility. FEMA can reimburse the costs to rebuild the asset to codes and specifications that were in effect at the time of the disaster. The FEMA Administrator can "modify" the eligible cost calculations where the actual costs of repairing the facility exceed the estimated cost. The Administrator can also authorize reimbursement for the costs of installing mitigation measures in conjunction with the repair of a damaged facility (called "406 mitigation"). Recent amendments to the Stafford Act passed in the Sandy Recovery Improvement Act also provide some *exceptions* to this method of calculating eligible costs that FEMA could leverage to allow for adaptive rebuilding. Grantees can opt for an "in-lieu contribution,"[12] which allows them to direct the money to an alternative project rather than repair the facility in place. Finally, FEMA can now provide lump sum payments based upon fixed estimates to grantees that voluntarily agree to this approach. FEMA could tap these alternative pathways to reimburse states and localities for adaptive rebuilding.

Although the Stafford Act's definition of eligible activities provides enough flexibility to allow for a range of adaptive measures, FEMA regulations present a barrier:

- FEMA regulations preference repair over replacement, and only allow relocation in limited instances. FEMA will only reimburse for the costs to repair a facility where the damage to the facility is less than 50% of the cost of replacement.[13] If the facility is more than 50% damaged, it can be replaced in the same location.[14] Then, relocation may be allowed at the discretion of the FEMA Administrator, but only if the facility is subject to repetitive heavy damage and relocation is "cost effective,"[15] or where local codes and standards require relocation.[16] The way that FEMA and other agencies calculate cost effectiveness often poses a challenge (see discussion of BCA below). This hierarchy and the added documentation required to relocate a facility threatens to perpetuate a cycle where facilities may be repeatedly repaired or put back in harm's way at public expense, rather than relocated to safer locations to avoid future damage. FEMA should reform its regulations and methods for conducting BCA.

The Hazard Mitigation Grant Program

Section 404 of the Stafford Act also created the Hazard Mitigation Grant Program,[17] which after a presidentially declared disaster provides state and local grantees with funding to undertake projects to mitigate future damage.[18] Section 404 allows for a wider variety of fundable mitigation projects than the PA program, and the projects do not have to involve a facility that was damaged during the disaster. Hazard mitigation activities are defined as "any cost effective measure… which will reduce the potential for damage to a facility from a disaster event."[19] Eligible activities include: acquisition, elevation, retrofits, vegetative management, stormwater management, and some structural flood control projects.[20] State and local grantees must have adopted a FEMA-approved Hazard Mitigation Plan (HMP).[21] In general, the federal share is 75% for hazard mitigation activities.

Similar to the PA program, the HMGP also has several limitations that restrict the ability of state and local governments to use these funds for adaptive projects:

- One of the primary goals of the HMGP is to buy down risk to the National Flood Insurance Program (NFIP, discussed in more detail in Chapter 3).[22] As a result, the benefits of a project are often calculated in terms of how much the project will reduce insured losses to the NFIP. As a result, it is difficult to apply HMGP funding to projects that will not have clearly quantifiable reductions in flood insurance claims. Projects that often do not qualify for HMGP funding include: projects designed to remove structures out of erosion hazard areas along stream channels, buyouts outside of the 100-year floodplain, and green infrastructure projects designed to capture rainwater on sites during less intense rain events (i.e., less than 100-year event).
- HMGP funding must be directed towards projects included in state and local Hazard Mitigation Plans (HMPs). In most places, HMPs fail to assess how the risks of natural hazards may increase as a result of climate change.[23] Thus, in these jurisdictions, adaptive projects may not be included in the HMP and will be ineligible for funding as a result. This limitation is exacerbated by the fact that pre-event HMPs often fail to drive post-event hazard-mitigation investments. Often HMPs do not inform local land-use plans and regulations and, as a result, fail to connect to the regulatory mechanisms that will largely drive post-disaster redevelopment.

- FEMA's method of determining cost effectiveness also limits adaptive rebuilding with these funds. HMGP projects must address a repetitive problem and be a "cost effective" long-term solution.[24] FEMA uses a benefit-cost worksheet that relies on historical flood data to calculate the cost effectiveness of a project. In past recovery efforts, this has limited the ability of grantees to factor in the long-term benefits of adapting to future impacts, in addition to other non-economic benefits such as recreational and ecosystem benefits provided by a project. Post-Sandy, FEMA has issued policies and tools that allow communities to consider future climate impacts and ecosystem services in their calculation of benefits.[25] However, it is unclear whether states and localities will have the technical capacity to allow them to effectively leverage these new policies without further guidance on how to quantify future and non-economic benefits.

The Community Development Block Grant Program

In addition to the Stafford Act programs described above, Congress often appropriates disaster relief funds through the Community Development Block Grant (CDBG) program. The CDBG program is authorized by the Housing and Community Development Act of 1974 and administered by HUD.[26] CDBG was originally created as a formula block grant program to support economic development activities of state and local governments. However, in disaster relief appropriations bills since Hurricane Andrew in 1992, Congress has appropriated funding to the CDBG program to also support disaster response and recovery.[27] CDBG offers many benefits because funds can be used to support a wide array of eligible activities: to acquire real property, demolish structures, prepare sites for development, to establish revolving funds, and to support economic development, among other things.[28] However, some rules and requirements apply: grantees must develop "Action Plans" describing how they will allocate the funding pursuant to HUD guidance; and grantees must direct a specified percentage of the funding to low- and moderate-income populations (the Sandy Supplemental required 50%).[29]

CDBG is often used as a vehicle for distributing disaster relief funds because the program provides more flexibility than other funding sources. Because funds are allocated through block grants and can support a wide array of activities, they allow state and local grantees to exercise wide discretion to direct their use. Funds can be used as the state and local match for other programs (such as the HMGP) or to make up the difference in costs needed to improve an asset. However, the flexibility of CDBG often leads grantees to use the money to backfill funding needs that cannot be supported through other programs. Therefore, they will have limited value in supporting adaptive rebuilding if federal agencies cannot encourage a more strategic application of these funds to projects that build long-term community resilience.

Congress requires that communities develop "Action Plans" describing how they will direct CDBG funds. With Sandy funds, HUD used the Action Plan requirements to encourage state and local grantees to address the long-term threats posed by climate change to projects funded with CDBG.[30] The problem is that Action Plans are a separate and distinct planning requirement from the plans and requirements of other programs. For example, allocation of HMGP funds are made pursuant to Hazard Mitigation Plans and post-event plans that do not align with the CDBG planning requirements. These funds are also often distributed on different schedules. The differences in planning, reporting, and the timing of distribution of funds make it difficult for grantees to combine the different streams of funding to achieve a more resiliently designed facility or project.

Challenges Posed by Agency Benefit-Cost Analysis:

The process by which a variety of federal agencies calculate cost effectiveness was also widely discussed as a barrier to funding adaptation with disaster relief funds. With both PA and HMGP funding, FEMA requires a cost-effectiveness analysis. FEMA calculates cost effectiveness using a benefit-cost analysis (BCA) that compares the cost of the improvement to the risk and cost of in-kind replacement. For a measure to be eligible, the measure may not "cost more than the anticipated value of the reduction in both direct damages and subsequent negative impacts to the area if future disasters were to occur."[31] The costs of a project are based upon an estimate of materials, labor, fees, contractor costs, and management costs. The benefits of a project are estimated based upon losses avoided, including casualties, physical damages, loss of function, and emergency management costs.[32]

- One major problem[33] with FEMA's BCA is that it has historically not accounted for the increased risk of future damage under different climate change scenarios. The probability of future loss was determined by reference to the community's Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS).[34] Both documents are based upon consideration of historical flood data and do not account for how flood risks will change over time as sea levels rise and precipitation increases. Thus, FEMA's prescribed methods of determining cost effectiveness may not accurately value the benefits of adapting an asset during the rebuilding process and the costs of failing to do so.[35] However, FEMA does allow for consideration of "cost avoidance," which values the damages avoided in the future due to mitigation measures.[36] While this factor does not explicitly consider future impacts of climate change, it may provide flexibility to allow FEMA and applicants to account for increased risk of damage posed by reasonable, and scientifically supported projections of climate change.

- FEMA has also recently issued two Disaster Assistance Policies and an update to its Benefit-Cost Toolkit,[37] which will allow state and local grantees to account for ecosystems services in their BCAs. It is, however, unclear whether state and local governments have the technical capacity and information needed to quantify non-economic benefits and the benefits of adapting to climate change in a way that will satisfy the federal agencies that must approve the grantees' worksheets. As the policies and tools were recently issued in 2013 and 2014, it will be useful to assess the effectiveness and application of these policies to rebuilding decisions with Sandy disaster relief funding.

- One of the factors that critically influences the outcome of the BCA is the "discount rate," which is established by the Office of Management and Budget (OMB) through OMB Circular A-94.[38] The discount rate is used to compare the value of the federal investment made today to the value of that investment in the future to determine the "present value" of the money proposed to be spent. The higher the discount rate, the lower the present value of the project, which reduces the likelihood that the project will have a benefit to cost ratio of greater than one, which is required to receive funding. When talking about hazard mitigation projects or adaptive projects,[39] a higher discount rate undervalues the economic benefits of those mitigation measures; and some projects may then not meet the required benefit-cost ratio, disqualifying that project for funding.[40] OMB Circular A-94 sets a 7% discount rate for disaster recovery projects that require a BCA to be funded (e.g., most hazard mitigation projects, and relocation with PA funds). The discount rate was set by a panel of economic experts that advise OMB and has not been revisited since 1992. For purposes of climate impacts that will be felt more acutely by future generations, this rate undervalues the benefits of preventive action. OMB should revisit the discount rate and

explicitly consider how climate change should affect the accounting of public investments to prepare for impacts.[41]

Challenges Posed by the National Environmental Policy Act:

Because federal funding decisions are "major federal actions," projects funded through disaster relief programs must also comply with the environmental review requirements of the National Environmental Policy Act (NEPA). Environmental review can add to the time and costs needed to implement an adaptive project, and NEPA requirements could discourage states and localities from implementing adaptive measures during rebuilding where compliance delays efforts to quickly recover.

NEPA directs federal agencies to assess the environmental consequences of "major federal actions significantly affecting the environment." NEPA provides three main pathways for complying with environmental review requirements: (1) statutory exclusions, (2) categorical exclusions, and (3) Environmental Impact Statements (EISs). Actions that do not significantly affect the quality of the human environment may be statutorily or categorically excluded from NEPA review. All other actions that do not fit into one of the two exclusions must complete an environmental review document (EIS or Environmental Assessment). This can be problematic because EISs require lengthy and sometimes expensive analysis and processes such as the identification and evaluation of alternatives, disclosure of environmental impacts, and public scoping and comment periods.[42]

- The challenge for adaptation is that although many disaster relief projects are categorically excluded from environmental review requirements and can proceed with little time and expense, these exclusions are often limited to projects that restore a transportation facility to its pre-disaster right-of-way.[43] Adaptive measures may not qualify for one of the streamlined exclusions because such measures frequently result in alterations in the size, capacity, or location of the facility. Thus, adapting public facilities will often require the completion of full-blown EIS. When pressed with the need to repair and rebuild critical assets quickly after a disaster, the additional time and expense associated with environmental review may discourage state and local governments from pursuing adaptive rebuilding.
- Each agency also has its own process for ensuring that recipients of disaster relief funds comply with NEPA. Thus, where a single project needs to combine different funding streams, the applicant may need to comply with separate environmental review requirements set by the individual agencies administering the funds. This can delay a rebuilding project and add costs that may discourage applicants from pursuing adaptive improvements.

RECOMMENDATIONS

This chapter discusses a variety of recommendations about how federal agencies could reduce barriers and leverage existing disaster relief programs to promote or enable adaptation. These recommendations are discussed here and organized by program:

All Disaster Relief Programs

HUD and FEMA should align planning requirements across disaster programs. FEMA and HUD administer the three major programs that support resilient rebuilding of public and private

development in the aftermath of a major disaster event: the PA program, HMGP, and CDBG. These agencies should better align their paperwork and reporting requirements. All disaster recovery decisions should be driven by a single plan, rather than having multiple separate plans. The current approach of requiring multiple plans leads to piecemeal rebuilding efforts and discourages adaptation because communities find it too difficult to align different funding streams that are all being directed by different plans. Federal agencies should use the same data to determine program eligibility. Federal agencies should also harmonize their guidance and regulations across programs so that they are not denying local efforts to rebuild more resiliently when there is no basis in law for doing so. More research would be required to determine whether agencies could integrate their disaster recovery planning requirements using existing authority, particularly environmental review.

Federal agencies should encourage regional planning to inform disaster recovery efforts. Because natural disasters do not respect jurisdictional lines, there is a greater need to coordinate recovery efforts across jurisdictions. Currently, federal agencies do not require or provide incentives for regional coordination. Regional planning could create more administrative efficiencies, improve interagency and intergovernmental coordination, improve the allocation of funding for mitigation measures, and ensure that mitigation decisions are happening on the appropriate scale (e.g., watershed-scale for floodplain management decisions).

Federal agencies should improve interagency cooperation and ensure that senior-level policy recommendations are translated to staff. The National Disaster Recovery Framework (NDRF) and Sandy Recovery Task Force have both led to better interagency coordination among senior-level officials. But more work needs to be done to ensure that the policies developed through the NDRF and the SRTF are translated down to the staff level. The process has also not led to better coordination with state and local officials. State and local officials report that it is often difficult to determine who at the relevant federal agencies can resolve a conflict. More standardization of the process may help break down the agency silos. Additionally, federal agencies should educate staff on the ground (including examiners) and reduce staff turnover during the disaster recovery process.

NATIONAL DISASTER RECOVERY FRAMEWORK

The NDRF was created to coordinate disaster recovery efforts across federal agencies and between levels of government both pre- and post-disaster. The NDRF defines leadership roles and responsibilities among the federal agencies, including FEMA, HUD, the Army Corps, Department of Commerce, Department of Health and Human Services, and the Department of the Interior. The NDRF was developed to comply with the Post-Katrina Management Reform Act of 2006 and Presidential Policy Directive (PPD-8).

FEMA, National Disaster Recovery Framework: Strengthening Disaster Recovery for the Nation (September 2011), available at: http://www.fema.gov/pdf/recoveryframework/ndrf.pdf.

Federal agencies should require state and local governments to consider climate change in all disaster recovery plans and should enforce those requirements. Disaster relief programs are designed to support recovery from the current disaster and not to reduce future risk. As a result, these programs often place emphasis on recovering quickly. Federal agencies could use their authority to approve recovery plans to ensure that funds are being used to reduce long-term risk.Similar to HUD,

other federal agencies could use their power to approve plans and disaster relief expenditures to require that the assets that are rebuilt with tax-payer money are sustainable given long-term projections of climate change. FEMA is in the process of updating its Hazard Mitigation Planning Guidance (called the "Blue Book"), which provides instructions to state and local governments on how to develop HMPs and to FEMA staff on how to evaluate and approve Hazard Mitigation Plans (HMPs).[44] FEMA has announced that it will include instructions in this manual on how states and localities can incorporate consideration of climate change in HMPs, and how FEMA staff should review and approve plans based upon the treatment of climate risks. FEMA should also ensure that hazard mitigation funds can be used to conduct vulnerability assessments, update HMPs with climate risk information, and fund adaptive projects. Finally, in allocating disaster relief funds, federal agencies should ensure that post-disaster recovery decisions are informed by, and comply with, pre-disaster plans.

Federal agencies should offer incentives for communities that prepare. Federal disaster relief policies often do not reward proactive localities. Communities that plan for and reduce their impacts to disaster events may often receive less funding or be completely ineligible for disaster relief assistance.[45] This creates a perverse incentive for communities to neglect their duties to protect the public by taking preventative action to prepare for impacts. Agencies administering disaster relief funds should think about ways to reward good actors. For example, FEMA could offer increased federal funds to communities that incorporate recommendations from their hazard mitigation plans into their local land-use plans and ordinances, or to states and communities that secure independent sources of funding to implement hazard mitigation measures. Enhanced Hazard Mitigation Plans were mentioned as a way for the proactive states and communities to receive increased federal match by developing more robust HMPs.[46] Communities with high Community Rating System ratings (CRS, discussed in Chapter 3) could also be rewarded with increased federal funding. Congress should amend the Stafford Act to authorize FEMA to reward communities that have high CRS ratings and that implement policies to prepare for impacts from extreme weather events and climate change.

ENHANCED HAZARD MITIGATION PLANS

The State of California developed an "Enhanced" Multi-hazard Mitigation Plan that incorporates consideration of the long-term threats to the state posed by climate change. The state's 2013 plan considers climate impacts to public health, agriculture, and energy including heat emergencies, prolonged drought, wildfires, flooding, extreme weather events, and sea-level rise. California's 2013 SHMP was approved by FEMA as an *"Enhanced" State Mitigation Plan*, making California eligible for an increased federal contribution of mitigation funding following a disaster declaration. Since January 2010, having an enhanced plan has enabled California to receive approximately $33.8 million in Hazard Mitigation Grant Program funds and more than $135 million in federal Public Assistance funds.

FEMA and other agencies should review and revise their methods of assessing costs and benefits. Agencies should review their methods of analyzing costs and benefits to ensure that these analyses account for the long-term risks posed by climate change. They should also provide guidance to states and localities about how to quantify the benefits of adapting to long-term climate change impacts, the benefits of ecosystem services, and other non-economic benefits. FEMA, EPA, and the Corps have already begun assessing how to account for both climate change and non-economic benefits in BCA; however, this work has not been fully integrated into how these agencies administer their funding and

programs. Coordination among these agencies could help to ensure that similar BCA principles are being applied across programs. Additionally, more research will likely be required on how to quantify non-economic benefits and the benefits of adapting to long-term changes in the climate. The National Science Foundation, National Academy of Sciences, National Academy of Engineering, and other agencies that fund or undertake research should prioritize projects that will help federal agencies develop the science needed to reform BCA.

FEMA should amend benefit-cost-analysis (BCA) worksheets to incorporate updated regional data and to provide guidance to grantees on how to account for climate change and ecosystem service benefits. FEMA could coordinate with EPA, FHWA, and the Corps to develop methods for accounting for future climate impacts, ecosystem services, and other non-economic benefits and incorporate these considerations into BCA worksheets and other guidance to state and local grantees. Federal agencies should ensure that they have the most up-to-date economic data for regions.

OMB should reconsider its discount rate. OMB should reconsider the 7% rate under Circular A-94. Federal agencies should consider issuing policies to justify a reduced discount rate for certain projects that have broad and long-term social and non-economic benefits (such as floodplain buyouts). The White House should also convene a panel of economic experts to reevaluate BCA and the federal discount rate in light of projected climate change.

FEMA EFFORTS TO ELIMINATE BARRIERS TO ADAPTATION

In 2013, FEMA took important steps to address problems with the BCA for hazard mitigation projects. In June 2013, it issued Mitigation Policy FP-108-024-01 that allows for the inclusion of environmental benefits in BCA for acquisition projects. FEMA issued a Frequently Asked Questions (FAQ) on incorporating sea-level rise into hazard mitigation assistance BCA. The FAQ says that states may decide to include sea-level rise estimates in grant applications and BCA calculations, and provides a list of recognized sea-level rise estimation methods. FEMA has also issued a Climate Change Adaptation Policy, which outlines seven actions for integrating climate change adaptation into FEMA programs and operations, including: increased collaboration with other agencies to "enhance climate research, monitoring, and adaptation capabilities;" continued study of the impacts of climate change on the NFIP; consideration of how to incorporate climate change in grant making and BCA; continued engagement with local communities on how to address impacts; promotion of building standards and practices that consider the future impacts of climate change; and continued training to develop a "flexible, scalable, well equipped, and well trained workforce that is educated about the potential impact of climate change." FEMA is also in the process of developing a Climate Change Adaptation Implementation Plan as a follow-up activity detailed in the DHS Climate Change Adaptation Road Map (the agency's adaptation plan). Finally, in April 2014, FEMA released a new Version 5.0 of its BCA Tool that provides technical assistance for quantifying the ecosystem service benefits provided by a project.

Federal agencies should adopt minimum standards for resilient rebuilding and apply these standards to all major federal investments. The President's Climate Action Plan called for a national flood risk reduction standard that accounts for current and future risk. The Hurricane Sandy Recovery

Task Force (SRTF) called for all major rebuilding projects to be rebuilt to the best available FEMA guidance plus one foot of elevation (i.e., one-foot freeboard).[47] National Security Council Staff through the Mitigation Framework Leadership Group (MitFLG) are working to develop a flood risk reduction standard that will apply to all major federal investments.

A one-foot freeboard standard, such as that applied post-Sandy, may not, however, be appropriate for all regions and all assets. Some regions, such as the Gulf Coast, are projected to experience much greater localized rate of sea-level rise due to land subsidence. A national standard should account for regional variation. A one-foot freeboard standard may also not be appropriate for all types of structures. Critical assets (e.g., emergency evacuation routes, emergency shelters, hospitals, wastewater treatment facilities, and electrical substations) often have a longer design life and impacts to these facilities have much greater consequences for communities. As a result, critical facilities may warrant a more precautionary standard to reduce risks (e.g., three-foot freeboard). A one-foot freeboard standard may also not be appropriate for riverine floodplains. A standard for riverine floodplains should account for changes in flood heights based upon projections of how climate change will affect the intensity and duration of precipitation events, and how those changes will also exacerbate other flood-related hazards, such as erosion. Federal agencies should also think about other types of minimum standards, other than just elevating structures. For example, federal agencies could consider limiting the use of federal disaster relief funds to rebuild critical facilities in coastal high hazard areas, with an exception for communities that do not have suitable inland locations to relocate these facilities.

HURRICANE SANDY RECOVERY TASK FORCE

On December 7, 2012, President Obama issued Executive Order 13632 establishing the Hurricane Sandy Recovery Task Force (SRTF). The SRTF was chaired by HUD Secretary, Shaun Donovan, and included representatives from all federal agencies charged with administering Sandy relief funding including DHS, DOT, EPA, and the Corps. The SRTF was charged with identifying and working to "remove obstacles to resilient rebuilding in a manner that addresses existing and future risks and vulnerabilities and promotes the long-term sustainability of communities and ecosystems." On August 9, 2013, the SRTF released its Hurricane Sandy Rebuilding Strategy. In a comprehensive assessment of federal programs, the Strategy identifies 69 recommendations for both building resilience with Sandy disaster relief funding and also making longer-term reforms needed to prepare the nation for the increased risks posed by extreme weather and climate change. One particular recommendation requires that structures rebuilt with Sandy Relief funding be elevated to one foot above the most up-to-date federal flood guidance (including updated flood maps that were rolled out by FEMA shortly after the storm).

Exec. Order No. 13632, sec. 3, 77 Fed. Reg. 76339 (Dec. 7, 2012), available at: http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2013/HUDNo.13-125.

Federal agencies should develop, publish, and act upon lessons learned from disaster recovery efforts. From Katrina to Irene to Sandy, federal agencies are improving how they respond to disasters and learning how to allow for more adaptive rebuilding. However, more work needs to be done. Federal agencies should capture the lessons they are learning from previous disasters: what worked, what did not work, what can be improved, and how. For example, HUD should publish the outcomes from

requiring states and localities to consider sea-level rise in CDBG Action Plans, including lessons learned and beneficial outcomes achieved from the projects that complied with HUD requirements. FEMA should publish the lessons learned from implementation of its disaster assistance policies and its new BCA tool that allows for consideration of ecosystem services.

Federal agencies should consider methods for allocating disaster relief funds directly to local or regional grantees. State entities and governors tend to set priorities for how disaster relief funding gets distributed, particularly HMGP funds. As a result, local communities do not know how much they are going to get, which makes it difficult for them to set rebuilding priorities. It is uncertain whether FEMA and other federal agencies can allocate disaster relief funds directly to local or regional grantees, but some suggested that this model could provide incentives for better planning and implementation of HMPs, particularly for large cities that have significant capacity to administer their own funds, such as New York City.

Federal agencies should encourage more informed private sector decision-making and should leverage public-private investments. Some suggestions for encouraging public-private investments included aligning federal tax credits, pooling resources with owners of pension plans, and involving other federal agencies such as the Department of Treasury. Federal agencies, universities, and NGOs should undertake more research to determine the best pathways for aligning public and private disaster recovery and preparedness investments.

Federal agencies should better align the timing and distribution of federal disaster relief funds. It is difficult for grantees to align funding streams when the timing and provision of funds is so uncertain. Where possible, federal agencies should distribute funds on similar schedules so that communities can combine funding streams to implement adaptive projects. Localities should also be encouraged to identify, in advance, sources of funding to implement mitigation measures recommended in local hazard mitigation plans.

Public Assistance Program

FEMA should authorize modifications or recognize mitigation under the Public Assistance program to support adaptation of damaged facilities, where appropriate. FEMA should provide guidance on when it will allow for modifications or recognize mitigation under the PA program to support more resilient rebuilding. The Stafford Act gives FEMA discretion to allow for the "modification" of its eligible cost calculation where the actual costs of repairing the facility exceeds the estimated costs for repair.[48] The FEMA Administrator also has authority to reimburse grantees for mitigation measures as part of a PA project (called "406 mitigation").[49] Installing the mitigation measure must be done in conjunction with the repair of a disaster-damaged facility, must be approved in advance, and must be deemed to be cost effective.[50] FEMA should use these pathways provided by Section 406 to reimburse state and local grantees for the costs needed to rebuild facilities in a manner that will promote their long-term resilience.

FEMA should provide guidance on how communities can use in-lieu contributions. With reforms enacted with the SRIA, state and local governments now have flexibility to redirect their PA funds to other projects rather than rebuild in place by opting for an "in-lieu contribution."[51] FEMA should clarify how grantees can opt for in-lieu contributions. FEMA should also ensure that other administrative or procedural barriers do not dissuade grantees from pursuing this avenue for reimbursement where appropriate.

FEMA should provide guidance on new authority to provide lump sum PA grants. The SRIA amended the PA program to allow communities to elect to receive a lump-sum grant from FEMA based upon fixed estimates. Communities that opt for lump-sum payment must agree to be responsible for any cost overruns if the actual costs of rebuilding exceed estimated costs. Through this pathway, communities can avoid project-by-project reimbursement and could be given the flexibility to direct funding to projects at a community-scale and in manner that will ensure the long-term resilience of the investments. FEMA is administering this program as a pilot for Sandy relief funding; FEMA should report on the outcomes of these pilots and adopt regulations that reduce administrative barriers and provide grantees with maximum flexibility to direct PA funds to projects that will ensure the long-term resilience of facilities.[52]

FEMA should consider future climate change impacts when determining whether to reimburse a grantee to relocate a facility under the PA program. FEMA should consider future climate impacts when calculating the risk of repetitive damage to a facility, and when determining whether it is more "cost effective" to relocate a facility rather than replace the facility in place.

FEMA should recognize higher state and local building codes even where some degree of discretion is required to implement the standards. FEMA should ensure that staff members are trained to recognize higher state and local standards when making determinations about eligible costs and approving Project Worksheets. FEMA and other federal agencies should recognize, comply with, and reimburse communities to rebuild to more restrictive state and local standards (e.g., communities with 3 foot freeboard[53]).

CHALLENGES TO RESILIENT REBUILDING IN VERMONT POST-IRENE

Vermont localities encountered barriers in trying to use federal disaster relief funds to rebuild their transportation infrastructure to be more resilient to future impacts in the aftermath of Hurricane Irene. Irene dumped more than 7 inches of rain on the state over the course of two days, which washed out hundreds of miles of roads and bridges. In the aftermath of the disaster, Vermont set about rebuilding its roads and bridges to higher state standards, but encountered legal barriers when FEMA initially refused to reimburse communities for the added costs. Vermont's standards required that culverts be designed to accommodate additional streamflow and to minimize impacts to aquatic species; permits are issued based upon a site-specific analysis. Requiring culverts to be upgraded will increase the resilience of roads and bridges because they will be less likely to be washed out in extreme rain events, which are projected to increase for the state under climate change scenarios. FEMA, however, initially denied reimbursement, arguing that the state standards for rebuilding culverts provided state regulators with too much discretion and thus did not comply with FEMA requirements that standards be "uniform." The state appealed the decision, and as of December 2013, FEMA had allowed one locality to be reimbursed and was considering the appeals of other localities.

Georgetown Climate Center, Lessons Learned from Irene: Climate Change, Federal Disaster Relief, and Barriers to Adaptive Reconstruction (December 2013), available at: http://www.georgetownclimate.org/lessons-learned-from-irene-climate-change-federal-disaster-relief-and-barriers-to-adaptive-reconstru.

The Hazard Mitigation Grant Program

FEMA should encourage better linkages between HMPs and post-disaster recovery and land-use plans. FEMA could make these linkages a requirement for approval of Hazard Mitigation Plans or Enhanced Hazard Mitigation Plans. There is a need to ensure that recommendations from state plans are translated down to the local level and mainstreamed into decision-making frameworks (local comprehensive plans, land-use ordinances, and capital improvement plans). Additionally, plans should factor in how funds will be distributed post-disaster and develop state and local sources for funding mitigation measures. These types of linkages could be better rewarded by FEMA through the Community Rating System (discussed in Chapter 3); for example, FEMA could award points to communities that incorporate recommendations from Hazard Mitigation Plans into local land-use plans and ordinances.

FEMA and other public agencies should provide guidance to help states and communities develop funding sources to support hazard mitigation and adaptation outside of the disaster relief context, and should develop case studies of jurisdictions that have effectively developed funding sources. FEMA should identify communities that are taking proactive steps to plan for and locally fund mitigation measures. Federal agencies should reward and champion these proactive communities as models for other communities.

NORTH CAROLINA LOCALITIES USE STORMWATER FEES TO FUND BUYOUTS

Charlotte and Mecklenburg County, North Carolina, impose stormwater fees to fund a buyout program that aims to reduce flood damage by purchasing high-risk properties. The stormwater fees are levied on all water customers as determined by the location of the property, its square footage of impervious surfaces (e.g., rooftops or driveways), and the cost of providing stormwater services. The fees are used to fund three different types of floodplain buyouts: annual buyouts are selected for acquisition based on overall flood risk to the property and other benefits that can be provided to the community through acquisition; "quick buy" properties are purchased by the county in the immediate aftermath of damage from destructive flooding; and "orphan" property acquisitions use stormwater fees to buy properties that did not meet the criteria for a federal grant buyout, but are adjacent to other bought-out properties. The goal of orphan buyouts is to encourage the last homeowners living in a high-risk neighborhood to move so that the roadway can be completely removed and the site can be restored to its natural floodplain function. By buying out flood-prone properties, the county has reduced its emergency response costs, created valuable recreational space for county residents, and increased property values. It is also avoids costs to the NFIP and federal disaster relief programs by reducing risks of catastrophic flooding.

FEMA and other federal agencies should support development of economic analyses that make a case for hazard mitigation. Several workshop participants raised the need for better data to show the return on investment from hazard mitigation activities. Experts often cite the statistic that for "every dollar expended on [hazard] mitigation, a $4 savings is realized"[54] However, this statistic averages across a range of mitigation measures and glosses over the complexity of trying to quantify the costs and benefits of a variety of different types of mitigation projects. Mitigation measures can include a range of different strategies including elevating structures, restoring

wetlands as natural flood buffers, and implementing land-use regulations that limit development in hazard-prone areas. Each provides different economic benefits, provides different levels of protection, and also provides a variety of non-economic benefits. For example, a recent Oxfam America and Center for American Progress report studied three coastal restoration projects and found that for every dollar invested, the projects brought, on average, $15 in economic returns.[55] To build political support for hazard mitigation at all levels of government, more refined economic analysis is needed to demonstrate the value of investments in mitigation across a range of different policies.

FEMA and other federal agencies should offer more technical support and guidance to states and localities about what tools, models, and data to use for different purposes, and should support local capacity building. FEMA, in partnership with other agencies such as EPA and NOAA, could provide technical and financial support to help communities consider climate change in hazard mitigation plans.[56] FEMA and other federal agencies should support local capacity.

FEMA should provide guidance on how states can opt to administer their own HMGP as authorized by the Sandy Recovery Improvement Act. Provisions in SRIA allow FEMA to streamline environmental review, BCA, and historic preservation requirements by considering multiple projects as a group. Projects that may not individually meet FEMA's BCA may meet these requirements when the cumulative benefits of multiple projects are added together. Section 1104 of the SRIA expands FEMA's authority to allow states to administer the HMGP.[57] This could provide states with more flexibility to determine the criteria for evaluating and justifying the cost effectiveness of mitigation measures. In adopting regulations, FEMA should seek to maximize the extent of authority it delegates to states that demonstrate their capacity to administer the HMGP.

The Community Development Block Grant Program

HUD should issue guidance on how CDBG can be used to encourage adaptive rebuilding. Without guidance, states and localities often use CDBG as a "gap filler." But, because this funding is so flexible, it has the most potential for allowing adaptive rebuilding. Communities can use CDBG funding to make up the cost difference needed to rebuild an asset to be resilient to climate change impacts—costs that cannot be reimbursed under other federal programs, such as the PA program. CDBG can also be used as the 25% state and local match needed for HMGP projects.

HUD should align planning and reporting requirements with FEMA requirements to ensure that CDBG can be used to supplement HMGP and PA funding. Because CDBG funding is so flexible and can be used to supplement other federal funds, CDBG presents the best option for making up for the limitations of other federal programs. If it were easier to couple funds together, grantees could more easily use CDBG to make up any necessary additional costs needed to implement an adaptive project that cannot be fully funded through one of the other disaster relief programs.

National Environmental Policy Act

Federal agencies administering disaster relief programs should integrate environmental review requirements under NEPA, where feasible. Separate environmental review requirements imposed by each agency administering disaster relief funds can also lead to piecemeal rebuilding efforts and inhibit the ability of states and localities to align funding streams. Although the SRIA allows for common environmental reviews across federal agencies, this has not occurred in the administration of funds, and grantees are having to do separate project-by-project environmental

review. Federal agencies should integrate their environmental review requirements and recognize environmental impact analyses prepared for other agencies.

Federal agencies should allow for multiple projects to be considered together when conducting environmental review for disaster recovery projects, where feasible. The SRIA allows FEMA to consider multiple projects as a group for purposes of environmental review, cost-effectiveness analysis, and historic preservation. FEMA should clarify how it will implement this new authority, and other federal agencies should analyze whether they have the authority to consider multiple projects in one environmental impact analysis.

CEQ should adopt guidance on how to consider potential climate impacts in environmental review documents required by NEPA. In February 2010, CEQ released draft guidance to federal agencies on how to consider greenhouse gas emissions in environmental review documents required under NEPA.[58] The guidance also called on federal agencies to consider how climate change could affect a proposed action or alternative. However, after the public comment period closed, CEQ failed to finalize the NEPA climate change guidance. By requiring federal agencies to assess impacts to a project from climate change and develop adaptive alternatives, CEQ could ensure the long-term viability of federal investments.

Federal agencies should consider funding pilot projects or issuing guidance on the use of Programmatic Environmental Impact Statements (PEISs) as a way of frontloading environmental review for adaptive rebuilding. PEISs are regionally focused studies that assess the environmental impacts of broad sets of policies, programs, and alternatives. Through a PEIS, agencies can assess the vulnerability of their critical systems (e.g., transportation systems) to climate impacts, identify a range of adaptation alternatives for particular assets (such as relocating, elevating, or protecting assets), and begin the process of evaluating the environmental impacts of different alternatives. Then, if a disaster strikes and disaster relief funding becomes available, state and local governments can rely on a previously prepared PEIS, truncating the environmental review process required to implement selected project alternatives. By conducting the environmental analysis during a pre-disaster planning phase, communities will be in a better position to quickly direct disaster relief funding, and environmental review requirements are less likely to be circumvented due to exigencies posed by disaster recovery needs.

Recommendations for Congress

Congress should better align the planning and environmental review requirements between disaster relief programs. Congress should require the integration of disaster recovery planning requirements through language in appropriations bills. Congress should consider allowing state administration of other disaster relief programs (such as the PA program), similar to the authorization in the SRIA allowing for state administration of the HMGP. Congress should also consider broadening the provisions in the SRIA that allow for unified environmental review for HMGP projects to other programs, such as CDBG.

Congress should allocate more funding for pre-disaster mitigation. FEMA, where it has authority, should direct more funding to pre-disaster mitigation programs. The HMGP is only one program that funds hazard mitigation activities; however, the focus of this program is largely reactive—meaning that funds only become available after a disaster. FEMA administers several other pre-disaster mitigation programs that provide funds to communities to allow them to implement proactive measures to reduce their risks before damage occurs, including the Flood Mitigation Assistance (FMA) and Pre-Disaster Mitigation (PDM) programs.[59] These programs, however, receive a fraction of

the funding that the HMGP receives (e.g., in FY12 the HMGP received over $1 billion in appropriations, whereas the PMA and FMA programs combined only received $77 million).[60] Both programs are also administered through a competitive process, which limits the ability of smaller states and communities or those with less administrative capacity to receive these funds. With additional funding for pre-disaster mitigation, communities could take preventative measures to reduce or avoid damages—rather than waiting for the next storm.

Congress should consider allowing disaster recovery funds to be spent over longer time frames and should align the timing and distribution of funds through the various disaster relief programs. Sandy-affected communities are considering green banks and revolving loan funds to finance resiliency measures and to maximize the return on the federal investment. However, because of the four-year limit on expending disaster relief funds, they are facing challenges in using the funds in this manner.

Congress should allocate funding to allow for local capacity building. Communities vary in their resources and capacity to plan and direct resilience efforts. Many localities do not have a dedicated local recovery officer, which makes it difficult to coordinate with FEMA in the aftermath of disaster. Congress should provide funding to support dedicated recovery officers for particular localities or regions.

Congress should develop mechanisms to provide support to communities that receive affected populations. Disaster relief programs fail to provide assistance to communities that *receive* the people who have lost their homes in natural disasters. For example, Baton Rouge and Lafayette, Louisiana, had dramatic, overnight population increases post-Hurricanes Katrina and Rita. Their populations continue to be much higher nine years later and will likely continue to grow given the combined pressures of sea-level rise, land loss, and greater frequency of intense storms. Yet these and many other affected areas are ineligible to receive disaster relief funds to help plan and to provide services for swelling populations. By allocating funding to receiving communities, Congress could facilitate managed relocation away from vulnerable coastal areas.

Congress should remove pre-disaster condition language from the Stafford Act. In this era of climate change, a policy of restoring assets to their pre-disaster condition no longer makes fiscal sense. Congress should consider the more flexible authority granted to FHWA to administer funds under the Federal Aid Highway Act Emergency Relief (FHWA-ER) program, where state and local governments can be reimbursed for the costs to repair or reconstruct a "comparable" highway facility.[61] Comparable facility is defined broadly as a "facility that meets the current geometric and construction standards required for the types and volume of traffic that the facility will carry."[62] This definition is broad enough to allow FHWA to approve additional resiliency measures for rebuilt assets.[63] Likewise, FEMA needs similar authority to reimburse for improvements that will ensure the long-term viability of recovery investments.

Congress could consider adding a national priority for disaster recovery to the Housing and Community Development Act to codify a CDBG Disaster Relief program. Some workshop participants reported that the requirement that at least 50% of CDBG-DR money go to benefit low- and moderate-income communities sometimes created unnecessary road blocks to using the funds to spur economic development in disaster-affected areas. It was suggested that Congress create an additional national priority specifically for disaster recovery. However, others were reticent to shift the focus of CDBG funding away from low- and moderate- income communities and suggested that CDBG offers sufficient flexibility to allow the funds to be directed to a variety of projects.

CHAPTER 2 ENDNOTES

1. NOAA, National Weather Service, (Sept. 2012), available at: http://www.nws.noaa.gov/om/assessments/pdfs/Irene2012.pdf; NOAA, NWS Service Assessment, Remnants of Tropical Storm Lee and the Susquehanna River Basin Flooding of September 6-10, 2011 (May 2012), available at: http://www.nws.noaa.gov/os/assessments/pdfs/LeeSusquehanna12.pdf.
2. Don Jergel, "NOAA: 2012's U.S. Billion-Dollar Extreme Weather Events 'Impressive'" Insurance Journal (Jan. 4, 2013), available at: http://www.insurancejournal.com/news/national/2013/01/04/276178.htm [damages for Katrina, Rita, Wilma and Dennis adjusted to 2012 dollars].
3. U.S. Global Change Research Program, The Third National Climate Assessment at Ch. 2, 45 (May 2014) (hereinafter NCA 2014).
4. NCA 2014 at 59.
5. Climate Central, Surging Seas: Sea level rise, storms & global warming's threat to the US coast (March 2014), available at: http://sealevel.climatecentral.org/research/reports/surging-seas.
6. A "major disaster" is defined as any natural or man-made catastrophe anywhere in the United States, which, in the determination of the President, causes damage "of sufficient severity and magnitude to warrant major disaster assistance to supplement the efforts and available resources of the States, local governments, and disaster relief organizations." 42 U.S.C. § 5122 (2006).
7. Once the president declares a major disaster local governments may apply for federal assistance through a state agency, which forwards the request to FEMA. Following a request for reimbursement, FEMA inspectors or state officials prepare a project worksheet specifying damage caused by the disaster and eligible costs. A panel of experts develops a range of costs (floor and ceiling cost estimates) that reflect the anticipated cost to restore the facilities. 44 C.F.R. §§ 206.200-206.228 (2012).
8. Most recently in 2013, Congress enacted the Sandy Relief Appropriations Act (Pub. L. No. 113-2, 127 Stat. 4) through which it appropriated $50.7 billion in disaster relief funds to communities affected by Superstorm Sandy. Division B of the Act, entitled the "Sandy Recovery Improvement of Act of 2013" (SRIA), included key reforms to the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) – the statute that governs two of the primary disaster recovery programs: the Public Assistance program and the Hazard Mitigation Grant Program.
9. Sandy Relief Act, Pub. L. No. 113-2, § 1102, 127 Stat. 4, 40 (2013).
10. Sandy Relief Act, § 1106, 127 Stat. at 45-46.
11. 42 U.S.C. § 5172(e)(1)(A).
12. Provisions in SIRA removed a 10% penalty that was previously imposed on applicants that opted for the in-lieu contribution. 42 U.S.C. § 5172(c)(1)(A) (2006),Pub. L. No. 113-2, sec. 428, 127 Stat. 4, 39 (2013). Prior to the SRIA, reimbursement was limited to 90% of eligible costs, meaning that FEMA can reduce the 75% federal share by 10% where an applicant elects to take the PA funds in-lieu of repairing or restoring a facility in place. Section 428 of Division B states that applicants can elect to receive an "in-lieu contribution, without reduction." Sandy Relief Act, Pub. L. No. 113-2, sec. 428(e)(1)(B), 127 Stat. at 39 (Jan. 29, 2013).
13. 44 C.F.R § 206.226 (2012).
14. 44 C.F.R. § 206.226(f)(2).
15. 44 C.F.R. § 206.226(g). The cost effectiveness or benefits of relocation are measured in terms of the damage prevented by moving away from the hazardous location. FEMA operates under a presumption that relocation is only "cost effective if the damage is severe enough that the facility qualifies for replacement (i.e., is greater than 50 percent damaged). FEMA, Public Assistance Program Guide at Ch. 2 (Jun. 2007); available at http://www.fema.gov/public-assistance-policy-and-guidance/public-assistance-guide.
16. Federal, state, or local standards may sometimes require relocation. For example, if local floodplain regulations prohibit critical facilities in special flood hazard areas (i.e., the 100-year floodplain), FEMA would approve reimbursement to relocate the damaged critical facility. FEMA, Public Assistance Program Guide at Ch. 2.
17. Section 5170(c) of the Stafford Act provides: "The President may contribute up to 75 percent of the cost of hazard mitigation measures which the President has determined are cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster."
18. Although often distinguished as different activities, adaptation is hazard mitigation by another name: Hazard mitigation activities are designed to lessen or avoid future impacts, but future impacts are typically determined based upon consideration of historic data. Adaptation activities are also designed to lessen or avoid future impacts; however, the probability of future impacts is determined based upon climate projections.
19. 44 C.F.R. § 206.2.
20. 44 C.F.R. § 206.434. Examples of structural changes include retrofitting structures to be more resistant to wind-hazards or elevating assets and building seawalls to reduce flood damage.
21. Id.

22. See FEMA, Procedures for Developing Scopes of Work for a Drainage Storm Water Management Program at 3 (Jan. 2005) ("Stormwater HMGP Program Manual").

23. Matthew Babcock, Center for Climate Change Law Columbia Law School, State Hazard Mitigation Plans & Climate Change: Rating the States 5 (Nov. 2013) available at: http://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/Students/SHMP%20Survey_Final.pdf.

24. Five percent of HMGP funds can be used to fund projects where cost-effectiveness cannot be determined because it is infeasible or administratively burdensome. FEMA, Hazard Mitigation Assistance Unified Guidance 25 (June 2011), available at: http://www.fema.gov/library/viewRecord.do?id=4225.

25. FEMA, Mitigation Policy – FP-108-024-01, Consideration of Environmental Benefits in the Evaluation of Acquisition Projects Under the Hazard Mitigation Assistance Programs (Jun. 18, 2013), available at: http://www.fema.gov/media-librarydata/20130726-1920-25045-4319/environmental_benefits_policy_june_18_2013_mitigation_policy_fp_108_024_01.pdf; FEMA, Incorporating Sea Level Rise (SLR) into Hazard Mitigation Assistance (HMA) Benefit Cost-Analysis Frequently Asked Questions (FAQs), available at: http://www.fema.gov/media-library-data/1387903260455-e6faefb55a3f69d866994fb036625527/HMA+Sea+Level+Rise+FAQ+12-23-2013.pdf; see also FEMA, Benefit Cost Tool Version 5.0 New Features, infra. note 37.

26. CDBG funds are typically allocated by formula grants to support economic development activities of state and local governments. Because these funds are issued through block grants, state and local recipients (grantees) exercise a great degree of discretion in determining how to use the funds. The only requirement is that the funded activities meet three national priorities: (1) benefit low- and moderate-income families (see definition infra. note 29); (2) aid in the prevention or elimination of slums or blight; or (3) meet other community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community 42 U.S.C. § 5306(d) (2006); 24 C.F.R. § 570.200(a)(2). It is under the third priority that Congress has funded the CDBG program to support disaster relief. Eugene Boyd, CRS Report for Congress, RL33330, (Sep. 21, 2011).

27. 42 U.S.C. § 5172(c)(1)(A) (2006), amended by Sandy Relief Act, sec. 428, 127 Stat. at 41. Brown, note 33 at 12; GAO-09-541, Gulf Coast Disaster Recovery: Community Development Block Grant Program Guidance to States Needs to Be Improved at 2 (Jun. 2009).

28. 42 U.S.C. § 5305.

29. For the purposes of the CDBG program, a "low- and moderate-income person" means a member of a family having an income equal to or less than the Section 8 low-income limit established by HUD every year. 24 C.F.R. § 570.3 (2012). Generally, a Section 8 low-income family is one whose annual income does not exceed 80 percent of the median income for the area, adjusted for family size. 42 U.S.C. § 5302(a)(20)(A). In fiscal year 2011, a family of four having an income less than $67,600 qualifies as a CDBG low- and moderate-income family in the District of Columbia. Dept. of Housing and Urban Development, (last updated July 14, 2011).

30. Often state or local grantees must submit an "Action Plan" for using the funds to the HUD Secretary for approval. For Sandy money, the Action Plans were required to demonstrate how the intended use of the funds will address the "recovery, restoration of infrastructure and housing, and economic revitalization in the most impacted and distressed areas." Sandy Relief Act, Pub. L. No. 113-1, 127 Stat. at 38 (Jan. 29, 2013). HUD further refined this requirement by issuing guidance specifically requiring grantees to conduct a comprehensive risk analysis of the long-term vulnerability of major infrastructure projects to climate change impacts. Department of Housing and Urban Development (HUD), 78 Fed. Reg. 69104-01, 69107 (Nov. 18, 2013).

31. 44 C.F.R. § 206.434.

32. FEMA, Supplement to the Benefit-Cost Analysis Reference Guide , at 2-3 (June 2011), available at: http://www.bchelpline.com/BCAToolkit/resource_files/BCA_Reference_Guide_Supplement.pdf. Costs include: Casualties: deaths, injuries and illnesses; physical damages: to buildings, their contents, infrastructure, landscaping, site contamination, vehicles and equipment; loss of function: displacement costs, loss of rental income, loss of business income, lost wages, disruption time of residents, loss of public services, loss of utility services, and the impact of road or bridge closures; and emergency management: costs for emergency operation centers, evacuations and rescues, security, temporary protective measures, and debris removal and clean up.

33. FEMA's BCA is also problematic because it does not account for indirect benefits that accrue to the state and local government from the activity, such as increased real estate values, environmental benefits, recreational benefits, and revenue generated from tourism. Association of State Floodplain Managers (ASFPM), Use of Benefit/Cost Analysis for FEMA Programs 9 (2007), available at: http://www.floods.org/PDF/ASFPM_White_Paper_BCA_0707.pdf.

34. FEMA, Supplement to the Benefit-Cost Analysis Reference Guide at 2-3.

35. Gary Yohe, Addressing Climate Change through Risk Management, Pew Benefits Workshop at 213 (May 2010) http://www.c2es.org/docUploads/yohe-climate-change-risk-management.pdf.

36. FEMA, Disaster Assistance Policy 9526.1, at Sec. B(3).

37. FEMA, Benefit Cost Tool Version 5.0 New Features (Apr. 2014), available at: http://www.fema.gov/media-library-data/1396545579199-3bce10f3252b5ec22deb6e087d4309bd/New+features+BCA+Version+5-0.pdf.

38. Note that some agencies set their discount rate or their discount rate is set by statute, and is therefore exempt from OMB Circular. For example, Corps discount rate is established by the formula in Water Resources Development Act. See Kyna Powers, CRS,

Benefit-Cost Analysis and the Discount Rate for the Corps of Engineers' Water Resource Projects: Theory and Practice (Jun. 23, 2003), available at: http://www.wcu.edu/WebFiles/PDFs/Corps_Benefit_Cost_Analysis.pdf; OMB Circular No. A-94, App. C, Discount Rates for Cost-Effectiveness, Lease Purchase and Related Analyses (Rev. Dec. 2013), available at: http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c.

39. Jane Leggett, in a 2011 Congressional Research Service report, discusses the limitations of cost-benefit analysis in guiding long-term mitigation policies, but some of the concepts about the limitations of discount rates and the inability to quantify benefits given uncertain climate change scenarios also apply to adaptation policy decision-making. "The outcomes of CBA for choices having long-term effects can be strongly determined by the choice of "discount rates" to reflect the "time value of money"—that is, the observation that people would typically prefer to get a given amount of money today rather than a year from now. Respected economists disagree over what the appropriate discount rate should be for climate change decisions, and even when discounting should be used at all when choices affect unborn generations. This discounting controversy remains unresolved despite decades of discourse." Jane A. Leggett, CRS, Climate Change: Conceptual Approaches and Policy Tools (Aug. 29, 2011), available at: http://www.fas.org/sgp/crs/misc/R41973.pdf.

40. Association of State Floodplain Managers (ASFPM), Discount Rate Position Paper (May 17, 2008), available at: http://www.floods.org/PDF/WhitePaper/ASFPM_Discount_%20Rate_Whitepaper_0508.pdf.

41. ASFPM, Discount Rate at 3. ASFPM further argues that a social discount rate should be applied to quantify the benefits of hazard mitigation projects because they buy down risks to federal programs, such as disaster relief programs and the NFIP, and they protect public health, safety, and welfare.

42. Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, Improving the Process for Preparing Efficient and Timely Environmental Reviews Under NEPA (Mar. 6, 2012); Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects (Mar. 22, 2012); Linda Luther, CRS Report for Congress RL34650, Implementing the National Environmental Policy Act (NEPA) for Disaster Response, Recovery, and Mitigation Projects; Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010); Mark Squillace & Alexander Hood, NEPA, Climate Change, and Public Lands Decision Making, 42 Envtl. L. 469 (2012); Amendments to FHWA regulations for Categorical Exclusions, 23 C.F.R. Part 771 (Feb. 2013). (Mar. 6, 2012), Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects (Mar. 22, 2012); Linda Luther, CRS Report for Congress RL34650, ; Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, (Feb. 18, 2010); Mark Squillace & Alexander Hood, , 42 Envtl. L. 469 (2012); Amendments to FHWA regulations for Categorical Exclusions, 23 C.F.R. Part 771 (Feb. 2013).

43. MAP-21 expanded the categorical exclusion for disaster recovery projects to cover the reconstruction, retrofit or repair of facilities within the right-of-way "in a manner that substantially conforms to the preexisting design, function, and location as the original (which may include upgrades to meet existing codes and standards as well as upgrades warranted to address conditions that have changed since the original construction)." Thus, rebuilt facilities can vary from the pre-disaster footprint. 23 C.F.R. 771.117(c)(9).

44. FEMA, State Multi-Hazard Mitigation Planning Guidance, available at: http://www.fema.gov/media-library/assets/documents/12679?id=3115.

45. In recent testimony before the Senate Committee on Homeland Security and Government Affairs, Collin O'Mara, Secretary of the Delaware Department of Natural Resources and Environmental Control, backed up this complaint about federal disaster relief policies stating that federal agencies should "stop rewarding communities that fail to prepare: Some states and local governments have spent significant local resources to improve the resiliency of their communities, while others spend virtually nothing despite their ability to invest… . When a disaster hits, the communities that have used their own resources (and as a result suffer less damage) are effectively penalized through the nearly full reimbursement of damages for the unprepared communities, which is effectively a large subsidy for less responsible communities." In his testimony he cited the specific example that, after Sandy, Delaware received PA funding but was considered ineligible for CDBG funding because the state submitted fewer claims because it had made strategic investments to prepare. Hearing on Preparing for Extreme Weather Events: The Costs of Not Being Prepared (Feb. 12, 2014), available at: http://www.hsgac.senate.gov/hearings/extremeweather-events-the-costs-of-not-being-prepared1.

46. The Stafford Act allows states that develop "enhanced" HMPs to receive a 5% increase (up to 20%) in their total eligible HMGP funding after a disaster declaration. 42 U.S.C § 5165(e)(1). To be certified as "enhanced", the plan must demonstrate that plan recommendations are integrated with state, regional and local planning initiatives, the state is capable of implementing the plan, the state has capacity to manage the HMGP (such as complying with application timeframes, preparing and submitting accurate environmental reviews, etc.), the state has a strategy for assessing the efficacy of completed mitigation actions (i.e., record of costs avoided), the state effectively uses existing mitigation programs to achieve mitigation objectives, the state is committed to a comprehensive state mitigation program (demonstrated through local training, planning grants, legislative initiatives, public-private partnerships, state-sponsored funding for mitigation activities, state building codes, etc.). 44 C.F.R. § 201.5; see also FEMA, State Multi-Hazard Mitigation Planning Guidance ("Blue Book") Part 2 (Jun. 2007), available at: http://www.fema.gov/media-library/assets/documents/12679.

47. Since Katrina, FEMA has updated floodplain maps in the aftermath of major storm events, which include updated elevations for

the 100-year flood event, called Advisory Base Flood Elevations (ABFE). The Hurricane Recovery Task Force recommended that structures rebuilt with Sandy funding be elevate one foot above the ABFE issued for New York and New Jersey after Hurricane Sandy. After Sandy, FEMA issued update floodplain maps for affected regions and NOAA, USGS, the Corps and FEMA partnered to develop maps showing the horizontal expansion of the 100-year floodplain with different scenarios of sea-level rise for the 2050 and 2100 time scales. The Corps also developed a Sea-Level Change Calculator to help communities assess projected flood elevations under different sea-level rise scenarios. NOAA National Ocean Service, Planning Today for Sea Level Rise Tomorrow, available at: http://oceanservice.noaa.gov/news/features/aug13/sandy-slr-tool.html; U.S. Global Change Research Program, Sea Level Rise Tool for Sandy Recovery, available at: http://www.globalchange.gov/browse/sea-level-rise-tool-sandy-recovery#overlay-context; U.S. Army Corps of Engineers, Climate Change Adaptation: Comprehensive Evaluation of Projects with Respect to Sea-Level Change: Sea-Level Change Curve Calculator, available at: http://www.corpsclimate.us/ccaceslcurves.cfm.

48. "In any case in which the actual cost of repairing, restoring, reconstructing, or replacing a facility under this section is greater than the ceiling percentage established under [the method described above], the President may determine that the eligible cost includes a portion of the actual cost of the repair, restoration, reconstruction, or replacement that exceeds the cost estimated…" 42 U.S.C. § 5172(e)(2).

49. 44 CFR § 206.226 (e).

50. FEMA, Recovery Policy 9526.1, Hazard Mitigation Funding Under Section 406 (Stafford Act) (Mar. 30 2010), available at: http://www.fema.gov/pdf/government/grant/pa/9526_1.pdf.

51. Provisions in the SIRA removed a 10% penalty that was previously imposed on applicants that opted for the in-lieu contribution. Section 428 of Division B states that applicants can elect to receive an "in-lieu contribution, without reduction." Sandy Relief Act, Pub. L. No. 113-2, sec. 428(e)(1)(B), 127 Stat. at 39 (Jan. 29, 2013).

52. FEMA, Sandy Recovery Improvement Act Fact Sheet (Mar. 2014), available at: http://www.fema.gov/media-library-data/1394805512529-69dda27af3e128a1406387d288fd162c/SRIA+Overview+Fact+Sheet+and+Status+Updated+03042014_508.pdf.

53. Freeboard is an amount of additional elevation required above the base flood elevation intended to compensate for uncertainties in flood heights. FEMA, Freeboard, available at: http://www.fema.gov/floodplain-management/freeboard.

54. FEMA, Fact sheet: Mitigation's Value to Society (2007), available at: https://www.fema.gov/media-library/assets/documents/12305; Multihazard Mitigation Council, Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities (2005), available at: http://www.floods.org/PDF/MMC_Volume1_FindingsConclusionsRecommendations.pdf.

55. Michael Conathan, et al., Oxfam America and Center for American Progress, The Economic Case for Restoring Coastal Ecosystems (April 2014), available at: http://cdn.americanprogress.org/wp-content/uploads/2014/04/CoastalRestoration_report2.pdf.

56. For an example of an EPA project designed to consider how to incorporate consideration of climate change in hazard mitigation plans see Robert Verchick and Abby Hall, Adapting to Climate Change While Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods, 2011 B.Y.U. L. Rev. 2203, 2235 (2011).

57. FEMA recently released an Advance Notice of Proposed Rulemaking (ANPRM) seeking comments on how it should implement the Program Administration by States (PAS) provisions of the Sandy Recovery Improvement Act. Under the PAS pilot, FEMA delegates certain oversight responsibilities to states that voluntarily opt to participate in the pilot program. To assume these responsibilities, the state must have an approved State Hazard Mitigation Plan, must demonstrate the capacity to administer the program, and have a "demonstrated commitment to mitigation activities." In the ANPRM, FEMA is seeking comment on how it can develop criteria for assessing a state's capacity to administer the HMGP, prepare and approve cost-benefit analyses, perform environment and historical preservation review requirements, evaluate subapplications from local applicants, monitor implementation of local projects, maintain financial records, etc. Through this ANPRM FEMA is exploring what aspects of its oversight it can delegate to state agencies, including cost-effectiveness determinations, technical feasibility and engineering, and final eligibility for funding. And, although FEMA must retain final review and approval authority for assessment the environmental impacts of a project, FEMA may delegate authority to conduct environmental and historical preservation review to the states. Hazard Mitigation Grant Program (HMGP); Program Administration by States, 79 Fed. Reg. 13970 (Mar. 12, 2014).

58. Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Department & Agencies, Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010), Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Department & Agencies, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions (Feb. 18, 2010), available at: http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf.

59. The Pre-disaster Mitigation (PDM) program is a competitive grant program administered by FEMA to make funds available to local, state, and tribal governments to support mitigation activities. Funds can be used to update hazard mitigation plans or to implement cost-effective mitigation projects. FEMA, Pre-Disaster Mitigation Grant Program, available at: http://www.fema.gov/pre-disaster-mitigation-grant-program. The Flood Mitigation Assistance (FMA) program is also a competitive grant program administered by FEMA; funds are made available to help communities develop comprehensive flood mitigation plans and implement mitigation projects that reduce the long-term flood risk to NFIP-insured structures. One of the goals of the program is to reduce the number of repetitive loss properties through funding projects to elevate, acquire or demolish those structures. FEMA, Flood Mitigation

Assistance Program, available at: http://www.fema.gov/flood-mitigation-assistance-program.

60. Estimates of budgets for these three programs for FY 2012 from the Catalog of Federal Domestic Assistance, available at: http://www.cfda.gov.

61. The total cost of a project eligible for ER funding may not exceed the cost of repair or reconstruction of a comparable facility. ER funds may participate to the extent of eligible repair costs when proposed projects contain work not eligible for ER funds. 23 C.F.R. § 668.109(e). Comparable facility means a facility that meets the current geometric and construction standards required for the types and volume of traffic that the facility will carry over its design life. 23 U.S.C. § 125(d)(2)(A).

62. 23 U.S.C.A. § 125(d)(2) (West 2013);Robert S. Kirk, CRS Report for Congress, R42804, Emergency Relief Program: Federal Aid Highway Assistance for Disaster Damaged Roads and Bridges at 4 (Nov. 2012).

63. See FHWA, Emergency Relief Handbook at 28-29, (May 2013), available at: https://www.fhwa.dot.gov/reports/erm/er.pdf (FHWA notes that future sea level can be taken into account and that ER funds can fund resiliency measures as a betterment where the cost of relocation is economically justified considering the projected increases in damage to the facility from sea-level rise, wave action, and storm surges. A recent Congressional Research Service report suggests that MAP-21's amendments to the definition of "comparable facility" to include the "design life" of the facility, may provide increased flexibility to allow facilities to be rebuilt to be more "resilient in coping with future emergencies." Painter, note 16, at 29. In some instances, FHWA has allowed ER funds to be used to replace facilities to accommodate additional traffic volumes, such as by adding lanes.

CHAPTER 3

FEMA PROGRAMS

CHAPTER INTRODUCTION

The National Flood Insurance Program (NFIP) will greatly influence local resilience to flood impacts. Flood resilience is often described in terms of multiple lines of defenses. One line of defense is floodplain regulations, which can be used to ensure that structures are designed to withstand flood impacts and that development is directed out of flood-prone areas. A second line of defense is insurance; in the event that structures are damaged by flooding, flood insurance provides landowners with the financial resources they need to rebuild. The NFIP largely governs both of these lines of defense: the NFIP is the primary insurer of flood losses, and the NFIP drives local floodplain regulations because communities must implement minimum regulations to participate in the program.

The problem, however, is that the NFIP (like many laws that pre-date mainstream understanding of climate change) is grounded in the principle of stationarity[1]—meaning that both flood insurance rates and minimum regulatory requirements are set using historical flood data. Thus, local floodplain regulations do not account for the increasing flood risks posed by sea-level rise and changes in precipitation from climate change. As a result, the NFIP is becoming increasingly insolvent. The program is approximately $24 billion in debt. Since Katrina, the program has had to borrow from the general fund to pay off mounting flood insurance claims from a series of billion dollar disasters.

Congress attempted to address some of these deficiencies in 2012 by enacting the Biggert-Waters Flood Insurance Reform Act (Biggert-Waters). Biggert-Waters phased out flood insurance subsidies that were largely blamed for the NFIP's insolvency. However, as the Federal Emergency Management Agency (FEMA) began to implement the rate increases called for by Biggert-Waters, these reforms became subject to mounting political pushback from both sides of the aisle. As a result, Congress recently rolled back some of the rate increases through the Homeowners Flood Insurance Affordability Act (HFIAA, described below), signed into law on March 21, 2014.

This chapter focuses on opportunities to retool the NFIP to better prepare communities for the increasing flood impacts that they are likely to experience from sea-level rise and changes in precipitation. It examines ways to improve FEMA's floodplain mapping program to better account for climate change and to provide communities with better tools to manage flood risks. It also examines opportunities to improve the resilience of structures and to ensure that low-income communities are not priced out of flood insurance because of subsidy reforms. Flood insurance rates will continue to rise despite the slow down in rate increases mandated by HFIAA. Thus, recommendations for ensuring insurance affordability will continue to be important.

This chapter identifies a range of opportunities for reforming the NFIP to ensure that communities and property owners are preparing for future increases in flooding due to climate change. The NFIP drives local floodplain regulations and flood insurance rates, and it provides the floodplain maps that private landowners and localities use to understand their flood risks. Therefore, the NFIP and the Community Rating System (CRS) provide vehicles for promoting resilience to future flood impacts. Floodplain maps, called Flood Insurance Rate Maps (FIRMs), are incorporated by reference in most local floodplain ordinances and can now include information about how flood impacts will be exacerbated by climate change. FIRMs with climate information can also be used by local governments to inform land use and investment decisions. Finally, FEMA can ensure that landowners are receiving accurate price signals from the insurance market about the risks of developing in flood-prone areas. The following is a summary of the recommendations from this workshop session, and a more detailed discussion of each recommendation is included below.

Floodplain Mapping

- FEMA should delegate more mapping authority to states.
- FEMA should coordinate data collection with other agencies, states, and localities, to develop FIRMs and to offer other tools for identifying and responding to long-term flood risks.
- FEMA should re-envision its mapping program so that the floodplain maps better suit the different purposes for which the maps are used—communicating risk, setting insurance rates, and regulating land use.
- FEMA should make digital-FIRMs truly digital.
- FEMA should use the authority provided by Biggert-Waters to provide information about how climate change will exacerbate flood-related hazards on floodplain maps.
- FEMA should issue guidance about how hazard mitigation funding can be applied to other types of hazard areas (e.g., erosion hazard areas).
- FEMA should provide guidance to states and localities about methods for funding floodplain mapping.
- FEMA and the President should convene the Technical Mapping Advisory Council (TMAC) called for by Biggert-Waters, and the TMAC should provide recommendations that encourage more delegation of mapping authority to states and localities, require inclusion of climate change projections on FIRMs, and develop strategies for financing mapping updates.

Floodplain Regulations

- FEMA should consider more restrictive minimum standards for local floodplain regulations.
- FEMA should leverage the Community Rating System (CRS) to provide additional credits for adaptive land-use management.
- HUD should determine and issue guidance on whether federal funds can be used to support community applications to the CRS program.

Insurance Affordability

- FEMA should recognize partial mitigation for purposes of setting insurance rates for older building stock.
- FEMA and other federal agencies should invest in communication, outreach, education, and training.
- FEMA should expand its flood insurance affordability study to address regional differences.
- FEMA and other agencies (such as Department of Housing and Urban Development (HUD)) should fund or finance structural mitigation.
- The Federal Housing Finance Agency (FHFA) should reform its policy preventing Freddie Mac and Fannie Mae from purchasing mortgages for properties with property-assessed clean energy (PACE) loans.

Recommendations for Congress

- Congress should appropriate sufficient funding to allow FEMA to update floodplain maps on a more regular basis and include climate change information.
- Congress could increase the amount that homeowners can claim on their flood insurance policies through Increased Cost of Compliance (ICC) coverage to allow them to fund measures to mitigate flood risks, such as elevating structures.

CLIMATE IMPACTS TO THE NATIONAL FLOOD INSURANCE PROGRAM

The National Flood Insurance Program (NFIP) was created in 1968 to offer federally-subsidized flood insurance for property owners and to promote land-use controls in floodplains.[2] The program provides flood insurance coverage for 5.6 million American households and insures more than $1 trillion in assets.[3]

Sea-level rise and increases in the intensity of precipitation in some regions will change flood patterns in two significant ways: flood impacts will be driven further inland and will affect more people and structures; and higher flood heights will cause structures to be more significantly damaged during flood events.

Climate change will also have significant ramifications for the solvency of the NFIP, particularly if the federal government continues to subsidize rates for grandfathered structures and rely on historical flood data for rate-setting and floodplain regulations. A June 2013 report commissioned by FEMA and authored by the consulting firm AECOM assesses the potential long-term effects of climate change on the NFIP.[4] The report concludes that the 100-year floodplain may increase by approximately 45% in riverine floodplains and 55% in coastal floodplains where communities attempt to stabilize the shoreline through beach nourishment and other activities. The report indicates that 70% of these changes in the floodplain are attributable to climate change and 30% to population growth.

These changes in the 100-year floodplain will have important economic and social consequences. The number of structures subject to requirements to purchase flood insurance will increase by between 80% to 130%. The number of flood insurance policies for coastal areas would more than double nationally, and the average cost of insurance payouts could increase by 90% by 2100. To ensure the solvency of the NFIP, the report projects that insurance rates would need to rise by up to 70% in coastal floodplains and 40% on average through the year 2100 to offset projected increases in claims.

FEMA PROGRAMS

National Flood Insurance Program (NFIP)

The Federal Emergency Management Agency (FEMA) is charged with administering the NFIP. Once a community agrees to participate in the NFIP, certain mandatory requirements are triggered.

FEMA implements the mandatory components of the NFIP through three activities:

- **Mapping**: FEMA develops floodplain maps (called flood insurance rate maps or "FIRMs"), which delineate the 100-year floodplain. The 100-year floodplain includes areas that have a 1% annual chance of flooding based upon historical flood data—these areas are called Special Flood Hazard Areas (SFHA).
- **Insurance**: Property owners in SFHAs must purchase insurance in order to obtain a federally-backed mortgage.
- **Regulation**: In order to participate in the program, communities must impose minimum regulations on development in SFHAs. For example, communities must require that all new and redeveloped structures are elevated to a level at or above the 100-year ("base flood") elevation (i.e., above the projected height of floodwaters during the 100-year flood event).

The NFIP has inspired most communities to adopt local floodplain regulations.

Biggert-Waters

In 2012, Congress attempted to reform the NFIP through the Biggert-Waters Flood Insurance Reform Act of 2012. Biggert-Waters included two relevant changes that affect state and local adaptation efforts. First, Biggert-Waters gave FEMA explicit authority to develop maps that account for future changes in sea levels, precipitation, erosion hazards, as well as other factors.[5] This new authority is significant, because before this change FEMA was only allowed to consider historical flood data when delineating SFHAs and setting insurance rates.

Second, Biggert-Waters called for insurance subsidies to be phased out. When the NFIP was first enacted, existing floodplain development (pre-dating the Act) was "grandfathered."[6] Meaning that these properties did not have to comply with local floodplain regulations (until the structure was substantially damaged or rebuilt), and owners of grandfathered structures have enjoyed highly subsidized insurance rates since the inception of the program. Biggert-Waters eliminated subsidies for many of these properties including: severe repetitive loss properties,[7] second homes, business properties, homes substantially damaged or improved (i.e., greater than 50% of the market value of the home), and homes sold to new owners.[8] By phasing out grandfathering, Biggert-Waters threatened significant rate increases for many landowners.

Biggert-Waters also included more controversial provisions that required all grandfathered rates to be phased out after a community was remapped. FEMA was required to raise rates on grandfathered properties upon the adoption of a new FIRM. These properties would have seen increases of up to 20% annually until their property was paying full actuarial rates, had these reforms been implemented.[9] This provision of Biggert-Waters became the subject of much political rancor because it threatened to dramatically raise rates on low- and middle- income property owners through no fault of their own. Some were worried that the rate hikes would price people out of their homes or force them to drop flood insurance (their final line of defense in the event of flood damages). Rate increases also have a dramatic effect on property resale value for those who might need to sell their homes — their biggest asset.

Homeowner's Flood Insurance Affordability Act (H.R. 3370)

Faced with intense pushback, Congress passed H.R 3370, the "Homeowners Flood Insurance Affordability Act" (HFIAA), with bipartisan support on March 14, 2014; President Obama signed the legislation on March 21, 2014.[10] The legislation strikes the provisions of Biggert-Waters that raised rates upon the adoption of a new FIRM, amends rate increases on properties that have allowed their flood

insurance to lapse because they were no longer required to retain coverage, and repeals provisions that triggered rate increases on new owners after a property's sale.[11]

The Congressional Budget Office (CBO) estimated that these provisions of the legislation would cost the NFIP $2 billion over 10 years. To offset these costs, HFIAA includes a new surcharge on NFIP policyholders.[12] Residential customers will now pay $50 a year on top of their premiums, and businesses and second homeowners will pay $250 a year.[13] HFIAA, however, leaves intact provisions in Biggert-Waters that allow FEMA to include future projections of sea-level rise and other hazards on FIRMs. It also maintains rate increases on properties damaged in repetitive storm events. However, HFIAA lowers the allowable rate increase from 20% to 15%.

This chapter's analysis and recommendations attempt to reflect these recent changes in law, particularly how HFIAA will affect the issue of insurance affordability. HFIAA addressed some of the concerns about dramatic rate hikes on property owners, but landowners are still likely to see some increase in their insurance rates and the NFIP also continues to carry debt that will need to be repaid through rate increases or other measures. The chapter identifies instances where these recent changes in law may affect the specific recommendations detailed below.

Community Rating System

FEMA also administers the Community Rating System (CRS), which is an incentive-based subprogram of the NFIP. Adopted in 1994, the CRS was designed to encourage local communities to enhance floodplain regulations above the NFIP's minimum standards. Participating communities earn points by implementing activities designed to reduce flood losses. For example, communities can receive points for implementing more restrictive floodplain regulations, for developing better maps, and for conducting staff training and public outreach about flood risks. The points a community earns determine the community's rankings (1 being highest, 10 being lowest). The community's CRS ranking translates into insurance discounts for property owners in those communities. The higher the community ranking, the greater the insurance discount received by landowners in the floodplain (up to 45% for Class 1 communities).[14]

The governing theory is that the recognized activities will reduce future flood losses, resulting in savings to the NFIP. CRS returns a portion of those benefits to landowners and the community through an insurance discount. The CRS is designed to support the NFIP, but can be used in an adaptation context to help compensate for limits of the NFIP posed by the program's reliance on historical flood data as the basis for setting minimum requirements. Communities that implement more robust floodplain regulations are rewarded with reduced insurance rates, and FEMA recently updated the CRS program to explicitly reward communities that consider sea-level rise and other climate change effects in their floodplain management programs.

CHALLENGES TO ADAPTATION PRESENTED BY THE NFIP

The NFIP has several limitations when it comes to promoting coastal resilience, including outdated floodplain maps, deficiencies in local floodplain regulation, and the affordability of insurance.

Floodplain Mapping

Flood Insurance Rate Maps (FIRMs) are inherently maladaptive because they are developed using historical flood data. Many communities' FIRMs have not been updated in decades and, therefore, do

not even account for changes in flood risk due to increases in development in the floodplain, let alone increased risks posed by climate change. FIRMs are also used for two very different and somewhat incompatible purposes: the primary purpose of a FIRM is to establish rates for insurance, but the maps are also used to set floodplain regulations and to determine how high structures should be elevated. Whereas rate-setting decisions can be adjusted over time to account for increases in claims, land-use decisions are typically made based upon consideration of how the community will change over a prolonged 30-year or more time frame. Structures developed under regulations adopted today can have a 50-year or more design life. Thus, the maps and data we use to set insurance rates are not the best tools for also making land-use decisions that will have long-term and permanent ramifications on how a community develops and its future resilience.

There is also a need for new terminology to define and discuss flood risk. The NFIP adopted the term "100-year flood" to describe the flood event that has a 1% chance of occurring in any given year based upon historical flood data. However, this term is often misinterpreted by the public to mean a flood event that will occur every 100 years, when in fact repeated 100-year flood events can happen in successive years. The term will become increasingly meaningless, as the climate changes and historical data are less and less useful for predicting future floods. The 100-year floodplain concept also creates a dynamic where landowners are either "in or out" of the floodplain with attendant consequences. Landowners that are "in" the 100-year floodplain are subject to regulation and insurance purchase requirements, which many people resist. Landowners that are "out" of the 100-year floodplain can still be at risk of significant flood impacts, but are not subject to regulatory or insurance purchase requirements (and, thus, are less likely to procure flood insurance). This "in-or-out" dynamic is problematic for communicating actual risk and for encouraging landowners to purchase insurance. It is also largely responsible for generating the political resistance to map updates that change the lines of who is in and out of the regulated floodplain.

Insurance Affordability

After the enactment of Biggert-Waters, many communities were concerned about the economic and social impacts of rate increases on landowners. Landowners that had enjoyed grandfathered rates since the 1960's were faced with dramatic increases in their insurance rates as their grandfathered status was phased out with the adoption of the new FIRM. This was particularly problematic in older Northeastern cities with significant building stock that pre-dates modern building codes. Many of these structures cannot be elevated to obtain lower insurance rates, and lower-income landowners faced dramatic increases in rates that they could not afford.

Elevation is also the only form of structural mitigation that FEMA recognizes when setting insurance rates. Some older building stock, such as old brownstones or row houses, cannot be elevated. These homeowners were facing dramatic increases in their rates because they were unable to elevate their homes to comply with NFIP minimum standards. This caused many state and local decision-makers to worry that their residents would lose their last line of defense—insurance. These homeowners would either be priced out of their homes or forced to drop insurance with implications for the resale value of the building as well.

Floodplain Regulations

The minimum standards set by the NFIP will also become increasingly insufficient to reduce risks to development in the face of climate change. Because the floodplain regulations are keyed to the outdated, backward-looking FIRMs, regulatory requirements are not being applied in all parts of the community that are and will increasingly be subject to flooding. Buildings are also not being constructed in a manner

that will adequately mitigate the risk of flooding over their design life. The NFIP also focuses solely on "structural mitigation" (i.e., reducing flood risks to structures by designing structures to be more resilient to impacts). FEMA does not require communities to limit development in floodplains or restrict uses in floodplains (these types of use restrictions are often called "non-structural" mitigation). Finally, the siloed nature of local regulatory programs can impede adaptation. Communities often have a variety of different regulations that deal with flood risk: floodplain, wetlands, coastal, and stormwater regulations, among others. These regulations are sometimes in separate parts of local codes and can be separately administered by different agencies. As a result, they fail to achieve the systematic flood-risk reductions that could be achieved if these regulatory frameworks were better integrated and aligned.

Community Rating System

FEMA may also not be fully leveraging the potential of the Community Rating System for promoting adaptation. There are significant barriers to entry to the CRS, especially for older cities that have many structures that were built before modern building codes. The CRS also does not have a strong focus on climate change resilience and more could be done through the program to promote adaptation. The incentives provided by the CRS are not enough to prompt these communities to adopt more robust floodplain regulations. Finally, the policies promoted are often not appropriate for older, built-out cities with significant existing development and less new development.

RECOMMENDATIONS

FEMA could better leverage all three components of the NFIP to promote adaptation as follows.

Floodplain Mapping

FEMA should delegate more mapping authority to states. FEMA has authority to enter into agreements with state and local partners to identify and publish floodplain maps.[15] FEMA has used this authority to institute the Cooperating Technical Partners (CTP) program designed to improve coordination between FEMA and state and local partners in the development of FIRMs. FEMA can provide funds through cooperative agreements to allow CTP partners to undertake mapping activities for NFIP compliance, pursuant to FEMA minimum standards. However, many communities report that the CTP program is too administratively onerous, and does not allow partners the flexibility to develop mapping products useful for local needs. Communities seek broader delegation of authority from FEMA to administer their own mapping programs with local contractors that are familiar with local conditions. In developing standards for delegating mapping authority to states and localities, FEMA should ensure that the maps are developed based upon the best available data so that the maps serve their primary purpose of ensuring that insurance rates are accurately priced. It is also important to recognize that states and localities can face more intense political pressure where maps affect insurance rates, real estate values, and development.

FEMA should coordinate data collection with other agencies, states, and localities, to develop FIRMs and to offer other tools for identifying and responding to long-term flood risks. Many federal agencies provide technical assistance and guidance, including FEMA, USGS, the Corps, EPA, NOAA, etc. These agencies should coordinate their data collection activities to ensure that data can be integrated with (and used by) the various agencies for a variety of purposes and to ensure that agencies are not duplicating effort. Some data collection activities, such as LiDAR,[16] are more cost

effective when done at the federal level because federal agencies can map entire regions at one time. Other data collection activities, such as local site analyses, are more cost effective when done by state and local governments using local contractors that are more familiar with site-specific local conditions. FEMA should leverage the data collection efforts at all levels of government. FEMA should also develop consistently applied national standards for data collection and mapping to provide guidance to state, local, federal, and private partners. FEMA standards can provide the minimum requirements, but allow partners to exceed those standards where higher resolution data or mapping products are needed. Federal agencies should also provide technical support to help states and localities determine what resources and tools to use for what purposes and to help translate climate data for local uses. Federal agencies could leverage the services of professional associations, such as the American Planning Association or the Urban Sustainability Directors Network, to help connect planners with scientists to bridge the communications gap and help translate science and risk communications for a local audience.

FEMA should re-envision its mapping program so that the floodplain maps better suit the different purposes for which the maps are used—communicating risk, setting insurance rates, and regulating land use. FEMA has made a start at developing products to better communicate risk with its Risk MAP program.[17] Risk MAP offers communities a suite of data, information, and non-regulatory products to help them better manage and reduce flood risks, including: flood depth grids, higher quality elevation data, and risk assessments for specific watersheds. However, communities need more than just data to be inspired to act. Better maps can be used to spur a broader discussion with communities about what they value and how to engage in active risk management strategies to protect what they value. Communities also need more data and information across hazards. Flood inundation is just one hazard the communities must manage; other hazards such as erosion and sea-level rise are not accounted for in these tools but need to be accounted for so that communities can develop and implement multi-hazard mitigation strategies. FEMA should develop or help communities develop maps that address their full range of flood and flood-related hazards. FEMA should also help communities develop tools and strategies for communicating flood risks and other flood-related hazards to elected officials and the public.

FEMA should make digital-FIRMs truly digital. Historically, FEMA delineated flood zones on paper maps called Flood Insurance Rate Maps (FIRMs). Through its map modernization program, FEMA has been working to convert paper-based FIRMs to digital formats (DFIRMs). However, some communities have only received scanned versions of the paper FIRMs. DFIRMs provide a more user-friendly GIS-based system to translate flood hazard information into web-based viewers. DFIRMs should, however, be based on updated flood insurance studies (FIS) and updated flood data to ensure that communities are using the most up-to-date and accurate information for managing flood risks.[18]

FEMA should use the authority provided by Biggert-Waters to provide information about how climate change will exacerbate flood-related hazards on floodplain maps. Amendments explicitly allow FEMA to consider sea-level rise in its mapping program.[19] Biggert-Waters provides FEMA with additional authority to update FIRMS with "any relevant information or data… regarding changes in sea levels, precipitation, and intensity of hurricanes."[20] FEMA should leverage this authority to develop advisory layers for communities seeking information about how climate change will affect flood hazards. FEMA should also work to ensure that they are using the best available climate data and scenarios that align with local adaptation planning. FEMA should issue guidance about how these advisory layers can be used to direct hazard mitigation funding and inform local land-use decisions and benefit-cost analysis. FEMA should also update the CRS to award additional points to localities that work with FEMA to develop advisory layers considering climate change.

NORTH CAROLINA FLOODPLAIN MAPPING

The state of North Carolina has assumed floodplain mapping authority and has studied how sea-level rise will change flood risks in the state. In 2009, FEMA granted $5 million to North Carolina to conduct a sea-level rise risk assessment. The study evaluated the state's risk of flooding under various scenarios of potential sea-level rise (up to 1 meter) over four "time slices" through 2100, and included consideration of how flood risks would change based upon storm intensity and frequency. The assessment leveraged storm surge and topographical data used to update and digitize the state's FIRM. North Carolina took over its own mapping program through a Cooperating Technical Partnership agreement with FEMA. The state has allocated over $143 million to the program since 2000 and funds this effort through a real estate recordation fee. The state's new Flood Risk Information System (FRIS) will provide digital floodplain information based upon high resolution LiDAR data to show base flood elevations, flood depths, stream networks, and topography, among other features. North Carolina has offered to share its FRIS system framework with other interested states. Although North Carolina has state-of-the-art sea-level rise information, the state legislature instituted a barrier to the use of this information by state and local planners. Recently enacted legislation places a 4-year moratorium on the use of sea-level rise projections for planning.

FEMA SEA-LEVEL RISE PILOTS

FEMA has undertaken several studies of methods to map sea-level rise on FIRMs. In 2010, FEMA funded the California Coastal Analysis and Mapping Program Open Pacific Coast Study to analyze how sea-level rise scenarios may change wave hazards, the depth and extent of flood inundation, and erosion along a nine-mile segment of the Pacific Ocean in the city of San Francisco. The results of the analysis will be included as a non-regulatory Risk MAP product for the city. A similar pilot is also being conducted in Hillsborough and Pinellas Counties in Florida.

FEMA, FEMA Kicks-Off Sea Level Rise Pilot Study for Coastal Floodplain (2014), available at: http://www.r9map.org/Pages/EbulletinStory.aspx?storyID=70.

FEMA should issue guidance about how hazard mitigation funding can be applied to other types of hazard areas (e.g., erosion hazard areas). FEMA hazard mitigation funds (discussed in Chapter 2) are typically used to buy down risk to the NFIP—meaning that these funds often cannot be applied to other types of hazards in the floodplain, such as to acquire structures at risk of erosion hazards along a stream channel. Where FEMA allows for additional hazard layers to be included on FIRMs, FEMA should also clarify how these hazard areas will inform hazard mitigation funding decisions.

FEMA should provide guidance to states and localities about methods for funding floodplain mapping. Biggert-Waters amended the NFIP to remove the limitation on the amount that state and

local governments can contribute to update FIRMs. They can now contribute 100% of the funding needed to update their FIRMs (this amount was previously capped at 50%).[21] This provides an opportunity for states and communities to take more ownership of their floodplain mapping programs, where they can develop a consistent source of funding to pay for map updates. North Carolina maintains its floodplain maps through a real-estate recordation fee.

FEMA and the President should convene the Technical Mapping Advisory Council (TMAC) called for by Biggert-Waters, and the TMAC should provide recommendations that encourage more delegation of mapping authority to states and localities, require inclusion of climate change projections, and develop strategies for financing mapping updates. Biggert-Waters called for the reestablishment of the TMAC to make recommendations to FEMA about how to update and improve FIRMs.[22] The TMAC is charged with providing recommendations to FEMA about how to "improve in a cost-effective manner the accuracy, general quality, ease of use, and distribution and dissemination of flood insurance rate maps and risk data… ." Other duties of the TMAC include recommending "procedures for delegating mapping activities to State and local mapping partners," and "methods for improving interagency and intergovernmental coordination on flood mapping and flood risk determination."[23] Since Biggert-Waters passed in 2012, FEMA has solicited nominations for the TMAC, but formal membership has not been announced as of June 2014. This body of experts could be influential in helping FEMA address some of the challenges in administering the mapping program and updating maps to reflect climate-change risks.

Floodplain Regulations

FEMA should consider more restrictive minimum standards for local floodplain regulations. FEMA could require a federal freeboard requirement as a minimum floodplain standard (freeboard requires that a structure be elevated above the flood level for the 100-year flood event, usually a foot or more above the base flood elevation). FEMA could consider other types of minimum standards, such as limiting new development or large-scale development projects in coastal high hazard areas or other highly vulnerable parts of the floodplain. FEMA could also require that the redevelopment of critical facilities be limited in SFHAs or that critical facilities be designed with additional freeboard. FEMA should also issue more guidance on floodplain best practices implemented by NFIP participating communities. One example is Hillsborough County, FL, where the community designated areas for future growth in disaster recovery plans to encourage investors to revitalize these areas, rather than designating areas where it would not build back after a disaster.

FEMA should leverage the Community Rating System (CRS) to provide additional credits for adaptive land-use management. The CRS could be used as a way to reward best practices. For example, the CRS could reward communities that incorporate climate-change scenarios into floodplain mapping products. It could be used to encourage more integrated watershed-scale floodplain management. Communities should be awarded points for coordinating floodplain regulations with stormwater and wetlands regulations.

Federal agencies, such as HUD, should also determine and issue guidance on whether federal funds can be used to support community applications to the CRS program. For example, communities are uncertain whether they can use CDBG funding to support CRS applications. FEMA and Congress should consider whether a community's CRS rating can be used as an indicator justifying a better cost-share under federal disaster relief programs. FEMA and Congress should also consider ways to allow communities to recoup some of the financial benefits of participating in the CRS program, rather than have all of the benefits flow to individual policyholders.

Insurance Affordability

FEMA should recognize partial mitigation for purposes of setting insurance rates for older building stock. FEMA or other federal agencies should fund studies to develop the economic and technical knowledge needed to quantify the benefits of different partial mitigation strategies. The only form of mitigation that FEMA recognizes when setting insurance rates is elevation above the base flood height. Many older buildings cannot be elevated and, in an era of rising insurance rates, owners of these properties may be faced with dramatic increases in their insurance because they are not able to mitigate their risk in a way that FEMA will recognize for rate-setting purposes. New authority granted by HFIAA allows FEMA to consider a range of flood mitigation activities when setting premium rates and to recognize partial mitigation credit for different types of flood-proofing (such as raising electrical equipment).[24]

FEMA and other federal agencies should invest in communication, outreach, education, and training. As the Biggert-Waters reforms were rolled out, there was public confusion about the extent and impact of rate increases. States, localities, and the public needed information about how much insurance was going to cost and how to retrofit homes to avoid dramatic rate increases. In combination with risk information (such as updated floodplain maps and climate change hazard information), communities also need answers about what they can do with that information to respond to and prepare for impacts. Communities need better training of local floodplain administrators. FEMA could require basic training and continuing education of these local officials.

FEMA should expand its flood insurance affordability study to address regional differences. Biggert-Waters required FEMA to undertake a study of the affordability of insurance for certain policyholders. The study called on FEMA to examine methods of making premium aid available through targeted assistance and to analyze the budgetary implications of these methods. The National Academy of Sciences was to conduct the study and include a cost-benefit comparison between full, risk-based premiums with means-tested assistance. An affordability study at a national-scale will not address the regional differences in building stock and other factors that affect affordability. New York City, in the aftermath of Sandy, conducted its own affordability study in different portions of the city. Although Biggert-Waters provided specific parameters for the study, which may not allow for a regional approach, a regional analysis would benefit the federal study. The recently enacted HFIAA may provide an opportunity. It refined the affordability study requirements to call for the development of an "affordability framework." The legislation also authorizes additional funding for this work.[25] A regional affordability study could inform FEMA's development of the affordability framework called for by the HFIAA.

FEMA and other agencies (such as HUD) should fund or finance structural mitigation. As subsidies are phased out, landowners will need to bring their structures into compliance with building elevation requirements or face exorbitant rate increases. The only funding available to help landowners elevate structures is the Increased Cost of Compliance[26] fund, but this funding is insufficient to raise most structures. FEMA should collaborate with other federal agencies to explore the possibility of creating a PACE-style program to provide on-bill loans to elevate structures. Property Assessed Clean Energy (PACE) programs allow local governments to provide loans to businesses and homeowners to finance small-scale renewable energy or energy efficiency projects (such as rooftop solar). Borrowers repay these loans through increased property taxes assessed to the improved property. The loan is secured through a tax lien on the property that passes to future owners if it is not repaid at the time of sale. Elevation could be funded through a similar tax-lien financing program where state and local

governments could lend money to landowners to help them finance elevation of their structure. The loan could be repaid by reductions in the landowners flood insurance rates. HUD could explore the possibility of using CDBG to contribute to such a program. State legislatures would also need to amend state statutes authorizing PACE-lending to allow for loans to be used for purposes of elevating structures.

The Federal Housing Finance Agency (FHFA) should reform its policy preventing Freddie Mac and Fannie Mae from purchasing mortgages for properties with Property-Assessed Clean Energy (PACE) loans. To ensure that a PACE-style program would allow for retrofits to residential structures the FHFA would also have to reform its directive that prevents Fannie Mae and Freddie Mac[27] from purchasing mortgages on properties that have PACE loans against them. In the wake of the 2007 housing crisis, FHFA was created to stabilize the mortgage market by managing, through a conservatorship, Fannie and Freddie.[28] In 2010, FHFA issued a directive instructing Freddie and Fannie not to purchase mortgages with outstanding PACE loans because, as tax liens, these loans take priority over other secured debt on the property including any mortgage debt held by these federal entities. As a result of this directive, most local governments suspended their residential PACE programs out of concern about the ability of property owners to obtain mortgages.[29] For a PACE-style program to be an effective mechanism for financing structural mitigation, FHFA would have to rescind this directive.

Recommendations for Congress

Congress could enact several reforms to the NFIP that would provide FEMA with additional flexibility to promote state and local adaptation:

Congress should appropriate sufficient funding to allow FEMA to update floodplain maps on a more regular basis and include climate change information. Although Biggert-Waters authorized the appropriation of $400 million to FEMA to implement mapping updates, recent budget proposals request a fraction of that amount for the mapping program: $89.4 million in 2013.[30] Congress should also consider enacting legislation that would allow FEMA to recoup its costs of mapping from private partners.

Congress could increase the amount that homeowners can claim on their flood insurance policies through Increased Cost of Compliance (ICC) coverage to allow them to fund measures to mitigate flood risks, such as elevating structures. Currently, landowners are limited to $30,000, but this is seldom enough to provide for the full costs of elevating a structure.

CHAPTER 3 ENDNOTES

1. Stationarity is a principle used for managing ecosystems that assumes "that natural systems fluctuate within an unchanging envelope of variability." Management approaches applying the principle of stationarity rely on historical data to project what will occur in the future. Robin Kundis Craig, "Stationarity Is Dead" - Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 Harv. Envtl. L. Rev. 9, 15 (2010), quoting P.C.D. Milly et al., Stationarity Is Dead: Whither Water Management?, 319 Science 573, 573 (2008).
2. Federal Emergency Management Agency (FEMA), The National Flood Insurance Program, available at: http://www.fema.gov/about/programs/nfip/index.shtm (last visited Apr. 15, 2012); Federal Emergency Management Agency 1 (FEMA), National Flood Insurance Program: Program Description 2 (Aug. 2002), available at: http://www.fema.gov/library/viewRecord.do?id=1480 [hereinafter NFIP Description].
3. Dan Huber, Center for Climate and Energy Solutions, Fixing a Broken National Flood Insurance Program: Risks and Potential Reforms 1 (June 2012), available at: http://www.c2es.org/docUploads/flood-insurance-brief.pdf.
4. AECOM, prepared for the Federal Insurance and Mitigation Administration (FIMA) and FEMA, The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100 (Jun. 2013), available at: http://www.aecom.com/deployedfiles/Internet/News/Sustainability/FEMA%20Climate%20Change%20Report/Climate_Change_Report_AECOM_2013-06-11.pdf.
5. The Biggert-Water Flood Insurance Reform Act of 2012, Pub. L. No: 112-141. (amending 42 U.S.C. 4104(b)). The Act allows FEMA to update FIRMs to include "relevant information and data" on flood hazards caused by land-use changes, and "future changes in sea levels, precipitation, and intensity of hurricanes," among other things.
6. Grandfathered structures are called pre-FIRM properties, because they existed before the community's FIRM was adopted. Thomas L. Hayes et al., FEMA, National Flood Insurance Program Actuarial Rate Review In Support of the Recommended October 1, 2011 Rate and Rule Changes at 3 (2011), available at: http://www.fema.gov/library/viewRecord.do?id=4853 [hereinafter "Actuarial Rate Review 2011"]. ("A Flood Insurance Rate Map, or FIRM, is an official map of a community on which FEMA has delineated both the Special Flood Hazard Areas and the risk premium zones that are applicable to the community. 'Post-FIRM' pertains to a building for which construction or substantial improvement occurred after December 31, 1974, or on or after the effective date of an initial FIRM, whichever is later. 'Pre-FIRM' pertains to a building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial FIRM.").
7. Biggert-Waters incorporates the definition of "severe repetitive loss properties" from a repealed section of the National Flood Insurance Act, 42 U.S.C. § 2102a, as properties that have "incurred flood-related damage (i) for which 4 or more separate claims payments have been made under flood insurance coverage under this title, with the amount of each claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or (ii) for which at least 2 separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the value of the insured structure." H.R. 4348, Sec. 100205(h)(3).
8. Id. (amending 42 U.S.C. § 4012).
9. Id. at Sec. 100207 "(amending 42 U.S.C. § 4015(f)) (upon the effective date of any revised or updated flood insurance rate map under this chapter, the Flood Disaster Protection Act of 1973, or the Biggert-Waters Flood Insurance Reform Act of 2012, any property located in an area that is participating in the national flood insurance program shall have the risk premium rate charged for flood insurance on such property adjusted to accurately reflect the current risk of flood to such property, subject to any other provision of this chapter. Any increase in the risk premium rate charged for flood insurance on any property that is covered by a flood insurance policy on the effective date of such an update that is a result of such updating shall be phased in over a 5-year period, at the rate of 20 percent for each year following such effective date.)."
10. Homeowner Flood Insurance Affordability Act of 2014 (HFIAA), Pub. L. No. 113-89, (H.R. 3370, 113th Cong. 2014).
11. HFIAA at §§ 3 and 4 (amending 42 U.S.C. § 4015 and 4014 respectively).
12. Evan Lehmann, Obama Will Sign Discounted Flood Insurance Bill After It Sailed Through the Senate, E&E News, Climate Wire (Mar. 14, 2014), http://www.insurancejournal.com/news/national/2014/03/13/323273.htm?print.
13. HFIAA at § 1308A.
14. FEMA, NFIP Community Rating System Coordinator's Manual (CRS Manual) 110-3, App. B (Sep. 2013), available at: http://www.fema.gov/media-library/assets/documents/8768.
15. 42 U.S.C. §§ 4101(a) and 4102(a).
16. Light Detection and Ranging, a remote sensing technology that uses a laser to measure distance and is used to make high-resolution maps.
17. FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program was created after Congress called upon FEMA to update and modernize its floodplain mapping program, called "map modernization". Map Modernization sought to update all FIRMs

nationwide, improve their accuracy, and convert them to digital form. FEMA, Risk Mapping, Assessment, and Planning (Risk MAP) Multi-Year Plan: Fiscal Years 2010-2014, Fiscal Year 2009 Report to Congress at 4-5 (2009), available at: https://www.fema.gov/media-library/assets/documents/15651.

18. Id. at 12-14; FEMA, Increasing Options with Digital Flood Data, available at: http://www.fema.gov/media-library-data/20130726-1626-20490-0912/digital_policy_factsheet_june2010.pdf
19. The Biggert-Water Flood Insurance Reform Act of 2012, H.R. 4348, 112th Cong. §§ 100215(d), 100216 (b) (2012). In this section, FEMA is also directed to update FIRMs with respect to "(i) all populated areas and areas of possible population growth within the 100-year floodplain; (ii) all populated areas and areas of possible population growth within the 500-year floodplain; (iii) areas of residual risk, including areas that are protected by levees, dam, or other flood control structure; and (iv) the level of protection providing by flood control structures." FEMA is also directed to update maps using the most "accurate topography and elevation data available;" "acquire new ground elevation data" wherever necessary; and develop "flood data on a watershed basis."
20. Biggert-Waters directs FEMA to consider the "best available science regarding future changes in sea levels," The new mapping provisions provide that FEMA: "[1] shall establish an ongoing program under which the [FEMA] Administrator shall review, update and maintain National Flood Insurance Program rate maps... [2] In updating maps under this section, the Administrator shall include… (D) any relevant information or data of the National Oceanic and Atmospheric Administration and the United States Geological Survey relating to the best available science regarding future changes in sea levels, precipitation, and intensity of hurricanes.
21. Biggert Waters at § 100219 (amending 42 U.S.C. § 4101(f)(2)).
22. Biggert Waters at § 100215(d).
23. Biggert Waters, Sec. 100214 (amending 42 U.S.C. § 4019).
24. HFIAA amended Section 4014 of the National Flood Insurance Act (42 U.S.C. 4014) to grant the FEMA Administrator new authority to conduct studies and investigations and establish premiums flood insurance based upon accepted actuarial principles and "the flood mitigation activities that an owner or lessee has undertaken on a property, including differences in the risk involved due to land use measures, floodproofing, flood forecasting, and similar measures."
25. HFIAA at §§ 9 and 16.
26. FEMA, Increased Cost of Compliance Coverage, available at: http://www.fema.gov/national-flood-insurance-program-2/increased-cost-compliance-coverage ("Flood insurance policyholders in high-risk areas, also known as special flood hazard areas, can get up to $30,000 to help pay the costs to bring their home or business into compliance with the community's floodplain ordinance." Funds can be used to elevate, relocate, demolish or flood-proof structures. ICC claims can only be paid for substantially damaged or repetitively flood-damaged structures. Funds can only be used to pay for the costs of bringing the structure into compliance with the local floodplain ordinance.).
27. Fannie Mae and Freddie Mac are two government-sponsored, though publicly traded, enterprises that were created by the government to finance home mortgages.
28. For details on the Federal Housing Finance Agency and its conservatorship of Fannie Mae and Freddie Mac, see FHFA, Federal Housing Finance Agency Strategic Plan, Fiscal Years 2013-2017: Preparing a Foundation for a More Efficient and Effective Housing Finance System, available at: http://www.fhfa.gov/webfiles/24790/Final%20FHFA%20Strategic%20Plan-10-9-12.pdf. See also Press Release from U.S. Secretary of the Treasury Henry Paulson, Jr., Treasury and Federal Housing Finance Action to Protect Financial Markets and Taxpayers (Sep. 7, 2008), available at: http://www.treasury.gov/press-center/press-releases/Pages/hp1129.aspx.
29. Press Release from Federal Housing Finance Agency, Certain Energy Retrofit Loan Programs (Jul. 6, 2010), available at: http://www.fhfa.gov/webfiles/15884/PACESTMT7610.pdf. See also John Farrell, Fannie Mae and Freddie Mac Won't Allow PACE Liens, Institute for Local Self Reliance (Jul. 2, 2010), available at: http://www.ilsr.org/fannie-mae-and-freddie-mac-wont-allow-pace-liens/.
30. FEMA, Department of Homeland Security Federal Emergency Management Agency Flood Hazard Mapping and Risk Analysis Fiscal Year 2013 Congressional Justification (Feb. 13, 2012), available at: http://www.fema.gov/pdf/about/budget/11g_fema_flood_hazard_mapping_risk_analysis_dhs_fy13_cj.pdf.

CHAPTER 4

HUD PROGRAMS

CHAPTER INTRODUCTION

Climate change will not affect all communities equally. While impacts such as sea-level rise, drought, and heat will certainly affect everyone, the most vulnerable members of our communities will bear a disproportionate share of the harm from those impacts. For example, populations such as the elderly and the homeless are much more vulnerable to more extreme heat waves and low-income residents are more likely to live in urban areas that are subject to the urban heat island effect.

While adaptation efforts across the board should take this differential impact into account, some federal agencies are already in prime position to address these disparities. The Department of Housing and Urban Development (HUD) has as its mission to support affordable, sustainable, and safe housing and to promote community development in urban areas. The agency's largest programs focus primarily on supporting low- and moderate-income communities, making HUD a logical fit to support adaptation to protect those communities from climate impacts. Because HUD is primarily a grant-making agency, as opposed to a regulatory agency, participants in the HUD session focused mostly on opportunities to use HUD funding streams in more adaptive ways and on HUD's role in encouraging and enabling state and local adaptation.

HUD faces challenges, however, in supporting adaptive development, construction, and renovation in local communities. With HUD's formula funding programs, communities have broad discretion to use funds to support local priorities. This leaves HUD with little leverage to require consideration of climate change impacts in how those funds are spent. HUD's discretionary grant programs would look more promising, given the greater discretion HUD can exercise over the funds' uses. Recent years' budgets, however, have drastically cut these discretionary programs and in many cases have even eliminated them entirely.

In addition to these specific challenges, the housing crash and the recession in recent years have created a crisis situation for HUD as the primary agency responsible for trying to ensure safe, affordable housing for Americans. HUD grant recipients have largely been in crisis management mode when thinking about both housing and economic development. HUD faces challenges asking grantees to prioritize adaptation to climate change on top of issues perceived to be more urgent.

Careful consideration of how to engage HUD grantees is necessary in order to encourage more adaptive use of those funds at the state and local level. This chapter focuses on two main categories of programs administered by HUD: the Community Development Block Grant (CDBG) program and discretionary grant programs such as Choice Neighborhoods. Additionally, this chapter discusses opportunities to incorporate climate change considerations into the Federal Housing Administration's policies regarding mortgage insurance.

Below is a summary of the recommendations, with a detailed discussion of each in the following sections:

HUD Recommendations

- HUD should clarify allowable uses of funds for climate adaptation.
- HUD should provide models of how to use funds more adaptively.
- HUD should foster more peer-to-peer climate learning opportunities.

- HUD should cultivate relationships and federal partnerships to translate climate science for grantees.
- HUD should explore whether the Federal Housing Administration's mortgage insurance program can incorporate climate considerations into its eligibility criteria.

Recommendations for Congress

- Congress should fully fund HUD discretionary grant programs.

HUD PROGRAMS AND ADAPTATION

HUD's programs include community planning and development, public housing, fair housing, and mortgage support through the Federal Housing Administration (FHA) and related agencies. Within each category, HUD administers funding to support "strong, sustainable, inclusive communities and quality affordable homes for all."[1] This chapter focuses on opportunities to incorporate climate change considerations into community planning and development and not just individual buildings or projects. Within community planning and development, HUD has formula funding programs such as CDBG and discretionary grant programs such as Choice Neighborhoods.

The CDBG program is primarily intended to support community development in an extremely flexible manner by allowing state and local governments to determine their own priorities within a set range of criteria. The breadth of activities that grantees can support using CDBG funds is both an opportunity and a challenge from the perspective of promoting adaptation to climate change. On the one hand, grantees can use funds in a multitude of ways and have great discretion to design projects as they see fit, as long as one of the national objectives is being met. The potential to use CDBG funds to address adaptation in vulnerable communities therefore seems not to have specific legal barriers. However, as administrators of a formula grant program, HUD staff have limited influence over how grantees choose to spend the funds. This tension will be explored in greater detail in the CDBG section below.

In contrast, HUD has administered a number of discretionary grant programs in the past several years that had great potential to support climate adaptation. Community Challenge Grants, Choice Neighborhoods, Sustainable Communities Initiative, and others all were promising with respect to funding climate adaptation planning and implementation. Each of the programs, however, has been defunded in recent years. President Obama's Fiscal Year 2015 budget calls for renewed funding for the Choice Neighborhoods program,[2] but there is no guarantee that Congress will include that funding in its final appropriations. More discussion of the challenges and opportunities of the discretionary grant program is in the "Discretionary Grant" section below.

FHA guarantees home loans for homeowners across the country. In 2012, FHA issued a directive that it would no longer guarantee loans for new residences being built in coastal high hazard areas.[3] The federal government, acting as insurer in this case, may have the ability to incorporate more considerations of climate risk other than coastal hazards. More discussion of this question is below.

Community Development Block Grant Program

The Community Development Block Grant (CDBG) program is one of the major formula grant programs administered by HUD. The program authorizes HUD to provide funding to states, cities, and urban counties.[4] The grantees (cities, counties, or states) then determine which projects receive funding and distribute the funds accordingly. This chapter focuses primarily on the Entitlement Communities program because it receives the highest levels of funding and grantees have more discretion over their funds. Therefore, the Entitlement Communities program provides the best opportunity for supporting state and local adaptation.

CDBG Entitlement Communities grants are primarily intended to develop "viable urban communities, by providing decent housing and a suitable living environment and expanding economic opportunities, principally for persons of low and moderate income."[5] The primary national objective of the CDBG Entitlement Communities program is to benefit low- and moderate-income families. For the purposes of the program, a "low- and moderate-income person" means a member of a family having an income equal to or less than the Section 8 low-income limit established by HUD every year.[6] The CDBG Entitlement Communities' second national objective is to aid in the prevention or elimination of slums or blight. The third and final purpose of the CDBG Entitlement Communities program is to address urgent needs.[7]

To these ends, entitlement communities may use CDBG funds for a wide range of activities. Most importantly, CDBG Entitlement Communities funding may be used to purchase or lease real property; demolish or move buildings and other structures; purchase, construct, install, or rehabilitate public improvements and facilities; rehabilitate residential, commercial, industrial, and nonprofit-owned property; and provide assistance to businesses to carry out economic development and job creation services.[8] Generally, CDBG funds cannot be used for the acquisition, construction, or reconstruction of buildings for the general conduct of government; political activities; or the construction of new housing.[9] Entitlement communities are free to develop their own programs and funding priorities, but grantees must certify that they have prioritized activities that benefit low- and moderate-income persons to the greatest extent feasible.[10]

As a formula grant program, CDBG funds flow to entitlement communities and states without a formal application process. Entitlement communities are required to submit to HUD a Consolidated Plan describing the grantee's needs, resources, priorities, and proposed projects.[11] The Consolidated Plan must also include several required certifications, including the certification that not less than 70% of the CDBG funds received, over a three-year period, will be used for activities that benefit low- and moderate-income persons, and that the grantee will affirmatively further fair housing.[12]

HUD will generally approve Consolidated Plans unless they are inconsistent with the statutory requirements or are substantially incomplete.[13] This approach, laid out in statute and regulation, has resulted in a relatively "hands-off" approach by HUD staff in communicating with state and local grantees. HUD staff members are largely trained to advise grantees that they can use CDBG funds in any way that does not violate the rules, as opposed to providing guidance on what activities might be possible or even beneficial under the rules.

This mindset of simply preventing violations, as opposed to providing advice or guidance on best practices, can be a barrier to helping grantees achieve the most adaptive use of the funds. The rules governing CDBG may even leave room for regulatory changes to require consideration of resilience with the funds; the "hands-off" agency approach, however, might make change difficult. Agency staff have traditionally been reluctant to place new restrictions, especially in recent years in light of the housing crisis and stretched local budgets; it is unclear whether that reluctance remains as strong now that the housing market has begun to stabilize.

In addition to this challenge, staff members in regional HUD offices have varying levels of knowledge of and experience with principles of sustainability and resilience. HUD regional staff are often the primary points of contact for many grantees, and therefore are in a position to influence grantees' thinking about how to use those funds. Regional staff training in sustainability and resilience has been secondary to training in the basics of compliance with regulatory requirements, and regional staff's knowledge about best practices related to sustainable and adaptive development is varied.

Discretionary Grant Programs

Over the years, HUD has administered many grant programs over which it has much more discretion to set requirements through Notices of Funding Availability (NOFAs). Several programs funded in the past five years provided potential for selected jurisdictions to innovate in several areas, including sustainability. This section provides a brief description of two of those grant programs (Choice Neighborhoods and Sustainable Communities Regional Planning Grants), identifies their current funding status, and provides recommendations for re-invigorating those programs for supporting adaptation.

Choice Neighborhoods: The Choice Neighborhoods program, begun in FY 2011, encourages communities to implement a variety of reforms to attack the causes of poverty, with the end goal of transforming low-income communities and public housing projects into mixed-income neighborhoods. Reforms can address many areas, such as improving public schools, building transportation infrastructure, and increasing access to jobs and services.[14] The program is part of the White House Neighborhood Transformation Initiative, a partnership between HUD and the Departments of Education, Health and Human Services, Justice, and Treasury. Program funds can be used for a variety of activities, including sustainable neighborhood design and building housing using energy-efficient principles that seem compatible with building climate resilience.[15] The program was funded during the past few fiscal years, and the President's FY 2015 budget includes roughly $120 million for the program in the HUD budget request, plus more from another legislative package the White House has proposed.[16] Whether Congress chooses to include funding for the program in this year's appropriations bill, however, remains to be seen.

Sustainable Communities Regional Planning Grants: Another collaboration across agencies (this time, HUD, EPA, and DOT), the Sustainable Communities Initiative (SCI), was designed to foster regional and cross-agency collaboration to develop and plan sustainable reforms in housing, transportation, land use, and economic development. The goal of these planning efforts is to allow jurisdictions to work together to address the challenges of economic revitalization, social inclusion, public health, energy use, and climate change. Funded in FY 2011 and 2012, the FY 2015 budget renames the program "Integrated Planning and Investment Strategies" (IPIS) and requests $75 million from a separate legislative package.[17] SCI was an extremely popular program with enormous potential to support climate adaptation planning and implementation at a regional level; as with Choice Neighborhoods, whether Congress will support the program in this year's appropriation is uncertain.

The primary challenge of using discretionary grants to support adaptation is that their funding levels have been severely cut in recent years, making innovation more difficult for local agencies. If Choice Neighborhoods and IPIS receive funding this year, they could support more regionally based and neighborhood-focused planning for resilience and sustainability. HUD has already taken affirmative steps to incorporate sustainability into discretionary spending by placing a preference in the General NOFA for sustainability principles.[18] Communities applying for discretionary grant funds can receive up to two bonus points for "Preferred Sustainability Status," defined as acting in accordance with the Partnership

for Sustainable Communities' Six Livability Principles. The Principles include promoting equitable and affordable housing and providing more transportation choices. The Principles incorporate climate and environmental aspirations throughout.[19] With little to no discretionary money, however, this positive change will have little impact.

SUSTAINABLE COMMUNITIES INITIATIVE

The original SCI grants were constructive for state and local decision-makers in a few important ways. First, as discussed above, they created a peer-sharing network that continues to be useful to former grantees as they solve problems and try new strategies. Second, the act of working regionally seems to have boosted resilience generally and increased preparedness for grantees. New York City participants indicated that they were only able to propose building and zoning code changes so quickly after Superstorm Sandy because their SCI grant had helped establish a Climate Committee that had already done a lot of work looking at those codes. With much research already done and the collaborative relationships and trust already established, quick action post-disaster was possible. Third, working at the regional level gave some grantees a better understanding of their regionally concentrated areas of poverty and of the design of their regional infrastructure, such as transportation.

Federal Housing Administration Mortgage Insurance

The Federal Housing Administration insures mortgages from approved lenders on single-family and multi-family homes. The FHA mortgage insurance program helps protect lenders against losses from homeowner default, allowing rates to be lower and homeownership therefore more affordable. FHA currently insures nearly 5 million single family and multi-family homes across the country.[20]

In recent years, the FHA has taken affirmative steps to ensure that it is not insuring high-risk properties in floodplains and other vulnerable areas. The National Flood Insurance Program (NFIP), administered by FEMA, already requires that property owners located in Special Flood Hazard Areas (SFHAs) purchase flood insurance in order to be eligible for FHA mortgage insurance.[21] In December 2010, however, FHA issued a "Mortgagee Letter" to all mortgagees, mortgage servicers, and appraisers in their system updating guidance on the availability of FHA-insured mortgages in flood zones.[22] The new guidance states that FHA will not insure mortgages for new construction within a designated Coastal Barrier Resource System (CBRS) area.[23] The practical effect of this guidance was to prohibit any new construction supported by an FHA-mortgage within CBRS-protected areas and therefore protect those areas in conjunction with the CBRS program.

HUD (in the form of FHA) has in this case amended its programs to be in better alignment with the goals, priorities, and programs of another agency (Department of the Interior's Fish and Wildlife Service). If FHA supported new development in CBRS areas, the purpose of the CBRS program could be frustrated, but HUD acted to support the programs goals instead.

RECOMMENDATIONS

This section explores several recommendations for HUD (and in one case for Congress) to more completely support state and local adaptation. These recommendations are organized by program.

Community Development Block Grant (CDBG) Program

Given the current prevailing culture within HUD, recommendations for near-term change are likely to be most successful if they address the agency's hands-off approach to administering CDBG funding. The following recommendations are geared toward supporting grantees that would like to be able to use funds for adaptive projects. With the housing market increasingly stabilizing and the economy recovering, state and local grantees may now be more open to considering climate change as part of their approach to using CDBG funds.

HUD should clarify allowable uses of funds for climate adaptation. HUD staff should make explicit that communities are allowed to use CDBG funds for adaptation as long as the underlying requirements are met. In September 2012, the Federal Highway Administration (FHWA) issued a letter to state departments of transportation and metropolitan planning organizations clarifying the funding streams that the agency believed were well-suited to adaptive uses and the types of activities that were eligible under those funding streams.[24] HUD should produce a similar memo (including CDBG but also other programs) explaining the potential climate-smart uses of those funds. Additionally, program staff should provide more explicit language in the CDBG program guide to provide more specific guidance on how interested communities could use funds for adaptation. By providing confirmation that funds can be used for some adaptive purposes and guidance on what those purposes might be, HUD can provide certainty for grantees interested in building and developing more resiliently.

HUD should provide models of how to use funds more adaptively. More specific than general guidance, HUD could follow its own post-Sandy example and provide models for jurisdictions to use straight "out of the box." For resilience and adaptation, HUD could create a similar set of toolkits using examples from the Sustainable Communities Initiative and other grantees. By providing models that are compliant with all applicable regulations, HUD can take a step beyond simple clarification that adaptation is allowed to make things easier for grantees.

SANDY TOOLKITS

After CDBG disaster relief (CDBG-DR) funds were disbursed to states in the mid-Atlantic after Superstorm Sandy, HUD provided toolkits to help grantees quickly evaluate their needs post-disaster and prepare a plan to spend CDBG-DR funds to begin recovery. These toolkits covered areas such as unmet needs assessments, buyouts, homeowner rehabilitation, and others, providing step-by-step instructions and real-life examples that jurisdictions could simply use with the knowledge that they would be in full compliance with all program rules.

HUD should foster more peer-to-peer climate learning opportunities. The Sustainable Communities Initiative has been praised for the peer-to-peer learning that it has enabled among grantees. While information from HUD or from outside groups is certainly useful, some participants who had been part of an SCI team felt that HUD had facilitated an extremely active network that provided insight and feedback that grantees could only get from their peers. HUD should try to identify a source of funding to continue such networks and to share the lessons learned more broadly outside of the SCI group. If the President's FY 2015 budget is funded at its requested level, funding for this type of peer-to-peer network may be available (see discretionary funding section below).

HUD should cultivate relationships and federal partnerships to translate climate science for grantees. Understanding climate science and potential impacts can be challenging for state and local decision-makers. HUD could form partnerships with other federal agencies that create and translate the science for practical use to ensure that the translation works well for community development and housing agencies. HUD could partner with NOAA, Department of Interior, EPA, and others to help make actionable climate science available to grantees, as well as providing experts who can help translate the science.

FHA Mortgage Insurance

HUD should explore whether FHA's mortgage insurance program can incorporate climate considerations into its eligibility criteria. As with excluding Coastal Barrier Resource System areas from eligibility for FHA-backed loans, HUD should coordinate with other agencies to see whether other climate-relevant criteria should be included in the eligibility for FHA mortgage insurance. Eligibility for the program drives or precludes residential development in particular areas; FHA could have a significant impact on development in climate-vulnerable areas.

Recommendations for Congress

Congress should fully fund HUD discretionary grant programs. Not only have past grants funded innovative and important advances in regional planning and implementation, but others have supported sustainable development in some of our most vulnerable neighborhoods. Continuation of this work is vital to provide support for leaders in resilience and to provide examples for other jurisdictions to follow.

CHAPTER 4 - ENDNOTES

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CHAPTER 5

NATURE-BASED ADAPTATION STRATEGIES

CHAPTER INTRODUCTION

Recent hurricanes have brought renewed focus on the flood risk reduction benefits of natural shorelines.[1] During Hurricane Sandy, towns protected by sand dunes suffered far less damage than towns without dunes. In the aftermath of the storm, the Army Corps of Engineers (Corps) is examining options for restoring wetlands in Jamaica Bay to dampen storm surges and reduce risks to this part of New York City. These methods are not new. For example, Maryland has been encouraging living shorelines[2] as a way of providing flood and erosion control along the Chesapeake Bay for more than a decade. After Tropical Storm Isabel battered the coast in 2003, living shoreline projects in Maryland maintained structural stability and most property owners only had to perform minor maintenance on the sites.[3]

This renewed focus on nature-based strategies is due to improvements in our understanding of the value of intertidal areas. Depending on their characteristics, intertidal areas can provide important ecosystem services: they filter polluted runoff, provide habitats for a variety of species, dissipate and absorb flood waters, buffer storm surges, and are places for recreation. However, these areas are increasingly being squeezed on two sides—by rising seas and encroaching coastal development and armoring. As sea-level rise intensifies, these environments will be increasingly degraded and potentially lost. Rising seas will inundate large portions of the coast and, if shorelines are increasingly armored, coastal ecosystems will be unable to naturally maintain their position or migrate inland.

Coastal managers often struggle to balance the need to conserve these valuable ecosystems while also protecting upland development. Traditional "gray" approaches have relied on armoring (such as sea walls and bulkheads) to control flooding and erosion. But armoring adversely affects coastal stability, water quality, and ecosystems. Armoring can destroy natural coastal features such as beaches, dunes, and wetlands, damaging the coastal environment and reducing the environmental and flood risk reduction benefits provided by these systems.

"Green" or nature-based approaches promise a more ecological (and often more cost effective) alternative to armoring. For purposes of this report, the term "nature-based approaches" is used to refer to human-engineered methods for restoring or preserving natural shorelines.[4] Nature-based methods stabilize shorelines by combining plants, sand, rocks, and other materials, and include strategies such as dune management, beach nourishment, and wetlands restoration. These methods are designed to preserve the capacity of natural shorelines to adapt to impacts and enhance the ability of these coastal ecosystems to reduce flooding. Sometimes these strategies include hybrid approaches that use hard structures combined with natural features, called "living shorelines." Living shorelines often combine wetlands restoration projects with structural measures, such as low rock sills, that are designed to ensure tidal connectivity while attenuating waves.[5]

Nature-based projects tend to vary significantly in terms of their design and scale. Nature-based strategies can include everything from small-scale, parcel-level projects to large-scale, watershed-level approaches that combine multiple projects to achieve system-wide benefits. Living shorelines, for example, are often implemented on an individual property or grouping of properties. Nature-based approaches also include comprehensive strategies like the Louisiana Coastal Master Plan and the South Bay Salt Ponds Restoration project in the San Francisco Bay, which combine hundreds of different projects across thousands of acres. Although both types of strategies help preserve valuable coastal ecosystems, the scale of the project influences how effective the project will be at reducing flood risks and how challenging it will be to implement. Larger projects are more effective at dampening storm surges, but are also much more difficult to fund, design, and permit.

Because of the great diversity of nature-based approaches, these types of projects are technically challenging to permit and construct. Projects must be designed to integrate with unique site-specific factors. Coastal and estuarine shorelines are highly variable in terms of their coastal landform and conditions, hydrodynamics, habitat types and conditions, presence and proximity of development, and extent of armoring. Nature-based approaches also tend to vary significantly in terms of their efficacy in reducing flood risks and these benefits can be difficult to quantify.[6] Because of the dynamic nature of shorelines, nature-based projects require continued maintenance over time to sustain the flood risk reduction benefits provided by the project. Finally, implementation often requires alignment of policies and regulations across all levels of government—involving federal, state, and local decision-makers.

As a result, nature-based approaches are far from mainstream and have not been widely applied along all coastal and estuarine shorelines. This chapter explores opportunities for federal agencies to encourage and support the wider deployment of nature-based coastal adaptation strategies through federal civil works projects, funding programs, and regulatory programs. A summary of recommendations is included here:

General Recommendations

- The White House Council on Environmental Quality (CEQ) should finalize and adopt the updated Principles and Guidelines for water resource development projects.
- The Corps and other federal agencies should provide more technical assistance, education, and training to improve understanding of how to design nature-based approaches and evaluate their efficacy.
- The Corps and other federal agencies should convene a work group to explore nature-based approaches, including state and local government, scientists, NGOs, academia, and the business community.

Army Corps of Engineers Civil Works Projects

- The Corps should work with other federal agencies, academia, NGOs, and the business community to develop a standard for measuring and quantifying the ecosystem services and flood risk reduction benefits of nature-based approaches.
- The Corps should develop case studies and lessons learned from application of its Sea-Level Change Guidance for civil works projects and should apply this analysis to ecosystem restoration projects.
- The Corps should shorten the time period for taking a project from planning to implementation.

Funding Programs

- Federal agencies or CEQ should map the various federal funding streams that can be used to implement nature-based approaches and provide guidance on how grantees can combine funding streams with other state and federal sources to take nature-based projects from planning to implementation.
- Federal agencies should fund research that will demonstrate the multiple benefits of nature-based approaches.

- Federal agencies should, where feasible, distribute grants through private foundations to help grantees align federal funding streams, similar to the National Fish and Wildlife Foundation (NFWF) model used to distribute Sandy funding.
- Federal agencies should provide guidance to states and localities about mechanisms to raise money to leverage federal funds.
- The Federal Emergency Management Agency (FEMA) should issue guidance to clarify when and how Hazard Mitigation Grant Program funds can be used to restore acquired properties for ecosystem and flood control benefits.
- Federal agencies should fund more integrated watershed planning and support regional coordination of coastal protection strategies.
- Federal agencies should continue and increase the role of interagency review boards in administering grants.
- The Department of Housing and Urban Development (HUD) should develop guidance on whether and how states and localities can use Community Development Block Grant funding to implement nature-based approaches.

Army Corps Regulatory Programs

- The Corps should develop more regional general permits for nature-based approaches.
- The Corps should develop guidance on which nationwide permits can be used for small-scale living shoreline projects.
- The Corps should explore opportunities to better align federal, state, and local permitting requirements for nature-based approaches through Programmatic General Permits (PGPs), Special Area Management Plans (SAMPs), and the National Estuary Program (NEP).
- The Corps should consider climate change in its regulatory program when it requires permit applicants to mitigate environmental impacts (i.e., compensatory mitigation requirements).
- Federal agencies, CEQ, universities, or NGOs should develop or compile model ordinances or model legislation for implementing nature-based approaches at the state and local level.

Other Federal Programs

- FEMA should increase the amount of Community Rating System (CRS) credits provided to communities that conserve open space and implement ecosystem restoration projects that provide flood risk reductions.

Recommendations for Congress

- Congress should appropriate funds to the Corps for more "multi-purpose projects" — projects that provide both flood control and ecosystem benefits.
- Congress should explicitly allow for the transfer of funds between federal agencies and programs that support ecosystem restoration and flood control projects.
- Congress should appropriate funds that support ecosystem restoration and flood control projects as multi-year money.

- Congress should authorize federal agencies to accept private funds to undertake ecosystem restoration and flood control projects.
- Congress should reform incentives for levees in the National Flood Insurance Program (NFIP).

FEDERAL PROGRAMS AFFECTING NATURE-BASED APPROACHES

Nature-based projects can be implemented through several pathways.[7] The Corps can undertake ecosystem restoration and flood control projects through its civil works program. States, localities, and private NGOs also implement these types of projects, often with federal funds provided through a variety of federal programs (listed below). Finally, private landowners also determine whether to armor shorelines or use nature-based approaches on private lands. Private projects are governed by the permitting requirements imposed by the Corps (under the Clean Water Act and the Rivers and Harbors Act) and state and local regulations.

This chapter provides a summary of each of these pathways: the Corps civil works program, other federal funding programs that support ecosystems restoration, and the Corps regulatory program. It identifies the federal programs that present opportunities for supporting nature-based approaches. Finally, it provides recommendations for retooling these programs to encourage the implementation of nature-based approaches on a broader scale.

Corps Civil Works Projects

Corps civil works projects will play a critical role in any strategy to encourage nature-based coastal adaptation. The Corps is primarily charged with designing and constructing structural flood control measures, such as sea walls, storm surge barriers, and levees. A Corps approach that relies solely on structural measures to control flooding and erosion will diminish the ability of natural systems to adapt to climate change and to provide natural flood buffers. Additionally, nature-based projects are best designed at a watershed scale because of the complex interactions among coastal processes. The Corps' authority over both large-scale flood risk reduction and ecosystem restoration projects gives it broad powers to implement a range of nature-based and hybrid projects and evaluate the efficacy of these approaches over time.

Congress directs the Corps civil works activities through authorization bills, such as the Water Resource Development Act (WRDA).[8] The Corps receives funding for projects authorized in WRDAs through annual, supplemental, and emergency appropriations bills. Congress authorizes three types of Corps civil works projects: (1) flood control, (2) ecosystem restoration, and (3) multi-purpose projects.[9] Corps projects are typically authorized in two phases. First, the Corps conducts a feasibility study and environmental review. Second, after internal Corps approvals,[10] Congress may authorize and appropriate funds to construct the project. State and local government sponsors must typically contribute a 45% cost-share to a project.

However, several aspects of the WRDA process complicate efforts to incorporate nature-based approaches into civil works projects, particularly projects authorized as flood control projects. First, Corps projects have historically been authorized as earmarks through WRDAs—meaning that Congress

typically provides only project-specific authorizations and appropriations that cannot be diverted to other projects or substantially changed without legislative amendments. Second, the Corps applies a Benefit-Cost Analysis (BCA) that has historically failed to account for the ecosystem service benefits provided by nature-based approaches. Thus, projects that include a nature-based component often fail to meet the required BCA ratio (of greater than 1) and, therefore, cannot receive funding. Third, civil works projects take an extremely long time to proceed from the study phase to implementation. Fourth, there is a backlog of 1,000 projects that have been studied and authorized, but have not received funding for construction from Congress.[11] It is unclear whether the recently passed Water Resources Reform and Development Act of 2014 (WRRDA 2014) may help eliminate some of these roadblocks.[12]

Funding Programs that Support Nature-Based Approaches

A variety of federal agencies administer grant programs that support ecosystem restoration and flood risk reduction projects (NOAA, EPA, USFWS, the Corps, FEMA, USDA-NRCS, DOD, NSF and others). Each program is designed to fund specific types of restoration projects with different characteristics. For example, NOAA provides funds to acquire and restore coastal wetlands;[13] DOD provides funds to conserve lands as buffers between development and military installations;[14] NSF provides funds for research on coastal ecosystems;[15] and USDA provides funds to conserve farmed wetlands and purchase floodplain easements.[16] A table of the various federal programs is provided at the end of this chapter.[17]

It is challenging for state and local grantees to navigate this patchwork of programs and align funding streams to take a restoration project through the various stages from planning to implementation. Each of these programs has its own rules, restrictions, and requirements, which makes it difficult to align funding, particularly for large-scale multipurpose projects. Many of these programs have been the target of budget cuts or have been zeroed out in recent years—for example, the popular Coastal Estuarine Land Conservation Program (CELCP), administered by NOAA, has not received funding in the last two years. Additionally, federal agencies often cannot combine resources with other agencies.[18] Grant criteria often disfavor projects with multiple purposes (ecosystem restoration and flood risk reduction), particularly grants that require cost-benefit analyses that do not value the benefits of ecosystem services (see discussion of the HMGP in Chapter 2). Finally, there is a dearth of funds available to support monitoring and evaluation of restoration projects, which makes it difficult to demonstrate the flood risk reduction benefits of nature-based approaches.

Corps Regulatory Requirements

Projects on private lands are often governed by the Corps regulatory program. The Corps is responsible for permitting shoreline activities under Section 10 of the Rivers and Harbors Act of 1899 (RHA) and Section 404 of the Clean Water Act (CWA).[19] Essentially all ground-disturbing activities in intertidal areas and areas adjacent to wetlands require a Corps permit.[20]

Getting a permit for a large-scale, nature-based project can often be a time consuming and expensive process. In most states, many nature-based projects require an individual permit from the Corps, which entails lengthy site-specific review. It can take the Corps up to three years to complete the administrative requirements to issue an individual permit, including compliance with the National Environmental Protection Act (NEPA), the Endangered Species Act, and federal consistency review under Section 401 of the Coastal Zone Management Act.[21] By contrast, small-scale projects can often proceed with limited or even no Corps review.[22] The extra time and effort required to obtain a permit for a nature-based project can steer both public and private landowners to take the easier path of hard armoring.

In addition to a Corps permit, nature-based projects must also often comply with local and state laws, and these laws are often not equipped to efficiently permit projects with multiple site-specific conditions. Nature-based projects can often extend from uplands well into navigable waters, and thus trigger review by regulators at all levels of government: federal, state, and local. Because of these regulatory hurdles, nature-based projects often face prolonged permit review, uncertainty in approval, and additional costs.

The Corps regulatory program also does not account for climate change. As a result, the Corps does not require armoring projects to mitigate the full extent of their environmental impacts because the Corps is not factoring in how those impacts will be compounded over time as sea levels rise and intertidal areas are squeezed out.

Finally, other federal programs will also influence coastal protection decisions. For example, the NFIP (described in Chapter 3) creates regulatory incentives for armoring. Areas protected by flood control structures, such as levees, can be exempted from NFIP requirements (insurance purchase requirements and land-use regulations). This creates incentives for communities to build and maintain levees and other structural flood control measures to avoid NFIP requirements, rather than exploring nature-based strategies.

RECOMMENDATIONS

This section explores several recommendations for federal agencies and Congress to encourage and support the wider deployment of nature-based coastal adaptation strategies through federal civil works projects, funding programs, and regulatory programs. These recommendations are organized by program.

General Recommendations

CEQ should finalize and adopt the updated Principles and Guidelines for water resources development projects. Under a directive from Congress and President Obama, CEQ revised the "Principles and Guidelines" for water resource development projects.[23] The Principles and Guidelines provide direction to federal agencies regarding the selection and evaluation of "major water projects."[24] The draft Principles and Guidelines have two components: (1) the Principles and Requirements (P&Rs), which set out broad principles to guide water investments, and (2) Interagency Guidelines for implementing the P&Rs. The P&Rs were finalized in 2013.[25] The draft Interagency Guidelines, however, were released for public comment in 2013, but have yet to be finalized. When adopted, the Principles and Guidelines will require federal agencies to consider nature-based approaches. Project implementation studies will be required to consider: (1) environmental preservation goals as coequal to economic development goals; (2) the monetary and non-monetary benefits provided by ecosystems services; and (3) avoidance of "the unwise use of floodplains and flood-prone areas." Specifically, the P&Rs require the Corps to study project alternatives that minimize direct and indirect adverse impacts to floodplain function.[26] The Corps is also specifically directed to provide descriptions of both the historic and probable future flood risks to a proposed activity given climate change.[27] The draft Interagency Guidelines include procedures for determining the applicability of the P&Rs to an agency's water resource investments, and a detailed methodology for implementing the P&R with regard to applicable projects. CEQ should adopt the Interagency Guidelines and finalize the Principles and Guidelines so that federal agencies begin to apply these considerations to water resource projects.

The Corps and other federal agencies should provide more technical assistance, education, and training to improve understanding of how to design nature-based approaches and evaluate their efficacy. State and local proponents of nature-based projects often lack the technical capacity to design these types of projects and evaluate their efficacy for providing flood risk reduction benefits. As a result, it can be difficult to encourage private landowners to opt for nature-based approaches rather than familiar and tested armoring approaches. The Corps and other federal agencies can provide technical assistance, guidance, and decision-support tools to help state and local governments implement nature-based approaches and educate contractors and the public about the efficacy of these approaches. The NSF should fund projects that evaluate the performance of nature-based approaches at providing flood risk reduction benefits and that help to value ecosystem services. Federal agencies should require and fund long-term monitoring of nature-based projects as a condition of federal grants. Federal agencies should also develop indicators for evaluating and documenting the success of these types of projects—both in terms of their ecosystem services and flood risk reduction benefits. The Corps should capture and disseminate lessons learned from nature-based projects constructed with Sandy disaster relief funds.

SYSTEMS APPROACH TO GEOMORPHIC ENGINEERING (SAGE)

The Corps, NOAA, and FEMA created the interagency SAGE team. SAGE is designed to explore comprehensive approaches to coastal protection.[29] Rather than take a parcel-by-parcel approach to provide flood and erosion control, SAGE examines systematic and regional approaches by integrating both green and gray alternatives across regions and watersheds. SAGE provides an opportunity for the Corps to examine mechanisms for better integrating nature-based approaches into their regulatory program, to provide technical guidance on how to design and construct nature-based projects, and to implement pilot projects.

The Corps and other federal agencies should convene a work group to explore nature-based approaches, including state and local governments, scientists, NGOs, academia, and the business community. This group should explore integrated green and gray approaches to coastal protection, study the effectiveness of these approaches, and develop indicators for evaluating these types of projects. This group could build upon efforts undertaken by the Corps to solicit input from a wide range of stakeholders as it developed the North-Atlantic Coast Comprehensive Study (Comprehensive Study). The Corps could continue to work with this group of experts to explore strategies for removing policy and technical barriers to implementation of nature-based projects.

THE NORTH-ATLANTIC COAST COMPREHENSIVE STUDY

The Sandy Relief Act called for the Corps to prepare the North-Atlantic Coast Comprehensive Study (Comprehensive Study) "to address the flood risks of vulnerable coastal populations in areas impacted by Hurricane Sandy." A draft of the Comprehensive Study was released in March 2013. The study examines a range of system approaches for improving coastal resilience. The study also included an analysis of how low, medium, and

high scenarios of sea-level rise will change flood and erosion risks in the study area (31,000 miles of coast from VA to NH). As part of this initiative, the Corps convened stakeholders from state, local, and tribal governments, and representatives from NGOs, academia, and business to assess the role of nature-based approaches in promoting coastal resilience.[30] The final report is due to Congress in January 2015.

USACE, North Atlantic Coast Comprehensive Study (2014), available at: http://www.nad.usace.army.mil/CompStudy.aspx.

Army Corps of Engineers Civil Works Projects

The Corps should work with other federal agencies, academia, NGOs, and the business community to develop a standard for measuring and quantifying the ecosystem services and flood risk reduction benefits of nature-based approaches. When applying BCA for flood control projects, the Corps should consider the ecosystem services and flood risk reduction benefits of incorporating nature-based approaches into project design. The Corps should align this work with other federal agencies (FEMA and EPA) that are exploring how to value ecosystem services and the flood risk reduction benefits of natural systems in their BCA (see discussion of BCA in Chapter 2).[31]

The Corps should develop case studies and lessons learned from application of its Sea-Level Change Guidance for civil works projects and should apply this analysis to ecosystem restoration projects. Corps Guidance requires the Corps to consider how sea-level change will affect a civil works project site.[32] The Corps should consider whether sea-level rise can be addressed through its regulatory programs. In particular, the Corps should assess the cumulative impacts to wetlands and beaches as a result of sea-level rise where hard armoring is permitted. The Corps should also develop case studies to share the lessons it is learning from the application of their Sea-Level Change Guidance and to inform other federal, state, and local adaptation efforts. For example, the lessons learned from the Corps' efforts to incorporate consideration of sea-level rise into large-scale flood control and restoration projects could inform the design and engineering of both public and private nature-based projects. More efforts are needed to translate the knowledge and expertise being developed by federal agencies to other agencies and to state and local actors.

The Corps should shorten the time period for taking a project from planning to implementation. Large-scale restoration projects can take 8 to 10 years in the planning phase. This is too long when communities are trying to implement quick solutions to provide flood risk reduction benefits. It is unclear if the Corps can reduce delays in the project approval process administratively and whether fixes included in the 2014 WRRDA will resolve some of the delay. The 2014 WRRDA includes "streamlining" provisions that aim to speed the environmental and endangered species review process.[33]

Funding Programs

Federal agencies or CEQ should map the various funding streams that can be used to implement nature-based approaches and provide guidance on how grantees can combine funding streams from other state and federal sources to take nature-based projects from planning to implementation. Large-scale restoration projects require several phases of work: planning, acquisition, design, and construction. Federal grants often can only be used to support one phase of

the work, and thus implementation is delayed as the state and local proponent has to raise funds to support subsequent phases of work. Additionally, few if any programs are available to support post-implementation monitoring to evaluate the performance of these projects over time. Empirical evidence is needed to evaluate the multiple benefits of these projects. Federal agencies or CEQ should provide guidance on which federal programs can support monitoring, evaluation, and maintenance of nature-based approaches and should require post-implementation monitoring as a condition of grants.

Federal agencies should fund research that will demonstrate the multiple benefits of nature-based approaches. State and local proponents of nature-based strategies report difficulty: (1) quantifying how these strategies will help avoid losses over the long-term, (2) monetizing ecosystem services benefits, and (3) measuring ecosystem and flood risk reduction benefits across a range of different types of ecosystems and shorelines. The federal government should fund research that can be used by federal agencies in their efforts to update BCA to include ecosystem and other adaptive benefits. Research should also be funded that will evaluate the effectiveness of different nature-based approaches at reducing flood risks. The DOD could fund pilot projects to protect military assets with nature-based approaches and share the lessons learned from these projects (including quantification of benefits) with other federal agencies and state and local partners.

Federal agencies should partner with private foundations to distribute grants to help grantees align federal funding streams, where feasible.[34] Several bureaus in the Department of the Interior (DOI) received Sandy disaster relief money to fund nature-based projects. DOI awarded this funding through competitive grants administered by the National Fish and Wildlife Foundation (NFWF). NFWF took funding from multiple agencies and packaged the funding into grants. By doing so, NFWF was able to provide a one-stop clearinghouse for grants for watershed restoration projects to be funded with Sandy funds. As a private middleman, NFWF was able to navigate and ensure compliance with the specific rules and regulations of each federal grant program, while sparing each state and local grant applicant this work.

Federal agencies should provide guidance to states and localities about mechanisms to raise money to leverage federal funds. Federal agencies can identify the most innovative state and local funding measures and encourage other jurisdictions to replicate these models by selecting projects that include state and local cost sharing.

MARYLAND ZERO-INTEREST LOANS FOR LIVING SHORELINES

Maryland provides zero-interest loans to support installation of living shorelines on public and private lands. The state funds this loan program through the Shore Erosion Control Revolving Loan Fund. Property owners can receive a zero-interest loan of up to $25,000 to pay 75 percent of a project's cost or 100 percent for a project on public lands. Maryland leveraged Coastal Zone Management funds and the CELCP program to plan and provide initial support for the loan program.

Maryland Department of Natural Resources, Grants and Loans Center, available at: http://dnr.maryland.gov/land/grantsandloans/grants.asp.

FEMA should issue guidance to clarify when and how Hazard Mitigation Grant Program (HMGP) funds can be used to restore acquired properties for ecosystem and flood control benefits. After a presidentially-declared disaster, the HMGP provides a large source of funding that can be used to acquire properties in flood-prone areas. Structures on bought-out properties must be removed and the property must be dedicated permanently as open space.[35] Section 404 of the Stafford Act allows for the broad use of HMGP funds for mitigation activities that are "cost-effective and which substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster." However, it is unclear to what extent FEMA regulations allow HMGP funds to be used to restore natural floodplain function or when hybrid approaches, such as living shorelines, can be implemented on acquired lands to enhance the flood risk reduction benefits of the property for adjacent lands.

Federal agencies should fund more integrated watershed planning and support regional coordination of coastal protection strategies. Comprehensive coastal protection strategies will require coordination across multiple communities, counties, and sometimes even states. Failure to coordinate across jurisdictions could result in maladaptive results. For example, when one coastal community builds a sea wall to reduce its flood risks this can divert floodwaters and exacerbate risks to neighboring communities. To ensure coordination, federal agencies should identify which federal grants can be used to support regional planning and encourage grantees to coordinate coastal protection decisions. Federal agencies should also encourage communities to integrate those decisions into local land-use plans and other decision-making frameworks.

Federal agencies should continue and increase the role of interagency review boards in administering grants. By ensuring that other agencies weigh in on grant-making decisions, agencies can better align funding decisions, reduce duplication of effort, and reduce red tape.

PARTNERSHIP FOR SUSTAINABLE COMMUNITIES INTERAGENCY GRANT REVIEW BOARD

EPA, DOT and HUD have created an interagency collaboration called the Partnership for Sustainable Communities. The Partnership was created to align funding priorities and reduce bureaucratic barriers in order to promote investment in more livable communities through transit-oriented development and other activities. Through the partnership, the agencies created an interagency grant review board that allowed the agency to coordinate on grant decision-making and include common language in funding solicitations.[36]

HUD should develop guidance on whether and how states and localities can use Community Development Block Grant (CDBG) funding to implement nature-based approaches. Because of its flexibility, CDBG funds present a great opportunity for funding nature-based strategies particularly for low- and medium-income communities. However, state and local proponents reported uncertainty over whether CDBG funding can be appropriately applied to these types of projects.

REBUILD BY DESIGN

After Hurricane Sandy, HUD partnered with the Rockefeller Foundation to fund the Rebuild by Design competition. CDBG disaster relief funding was used to encourage innovative solutions for promoting flood resilience in Sandy-affected communities. Ten design teams were selected to develop scalable green-gray solutions for addressing impacts from future extreme weather and sea-level rise. Several of the projects involved the creation of green space to provide natural flood buffers and recreational opportunities in urban areas such as Hoboken, NJ and Staten Island, NY. In many cities, green-infrastructure improvements have been used to provide community amenities such as parks, walking and biking paths, and other recreational spaces in low-income communities. These amenities have improved urban access to nature, increased physical activity, and made densely developed neighborhoods more livable.

http://www.rebuildbydesign.org/

Army Corps Regulatory Programs

The Corps should develop more regional general permits for nature-based approaches. The CWA grants the Corps significant discretion to develop permits that can streamline regulatory review for nature-based approaches, such as regional general permits. Regional general permits provide streamlined regulatory review for certain activities that are "similar in nature" and that have no more than minimal individual and cumulative impacts in certain regions or watershed. Regional general permits offer a way to reduce regulatory barriers to nature-based projects.

MOBILE BAY LIVING SHORELINES GENERAL PERMIT

The Corps developed a regional general permit for living shoreline projects in Mobile Bay, AL. The Corps issued the Mobile Bay Living Shorelines General Permit (LGSP), which designates a set of pre-approved activities for using natural techniques to provide flood and erosion protection, including renewal of dunes, beaches, wetlands, marsh vegetation, oyster reefs, and grass beds.[37] The LGSP simplifies the permitting process for nature-based approaches. The Corps should consider developing regional general permits for other significant watersheds and estuaries.[38]

The Corps should develop guidance on which nationwide permits can be used for small-scale nature-based projects. The Corps issues nationwide permits (NWPs) for certain categories of projects that are similar in nature and deemed to have minimal adverse environmental impacts.[39] With a general permit the Corps does much of the administrative work up front (e.g., environmental review and consultation with other state and federal agencies), which simplifies the approval process and reduces the administrative burden for the project applicant. Some Corps district offices[40] authorize small-scale, nature-based projects through NWPs, however other districts do not. Corps Headquarters could issue guidance to its district offices on when it is appropriate to authorize small-scale, nature-based projects through NWPs.

The Corps should explore opportunities to better align federal, state, and local permitting requirements for nature-based approaches through Programmatic General Permits (PGPs), Special Area Management Plans (SAMPs), or the National Estuary Program (NEP). The cooperative federalism model of the CWA provides different methods by which states or localities can work with the Corps to develop permits that streamline and coordinate the review of nature-based approaches between levels of government. One option is for states to verify activities through a PGP. The Corps can issue a PGP by following the same procedures as for other general permits.[42] Under this option, a state agency verifies certain activities with limited Corps involvement. Maryland implements its Living Shoreline Protection Act through a PGP. The Maryland Department of the Environment verifies approximately 80% of shoreline projects pursuant to its PGP and state rules that favor nature-based approaches over armoring. SAMPs, such as the Rhode Island Ocean SAMP, could provide a planning framework for integrating permitting of nature-based approaches among federal, state, and local regulators. Finally, the NEP could also provide a vehicle for coordinating regulation of nature-based approaches across states. The Partnership for the Delaware Estuary is using the NEP to test approaches for coordinated permitting in Pennsylvania, Delaware, and New Jersey.

The Corps should consider climate change in its regulatory program when it requires mitigation of environmental impacts to wetlands. The Corps should reevaluate its mitigation requirements when permitting armoring or issuing nationwide permits to consider how environmental impacts to wetlands will be compounded over time as sea levels rise, storm intensity increases, and intertidal areas are unable to migrate inland. Where hard armoring is allowed, wetlands will gradually be converted to open water as sea levels rise and drown the wetlands. The loss of wetlands and the valuable ecosystem services they provide will have many negative environmental, economic, and social consequences, including diminished water quality, diminished recreational opportunities, and diminished habitats for fisheries and other species. These cumulative long-term impacts should be accounted for when the Corps calculates impact fees and imposes mitigation requirements in permits.

Federal agencies, CEQ, universities, or NGOs should develop or compile model ordinances or model legislation for implementing nature-based approaches at the state and local level. Nature-based projects often extend into areas under local jurisdiction. As a result, nature-based approaches must be integrated into local land-use policies to be successful. To do so, local governments need support navigating federal and state laws.

MISSISSIPPI-ALABAMA SEA GRANT PROGRAM LIVING SHORELINES MODEL ORDINANCE

In Alabama, the Mississippi-Alabama Sea Grant Program developed a model ordinance to support implementation of the Mobile Bay Living Shoreline General Permit. The model ordinance helps communities integrate living shoreline design guidelines into local ordinances. Similar tools could be developed for other states and localities trying to implement regulatory incentives for nature-based approaches.

Chris Boyd & Niki Pace, Mississippi-Alabama Sea Grant Legal Program, Coastal Alabama Living Shorelines Policies, Rules, and Model Ordinance Manual (2013), available at http://masgc.org/assets/uploads/publications/524/13-023.pdf.

Other Federal Programs

FEMA should increase the Community Rating System (CRS) credits provided to communities that conserve open space and implement ecosystem restoration projects that provide flood risk reductions. As described in Chapter 3, the CRS is an incentive-based sub-program of the NFIP that offers reduced insurance rates to landowners in communities that implement more robust floodplain management practices. Limiting development and removing development from flood-prone areas are the most effective strategies for mitigating flood risks. But these strategies are also among the most expensive and politically difficult to implement. The CRS provides points for communities that limit development in floodplains, preserve floodplains as open space, and implement regulations to manage stormwater.[43] FEMA should consider awarding credit for restoring open space to provide natural flood control benefits. FEMA should also award credits based upon the risk reduction benefits provided by ecosystem improvements.

Recommendations for Congress

Congress should appropriate funds to the Corps for more multi-purpose projects that provide both flood control and ecosystem benefits. The Corps is limited in its ability to innovate because Congress appropriates money to either flood control projects or ecosystem projects. The type of project controls and limits how the money may be spent and whether a detailed BCA is required (BCA is not required for ecosystem restoration projects but is required for flood control projects). Congress can avoid these arbitrary bureaucratic divisions by appropriating funds for "multi-purpose projects"— projects that provide both flood control and ecosystem restoration benefits. By doing so, Congress will provide the Corps with more flexibility to design projects that combine green and gray approaches.

Congress should explicitly allow for the transfer of federal funds between agencies and federal programs that support ecosystem restoration and flood control projects. The Constitution grants Congress the responsibility for federal spending.[44] As a result, federal agencies (considered part of the Executive Branch) are limited in how they can spend the money appropriated to them by Congress. One of these limits is that one federal agency may not transfer funds appropriated to it to another federal agency—this is considered an unauthorized "augmentation" of the other agency's budget.[45] Additionally, funds provided by one federal agency must often be accounted for and deducted from future federal grants to undertake subsequent phases of the project. This prohibition makes it difficult for federal agencies or state or local grantees to combine different federal funding streams to support large-scale restoration projects. For example, historically the Corps was unable to undertake civil works projects on lands owned by other federal agencies (e.g., USFWS or BLM) because the Corps investment was considered an augmentation of the other agency's budget. Language added to the WRRDA 2014 will cure this problem for some large-scale Corps projects,[46] but will not alleviate the problem for other federal funding sources. Congress should consider allowing funds from one program that supports land acquisitions and restoration projects to be merged with or transferred to other federal agencies that are supporting similar initiatives. Language include in the 2014 WRRDA could be used as a model.[47]

Congress should appropriate funds that support ecosystem restoration and flood control projects as multi-year money. Typically, appropriations require funds to be obligated (i.e., legally committed by grant or contract) in the fiscal year for which it was appropriated. This makes it difficult for state and local grantees to fund long-term restoration projects that have multiple phases (e.g., planning and acquisition). Through appropriation language (e.g., "funds shall remain available for obligation until expended"), Congress can provide more flexibility for multi-year restoration projects.[48]

Congress should authorize federal agencies to accept private funds to undertake ecosystem restoration and flood control projects. Federal agencies are often also prohibited from supplementing their budget with outside, private funding sources. This prevents agencies from engaging in public-private partnerships to support restoration and flood risk reduction projects. Congress should consider granting federal agencies authority to accept, administer, and spend private donations to allow for private contributions for ecosystem restoration and flood control projects.

Congress should reform incentives for levees in the National Flood Insurance Program. Incentives provided to communities that construct flood control structures have been the subject of ongoing debate. On one hand, removing these incentives would have devastating financial consequences for communities that rely on flood protection structures, such as Sacramento, CA and New Orleans, LA. As a result, efforts in Congress to curtail these incentives have repeatedly failed. On the other hand, NFIP incentives for levees encourage unsafe development in areas that have residual risk of flooding in the event of catastrophic failure. These incentives also encourage construction of flood control structures that can harm the environment and impair natural floodplain function. Thus, Congress should revisit incentives for the construction of new levees and promote incentives for communities that implement nature-based approaches to reduce flood risks.

TABLE 1: FEDERAL PROGRAMS THAT COULD BE USED TO SUPPORT NATURE-BASED ADAPTATION STRATEGIES

NAME	PURPOSE AND ELIGIBLE USES	FUNDING (approx. annual)
USACE		
Continuing Authorities Program	The Corps is authorized to undertake small-scale projects without project-specific authorizations from Congress. Projects include: streambank and shoreline erosion stabilization, beach erosion and hurricane storm damage reduction, navigation improvements, environmental mitigation, regional sediment management and beneficial reuse of dredge materials, flood control, and aquatic ecosystem restoration.	Annual cap for each type of project (e.g. $1.5M $55M).[49]
USFWS		
National Coastal Wetlands Conservation Grant Program[50]	Provides financial assistance for coastal wetlands conservation projects. The program provides matching grants to states to acquire, protect, restore, and manage coastal wetlands.[51] Funds are available to coastal states for acquisition of interests in coastal lands or waters, and for restoration, enhancement, or management, of coastal wetlands ecosystems. (CFDA 15.614)	Average $13-$17M annually.
State and Tribal Wildlife Grants	Provides financial assistance for state wildlife agencies to develop and implement programs to protect wildlife and habitats and develop wildlife action plans. State fish and wildlife agencies must have an approved State Wildlife Action Plan. Funds are distributed to each state based upon a formula, with 10% reserved for competitive grants. (CFDA 15.634)	$47M (FY2014 formula).
EPA		
National Estuary Program (NEP)[52]	Provides financial assistance to protect and restore nationally significant estuaries. Each NEP is operated by a Management Conference (MC) of public and private stakeholders and managed according to a Comprehensive Conservation and Management Plan (CCMP) that must address estuary water quality and habitat. (CFDA 66.456)	$27.3M (FY2013)
Nonpoint Source Implementation Grants[53]	Provides financial assistance for implementing Section 319 non-point source management programs designed to improve water quality in areas affected by nonpoint source pollution. Priority is given to activities creating watershed-based plans. (CFDA 66.460)	$164M (FY2012)
State Revolving Funds	Provides funding to capitalize state revolving loan funds (both Clean Water Act and Safe Drinking Water Act) that provide low or no-interest loans for the construction of municipal wastewater treatment facilities and the implementation of nonpoint source pollution control and estuary protection projects.[54] Subject to EPA regulation and oversight, each state maintains its own loan fund, capitalized by federal government grants and state matching funds. Loan repayments plus interest must be recycled back into the funds, making SRF programs self-perpetuating.	$2.385B (FY2012)[55]

Wetland Program Development Grants	Provides financial assistance to protect, manage, and restore wetlands. (CFDA 66.461, 66.462)	$2M (approx. FY2014)[56]
USDA		
Agricultural Conservation Easement Program (AECP) (previously the Wetland Reserve Program (WRP))	The Wetland Reserve Program was repealed and consolidated in the Agricultural Conservation Easement Program by the 2014 Farm Bill.[57] The WRP provided financial and technical assistance to help landowners protect and restore wetlands on their property through easements.[58] The AECP retains the easement program and allows for wetland reserve easements (to protect and restore wetlands) and agricultural land easements (to prevent non-agricultural use of farms or grasslands).	$57.6M (FY2014-2023)[59]
Watershed and Flood Prevention Operations (WFPO) Program[60]	Provides technical and financial assistance to states, local governments, and tribes to plan and implement projects to protect watersheds, mitigate floods and soil erosion, and improve water quality. To be eligible for assistance under the WFPO program, projects must be publicly funded, cover up to 250,000 acres, and result in benefits directly related to agriculture.[61]	$7.3M (FY2013)
Emergency Watershed Protection Program - Floodplain Easement Option (EWP-FPE)[62]	The emergency recovery program is used to purchase floodplain easements to relieve imminent hazards to life and property.[63] Landowners sign a permanent easement. To be eligible, the lands must have been damaged by flooding at least once in the past year or twice in the past 10 years. Other lands are considered for easement if they have value for flood storage and flow or erosion control.	$19.2M in 2013 in Sandy-affected regions
DOD		
Readiness and Environmental Protection Initiative (REPI)[64]	Provides funding for cost-sharing partnerships between the U.S. military, state and local governments, and private conservation groups to conserve large sections of land surrounding military installations. The protected land areas serve as a buffer between the military facilities and adjacent private development.	$33M for projects (FY 2012)
NSF		
Coastal Science, Engineering and Education for Sustainability (Coastal SEES)	Provides research grants for projects to support management of coastal ecosystems. Eligible projects include applied natural science and engineering research that integrate human processes and address coastal sustainability.	$13M for 10 projects in 2014.
DOI		
Landscape Conservation Cooperatives (LCCs)	LCCs function to provide (1) funding for applied science projects addressing landscape-scale impacts of climate change,[65] (2) decision-support tools and products to resource managers, and (3) funding for scientific research. There are 22 LCCs, each a network of resource managers and scientists who identify best practices for conservation and ecosystem restoration and identify science gaps.[66] DOI Bureaus work through the LCCs to distribute federal funds as discretionary grants and cooperative agreements. The USFWS has oversight of grants and cooperative agreements.	$15M (FY2013)

NOAA		
Coastal Estuarine Land Conservation Program (CELCP)	Provides financial assistance for land acquisition to protect important coastal and estuarine areas. Significant conservation, recreation, ecological, historical, or aesthetic values are considered. Also considered are lands threatened by conversion from their natural or recreational state to other uses.	No funding in FY 2013 or 2014.
Coastal Zone Management Grants[67]	Coastal restoration projects can be supported under Sections 306, 306A, and 309 of the Coastal Zone Management Act. Funds are provided to states to provide financial assistance for the administration of state coastal management programs and funds can be used to support land acquisition projects to preserve and restore coastal resources and other purposes.	$65.9M (FY 2012)
Community-Based Restoration Programs	Provides financial assistance to habitat restoration projects that benefit coastal habitats (salt marshes, sea grass beds, mangrove forests and freshwater habitat). (CFDA 11.463)	$10.8M (2013)[68]
FEMA		
Hazard Mitigation Grant Program (HMGP)	Provides financial assistance to support activities to mitigate future impacts and reduce loss of life and damage to property in the event of a major disaster (for a further description see Chapter 2). (CFDA 97.039)	A percentage of disaster relief appropriations allocated through HMGP
Pre-disaster mitigation (PDM) program	Provides financial assistance for hazard mitigation planning and projects to mitigate future impacts, prior to a presidentially-declared disaster. (CDFA 97.047)	FEMA proposed elimination of funding for PDM in FY 2013.[69]
Flood Mitigation Assistance (FMA) program	Provides financial assistance to reduce or eliminate long-term risk of flood damage to NFIP-insured structures. Funds can be used to relocate, acquire, elevate, or flood-proof structures. (CFDA 97.029)	$89M (FY2014)[70]
Repetitive Loss and Severe Repetitive Loss programs	Provides financial assistance to mitigate or remove structures that have been repetitively damaged in flood events from the floodplain, with the purpose of avoiding costs to the NFIP. (CFDA 97.110 and 97.036)	A portion of premium collections and policy fees (~$3.5B FY2013) used to support repetitive loss programs
HUD		
Community Development Block Grants (CDBG)	Provides financial assistance for economic development with a focus on low- and moderate-income communities (for further description see Chapter 4). (CFDA 14.218; 14.228)	$3B (FY 2012)[71]

CHAPTER 5 ENDNOTES

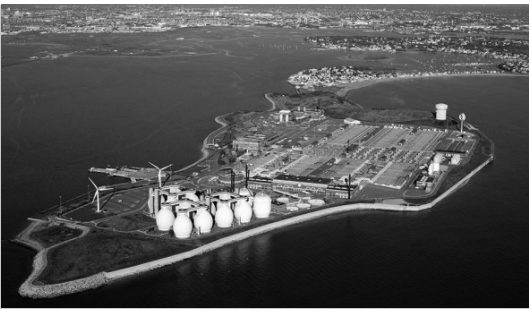
1. "The dense vegetation and shallow water in wetlands can slow the advance of storm surge somewhat and slightly reduce the surge landward of the wetland or slow its arrival time." USACE, Coastal Risk Reduction and Resilience (Sep. 2013), available at: http://www.corpsclimate.us/docs/USACE_Coastal_Risk_Reduction_final_CWTS_2013-3.pdf. Quoting Wamsley, T.V. (2009) Interaction of Hurricanes and Natural Coastal Features: Implications for Storm Damage Reduction. Doctoral Thesis, Water Resources Engineering, Lund University. LUTVDG/TVVR-1049; Wamsley, T.V., M.A. Cialone, J.M. Smith, and B.A. Ebersole (2009). Influence of landscape restoration and degradation on storm surge and waves in southern Louisiana. Journal of Natural Hazards 51(1): 207–224; Wamsley, T.V., M.A. Cialone, J.M. Smith, J.H. Atkinson, and J.D. Rosati (2010) The potential of wetlands in reducing storm surge. Ocean Engineering 37: 59–68.
2. Defined as "a shoreline restoration and protection concept that emphasizes the use of natural materials including marsh plantings, shrubs and trees, low profile breakwaters/sills, strategically placed organic material, and other techniques that recreate the natural functions of a shoreline ecosystem." Bhaskaran Subramanian et al., Current Understanding of the Effectiveness of Nonstructural and Marsh Sill Approaches, Living Shorelines Summit Conference Proceedings 35 (2006), available at: http://www.vims.edu/cbnerr/_docs/ctp_docs/ls_docs/06_LS_Eval.pdf.
3. Id. at 44.
4. One of the primary and repeated critiques raised during this workshop was the need for the community to come up with better terminology to define these approaches. The term "natural and nature-based features" (NNBF) is not only a mouthful, but the overly technical terminology also limits the ability to communicate and engage with the public on these multi-benefit approaches. However, without concurrence on an acceptable alternative – this chapter adopts the Corps terminology of nature-based approaches for purposes of this report.
5. The Corps defines natural features as those features that "are created and evolve over time through the actions of physical, biological, geological and chemical processes operating in the nature." The Corps defines nature-based features as "those that may mimic characteristics of natural features but are created by human design, engineering, and construction to provide specific services such as coastal risk reduction." Because nature-based features are subject to the same natural coastal processes, they must be maintained over time. The Corps contrasts these approaches with structural approaches that use hard engineered structures to reduce flooding and erosion and include levees, sea-walls, and storm surge barriers. Non-structural measures can also be used to reduce flood risks, and these approaches include "modifications in public policy, management practices, regulatory policy, and pricing policy." Non-structural approaches include acquiring flood-prone lands, relocating flood-prone structures, using land-use regulations to preserve open space or direct new development out of flood-prone areas. Most non-structural measures must be implemented at the state and local level. See generally, USACE, Coastal Risk Reduction and Resilience 2-5 (Sep. 2013), available at: http://www.corpsclimate.us/docs/USACE_Coastal_Risk_Reduction_final_CWTS_2013-3.pdf
6. While flood control structures can be engineered to provide a certain specific level of flood protection (e.g., protection from 1% chance flood event), nature-based approaches often cannot be designed to provide a specific level of protection. For purposes of the comprehensive study, the Corps assumed that nature-based approaches could reduce flood risks from a 10% annual-chance flood event. Draft North Atlantic Coast Comprehensive Study (NACCS) at 58 (2014).
7. This chapter only addresses some of the laws and policies that affect coastal protection decisions. The Corps recently released a draft of the North Atlantic Coast Comprehensive Study (Comprehensive Study) called for by the Sandy Relief Act. In it, the Corps identifies a suite of federal laws, regulations, guidance and executive orders that influence coastal resilience, including disaster relief appropriations, the Stafford Act, the NFIP, the Coastal Barriers Resources Act, the Coastal Zone Management Act, the Housing and Community Development Act, NEPA, historic preservation requirements, among others. NACCS at 71. USACE, North Atlantic Coast Comprehensive Study (2014), available at: http://www.nad.usace.army.mil/CompStudy.aspx
8. The last WRDA was passed in 2007 (P.L. 110-114). On May 22, 2014, Congress enacted the Water Resources Reform and Development Act (WRRDA) authorizing approximately $12.3 billion in water resource projects and instituting reforms to the Corps civil works projects. For a discussion of the WRRDA see infra note 25. For a history of WRDAs see Nicole T. Carter & Charles V. Stern, Army Corps of Engineers: Water Resource Authorizations, Appropriations, and Activities, CRS Report R41243 (Oct. 18, 2013).
9. Carter, CRS Report R41243 at 12 ("Flood control projects are intended to reduce riverine and coastal storm damage; these projects range from levees and floodwalls to dams and river channelization." Multipurpose projects include projects that "provide water supply, recreation, hydropower and for navigation and flood control.)" "Environmental activities include wetlands and aquatic ecosystem restoration and environmental mitigation for Corps facilities." Carter, CRS Report R41243 at 20.
10. A civil works project is typically only authorized for construction after review by the Civil Works Review Board and the completion of a feasibility study approved by the Corps' Chief of Engineers (called the "Chiefs Report"). The feasibility study evaluates the national economic development (NED) benefits of the project, compares the benefits and costs of the project, and includes an assessment of the project's environmental impacts under the National Environmental Policy Act (NEPA). Carter, CRS Report R41243 at 11.

11. Carter, CRS Report R41243 at summary.
12. For a discussion of both the Senate and House bills see Carter, CRS Report R41243 at 3-6
13. NOAA's Coastal and Estuarine Land Conservation Program (CELCP) historically provided significant funds to state and local governments to acquire vulnerable lands for conservation purposes. The CELCP program has not received significant new funding since 2012.
14. The Department of Defense funds the Readiness and Environmental Protection Integration (REPI) program, which was authorized by Congress in the National Defense Authorization Act, 10 U.S.C. Sec. 2684(a).
15. National Science Foundation, Coastal Science, Engineering and Education for Sustainability (SEES) research grant program. NSF, Coastal Science, Engineering, and Education for Sustainability (SEES) research grant program, available at: http://www.nsf.gov/pubs/2012/nsf12594/nsf12594.htm
16. Authorized by the Flood Control Act of 1944 and the Watershed Protection and Flood Prevention Act of 1954, reauthorized in the 2014 Farm Bill, Pub. Law 113-79 at 2506; Watershed and Flood Prevention Operations (WFPO) Program NRCS, available at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/landscape/wfpo/?cid=nrcs143_008271
17. Several other federal programs that are discussed in more detail in other chapters could also be leveraged to support nature-based approaches, including FEMA's Hazard Mitigation Grant Program (discussed in Chapter 2), HUD's Community Development Block Grant program (discussed in Chapter 2 and 3), and State Revolving Funds administered by EPA (discussed in Chapter 6).
18. Constitutional and statutory provisions limit the ability of one federal agency to "augment" the budget of another federal agency. This prohibition often limits the ability of states and localities to combine different sources funds and prohibits Corps civil projects on federally-owned lands. Programs that provide funding for ecosystem restoration are focused on small-scale projects, not system-wide approaches.
19. Under Section 10 of the Rivers and Harbors Act, the Corps has permitting authority over all activities that could obstruct navigability in tidal waters and navigable waterways. Rivers and Harbors Act of 1899, 33 U.S.C. §§ 401 et seq. The Corps also has authority under Section 404 of the CWA to issue permits for essentially all ground-disturbing activities in navigable waters and adjacent wetlands. 33 U.S.C. § 403. The Corps has combined permitting under both statutes into one process.
20. The Corps has authority to issue permits for work in navigable waters of the U.S., and discharges of dredged or fill material into waters of the U.S., including wetlands.
21. Kim Diana Connolly, et al., Wetlands Law and Policy: Understanding Section 404 152 (ABA, 2005).
22. Activities outside of the Corps jurisdiction—inland of the mean high tide line (MHTL) (Sec. 10) or inland of delineated wetlands (Sec. 404)—do not require a Corps permit. These projects can proceed with just the required state or local permits. Donald C. Baur et al., Ocean and Coastal Law And Policy 92-95 (ABA, 2008). This can facilitate hard-armoring approaches because it is relatively easy to build a hard structure entirely above the MHTL on many parcels. By contrast, it is difficult if not impossible to design a living shoreline without encroaching on regulated tidelands. The Clean Water Act also includes several statutory exemptions. CWA Section 404(f) exempts "maintenance ... of currently serviceable structures such as dikes, dams, levees, groins, riprap, [and] breakwaters." See also 72 Fed. Reg. 11196 (Mar. 12, 2007). Finally, the Corps issues nationwide permits (NWPs) for certain categories of projects that are similar in nature and deemed to have minimal adverse environmental impacts. 33 U.S.C. § 1344(e)(2). A general permit is essentially a "pre-issued" permit. The Corps does much of the administrative work up front (e.g., environmental review and consultation with other state and federal agencies), which simplifies the approval process and reduces the administrative burden for the project applicant. Some nationwide general permits authorize different types of small-scale armoring projects. See NWPs 3 and 13, Reissuance of Nationwide Permits, 72 Fed. Reg. 11101, 11101, 11111, 11112 (Mar. 12, 2007). For projects that fall under a NWP, applicants can typically proceed within a couple of months.
23. White House Council on Environmental Quality (CEQ), Updated Principles and Guidelines for Water and Land Related Resources Implementation Studies (2013), available at: http://www.whitehouse.gov/administration/eop/ceq/initiatives/PandG.
24. The new P&R cover all federal agencies, including Corps civil works projects. The P&R, however, "generally do not apply to regulatory activities," like the issuance of permits under Section 404 of the CWA. White House Council on Environmental Quality (CEQ), Principles and Requirements for Federal Investments in Water Resources, 2 (2013), available at: http://www.whitehouse.gov/sites/default/files/final_principles_and_requirements_march_2013.pdf.
25. The schedule for implementing the P&R and Interagency Guidelines remains uncertain due to a last-minute rider to the 2012 Fiscal Appropriations Bill, which blocks the Corps from implementing updates to the Principles and Guidelines. The rider states: "No funds are provided for the line item proposed for Water Resources Principles and Guidelines, as this is considered a new start. No funds provided to the Corps shall be used to develop or implement rules or guidance if an update or replacement to the document dated March 10, 1983, and entitled 'Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies' is during the fiscal year period covered by the Energy and Water Development Act for 2012. The Corps shall continue to use the Water Resources Principles and Guidelines in effect as of the date of enactment of this Act during that same period." H.R. Rep. No. 112-331 at 802 (2011) (Conf. Rep.). The block continues, as the 2012 Appropriations Bill was effectively extended by continuing resolution. See Consolidated and Further Continuing Appropriations Act, Pub. L. No. 113-6.
26. White House Council on Environmental Quality (CEQ), Principles and Requirements for Federal Investments in Water Resources,

11 (2013), available at: http://www.whitehouse.gov/sites/default/files/final_principles_and_requirements_march_2013.pdf.

27. Id. at 10.
28. White House Council on Environmental Quality (CEQ), Draft Interagency Guidelines, 2, available at: http://www.whitehouse.gov/sites/default/files/final_principles_and_requirements_march_2013.pdf.
29. U.S. Army Corps of Engineers, SAGE 2012 (Jun. 28, 2012), available at: http://www.iwr.usace.army.mil/Missions/Coasts/ProgramsandInitiatives.aspx
30. See discussion of November 20-22, 2013 Natural and Nature-based Features Policy and Technical Project Meetings available at: http://www.nad.usace.army.mil/CompStudy.aspx.
31. Nat'l Research Council at 117
32. U.S. Army Corps of Engineers, Sea-Level Change Consideration for Civil Works Programs (2011) [hereinafter Sea-Level Change Guidance].
33. The Water Resources Reform and Development Act of 2014 (WRRDA), H.R. 3080, 113 Cong., (2014) (enacted); H.R. Rep. No. 113-449 (2004). Sections 1002-1005 of the 2014 WRRDA includes provisions to streamline the environmental review process and consolidate studies with preliminary analysis of the federal interest in the project – costs, benefits, and environmental impacts (including compliance with the National Environmental Policy Act (NEPA). Other federal agencies can adopt and use environmental review documents prepared by the Corps under the streamlined provisions. The provisions also allow the Corps to adopt regulations allowing for the "programmatic" review of projects. The Corps is also directed to review its categorical exclusions from NEPA and establish new Categorical Exclusions as warranted. Specifically, Section 1005 authorizes the Corps to create a Categorical Exclusion for the "repair, reconstruction and rehabilitation" of water resources projects that are damaged as a result of a presidentially declared disaster, so long as the activity is in the same location and has the same capacity, dimensions and design of the original project.
34. Disaster Relief Appropriations Act of 2013, Pub. L. No. 113-2, 127 Stat. 4 , tit. 10, ch. 7 (H.R. 152, 113th Cong., Jan. 29, 2013) [hereinafter "Sandy Relief Act"] (to "increase the resiliency and capacity of coastal habitat and infrastructure to withstand storms and reduce the amount of damage caused by such storms."
35. 42 U.S.C. 5107(c).
36. Initial Report to Congress Office of Sustainable Housing and Communities Sustainable Communities Grant Program Evaluation (July 2012), *available at*: http://portal.hud.gov/hudportal/documents/huddoc?id=FINRepEvalSustComCS.pdf
37. ALG10-2011 Living Shorelines General Permit, available at: http://www.sam.usace.army.mil/Portals/46/docs/regulatory/docs/al_gen.pdf.
38. While many districts have regional conditions on nationwide permits or regional general permits that require the use of nature-based approaches (called "bioengineering" approaches), such as regional conditions on NWP 13 imposed by districts in San Francisco and Seattle, these conditions only deal with half of the challenge. While they favor the use of nature-based approaches over armoring, they do not simplify the permitting requirements for nature-based approaches and, therefore, nature-based approaches may still take significant time to be approved.
39. 33 U.S.C. § 1344(e)(2).
40. The Corps administers its regulatory programs across eight regional divisions and thirty-eight district offices. Because the Corps has some discretion over implementing its permitting process, each district office has developed a distinct culture and permitting is not uniformly administered. The practice of each district varies based on the unique demands of the region in which it operates. Baur et al., supra note 22, at 89.
41. Technically, states can also take over permitting authority for all projects except those affecting "traditional" navigable waters —those waters that have been, are, or could be used for navigation—pursuant to Section 404(g) of the CWA. This permitting authority is limited, however, in that it would not cover coastal waters up to the MHTL; the Corps still issues permits for these coastal activities. 33 U.S.C. § 1344(g)(1) (2010). The limited scope of the delegated authority has dissuaded many states from exercising this option; only two states–Michigan and New Jersey–have gone through this process. Environmental Protection Agency, State or Tribal Assumption of the Section 404 Permit Program, available at: http://www.epa.gov/owow/wetlands/facts/fact23.html. It would require an amendment to the CWA for states to assume full Section 404 permitting authority from the Corps, which is unlikely given federal navigational and security concerns. See Leah Stetson, Expanding the States' Role in Implementing CWA § 404 Assumption (2010), available at: http://www.aswm.org/swp/assumption/expanding_states_role_implementing_cwa_section_404_assumption_111810.pdf.
42. Chris Boyd & Niki Pace, Mississippi-Alabama Sea Grant Legal Program, Coastal Alabama Living Shorelines Policies, Rules, and Model Ordinance Manual (2013), available *at* http://masgc.org/assets/uploads/publications/524/13-023.pdf.
43. Communities that implement land-use regulations that minimize development in floodplains can receive up to 250 points under activity 422.e (Open Space Initiatives). Communities that preserve floodplains as open space can receive up to 1450 points under activity 422.a (Open Space Preservation). Communities that implement stormwater management regulations can receive up to 380 points under activity 452a. FEMA, National Flood Insurance Community Rating System Coordinator's Manual, FIA-15/2013, available at: http://www.fema.gov/media-library/assets/documents/8768.
44. U.S. CONST. Art. 1, Sec. 8

45. 31 U.S.C. §§ 1301 and 1532; GAO-04-261SP Appropriations Law—Vol. I at 2-25, available at: http://www.gao.gov/assets/210/202437.pdf; GAO-06-382SP Appropriations Law—Vol. 2 at 6-163.
46. WRRDA 2014 at §1025 provides: "Water Resources Projects on Federal Lands: (a) … The Secretary may carry out an authorized water resources development project on Federal land that is under the administrative jurisdiction of another Federal agency where the cost of the acquisition of such Federal land has been paid for by the non-Federal interest of the project."
47. For examples of where Congress has explicitly granted agencies transfer authority see Department of Homeland Security: Appropriations Transfer Authority, CRS RL31514, available at: https://opencrs.com/document/RL31514/.
48. WRRDA 2014 at §§ 1015-1024 provide the Corps with authority to take in financial and in-kind contributions from non-federal partners and to provide reimbursement for contributions, credit contributions as part of the non-federal cost share, and transfer credits to other projects.
49. Carter, CRS Report IB10133, at 16.
50. NWCGP was created by the Coastal Wetlands Planning, Protection and Restoration Act, 16 U.S.C. §§ 3951-3956.
51. Eligible participants in the grant program are coastal states bordering the Atlantic, Gulf of Mexico, Pacific, and the Great Lakes. Louisiana is excluded from eligibility as it has its own coastal wetland program under the Coastal Wetlands Planning, Protection and Restoration Act. The National Coastal Wetlands Conservation Grant Program fact sheet, available at: http://www.fws.gov/Coastal/CoastalGrants/docs/factsheets/2009/coastal_grant.pdf.
52. The NEP is administered by the EPA and was established to protect and restore nationally significant estuaries pursuant to Section 320 of the 1987 amendments to the Clean Water Act.
53. Clean Water Act, Section 319(h)
54. The Clean Water Act, 33 U.S.C. §1381(a) (2011); the vast majority of CWSRF funding is used to build, upgrade, or enlarge conventional wastewater treatment facilities. U.S. Gov't Accountability Office, GAO-06-579, Clean Water: How States Allocate Revolving Loan Funds and Measure Their Benefits 8 (2006) (finding that as of 2006, states had used 96% of SRF funding for conventional wastewater treatment projects).
55. Claudia Copeland, Congressional Research Service (96-647), Water Infrastructure Financing History of EPA Appropriations 4 (Apr. 5, 2012), available at: http://www.fas.org/sgp/crs/misc/96-647.pdf.
56. U.S. EPA, Request for Proposals, FY14 Region 4 Wetland Program Development Grants, available at: http://www.epa.gov/region4/water/wetlands/documents/fy14_wpdg_rfp_final_020414.pdf.
57. Agricultural Act of 2014, P.L. 113-79 § 2703.
58. U.S. Forest Service, Wetlands Reserve Program, Voluntarily Protecting Wetlands on Private Forest Lands, available at: http://www.fs.fed.us/spf/coop/programs/loa/wrp.shtml.
59. This figure is the 10-year projected outlay for all conservation programs in the 2014 Farm Bill. See Ralph M. Chite, The 2014 Farm Bill (P.L. 113-79): Summary and Side-by-Side, Congressional Research Service Report R43076 at 5 (Feb. 12, 2014).
60. Authorized by the Flood Control Act of 1944 (P.L. 78–534) and the Watershed Protection and Flood Prevention Act of 1954 (P.L. 83–566), reauthorized in the 2014 Farm Bill, P.L. 113- at 2506.
61. NRCS, Watershed and Flood Prevention Operations (WFPO) Program, available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/landscape/wfpo/?cid=nrcs143_008271
62. Authorized by the Agricultural Credit Act of 1978 (P.L. 95-334) and amended by Section 382 of the Federal Agriculture Improvement and Reform Act of 1996.
63. Floodplain easements protect and maintain floodplain function of flood water retention and ground water recharge.
64. REPI was authorized by Congress by a line item to the National Defense Authorization Act, 10 U.S.C. § 2684(a), Agreements to Limit Encroachments and Other Constraints on Military Training, Testing, and Operations.
65. About the LCC Network: http://lccnetwork.org/About.
66. The LCCs bring together academic institutions, NGOs, private and non-profit entities, and federal, local, state, and tribal governments and provide technical and scientific expertise to support ecosystem restoration and conservation planning.
67. Coastal Zone Management Act (16 U.S.C. §§ 1451–1464), through the Omnibus Public Land Management Act of 2009.
68. NOAA, National Marine Fisheries Service, "$10.8 Million in Funding for Coastal Habitat Restoration Projects to Benefit Fish," available at: http://www.habitat.noaa.gov/restoration/programs/crp/ffo2013.html
69. DHS, FEMA, National Pre-disaster Mitigation Program, Fiscal Year 2013 Congressional Justification, available at: https://www.fema.gov/pdf/about/budget/11d_fema_national_pre-disaster_mit_fund_dhs_fy13_cj.pdf.
70. FEMA, Fact Sheet FY2014 Flood Mitigation Assistance (FMA) Grant Program, available at: http://www.fema.gov/media-library-data/1399470154429-318af2e06da14d376b3419449ea8e11d/FY14_FMA_FactSheet_042214_508.pdf.
71. HUD, Community Development Allocations and Appropriations, http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/budget.



CHAPTER 6

WATER INFRASTRUCTURE

CHAPTER INTRODUCTION

On October 29, 2012, Hurricane Sandy made landfall on the East Coast of the United States powerfully demonstrating what many scientists and engineers had been saying for years:[1] bigger storms are coming, and our nation's water infrastructure is not ready.[2] The largest storm to hit the northeast United States in recorded history, Hurricane Sandy brought with it intense rainfall, strong winds, and a record 13-foot storm surge that overwhelmed water facilities in eight states and resulted in the release of almost 11 billion gallons of sewage into local rivers and bays.[3] Damage from the storm incapacitated numerous wastewater treatment plants and pumping stations, allowing some of this sewage to back up into city streets and residential homes.[4] For months after the storm, damage caused by Sandy caused untreated sewage to spill into Northeastern waterways.[5] Altogether, water infrastructure failures in the wake of Hurricane Sandy caused the release of enough sewage equivalent to filling New York's Central Park to a depth of 41 feet.[6]

Although Sandy was often referred to as "the storm of the century," climate change is making these extreme flood events more common—and more severe.[7] Projections show that, in many areas of the United States, an increase in global average air and ocean temperatures is likely to cause more intense tropical storms and hurricanes, and more intense and frequent precipitation events.[8] Sea-level rise, caused by climate change, threatens to inundate water facilities in coastal regions and makes severe flooding events more likely.[9] As Hurricane Sandy illustrated, cities and water utilities need to prepare for these impacts. Currently, however, few utilities incorporate climate considerations into water infrastructure planning and construction. Most utilities[10] instead rely on historical weather and flooding data that, in most cases, will not reflect future climate conditions.

Water infrastructure is typically expected to last for decades, but failing to properly account for climate change could render facilities obsolete or inoperable long before the end of their expected lifespan. New York City learned this the hard way during Hurricane Sandy. Prompted by flooding caused by Hurricane Irene and Tropical Storm Lee in 2011, New York incorporated more protective flooding measures into several new water facilities that began construction prior to Hurricane Sandy. Unfortunately, these measures were not sufficient to protect against Sandy-level flooding, and many of the new facilities—some of which were still under construction—were damaged and had to be rebuilt.

Climate change will affect water infrastructure in a number of ways. First, cities can expect increasingly heavy precipitation events and more rainfall during coastal storms.[11] Many existing systems lack the capacity to adequately handle stormwater from heavy precipitation events and even under current weather conditions combined sewer overflows (CSOs)[12] are common. More intense precipitation caused by climate change will exacerbate these problems.

Climate change will also increase the risk of storm surge and coastal flooding. Wastewater treatment plants are often located in low-lying areas that are close to water bodies,[13] and are especially vulnerable to impacts.[14] If floodwaters rise more quickly than the facility is able to discharge water, the system may back up and wastewater treatment facilities can flood from the inside.[15] Pipes, holding tanks, and pumps are also subject to damage if they become waterlogged from flooded soils.[16] Sewer overflows are likely to result, and even in separated systems, flooding may cause the discharge of untreated or only partially treated wastewater.

Hurricane storm surges and encroaching waters from sea-level rise can also allow saltwater to damage water system components. Salt is corrosive to electrical wires, metal, and concrete—nearly all the materials used to construct traditional water infrastructure.[17] Systems typically cannot be repaired

until salt is removed, a process that can take weeks.[18] During this time, corrosive damage worsens, and water quality problems may be exacerbated if facilities cannot run at full operation while they are being repaired.[19]

These physical impacts may also cause utilities to violate regulatory requirements under the Clean Water Act (CWA) administered by the Environmental Protection Agency (EPA). The CWA requires every utility to hold a permit that restricts the quantity of pollutants the utility may discharge and sets a maximum number of overflows that are allowed per year. If a utility exceeds these limits, it may face fines and significantly increased oversight and regulation.[20] Heavy precipitation and sea-level rise will increase the likelihood of system failures and overflows, which will put utilities at greater risk of financial penalties.

This chapter discusses the opportunities EPA and other relevant federal agencies have to support climate resilience at the state and local level through technical assistance, the State Revolving Fund (SRF) programs, and regulatory flexibility. Existing authorities and programs can be used to reduce the vulnerability of wastewater and stormwater infrastructure to climate impacts. Climate impacts related to drinking water, water supply, and drought will also require adaptive action, particularly in western states. These issues, while critically important, were not the focus of this workshop and so are not directly addressed in this chapter. The primary focus of this chapter is wastewater and stormwater infrastructure.

Below is a summary of the recommendations, with a detailed discussion of each in the following sections:

Recommendations for EPA and Other Federal Agencies

- Federal agencies should provide data and technical assistance to help utilities identify climate impacts to water infrastructure assets, assess vulnerabilities, plan system improvements, and monitor performance of gray- and green-infrastructure solutions.
- Federal agencies should adopt or support the use of a certification program from climate-smart water infrastructure.
- EPA should provide additional guidance to states to encourage the use of State Revolving Fund (SRF) money for climate adaptation projects.
- EPA should encourage states to prioritize adaptive projects when directing SRF funding.
- EPA should encourage states to offer financial incentives for investing SRF funds in climate resiliency.
- Federal agencies should provide guidance on how to align funding streams to retrofit or construct climate-resilient infrastructure.
- Federal agencies should coordinate across programs and agencies to encourage integrated watershed planning.
- EPA should integrate climate considerations the Clean Water Act and Safe Drinking Water Act regulatory programs.

Recommendations for Congress

- Congress should enact reforms to direct funding to climate-resilient water infrastructure.

Utilities can implement many specific strategies to adapt to the impacts of climate change on the water sector. Strategies are typically designed to meet at least one of the following three objectives: planning for short- and long-term climate impacts, enhancing system capacity, and protecting assets from physical damage. Utilities can use vulnerability assessments to determine the risk of climate impacts on their assets and operations. Once they understand their vulnerabilities, utilities can use a combination of green and gray approaches to enhance system capacity and protect assets from damage.

Vulnerability Assessments and Planning

Before a utility can implement specific adaptation strategies, it must determine how it will be affected by climate change over the short- and long-term, select appropriate adaptation strategies, and incorporate those strategies into its capital improvement plans. To incorporate climate risks into its planning methods, utilities often take steps to:

- Determine how and to what degree the utility will be affected by climate change by conducting risk and vulnerability studies.
- Update storm and wastewater management plans to account for any changes in risk over the short- and long-term.
- Upgrade best management practices based on models and climate predictions.
- Incorporate adaptive infrastructure into the utility's short- and long-term infrastructure and capital improvement plans.
- Conduct watershed-level coordination and planning.

One of the most important ways a utility can adapt is by incorporating climate change into its planning process, specifically into capital improvement plans (CIPs) when upgrades to infrastructure are required. CIPs guide utility investment decisions by creating a list of priority investments, identifying the appropriate funding streams to support those investments, and ordering those investments over a period of years.[21] In developing CIPs, the utility must often provide details about how the proposed project will eliminate a threat to public health, improve service quality, or modernize a facility. Thus, in order for capital-improvement decisions to account for climate risks, utilities will need to conduct risk and vulnerability studies to estimate the likelihood and extent of impacts on their facilities.

A separate limitation of the planning requirements for water utilities is that they fail to account for the variety of pollution sources at a watershed scale. Utilities are only one source of pollutants among a number of sources in a single watershed, including regulated sources of pollution, like large industrial facilities, and nonpoint sources, like agricultural and residential property owners. A successful plan to improve water quality would require the coordination across jurisdictional boundaries and among multiple stakeholders. However, most watersheds are not governed by an integrated water resource plan and decisions affecting water quality are often made at the local-, not regional-scale.

Gray Infrastructure

Many water utilities will also have to upgrade and improve their "gray infrastructure" to adapt to changing conditions caused by climate change. Gray infrastructure refers to traditional capital improvements for managing stormwater and wastewater, such as pipes and sewers.[22] Gray infrastructure collects

stormwater and wastewater and conveys it to a treatment facility or discharge point.

Gray infrastructure constitutes both a set of assets to be protected from climate impacts and a means by which to adapt to climate impacts. In the first case, gray infrastructure assets (e.g., water treatment facilities) may be vulnerable to sea-level rise, storm surges, and flooding events, requiring protective measures to prevent damage to facilities and interruptions in service. Protective measures may include installing sea walls to prevent the inundation of facilities, elevating discharge points to prevent back-flow, and, when possible, relocating facilities out of a vulnerable location.

Gray infrastructure can also play a role in adapting to climate impacts by enhancing system capacity to process stormwater. Gray-infrastructure strategies may include upgrading vulnerable and inadequate sewers and pump stations, installing additional storage tanks, increasing treatment capabilities, and designing new tunnels and pipes for increased capacity needs. For example, utilities may install larger conveyance structures and storage reservoirs to hold stormwater during heavy precipitation events in order to avoid overflows.

Green Infrastructure

As a complement or substitute to gray-infrastructure adaptations, "green infrastructure" can also be used to capture precipitation where it falls and augment or reduce the need for gray-infrastructure improvements. Green-infrastructure strategies often involve installing green roofs, porous pavement, rain gardens, and stormwater bumpouts, or other measures to increase pervious landscapes and capture more rain onsite.[23] Various methods can be used for encouraging or mandating green infrastructure, such as implementing a stormwater fee to reduce runoff, introducing public education measures or direct incentives to promote the installation of green infrastructure on private properties, or requiring green infrastructure through zoning ordinances and other regulatory methods.

These measures are adaptive because they can reduce the amount of stormwater entering the system, thereby reducing the likelihood of overflows. Green infrastructure can act as a substitute for gray-infrastructure improvements by, for example, reducing the need for additional storage reservoirs to hold stormwater. Green infrastructure may also be used as a complement to gray infrastructure, reducing the size, and therefore the expense of planned gray-infrastructure upgrades. Green-infrastructure strategies can be implemented more quickly than most gray-infrastructure projects. Thus, green infrastructure can be an interim fix while gray projects are financed and constructed, or as a flexible method for adapting to uncertain change in precipitation over time.

Taken together, gray and green infrastructure offer utilities a suite of tools to adapt water systems to climate impacts. However, there are a number of barriers that limit the widespread adoption of these measures. Utilities often face information, financial, regulatory, and political constraints to adapting to climate impacts.

Information Constraints

Utilities need data, tools, and technical assistance to adapt their systems to climate impacts. Local-scale climate data and modeling may be unreliable or hard to obtain, making it difficult for utilities to accurately predict future needs and risks when making infrastructure decisions. Regional climate centers may be needed to work directly with utilities and communities to develop and disseminate the necessary data, tools, and technical assistance.

- **Planning Needs:** Utilities need clear and defensible data and projections of how climate change will affect precipitation patterns, flood risks, and water supply and demand in order to include these considerations in their planning processes and their long-term investment

decisions. Often utilities lack the resources or capacity needed to develop or obtain climate projections for their region. In addition, regulators need to establish procedures or guidelines for how to implement watershed-scale planning for climate impacts. As described above, water quality is affected by pollutants entering the watershed from a number of different sources, yet decisions about how to manage and improve water quality are often not informed by plans that account for the variety of sources contributing to pollution in the watershed. While some utilities and regulators are beginning to adopt watershed-based permitting as a means to better address pollution at a watershed scale, these approaches are not common practice and they often do not consider how climate change will exacerbate water quality impacts.

WATERSHED-BASED PERMITTING

Watershed-based permitting is a process that aims to address all stressors within a hydrologically-defined drainage basin rather than focusing on individual pollutant sources on a discharge-by-discharge basis. In 2007, the EPA issued technical guidance to encourage stakeholders to begin implementing watershed-based permitting. In 2011, the Milwaukee Sewerage District (MMSD) was awarded an EPA Region 5 Water Quality Cooperative Agreement grant to develop the framework for a watershed-based municipal stormwater permit for the Menomonee River watershed. This kind of planning can serve as a model for other regions interested in addressing pollution and stormwater management across jurisdictions.

- **Gray Infrastructure Data Needs:** Utilities need specific data in order to make design and engineering decisions to manage capacity needs under different climate scenarios. In the absence of reliable information about the future, utilities often resort to historical data that may underestimate capacity needs and result in inadequate infrastructure construction. Alternatively, overbuilding capacity in the hopes of adapting to an uncertain future without sufficient data will tie up capital that could be better deployed to other priorities. Utilities need the best available data to make informed and prudent investment decisions while practicing adaptive management in order to design and build the facilities to meet the demand today with an ability to adaptively manage for future changes that may not be well understood.
- **Green Infrastructure Data Needs:** Similarly, utilities need reliable data to better understand the efficacy and reliability of green-infrastructure measures to be able to deploy these strategies as part of a comprehensive plan to both adapt to a changing climate and comply with regulatory requirements. For example, it can be difficult to quantify how much rainfall and what size storm can be managed with individual green-infrastructure projects, spread across an entire community. Widespread application of green infrastructure also requires a broad array of local decision-makers, beyond just the utility. For full implementation, these approaches often require local transportation agencies, planning departments, parks departments, and others. Additionally, the long-term success of green infrastructure is often dependent on proper maintenance, the costs of which are not eligible

for many federal sources of funding.[24] Uncertainty about the costs associated with green infrastructure operation and maintenance may discourage utilities from installing green infrastructure.[25]

EPA SUPPORT FOR GREEN INFRASTRUCTURE

EPA's 2013 Green Infrastructure Strategic Agenda renewed the Agency's support for green infrastructure in communities. EPA established 10 community partnerships in 2010. These partnerships, with communities from Jacksonville, FL, to Austin, TX, highlight effective approaches to implementing green infrastructure. EPA also provides technical assistance to communities across the country. Twenty-three communities received assistance in 2012 and 2013 with another 5-7 planned in 2014. Grantees in 2013 included Spartanburg, SC, Pima County, AZ, and Gary, IN. These projects highlighted the multiple benefits achievable through the use of green infrastructure. EPA plans to provide technical assistance totaling $400,000 to communities for the planning and implementation of green-infrastructure projects in 2014.

Financial Constraints

Utilities not only need the right information, they also need sufficient resources in order to implement adaptive measures. Financial constraints can limit local action. Many infrastructure facilities in the U.S. are aging and in severe disrepair. As a result, there is a major water infrastructure funding deficit. In 2010, the American Society of Civil Engineers estimated the U.S. wastewater and drinking water infrastructure funding deficit to be $54.8 billion, with this number expected to rise to $84.4 billion by 2020 and $143.7 billion by 2040.[26] Capacity upgrades necessitated by climate change will only increase this deficit.

How utilities finance capital improvements can also constrain adaptation. Utilities typically repay the costs of capital improvements through user fees paid by utility customers. As a result, utilities often must justify any additional costs to regulators with the authority to approve or deny rate increases (e.g., state utility regulators and public utility commissions).[27] Utilities require sufficient data to justify the cost of and need for climate adaptation strategies, including comprehensive planning and vulnerability assessments.

Regulatory Constraints

Many communities are also working diligently to achieve compliance with regulatory requirements under the Clean Water Act. When a regulated entity violates the CWA, the EPA takes enforcement actions seeking monetary penalties. These disputes often are settled through consent decrees, which are binding voluntary agreements between EPA and the violator. These decrees often require the utility to invest in upgrades designed to reduce pollution and put the jurisdiction in compliance with the CWA (e.g., reducing the number of CSOs to a certain target by a given year). The measures required in consent decrees however often fail to account for climate projections. As a result, the mandated investments may not result in compliance in future years as precipitation patterns change.

In addition, past consent decrees have relied heavily upon gray-infrastructure improvements and the EPA has only recently been allowing municipalities to incorporate green-infrastructure strategies. For example, Philadelphia[28] has made green infrastructure a critical piece of their strategy and has

found that implementation of these measures will provide a more cost-effective pathway to achieving compliance with their consent decree. However, many utilities are still operating under consent decrees that are decades old.[29] These long-term consent decrees may not include opportunities for reevaluation, potentially preventing a utility from adopting climate adaptive projects or from undertaking innovative green-infrastructure solutions.[30] These jurisdictions would benefit from the opportunity to revise their consent decrees.

Political Constraints

Climate change is still a contentious issue in many jurisdictions, and water utilities must gain support from elected representatives, local and state agency officials, their governing boards, and ratepayers to undertake infrastructure improvements. To garner the necessary political support, utilities need defensible data and projections, federal and state support for adaptation action, and communication tools to help them clearly convey the importance of making climate-smart investments. Utilities also need help communicating to their customers and stakeholders the co-benefits of adaptive strategies, like water conservation, improved water quality, reduced urban heat islands, and improved air quality.

FEDERAL PROGRAMS AFFECTING ADAPTATION IN THE WATER SECTOR

Water utilities are affected by a number of federal programs that can both encourage and impede adaptation to climate impacts. These programs offer opportunities for federal agencies to support adaptation directly or remove potential barriers to action by water utilities.

The Clean Water Act

The Clean Water Act[31] serves as the primary regulatory framework governing stormwater and wastewater management. The CWA authorizes the EPA to regulate discharge of pollutants into navigable waters. The CWA sets federal standards for improving water quality and is implemented by EPA in coordination with the states.[32]

The CWA requires the reduction of discharges of pollutants from "point sources" (i.e., discrete conveyances such as pipes) through the National Pollutant Discharge Elimination System (NPDES) permit program. Wastewater treatment facilities are required to meet NPDES permit obligations. Combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), and Municipal Separate Storm Sewer Systems (MS4s) are all regulated under the NPDES permit program. Where a community or utility has violated a permit, EPA takes enforcement actions. These actions are settled through consent decrees where the utility agrees to undertake certain actions to achieve regulatory compliance. Meeting these regulatory obligations often serves as the primary driver of utility investment decisions.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) sets standards for drinking water quality and regulates the states, localities, and utilities and their activities related to their provision of drinking water.[33] The SDWA focuses on treatment as a means of ensuring safe drinking water.

Climate change has major implications for drinking water utilities and their customers. Drinking water utilities must plan for increased variability and, in some regions, reduced water availability.[34] Adaptive measures in the drinking water sector include flexible treatment technologies, alternative water storage, water supply diversification, integrated water management, green-infrastructure measures, and water efficiency. As with stormwater and wastewater utilities, drinking water utilities require data and technical assistance to project future water availability and demand. These utilities also need resources to make needed climate-smart investments and political and regulatory support to justify these measures. The SDWA is the primary driver of drinking water utility behavior. Therefore climate adaptation related to drinking water must be integrated into efforts utilities are making to meet their regulatory obligations. However, these recommendations focus primarily on wastewater and stormwater adaptation, and thus few of the recommendations directly address drinking water and water supply.

State Revolving Funds

The Clean Water State Revolving Fund (CWSRF) and the Drinking Water State Revolving Fund (DWSRF) are two significant sources of federal financial support for local water infrastructure investments.[35] The CWSRF was designed to allow states the flexibility to design their programs to adapt to diverse and variable needs. A similar approach was taken in the design of the DWSRF in 1996. In both cases, the SRFs use federal funding to capitalize loan programs in each state (called a "capitalization grant"). States are then responsible for making this money available at below market interest rates to local jurisdictions or water utilities to invest in water infrastructure. States have considerable discretion in how they implement their SRF programs.[36]

In order to receive a capitalization grant, states must prepare an Intended Use Plan (IUP) that specifies how they intend to use the funds and how the use of the funds will support the goals of the SRF.[37] These plans must be submitted prior to the award of the capitalization grant.[38] The IUP outlines the eligible projects being considered for funding and the cost of each project. The IUP also describes the priority ranking system the state uses to assess projects and prioritize projects for funding. After a period of review and public comment, projects are funded based on their ranking under the state's priority ranking system.

EPA, through its regional offices, is required to provide oversight of the state SRF programs, including an annual oversight review of each IUP and annual report.[39] The CWA provides EPA authority to expand upon the requirements of the IUPs and capitalization grant agreements. For instance, the CWA specifies the elements that must be included in each state IUP, but specifically allows for additional elements to be included. The CWA also allows for additional requirements to be included in the capitalization grant requirements. These elements of the statute provide EPA flexibility in how EPA administers the SRF programs and may provide an opportunity for EPA to discuss and encourage states to consider climate change in their respective funding processes.

Adapting to climate change will require significant financial resources. Thus, it will be critical that the SRFs allow for and encourage utilities to undertake adaptive measures. Given the important role the SRFs play in helping communities achieve regulatory compliance, any changes to these programs must be crafted in order to maintain the availability and flexibility of these funds.

In May 2014, Congress passed the Water Resources Reform and Development Act (WRRDA) of 2014 (H.R. 3080). This legislation included the creation of a Water Infrastructure Finance and Innovation Act (WIFIA) and reauthorization of the CWSRF. This report does not analyze the potential effect of these provisions. However, the need for consideration of climate impacts on water infrastructure will remain relevant for projects funded under the proposed WIFIA.

Data, Technical Services, and Support

Federal agencies also provide data, technical assistance, and support to states, localities, and water utilities. These services have traditionally been focused on enabling compliance with the CWA and SDWA. Federal agencies have also begun to provide support for efforts to prepare for climate impacts. EPA and National Oceanic and Atmospheric Administration (NOAA) are the primary agencies engaged in providing this kind of support to water utilities. The EPA has developed the Climate Resilience Evaluation and Awareness Tool (CREAT) to enable water utilities to better understand and prepare for climate impacts on their operations. In addition, EPA administers a green-infrastructure technical assistance grant program to support communities interested in implementing green-infrastructure measures.

NOAA also provides data and technical assistance to enable water utilities to adapt to climate impacts. NOAA's Climate Program Office provides data, grants for climate research, and decision-making tools for water utilities. For example, the National Integrated Drought Information System (NIDIS) helps decision-makers assess drought risk and prepare for the effects of drought.[40] In addition, in 2011 the Sectoral Applications Research Program (SARP) within the Climate Program Office funded a project to develop tools for urban water supply planning.[41] While these programs highlight ongoing agency efforts to support state and local adaptation, many opportunities still exist to expand and improve federal support.

CLIMATE READY WATER UTILITIES INITIATIVE

EPA's Climate Ready Water Utilities (CRWU) initiative supports drinking water, wastewater, and stormwater utilities in addressing climate impacts. The CRWU program provides a number of tools and resources to assist utilities in meeting that challenge. For example, EPA developed the Climate Resilience Evaluation and Awareness Tool (CREAT) that helps utilities identify vulnerable assets and design measures to reduce their vulnerability. EPA is currently soliciting input from users to prepare version 3.0 of the CREAT tool. EPA also provides an Adaptation Strategies Guide for water utilities and toolbox that directs users to a variety of additional resources.

RECOMMENDATIONS

Federal agencies interact with state and local actors in the water sector by providing relevant data and technical assistance, providing funding through grants and loans, and administering regulatory programs, primarily under the CWA and SDWA. Each of these categories of federal activity provides an opportunity for federal agencies to better support state and local adaptation. The recommendations identified in the third workshop are presented here, organized by the challenges described above.

Data, Technical Assistance, and Communication Products

Federal agencies should provide data and technical assistance to help utilities identify climate impacts to water infrastructure assets, assess vulnerabilities, plan system improvements, and monitor performance of gray- and green-infrastructure solutions. Utilities need both data and tools to translate the data that will allow them to identify their vulnerabilities and

design adaptations. Utilities also need plain language tools suitable for communicating with political leadership and ratepayers. EPA is currently planning the third generation of the CREAT and is seeking input from utilities about upgrades to make this tool useful and relevant to users. EPA should take additional steps to provide the translation and communication tools utilities need to apply this information and build political support for adaptive measures. NOAA's Climate Program Office should also continue to expand support for local actors in need of data and modeling tools. Willing communities interested in adaptation must be able to justify the expense of adaptation actions. Federal agencies can support these communities by developing and recognizing metrics to measure, quantify, and potentially monetize, the benefits and co-benefits of adaptation actions. These metrics can be used to demonstrate the value of adaptation to political leaders, regulators, governing boards, investors, and ratepayers.

A related step involves incorporating the value of ecosystem services into benefit-cost analyses.

Federal agencies should adopt or support the use of a certification program for climate-smart water infrastructure. Federal agencies can drive innovation by developing a certification program for water infrastructure modeled after the successful Leadership in Energy & Environmental Design (LEED) and Energy STAR programs, which could create a market demand for resilient design and construction. A water infrastructure certification program would provide an incentive for designers, builders, utilities, and communities to design, build, and retrofit water infrastructure assets with climate impacts in mind. Some progress is already being made in this area with the proposed expansion of the Resilience STAR pilot program to include critical infrastructure (supported by the Department of Homeland Security).[42] The Resilience STAR program recognizes resilience in homes with a rating of one to five stars. A similar program for water infrastructure (e.g., treatment plants) could create an incentive for utilities to develop facilities that meet resilience criteria.

EPA ADAPTATION PLANNING

EPA has undertaken a comprehensive review of its programs and policies to identify steps the agency can take to better support adaptation. In 2012, the Agency developed a Draft Agency Climate Change Adaptation Plan. That plan identified priority actions the Agency would take to integrate climate adaptation planning into its activities. In 2013, EPA released 17 programmatic and regional adaptation plans. These plans highlight steps EPA will take to integrate adaption planning into the work of each program and regional office. The Office of Water's draft Implementation Plan identified climate impacts on water resources and specified priority actions the Office would take to integrate adaptation into its programs and policies. Among those priority actions were encouraging consideration of climate change in the management of the SRFs and integrating climate change considerations into water quality management planning projects. Similar implementation plans were developed for EPA regional offices that work closely with states in managing water resources. These plans indicate a willingness on the part of EPA to support states and localities as they adapt to climate impacts on water infrastructure.

EPA Adaptation Implementation Plans, http://epa.gov/climatechange/impacts-adaptation/fed-programs/EPA-impl-plans.html

Federal Investments

EPA should provide additional guidance to states to encourage the use of SRF funds for climate adaptation projects. Adapting to climate impacts, whether by modeling changes to the hydrological cycle, implementing green-infrastructure measures, or upgrading gray-infrastructure assets, will require significant investment. Many water system assets are financed, in part, by loans and grants from the state SRF programs, over which states have significant discretion to determine how to allocate funds. However, opportunities exist to leverage SRF funding to improve resilience to climate impacts. EPA's Office of Water 2013 Draft Climate Change Adaptation Implementation Plan recommends that climate considerations be integrated into the management of the SRFs.[43] EPA should take concrete steps to begin that process in order to ensure that federal funds are invested in climate-resilient projects while maintaining state flexibility to meet local and regional needs.

EPA could encourage states to prioritize adaptive projects when directing SRF funding. In order to receive SRF funding, states must prepare an IUP that specifies how they intend to use the funds and how the use of the funds will support the goals of the SRF. EPA, through its regional offices, is required to provide oversight of the state SRF programs, including the IUPs. This ability to review and oversee IUPs presents an opportunity for EPA to encourage the integration of climate adaptation considerations into state SRF programs. EPA could encourage states to prioritize projects in order to encourage more climate-resilient investments.

EPA should encourage states to offer financial incentives for investing SRF funds in climate resiliency. States can provide incentives like reduced interest rates on SRF loans or additional subsidization to encourage localities to invest in climate resilience. For example, the state of Massachusetts offers no interest SRF loans for projects that meet certain criteria.[44] This program is designed to provide no-interest loans for projects that remediate or prevent nutrient pollution in order to reduce algae blooms, fish mortality, and habitat loss. EPA should encourage states to adopt these kinds of financial incentives for programs that improve the climate resilience of a water system while maintaining the solvency of the SRF program.

Federal agencies should provide guidance on how to align funding streams to retrofit or construct climate-resilient infrastructure. Utilities and communities need additional guidance on how to align multiple federal funding streams to support vulnerability assessments, planning, design, and construction of resilient water infrastructure. One example of successful cross-agency collaboration is the Partnership for Sustainable Communities, a collaboration including the Department of Housing and Urban Development (HUD), EPA, and the Department of Transportation (DOT).[45] This Partnership coordinated housing, transportation, and water investments to promote the development of sustainable communities. This kind of collaboration can assist communities in preparing for climate impacts on water infrastructure. In addition, the Federal Emergency Management Agency (FEMA) and EPA should clarify when and how Hazard Mitigation Grants or Public Assistance funds (See Chapter 2 for more discussion of these programs) can be used to upgrade facilities after a disaster declaration and how these funds can be combined with SRF or other sources. Finally, the Community Development Block Grant (CBDG) program provides another opportunity for coordination. CBDG funds can, in some circumstances, be used to build or rehabilitate water infrastructure. EPA and HUD should clarify when funding streams can be used to adapt water infrastructure and when funding streams can be aligned.

Federal agencies should coordinate across programs and agencies to encourage integrated watershed planning. Water infrastructure programs are often housed in silos that make coordination across programs and agencies difficult. For example, EPA administers federal water quality programs while transportation projects that affect stormwater are often governed by local, state, and federal

departments of transportation. Communities have expressed the need for improved coordination to allow for the funding of regional planning and integrated watershed planning. The best examples of climate adaptation in the water sector often include collaborations between water utilities, transportation departments, energy utilities, and other relevant agencies. For example, the North Central Texas Council of Governments developed a Transportation Integrated Storm Water Management guide to help local governments design transportation projects with stormwater management in mind.[46] Federal funding streams should be structured to promote this kind of coordination. Communities also expressed a desire for cross-agency coordination on comprehensive projects. Examples of this kind of cross-agency and cross-sector collaboration are taking place as part of the post-Sandy Rebuild By Design program led by HUD.[47] Rebuild By Design has encouraged design teams to integrate housing, transportation, commerce, recreation, and other infrastructure to achieve resilient outcomes. Agencies could support these types of collaborations in advance of, rather than after, a disaster to allow for proactive adaptation. Green-infrastructure approaches could also be supported by better alignment of federal programs. For example, the Community Rating System (CRS) program administered by FEMA (See Chapter 3 for more discussion of the CRS) could be better leveraged to encourage green-infrastructure approaches that provide both water quality and flood reduction benefits.

Regulatory Programs

EPA should integrate climate considerations into the Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) regulatory programs. Communities and utilities are often driven primarily by the need to meet regulatory requirements under the CWA or SDWA. The steps and investments required to meet these regulatory mandates can often take precedence over measures to improve the long-term resilience of water systems. For example, utilities may make short-sighted investments required by consent decrees that fail to account for how those investments will fare given climate projections. However, both federal agencies and local actors are becoming increasingly aware of the need — and opportunities — to achieve both regulatory compliance and climate resilience. One such opportunity involves integrating the benefits of green infrastructure into EPA's regulatory regime. Climate considerations can be incorporated into new or existing consent decrees, municipal sewer (MS4) permits, and other regulatory programs. For example, EPA Region 10 recently sponsored a pilot research project to assess how projected climate change impacts could be incorporated into the Total Maximum Daily Load (TMDL)[48] for the South Fork of the Nooksack River in Washington.[49] Federal agencies expressed the view that their regulatory programs and permitting authorities are already relatively flexible. These agencies are beginning to encourage state and local actors to incorporate climate considerations into permitting processes and consent decrees. Specifically, EPA has encouraged communities to undertake this step in the form of pilots that can be used to demonstrate existing regulatory flexibility. Other regulatory and incentive-based programs should also be explored. For example, FEMA's Community Rating System could be used to incent green-infrastructure improvements that reduce flood risks and improve water quality.

Recommendations for Congress

Congress should enact reforms to direct funding to climate-resilient water infrastructure. The Green Project Reserve (GPR)[50] motivated utilities to make green investments. Congress created the GPR, which requires states to make a good faith effort to allocate a certain percentage of their SRF funding to projects addressing green infrastructure, water efficiency, energy efficiency, and environmentally innovative activities. The GPR provides an instructive example for how SRF funding could be used for climate adaptation. Congress could encourage or require that projects funded with SRF funding be resilient to the long-term impacts of climate change.

CHAPTER 6 ENDNOTES

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2. The term water infrastructure refers to the collection of infrastructure related to storm, waste, and drinking water. The third workshop focused on stormwater (runoff originating from precipitation events or surface flooding) and wastewater (sewage), though drinking water utilities are also subject to many challenges from climate change. In particular, drinking water availability may be severely compromised because of drought.
3. Kenward, A. et al., Climate Central, Sewage Overflows From Hurricane Sandy (April 2013), available at: http://www.climatecentral.org/pdfs/Sewage.pdf.
4. Id.
5. Id. at 3.
6. Id. at 2.
7. CBS News, Superstorm Sandy: How Storm Morphed from "Boring" to Killer Superstorm (Oct. 25, 2013); available at: http://www.cbsnews.com/news/superstorm-sandy-how-storm-morphed-from-boring-to-killer-superstorm/.
8. U.S. Environmental Protection Agency (EPA), Future Climate Change, available at: http://www.epa.gov/climatechange/science/future.html (last visited May 22, 2014).
9. CBS News, Superstorm Sandy: How Storm Morphed from "Boring" to Killer Superstorm (Oct. 25, 2013); available at: http://www.cbsnews.com/news/superstorm-sandy-how-storm-morphed-from-boring-to-killer-superstorm/.
10. Infrastructure facilities are usually owned by regional or local governmental authorities—though some are privately owned—that are responsible for a facility's construction, maintenance, and operation. Publicly-owned water treatment authorities are known as publicly-owned treatment works, or POTWs.
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13. This allows water to be more easily conveyed to the plant via gravity and makes it so treated sewage or stormwater can be easily discharged into receiving water. Kenward, A. et al., Climate Central, Sewage Overflows From Hurricane Sandy (April 2013), available at http://www.climatecentral.org/pdfs/Sewage.pdf, at 3.
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15. Id.
16. Id.
17. Colin Lecher, FYI: Why Does Salt Water Make Hurricane Damage So Much Worse, Popular Science (Nov. 1, 2012), available at: http://www.popsci.com/science/article/2012-10/fyi-does-salt-water-make-hurricane-damage-worse.
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19. Id.
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22. EPA, Green and Gray Infrastructure Research, available at: http://www.epa.gov/nrmrl/wswrd/wq/stormwater/green.html (last visited May 22, 2014).
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26. American Society of Civil Engineers (ASCE), Failure to Act: The Economic Impact of Current Investment Trends in Water and Wastewater Treatment Infrastructure (2011), available at: http://www.asce.org/uploadedfiles/infrastructure/failure_to_act/asce%20water%20report%20final.pdf.
27. Utility rate changes must be approved by regulators to ensure that they are necessary and reasonable. Utility profits are limited to an amount that regulators deem is a "reasonable rate of return."
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30. EPA, Proceedings of the First National Expert and Stakeholder Workshop on Water Infrastructure Sustainability and Adaptation to Climate Change 99 (2009), available at: http://www.epa.gov/nrmrl/wswrd/wq/wrap/workshop.html.
31. The Clean Water Act was passed in the form of amendments to the Federal Water Pollution Control Act in 1972 and amended repeatedly since. See EPA, History of the Clean Water Act. available at: http://www2.epa.gov/laws-regulations/history-clean-water-act (last visited May 22, 2014).
32. 33 U.S.C. §1251. The stated purpose of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" while preserving the "primary responsibilities and rights of States" in the protection and use of water resources.
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34. National Drinking Water Advisory Council (NDWAC), Final Report of the National Drinking Water Advisory Council (2010), available at: http://water.epa.gov/drink/ndwac/climatechange/upload/CRWU-NDWAC-Final-Report-12-09-10-2.pdf
35. The CWSRF was created by 1987 amendments to the CWA (33 U.S.C. §1251(a)(4)), and the DWSRF was created by the 1996 amendments to the SDWA. See EPA, Clean Water State Revolving Fund, available at: http://water.epa.gov/grants_funding/cwsrf/cwsrf_index.cfm (last visited May 22, 2014), and Drinking Water State Revolving Fund, available at: http://water.epa.gov/grants_funding/dwsrf/ (last visited May 22, 2014).
36. EPA incorporated these goals into its implementing regulations for the CWSRF. The regulations state that the purpose of the regulations is to "advance the general intent of title VI…which is to ensure that each State's program is designed and operated to continue providing assistance for water pollution control activities in perpetuity." The regulations also express EPA's intent to "implement the State water pollution control revolving fund program in a manner that preserves for States a high degree of flexibility for operating their revolving funds in accordance with each State's unique needs and circumstances." See 40 CFR §35.3100-§35.3170.
37. Clean Water Act §606(c), 33 U.S.C. §1386(c) (2011); 40 C.F.R. §35.3150(a) (CWA Section 606(c) says that states, "[a]fter providing for public comment and review…shall annually prepare a plan identifying the intended uses of the amounts available to its water pollution control revolving fund."). Safe Drinking Water Act §1452(b), 42 U.S.C. §300j-12; (the Final Guidelines for Implementation of the Drinking Water State Revolving Fund Program (63 FR 59848, I.B) state that "The State must prepare the IUP, and provide it to the public for review and comment prior to submitting it to the RA as part of its capitalization grant application.")
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43. EPA, Draft Office of Water Climate Change Adaptation Implementation Plan (2013), available at: http://epa.gov/climatechange/Downloads/impacts-adaptation/office-of-water-plan.pdf.
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47. Hurricane Sandy Rebuilding Task Force, Rebuild by Design, available at: http://www.rebuildbydesign.org/ (last visited May 22, 2014)
48. Section 303(d) of the CWA requires that jurisdictions develop TMDLs for impaired waters. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still safely meet water quality standards.
49. Steven Klein, EPA Region 10 Climate Change and TMDL Pilot: A Climate Change Risk Assessment for the Temperature TMDL in the South Fork Nooksack River, WA (2013) available at: http://oregonwatersheds.org/programs/fall-gathering/conference-presentations/klein-steven-climate-change-tmdls/at_download/file.
50. The Green Project Reserve was established by Congress in the American Recovery and Reinvestment Act of 2009 (ARRA). It requires that a certain percentage (e.g., 10% in FY 2012) of a state's CWSRF capitalization grant be directed toward projects that address green infrastructure, water efficiency, energy efficiency, or other environmentally innovative activities. See EPA, Green Project Reserve, available at: http://water.epa.gov/grants_funding/cwsrf/Green-Project-Reserve.cfm (last visited May 22, 2014).

APPENDIX A

ACRONYMS AND ABBREVIATIONS

APPENDIX A - ACRONYMS AND ABBREVIATIONS

ABFE	Advisory Base Flood Elevations
BCA	Benefit Cost Analysis
Biggert-Waters	Biggert-Waters Flood Insurance Reform Act of 2012
CBO	Congressional Budget Office
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant Disaster Relief
CELCP	Coastal Estuarine Land Conservation Program
CEM	Coastal Engineering Manual
CEQ	White House Council on Environmental Quality
CIPs	Capital Improvement Plans
Comprehensive Study	North-Atlantic Coast Comprehensive Study
Corps	U.S. Army Corps of Engineers
CREAT	Climate Resilience Evaluation and Assessment Tool
CRS	Community Rating System
CTP	Cooperating Technical Partners program
CWA	Clean Water Act
DRF	Disaster Relief Fund
DHS	Department of Homeland Security
DOD	Department of Defense
DOI	Department of Interior
DOT	Department of Transportation
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHA	Federal Housing Administration
FHFA	Federal Housing Finance Agency
FHWA	Federal Highway Administration
FHWA-ER	Federal Aid Highway Act Emergency Relief
FIS	Flood Insurance Study
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GCC	Georgetown Climate Center
GPR	Green Project Reserve
HMGP	Hazard Mitigation Grant Program
HIFAA	Homeowners Flood Insurance Affordability Act of 2014
HUD	Department of Housing and Urban Development

ICC	Increased Cost of Compliance
IUP	Intended Use Plan
LSGP	Mobile Bay Living Shorelines General Permit
MitFLG	Mitigation Framework Leadership Group
MMSD	Milwaukee Sewerage District
MS4	Municipal Separate Storm Sewer System
NDRF	National Disaster Recovery Framework
NFWF	National Fish and Wildlife Foundation
NCA 2014	Third National Climate Assessment
NEPA	National Environmental Policy Act
NEP	National Estuary Program
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NOFAs	Notices of Funding Availability
NSF	National Science Foundation
NWP	Nationwide Permits
PACE	Property Assessed Clean Energy
PDM	Pre-Disaster Mitigation
OMB	White House Office of Management and Budget
PEIS	Programmatic Environmental Impact Statement
PW	Project Worksheet
PA	Public Assistance program
PGP	Programmatic General Permit
P&R	Principles and Requirements
RHA	Rivers and Harbors Act of 1899
SAGE	Systems Approach to Geomorphic Engineering
SAMP	Special Area Management Plan
SCI	Sustainable Communities Initiative
SDWA	Safe Drinking Water Act
SRIA	Sandy Recovery Improvement Act
SRTF	Hurricane Sandy Recovery Task Force
SFHA	Special Flood Hazard Area
SRF	State Revolving Fund
Task Force	State, Local and Tribal Leaders Climate Preparedness and Resilience Task Force
TMAC	Technical Mapping Advisory Council
TMDL	Total Maximum Daily Load
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WRDA	Water Resources Development Act

APPENDIX B

RECOMMENDATIONS BY FEDERAL AGENCY

Federal Agencies Generally

- Federal agencies should issue guidance on what funds can be used to support adaptation. (Ch.1)
- Federal agencies should improve interagency collaboration, seizing opportunities to coordinate funding streams, paperwork and other regulatory requirements. (Ch.1)
- Federal partners should provide more actionable data and tools to help inform state and local planning. The recent announcement of a climate data initiative and the 2014 National Climate Assessment are important steps, but more work can be done to translate these tools and information for state and local users. (Ch.1)
- Cost-benefit analysis should include consideration of the value of ecosystem services and the costs of inaction. (Ch.1)
- Regional planning for disaster recovery, floodplain management, nature-based coastal adaptation, and drought management should be promoted. Impacts of climate change and rising seas do not respect jurisdictional boundaries. Regional coordination is necessary and can be used to leverage limited resources. (Ch.1)
- Federal agencies should support state and local efforts that promote resilience rather than administer resources in ways that maintain the status quo. (Ch.1)
- Federal agencies should encourage regional planning to inform disaster recovery efforts. (Ch. 2)
- Federal agencies should improve interagency cooperation and ensure that senior-level policy recommendations are translated to staff. (Ch. 2)
- Federal agencies should require state and local governments to consider climate change in all disaster recovery plans and should enforce those requirements. (Ch. 2)
- Federal agencies should offer incentives for communities that prepare. (Ch. 2)
- Federal agencies should adopt minimum standards for resilient rebuilding and apply those standards to all major federal investments. (Ch. 2)
- Federal agencies should develop, publish, and act upon lessons learned from disaster recovery efforts. (Ch. 2)
- Federal agencies should consider methods for allocating disaster relief funds directly to local or regional grantees. (Ch. 2)
- Federal agencies should provide incentives for better private decision-making and leverage public private investments. (Ch. 2)
- Federal agencies should better align the timing and distribution of federal disaster relief funds. (Ch. 2)
- Federal agencies administering disaster relief programs should integrate environmental review requirements under NEPA, where feasible. (Ch. 2)

- Federal agencies should allow for multiple projects to be considered together when conducting environmental review for disaster recovery projects. (Ch. 2)
- Federal agencies should consider funding pilot projects or issuing guidance on the use of Programmatic Environmental Impact Statements (PEISs) as a way of frontloading environmental review for adaptive rebuilding. (Ch. 2)
- Federal agencies or CEQ should map the various federal funding streams that can be used to implement nature-based approaches and provide guidance on how grantees can combine funding streams with other state and federal sources to take nature-based projects from planning to implementation. (Ch. 5)
- Federal agencies should fund research that will demonstrate the multiple benefits of nature-based approaches. (Ch. 5)
- Federal agencies should, where feasible, distribute grants through private foundations to help grantees align federal funding streams similar to the National Fish and Wildlife Foundation (NFWF) model used to distribute Sandy funding. (Ch. 5)
- Federal agencies should provide guidance to states and localities about mechanisms to raise money to leverage federal funds. (Ch. 5)
- Federal agencies should fund more integrated watershed planning and support regional coordination of coastal protection strategies. (Ch. 5)
- Federal agencies should continue and increase the role of interagency review boards in administering grants. (Ch. 5)
- Federal agencies or NGOs should develop or compile model ordinances or model legislation for implementing nature-based approaches at the state and local level. (Ch. 5)
- Federal agencies should provide data and technical assistance to help utilities identify climate impacts to water infrastructure assets, assess vulnerabilities, plan system improvements, and monitor performance of gray- and green-infrastructure solutions. (Ch. 6)
- Federal agencies should adopt or support the use of a certification program for climate-smart water infrastructure. (Ch. 6)
- Federal agencies should provide guidance on how to align funding streams to retrofit or construct climate-resilient infrastructure. (Ch. 6)
- Federal agencies should coordinate across programs and agencies to encourage integrated watershed planning. (Ch. 6)

The White House, the Council on Environmental Quality, and the Office of Management and Budget

- CEQ should update guidelines to federal agencies to ensure that federal adaptation plans include consideration of the programs and policies that affect state and local adaptation. (Ch.1)
- The White House and the Office of Management and Budget (OMB) should reduce time needed to pass changes to regulations under the Administrative Procedure Act to help

streamline implementation of recommended reforms. (Ch.1)

- OMB should reconsider its discount rate. (Ch. 2)
- CEQ should adopt guidance to federal agencies on how to consider potential climate impacts to a project in environmental review documents required by NEPA. (Ch. 2)
- CEQ should finalize and adopt the updated Principles and Guidelines for water resource development projects. (Ch. 5)

The Federal Emergency Management Agency and U.S. Department of Housing and Urban Development

- HUD and FEMA should align planning requirements across disaster relief programs. (Ch. 2)
- FEMA and other agencies should review and revise their methods of assessing costs and benefits. (Ch. 2)
- FEMA should amend benefit-cost analysis worksheets to incorporate updated regional data and to provide guidance to grantees on how to account for climate change and ecosystem service benefits. (Ch. 2)
- FEMA, where it has authority, should direct more funding to pre-disaster mitigation programs. (Ch. 2)
- FEMA should use its authority to authorize modifications and mitigation measures to support adaptation of damaged facilities with Public Assistance (PA) funding. (Ch. 2)
- FEMA should provide guidance on how communities can use new authorities provided by the Sandy Recovery Improvement Act (SRIA), including in-lieu contributions and lump sum PA grants. (Ch. 2)
- FEMA should consider future climate change impacts when determining whether to reimburse a grantee to relocate a facility under the PA program. (Ch. 2)
- FEMA should recognize higher state and local building codes even where some degree of discretion is required to implement the standards. (Ch. 2)
- FEMA should encourage better linkage between hazard mitigation plans and post-disaster recovery plans and land-use plans. (Ch. 2)
- FEMA and other federal agencies should provide guidance to help states and communities develop funding sources to support hazard mitigation and adaptation outside the disaster relief context and should develop case studies of states and communities that have effectively developed funding sources. (Ch. 2)
- FEMA and other federal agencies should support development of economic analysis to make a case for hazard mitigation. (Ch. 2)
- FEMA and other federal agencies should offer more technical support and guidance to states and localities about what tools, models, and data to use for different purposes; and FEMA and other federal agencies should support programs that build local capacity. (Ch. 2)
- FEMA should provide guidance on how states can opt to administer their own HMGP as authorized by the SRIA. (Ch. 2)

- FEMA should delegate more mapping authority to states. (Ch. 3)
- FEMA should coordinate data collection with other agencies, states, and localities, to develop FIRMs and to offer other tools for identifying and responding to long-term flood risks. (Ch. 3)
- FEMA should re-envision its mapping program so that the floodplain maps better suit the different purposes for which the maps are used—communicating risk, setting insurance rates, and regulating land use. (Ch. 3)
- FEMA should make digital-FIRMs truly digital. (Ch. 3)
- FEMA should use the authority provided by Biggert-Waters to provide information about how climate change will exacerbate flood-related hazards of floodplain maps. (Ch. 3)
- FEMA should issue guidance about how hazard mitigation funding can be applied to other types of hazard areas (e.g., erosion hazard areas). (Ch. 3)
- FEMA should provide guidance to states and localities about methods for funding floodplain mapping. (Ch. 3)
- FEMA and the President should convene the Technical Mapping Advisory Council (TMAC) called for by Biggert-Waters, and the TMAC should provide recommendations that encourage more delegation of mapping authority to states and localities, require inclusion of climate change projections on FIRMs, and provide strategies for financing mapping updates. (Ch. 3)
- FEMA should consider more restrictive minimum standards for local floodplain regulations. (Ch. 3)
- FEMA should leverage the Community Rating System (CRS) to provide additional credits for adaptive land-use management. (Ch. 3)
- FEMA should recognize partial mitigation for purposes of setting insurance rates for older building stock. (Ch. 3)
- FEMA and other federal agencies should invest in communication, outreach, education and training. (Ch. 3)
- FEMA should expand its flood insurance affordability study to address regional differences. (Ch. 3)
- FEMA and other agencies (such as HUD) should fund or finance structural mitigation. (Ch. 3)
- FEMA should issue guidance to clarify when and how Hazard Mitigation Grant Program funds can be used to restore acquired properties for ecosystem and flood control benefits. (Ch. 5)
- FEMA should increase Community Rating System (CRS) credits provided for communities that conserve open space and implement ecosystem restoration projects that provide flood risk reductions. (Ch. 5)
- HUD should issue guidance on how CDBG can be used to encourage adaptive rebuilding. (Ch. 2)

- HUD should align planning and reporting requirements with FEMA requirements to ensure that CDBG can be used to supplement HMGP and PA funding. (Ch. 2)
- HUD should determine and issue guidance on whether CDBG funds can be used to support community applications to the CRS program. (Ch. 3)
- HUD should clarify allowable uses of funds for climate adaptation. (Ch. 4)
- HUD should provide models of how to use funds more adaptively. (Ch. 4)
- HUD should foster more peer-to-peer climate learning opportunities. (Ch. 4)
- HUD should cultivate relationships and federal partnerships to translate climate science for grantees. (Ch. 4)
- HUD should explore whether Federal Housing Administration's mortgage insurance program can incorporate climate considerations into its eligibility criteria. (Ch. 4)
- HUD should develop guidance on whether and how states and localities can use Community Development Block Grant funding to implement nature-based approaches. (Ch. 5)

Federal Housing Finance Agency

- The Federal Housing Finance Agency (FHFA) should reform its policy preventing Freddie Mac and Fannie Mae from purchasing mortgages for properties with Property-Assessed Clean Energy (PACE) loans. (Ch. 3)

U.S. Army Corps of Engineers

- The Corps and other federal agencies should provide more technical assistance, education, and training to improve understanding of how to design nature-based approaches and evaluate their efficacy. (Ch. 5)
- The Corps and other federal agencies should convene a work group to explore nature-based approaches, including state and local governments, scientists, NGOs, academia, and the business community. (Ch. 5)
- The Corps could develop a standard for measuring and quantifying the ecosystem service and flood risk reduction benefits of nature-based approaches. (Ch. 5)
- The Corps should develop case studies and lessons learned from application of its Sea-Level Change Guidance for civil works projects and should apply this analysis to ecosystem restoration projects. (Ch. 5)
- The Corps should shorten the time period for taking a project from planning to implementation. (Ch. 5)
- The Corps should develop more regional general permits for nature-based approaches. (Ch. 5)
- The Corps should develop guidance on which nationwide permits can be used for small-scale living shoreline projects. (Ch. 5)

- The Corps should explore opportunities to better align federal, state and local permitting requirements for nature-based approaches through Programmatic General Permits (PGPs), Special Area Management Plans (SAMPs), and the National Estuary Program (NEP). (Ch. 5)
- The Corps should consider climate change in its regulatory program when it requires permit applicants to mitigate environmental impacts (i.e., compensatory mitigation requirements). (Ch. 5)

Environmental Protection Agency

- EPA should provide additional guidance to states to encourage the use of State Revolving Fund (SRF) money for climate adaptation projects. (Ch. 6)
- EPA should encourage states to prioritize adaptive projects when directing SRF funding. (Ch. 6)
- EPA should encourage states to offer financial incentives for investing SRF funds in climate resiliency. (Ch. 6)
- EPA should integrate climate considerations into the Clean Water Act and Safe Drinking Water Act regulatory programs. (Ch. 6)

Congress

- Congress should better align the planning and environmental review requirements between disaster relief programs. (Ch. 2)
- Congress should allocate more funding for pre-disaster mitigation. (Ch. 2)
- Congress should consider allowing disaster recovery funds to be spent over longer time frames and should align the timing and distribution of funds through the various disaster relief programs. (Ch. 2)
- Congress should allocate funding to allow for local capacity building. (Ch. 2)
- Congress should develop mechanisms to provide support to communities that receive disaster-affected populations. (Ch. 2)
- Congress should remove pre-disaster condition language from the Stafford Act. (Ch. 2)
- Congress could consider adding a national priority for disaster recovery to the Housing and Community Development Act to codify a CDBG Disaster Relief program. (Ch. 2)
- Congress should appropriate sufficient funding to allow FEMA to update floodplain maps on a more regular basis and include additional data layers of climate change hazards. (Ch. 3)
- Congress could increase the amount that homeowners can claim on their flood insurance policies through Increased Cost of Compliance (ICC) coverage to allow them to fund measures to mitigate flood risks, such as elevating structures. (Ch. 3)
- Congress should fully fund HUD discretionary grant programs. (Ch. 4)

- Congress should appropriate funds to the Corps for more multi-purpose projects that provide both flood control and ecosystem benefits. (Ch. 5)
- Congress should explicitly allow for the transfer of funds between federal agencies and programs that support ecosystem restoration and flood control projects. (Ch. 5)
- Congress should appropriate funds that support ecosystem restoration and flood control projects as multi-year money. (Ch. 5)
- Congress should authorize federal agencies to accept private funds to undertake ecosystem restoration and flood control projects. (Ch. 5)
- Congress should reform incentives for levees in the National Flood Insurance Program. (Ch. 5)
- Congress should enact reforms to direct funding to climate resilient water infrastructure and ensure that SRF investments are climate-smart. (Ch. 6)

The nonpartisan Georgetown Climate Center seeks to advance effective climate, energy, and transportation policies in the United States—policies that reduce greenhouse gas emissions, save energy, and help communities adapt to climate change.

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