CONCEPTS FOR THE NEXT WATER RESOURCES DEVELOPMENT ACT: PROMOTING RESILIENCY OF OUR NATION'S WATER RESOURCES INFRASTRUCTURE

(116–44)

HEARING

BEFORE THE

SUBCOMMITTEE ON
WATER RESOURCES AND ENVIRONMENT

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED SIXTEENTH CONGRESS

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U.S. House of Representatives
Washington, DC 20515

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NOVEMBER 15, 2019

SUMMARY OF SUBJECT MATTER

TO: Members, Subcommittee on Water Resources and Environment
FROM: Staff, Subcommittee on Water Resources and Environment
RE: Subcommittee Hearing on "Concepts for the Next Water Resources Development Act: Promoting Resiliency of our Nation's Water Resources Infrastructure"

PURPOSE

The Subcommittee on Water Resources and Environment will meet on Tuesday, November 19, 2019, at 10:00 a.m. in Room 2167, Rayburn House Office Building, to receive testimony related to the role of resiliency in the construction, and operation and maintenance of projects carried out by the U.S. Army Corps of Engineers (Corps). This hearing will be one of several related to the formulation of a new water resources development act (WRDA) for 2020.

BACKGROUND

U.S. ARMY CORPS OF ENGINEERS: STATE OF THE INFRASTRUCTURE

The Committee on Transportation and Infrastructure has jurisdiction over the Corps' Civil Works program. The Corps is the Federal government's largest water resources development and management agency and is comprised of 38 district offices within eight divisions. The Corps operates more than 700 dams; has constructed 14,500 miles of levees; and maintains more than 1,000 coastal, Great Lakes, and inland harbors, as well as 12,000 miles of inland waterways.[1]

Navigation was the earliest Civil Works mission, when Congress authorized the Corps to improve safety on the Ohio and Mississippi Rivers in 1824. Since then, the Corps' primary missions have evolved and expanded to include flood damage reduction along rivers, lakes, and the coastlines, and projects to restore and protect the environment. Along with these missions, the Corps is the largest generator of hydropower in the Nation, provides water storage opportunities to cities and industry, regulates development in navigable waters, provides disaster response and recovery during emergencies, and manages a recreation program. To date, the Corps manages nearly 1,500 water resources projects.

ROLE OF RESILIENCY IN CORPS PLANNING AND OPERATIONS

Most of the Corps' facilities and infrastructure was constructed in the early to mid-1900s. As a result, approximately 95 percent of the dams managed by the Corps are more than 30 years old, and half have reached or exceeded their 50-year project

[1] https://www.crs.gov/Reports/R45185#fn1.

lives.[2] The Corps' ability to manage its portfolio of aging infrastructure is coupled with the need to balance multiple authorized purposes and increased demands on the infrastructure. The Corps' infrastructure also faces new challenges in the frequency in which extreme weather events are occurring. How the Corps factors the frequency of extreme weather events and the role of resiliency in the operation, maintenance, and construction of its facilities is crucial both to the sustainability of the infrastructure as well as the Corps' ongoing responsibility to meet the authorized purposes of Corps projects.

In 2014, the Corps issued its USACE Climate Preparedness and Resilience Policy Statement, which declared that "it is the policy of USACE to integrate climate change preparedness and resilience planning and actions in all activities for the purpose of enhancing the resilience of our built and natural water-resource infrastructure and the effectiveness of our military support mission, and to reduce the potential vulnerabilities of that infrastructure and those missions to the effects of climate change and variability."[3] In 2016, the Corps further defined "resiliency" in its Resiliency Initiative Roadmap as "the concept to convey a holistic approach to addressing threats and uncertainty from acute hazards such as more frequent and/or stronger natural disasters, man-made threats, changing conditions from population shifts and climate change."[4] In this Roadmap, the Corps approaches resilience with four key actions: "prepare, absorb, recover, and adapt."[5]

RECENT REPORTS, TRENDS, AND EXAMPLES OF EXTREME WEATHER EVENTS:

In 1990, Congress enacted the Global Change Research Act which requires Federal agencies to report to the President and the Congress (at least every 4 years) on "the findings of the Global Change Research Program and the scientific uncertainties associated with those findings," the "effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity," as well as "current trends in global change, both human-induced and natural, and project major trends for the subsequent 25 to 100 years."[6]

Four of these reports, called National Climate Assessments, have been issued pursuant to the Global Change Research Act—the most recent of which was issued in 2018[7] (and slightly revised in 2019[8]). This report highlights recent trends with extreme weather events in the United States, including prolonged periods of excessively high temperatures, heavy precipitation, and in some regions, severe floods and droughts.[9] In addition, this "Fourth National Climate Assessment" highlighted how the intensity, frequency, and duration of Atlantic hurricane activity has substantially increased since the 1980s, including the number of strongest (Category 4 and 5) storms during this period.[10]

More recently, according to the National Oceanic and Atmospheric Administration (NOAA), the first eight months (January to August) of 2019 were the wettest on record for the nation.[11] Most of the precipitation fell within the Missouri, Mississippi, and Arkansas Rivers watershed, when a March 2019 "bomb cyclone" rain event in the Midwest resulted in massive flooding in the Missouri River Basin. At least 32 levee systems were overtopped or completely under water and, at last count, the Corps had discovered 114 breach sites in these systems.[12] While the flooding subsided, plains snowmelt added more water to the system. In April 2019, the Corps deployed six vessels in the Southwest Pass at the mouth of the Mississippi River to expedite dredging in the Gulf of Mexico in preparation for the additional water flow.

The extreme hydrologic events during the first eight months of 2019 continued at record-breaking levels as the water flowed downstream. For example, the December 2018 to August 2019 period is now the longest known flood of record for the Lower Mississippi River. In addition, the Corps has had to utilize the Bonnet Carre Spillway in Louisiana to relieve flooding impacts on the Lower Mississippi basin. The

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[2] See https://www.nap.edu/read/13508/chapter/3.
[3] See https://www.usace.army.mil/corpsclimate/Climate__Preparedness__and__Resilience/.
[4] https://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP__1100-1-2.pdf?ver=2017-11-02-082317-943.
[5] See Id.
[6] See Pub. L. 101–606.
[7] See https://nca2018.globalchange.gov/downloads/NCA4__2018__FullReport.pdf.
[8] See https://nca2018.globalchange.gov/downloads/NCA4__Errata__09October2019.pdf.
[9] See https://nca2014.globalchange.gov/highlights/report-findings/extreme-weather.
[10] See id.
[11] https://www.noaa.gov/news/january-through-august-was-wettest-on-record-for-us.
[12] https://www.epw.senate.gov/public/__cache/files/3/3/3340ee0b-51ad-40d4-8a06-ea79491dde63/F631CE8BBCD6E3B31B0DB99C44DD65CD.u.s.-army-corps-testimony-04.17.2019.pdf.

Corps' recent use of the Spillway is notable for several reasons. First, its most recent opening in May 2019 is only the 13th time the spillway has been used since its construction in the 1930s. Second, its use in 2018 and 2019 marks the first time the spillway has been used in consecutive years, as well as the first time the spillway has had more than one opening in a single year (Feb–April and May–July 2019).[13] The Mississippi River in Baton Rouge had a record of 211 days above flood stage for most of 2019, easily breaking the previous record set by the Great Flood of 1927 (of 135 days).[14]

STAKEHOLDER PERSPECTIVE: ARMY CORPS AND RESILIENT INFRASTRUCTURE

As noted above, the Corps has constructed and continues to operate and maintain critical flood control, navigation, and environmental restoration projects throughout the Nation. However, several notable climatic events, such as the hurricane seasons of 2005 (Katrina and Rita), 2012 (Superstorm Sandy), and 2017 (Harvey, Irma, and Maria), and the Midwest flooding of 2018 and 2019, have highlighted the challenges of continuously operating Corps projects at their authorized purpose when faced with extreme weather events.

This hearing is intended to examine how concepts of resilience are incorporated in the planning, design, construction, and operation and maintenance of existing projects, and how the Corps' existing infrastructure is managed both to address authorized purposes as well as meet potential future extreme hydrologic conditions.

WITNESSES

- Gerald E. Galloway, PE, PhD, Brigadier General (US Army-Retired), Glenn L. Martin Institute Professor of Engineering, University of Maryland
- Ann Phillips, Rear Admiral (US Navy-Retired), Special Assistant to the Governor for Coastal Adaptation and Protection, Commonwealth of Virginia
- Ricardo S. Pineda, PE, CFM, Chair, Association of State Floodplain Managers, Supervising Engineer Water Resources, California Department of Water Resources Division of Flood Management, *on behalf of the Association of State Floodplain Managers*
- Louis Gritzo, Ph.D, Vice President, FM Global Research Manager
- Melissa Samet, Senior Water Resources Counsel, National Wildlife Federation
- Julie Ufner, President, National Waterways Conference

[13] https://www.mvn.usace.army.mil/Missions/Mississippi-River-Flood-Control/Bonnet-Carre-Spillway-Overview/Spillway-Operation-Information/.

[14] https://www.weather.gov/lix/ms__flood__history.

CONCEPTS FOR THE NEXT WATER RESOURCES DEVELOPMENT ACT: PROMOTING RESILIENCY OF OUR NATION'S WATER RESOURCES INFRASTRUCTURE

TUESDAY, NOVEMBER 19, 2019

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON WATER RESOURCES AND ENVIRONMENT,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
Washington, DC.

The subcommittee met, pursuant to notice, at 10:01 a.m., in room 2167, Rayburn, Hon. Grace F. Napolitano (Chairwoman of the subcommittee) presiding.

Present: Representatives Napolitano, DeFazio, Mucarsel-Powell, Johnson of Texas, Garamendi, Huffman, Lowenthal, Carbajal, Espaillat, Fletcher, Finkenauer, Delgado, Craig, Rouda, Wilson, Lynch, Malinowski; Westerman, Massie, Woodall, Babin, Graves of Louisiana, Bost, Weber, LaMalfa, Mast, Palmer, and González-Colón.

Mrs. NAPOLITANO. Good morning everybody. This meeting is called to order.

And today's hearing focuses on the role of resiliency in assessing the U.S. Army Corps of Engineers infrastructure. Let me begin by asking unanimous consent that committee members not on the subcommittee be permitted to sit with the subcommittee at today's hearing to ask questions. No objection? So ordered.

I also ask unanimous consent that the Chair be authorized to declare a recess during today's hearing. And without objection, so ordered.

The Corps has defined resiliency as a holistic approach to addressing threats and uncertainty from acute hazards. These hazards include more frequent and stronger natural disasters, manmade threats, changing conditions from population shifts and climate change, good old climate change. The Corps is the largest water manager in the Nation, so it is important for us to understand how the Corps manages its inventory of projects in light of a changing climate, including how it builds resiliency into its decisionmaking. This will be a critical discussion in the formation of a new Water Resources Development Act, WRDA. We must also keep in mind the funding increases caused by disasters.

I am already having a discussion of aging infrastructure, changing hydrological conditions, and how we can better respond to these changes in my district in southern California and throughout the

Nation. We have several Corps facilities, including Whittier Narrows Dam. It is part of the Los Angeles County Drainage Area Flood Control System, which collects the runoff from the upstream watershed of the San Gabriel River and controls downstream releases to millions of people. Like many Corps facilities, it is over 50 years old—62 to be exact. It is classified by the Corps as a Dam Safety Action Classification 1, the highest classification, because of its potential risk to downstream populations should it fail.

I am working closely with the Corps to ensure the dam safety work is started and completed, after nearly 15 years working on it at the Whittier Narrows, to protect our communities from the threats of today and the future threats of climate change. We are also pushing for another important reason, and that is the ability to use Whittier Narrows and other water infrastructure like the Prado Dam to meet the future water needs of the community. We cannot do this if they fall apart or are in danger of failure.

In southern California, over half of our water supply is imported from the Bay Delta or the Colorado River. We experience frequent droughts. So we want to be able to utilize existing infrastructure and operate them in a way that meets existing authorized purposes, but also consider other needs like groundwater recharge and water supply. An example of this is with Prado Dam as a potential pilot project for the forecast-informed reservoir operations. This project helped to conserve 12,000 acre-feet of water in Lake Mendocino earlier this year by relying on better forecasting to help guide operations.

And we recognize that what resiliency means for California will be different than what it means for the Midwest or the eastern seaboard. However, because the Corps projects have a real impact on everyday lives and livelihood of American families and on our local, regional, and national economy, it is important that the Corps consider resiliency as part of its mission every day.

So I thank the witnesses for being here today and look forward to hearing your testimony.

[Mrs. Napolitano's prepared statement follows:]

Prepared Statement of Hon. Grace F. Napolitano, a Representative in Congress from the State of California, and Chairwoman, Subcommittee on Water Resources and Environment

The Corps has defined resiliency as "a holistic approach to addressing threats and uncertainty from acute hazards." These hazards include more frequent and stronger natural disasters, man-made threats, changing conditions from population shifts, and climate change.

The Corps is the largest water manager in the nation; so it is important for us to understand how the Corps manages its inventory of projects in light of a changing climate, including how it builds resiliency into its decision making. This will be a critical discussion in the formulation of a new water resources development act.

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cause of the potential risks to downstream populations should it fail. I am working closely with the Corps to ensure that the Dam Safety work is started and completed at Whittier Narrows to protect our communities from the threats of today, and the future threats of climate change.

We are also pushing for this work for another important reason, the ability to utilize Whittier Narrows, and other water infrastructure, like Prado Dam, to meet the future needs in the community. We cannot do this if they are falling apart.

In Southern California, over half of our water supply is imported from the Bay Delta or the Colorado River. We experience frequent droughts. We want to be able to utilize existing infrastructure and operate them in a way that meets existing authorized purposes, but also considers other needs, like groundwater recharge and water supply.

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I recognize that what resiliency means for California will be different than what it means for the Midwest, or the Eastern seaboard. However, because Corps projects have a real impact on the everyday lives and livelihoods of American families, and on our local, regional, and national economy, it is important that Corps considers resiliency as part of its mission every day.

Thank you to our witnesses for being here today. I look forward to hearing your testimony.

Mrs. NAPOLITANO. And at this time, I am pleased to yield to my colleague, ranking member of our subcommittee, my good friend Mr. Westerman, for any thoughts he may have.

Mr. WESTERMAN. Thank you, Chairwoman Napolitano. And I want to thank all of today's witnesses and especially Ms. Ufner in particular, who I understand just recently took over for the National Waterways Conference. And I would also like to take a moment to thank Amy Larson, the outgoing president of the conference, for her many years of work on behalf of inland navigation, flood control and water supply. Those are interests that are important and critical to constituents in my home State and all around the country.

The Army Corps of Engineers is the Nation's largest owner of water resource projects, as the chairwoman said, and they manage more than 1,500 projects. This includes being the largest generator of hydropower in the Nation, providing water storage opportunities to cities and industry, regulating continued operation and development of navigable waters, and providing disaster response and recovery during emergencies, among other issues. All told, these missions protect our citizens and ensure that our local and national economies thrive. Therefore, it is imperative to the millions of Americans who rely on these projects that we ensure they are operating well into the future and serving the purposes for which they were developed.

But as we know, the state of our water resource infrastructure is very poor. Most of the infrastructure was built many, many decades in the past and has not been adequately maintained. One of the most oft-cited statistics in this subcommittee, the American Society of Civil Engineers has given water infrastructure a D-plus grade.

I know how important this infrastructure is. Earlier this summer, hundreds of homes in my home State of Arkansas were affected by the flooding. Bridges were closed and barge traffic was stopped. At one point, this was costing my home State over $20 million in economic losses every day.

Over the past several appropriations cycles, including supplemental emergency funding bills, the Corps Civil Works program has never been flusher with funding, well over $15 billion in the last 2 fiscal years alone. We need to expeditiously turn this funding around in order to rebuild and improve our water resources infrastructure. But any conversation about resiliency planning for the future is moot if we cannot get any of these critical water resources infrastructure projects completed and delivered effectively and efficiently. The simple fact of the matter is that a project cannot be resilient unless and until it is built.

While I do look forward to today's discussion on resiliency planning, I want to strongly emphasize that a conversation about resiliency and planning for the future means nothing if the Corps is not completing projects currently on the books, including the Corps' emergency response and repair obligations. So I hope at a future hearing we can discuss in greater detail ways to make the agency more efficient and effective in completing projects. We must ensure that the Corps is truly fulfilling obligations after disasters hit and get communities back on their feet while being good stewards of scarce taxpayer dollars.

With all that said, I will say that I was pleasantly surprised last week to get an update from the Little Rock Corps office that they were making progress fixing a levee and restoring a pumping station way ahead of their initial proposed schedule. This should be the rule and not the exception. And I want to say thank you to Colonel Noe and the folks on his staff who are actually getting the job done and making progress.

I believe that we need to continue to work to reduce project vulnerabilities from future flood and storm events. In doing so, I believe in a few guiding principles. Non-Federal sponsors and the Army Corps need to have equal seats at the table and act as partners. Requirements should not be imposed on sponsors without their buy-in. Resilience is not a one-size-fits-all framework. It must be considerate of the local geography and climate and the local industry and economy. What works in California does not work in Arkansas. And we must be proactive with regards to our aging infrastructure.

Over the past 6 years, the committee has passed three WRDAs, authorizing approximately $56 billion worth of projects that proactively address ecosystem restoration initiatives, flood risk reduction efforts and hurricane and storm risk reduction projects and policies to help ensure a more resilient Nation. Similarly, the most recent WRDA included in the America's Water Infrastructure Act in 2018 authorized seven studies for flood risk reduction, authorized and modified several projects for construction of ecosystem restoration and storm damage reduction and flood risk management projects. They required a study on urban flooding and a report on storm mitigation projects in areas where significant risks for future extreme weather events are likely; required a report on North Atlantic coastal resiliency with considerations to current, near- and long-term predicted sea levels and storm strengths; and promoted natural and nature-based features in water resource project development, among many other provisions.

I look forward to hearing the perspectives and suggestions from our witnesses here today, as we look to inform our next WRDA bill.

[Mr. Westerman's prepared statement follows:]

Prepared Statement of Hon. Bruce Westerman, a Representative in Congress from the State of Arkansas, and Ranking Member, Subcommittee on Water Resources and Environment

Thank you, Chairwoman Napolitano. I want to thank all of today's witnesses, and Ms. Ufner in particular, who I understand just recently took over the National Waterways Conference. I'd also like to take a moment to thank Amy Larsen, outgoing president of the Conference, for her many years of work on behalf of inland navigation, flood control, and water supply interests—all of which are critical to constituents in my home state.

The Army Corps of Engineers is the Nation's largest owner of water resources projects—managing more than 1,500 projects. This includes being the largest generator of hydropower in the Nation, providing water storage opportunities to cities and industry, regulating continued operation and development in navigable waters, and providing disaster response and recovery during emergencies, among others.

All told, these missions protect our citizens and ensure that our local and national economies thrive. Therefore, it is imperative to the millions of Americans who rely on these projects that we ensure they are operating well into the future and serving the purposes for which they were developed.

But as we know, the state of our water resources infrastructure is very poor. Most of this infrastructure was built many, many decades in the past and has not been adequately maintained. In one of the most oft-cited statistics in this subcommittee, the American Society of Civil Engineers has given water infrastructure a D+.

I know how important this infrastructure is. Earlier this summer, hundreds of homes in my home state of Arkansas were affected by the flooding, bridges were closed, and barge traffic was stopped. At one point this was costing my home state over $20 million in economic losses every day.

Over the past several appropriations cycles, including supplemental emergency funding bills, the Corps Civil Works program has never been flusher with funding—well over $15 billion in the last two fiscal years alone. We need to expeditiously turn this funding around in order to rebuild and improve our water resources infrastructure.

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We must ensure that the Corps is truly fulfilling its obligations after disasters hit, and to get communities back on their feet, while being good stewards of scarce taxpayers' dollars.

That being said, I believe that we need to continue to work to reduce project vulnerabilities from future flood and storm events. In doing so, I believe in a few guiding principles. Non-federal sponsors and the Army Corps need to have equal seats at the table and act as partners—requirements should not be imposed on sponsors without their buy-in. Resilience is not a one-size-fits-all framework; it must be considerate of the local geography and climate, and the local industry and economy. What works in California doesn't work in Arkansas. And we must be proactive with regards to our aging infrastructure.

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Similarly, the most recent WRDA, included in the America's Water Infrastructure Act in 2018 authorized 7 studies for flood risk reduction; authorized and modified several projects for construction of ecosystem restoration, storm damage reduction, and flood risk management projects; required a study on urban flooding and a re-

port on flood and storm mitigation projects in areas where significant risk for future extreme weather events are likely; required a report on North Atlantic coastal resiliency with considerations to current, near, and long-term predicted sea levels and storm strengths; and promoted natural and nature-based features in water resources project development, among many other provisions.

I look forward to hearing the perspectives and suggestions from our witnesses here today as we look to inform our next WRDA bill.

Mr. WESTERMAN. Thank you, Madam Chair, and I yield back.

Mrs. NAPOLITANO. Thank you, Mr. Westerman.

The Chair now recognizes Mr. DeFazio.

Mr. DEFAZIO. Thanks, Madam Chair. Again, thank you for holding this hearing as we work toward reauthorizing the Water Resources Development Act next year.

This is a perspective that we have not spent a lot of time looking at. And I certainly share the gentleman's concerns about the efficiency in delivering projects and, you know, it seems that the Corps' capabilities of doing that vary by district around the country. So we will get into those issues, I assure him, when we get to authorization.

But we also have to look at whether or not there are some who do not believe in climate change. But we are having an awful lot of severe weather events. The three largest rainfall events on record in the U.S. happened in the last 3 years. The Lower Mississippi River set the record for longest known flood from December 2018 to August 2019. Hurricanes and extreme hydrologic events are no longer an exception, they are becoming the norm. And it is very expensive, if you just want to look at it from a hard fiscal point of view. Seventy-five percent of the disasters are related to floods, and flood losses have averaged $8 billion a year. So this is something we need to deal with and get ahead of as much as possible.

Structures are not the only answer. Yes, structures need to have integrity and also, you know, a lot of the Corps' infrastructure is aging. Locks are failing on the inland waterways. We have dams that are questionable for flood control. So we have to be looking at the structures we already have, their integrity.

But then as we look at future issues, the question is whether you want to use a structure, or you want to try and mitigate by using more natural systems. And we will hear something about that here today. So it is something that the committee has not spent a lot of time on, and I am pleased that it is the focus of today's hearing. But we will deal with the regular nuts and bolts of the Corps at future hearings.

Thank you, Madam Chair.

[Mr. DeFazio's prepared statement follows:]

Prepared Statement of Hon. Peter A. DeFazio, a Representative in Congress from the State of Oregon, and Chairman, Committee on Transportation and Infrastructure

Today's hearing deals with the resiliency of our water infrastructure. Want to see the impacts of climate change? Look no further than water. You can see this through sea level rise, glacier melt, and extreme weather events through droughts, hurricanes, and record rainfall. The three largest rainfall events on record in the U.S. have occurred in the last three years. The Lower Mississippi River set the

record for longest known flood from December 2018 to August 2019. We've dealt with hurricanes Katrina, Florence, Matthew, Irma, and Maria at a staggering pace.

Even if you don't believe that this is a result of climate change, we can at least agree that these extreme hydrologic events are no longer the exception and are now becoming the norm. Let's look at it from a fiscal perspective: more than 75 percent of declared Federal disasters are related to floods, and annual flood losses average almost $8 billion with over 90 fatalities per year. In 2019 alone, we have had 10 weather and climate disaster events with losses exceeding $1 billion each across the United States. This includes 3 flooding events, 5 severe storm events, and 2 tropical cyclone events.

The Corps plays a crucial role in managing for these risks as the largest water manager in the Nation. Investing in resiliency not only helps to protect our communities but also helps reduce future spending on disasters. We need to better prepare our communities to understand the risks associated with extreme weather events. How we work with academia through research and innovation is also key.

It is imperative that we support initiatives that work toward reducing carbon emissions, combating rising sea levels, investing in renewable energy, and building resilient infrastructure. I am considering ways to do this across all areas of our jurisdiction. Whether its reducing carbon emissions across all modes of transportation or reducing greenhouse gas emissions from pipelines and wastewater systems—we must do more.

As this committee discusses moving forward on a Water Resources Development Act in the next year, ensuring that our communities are dealing with and managing risk associated with extreme hydrologic events is important and must be part of the discussion.

Thank you.

Mrs. NAPOLITANO. Thank you, Mr. DeFazio.

We will now proceed to hear from the witnesses who will testify. I thank all of you for being here, and welcome.

On the panel, we have Dr. Gerald E. Galloway, brigadier general, U.S. Army, retired, Glenn L. Martin Institute professor of engineering at the University of Maryland. Welcome.

Ann Phillips, rear admiral, U.S. Navy, retired, special assistant to the Governor for coastal adaptation and protection, Commonwealth of Virginia. Welcome.

Ricardo Pineda, P.E., C.F.M., supervising water resources engineer, California Department of Water Resources, Division of Flood Management, on behalf of the Association of State Floodplain Managers. Welcome, sir.

Dr. Louis Gritzo, vice president of research, FM Global, welcome.

Melissa Samet, senior water resources counsel, National Wildlife Federation. Welcome, ma'am.

And Julie Ufner, president, National Waterways Conference. Welcome, ma'am.

And without objection, your prepared statements will be entered into the record. And all witnesses are asked to limit their remarks to 5 minutes.

And Dr. Galloway, you may proceed.

TESTIMONY OF GERALD E. GALLOWAY, P.E., PH.D., BRIGADIER GENERAL, U.S. ARMY (RET.), ACTING DIRECTOR, CENTER FOR DISASTER RESILIENCE, A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND; ANN C. PHILLIPS, REAR ADMIRAL, U.S. NAVY (RET.), SPECIAL ASSISTANT TO THE GOVERNOR FOR COASTAL ADAPTATION AND PROTECTION, COMMONWEALTH OF VIRGINIA; RICARDO S. PINEDA, P.E., C.F.M., CHAIR, ASSOCIATION OF STATE FLOODPLAIN MANAGERS, SUPERVISING WATER RESOURCES ENGINEER, CALIFORNIA DEPARTMENT OF WATER RESOURCES, DIVISION OF FLOOD MANAGEMENT, ON BEHALF OF THE ASSOCIATION OF STATE FLOODPLAIN MANAGERS; LOUIS A. GRITZO, PH.D., VICE PRESIDENT OF RESEARCH, FM GLOBAL; MELISSA SAMET, SENIOR WATER RESOURCES COUNSEL, NATIONAL WILDLIFE FEDERATION; AND JULIE A. UFNER, PRESIDENT, NATIONAL WATERWAYS CONFERENCE

General GALLOWAY. Thank you very much, Madam Chairman. Chairwoman Napolitano, Chairman DeFazio, Ranking Member Westerman, members of the committee, it is a distinct pleasure for me to be here today for this very timely hearing.

I am professor of engineering and I am also acting director of the Center for Disaster Resilience at the Clark School of Engineering at the University of Maryland. I came to Maryland from a 38-year career in the Army and 8 years' service in the Federal Government, most of which has been associated with water resources management.

In 1993 and 1994, I was privileged to work in the White House to lead an interagency study of the causes of the great Mississippi River flood of 1993, and to make recommendations to the President concerning the Nation's flood plain management. And more recently, I have had an opportunity as a member of the National Academy of Engineering to participate in two studies defining the importance of using resilience principles to better deal with growing natural disasters.

Resilience in the water world requires an ability to identify the growing risks that face us, to plan and prepare to deal with these risks, absorb the impact of a major hazard event without collapse, take a hit and still stand on your feet, and then come back better after the event because you have prepared before the disaster for this. It is a new approach to dealing with these kinds of disasters.

Since 1936, millions of Americans have been protected from the disastrous consequences of floods by projects authorized and funded by this Congress, yet we are seeing flood losses continuing to increase.

Today, we face a turning point as the combination of pressure for development, deteriorating infrastructure reaching the end of its usable life, failure to complete flood damage reduction projects that are waiting in line, and changes in climate and weather place major challenges in front of us. You do not have to look more than at the 2019 Midwest floods and the Hurricanes Harvey, Irma and Maria in 2017 to provide a glimpse at the vivid proof of the power of nature.

We also face a long-ignored and growing challenge of our flooding in urban areas, where considerable losses occur on a repetitive

basis as a result of our inability of outdated and undersized drainage systems to handle the increasing number of heavy precipitation events that we are seeing, as opposed to just the riverine events. In 2006, as many of you know, Constitution Avenue in Washington was under 3 feet of water. And in 2014, Metro Detroit suffered a major rainfall event that cost $1.8 billion, not from rivers but from the rainfall. Much of this is caught in the gap between flood and stormwater management and exacerbates an already inequitable treatment in providing flood risk reduction in low-income areas in these urban and rural communities.

There is a great opportunity ahead to incorporate resilience principles to modernize and make more flexible the development of water resource infrastructure and its associated management. From 1936 on, Congress has worked hard to do the right thing. Now is the time to replace 20th-century approaches with 21st-century resilience principles.

Building resilience to flooding will require recognition that all projects will not be able to be fully funded at the level of protection or service desired. You just cannot build to the supreme heights that many people would like to have. And as a result, planning for emergency measures and the possibility of flooding beyond the project design must be included in projects, and funding for that planning must be provided as the project is designed. It is going to take an extra effort in planning.

We must see coordination across all levels of Government in project development, not just in organizational silos. This will require breaking down barriers among agencies and their programs to maximize project effectiveness. Just as you all are doing with the WRDA 2018 review, Federal regulations on where USACE can carry on flood projects, the 800 cubic feet/second rule that came up, it is very important that we do let the agencies work together. Congress must remove its restrictions on USACE use of the more modern and broader-based principles, requirements, and guidelines for project justification. These restrictions on use of PR&G do not make sense anymore, restrict full consideration of social and environmental flood risk reduction benefits and limit project innovation, and fail the economically less fortunate.

Reports are made on flood disasters as they occur, but little is done to implement most of these recommendations found in the reports. Disaster preparation and resilience requires consideration of lessons learned as they are presented.

Lastly, resilience cannot be obtained if there is no funding. And this is something you all are well aware of. It is a challenge everywhere we go, that smaller communities cannot handle this.

This is a great opportunity ahead and I look forward to helping in any way that I can. Thank you.

[Mr. Galloway's prepared statement follows:]

Prepared Statement of Gerald E. Galloway, P.E., Ph.D., Brigadier General, U.S. Army (Ret.), Acting Director, Center for Disaster Resilience, A. James Clark School of Engineering, University of Maryland

Chairperson Napolitano, Ranking Member Westerman, Members of the Committee. It is a distinct privilege to participate in this important and timely hearing

and I want to thank the Committee for the opportunity. I am Gerald E. Galloway, a Glenn L. Martin Institute Professor of Engineering and Acting Director, Center for Disaster Resilience at the A. James Clark School of Engineering, University of Maryland, where I teach and do research in water resources and natural disaster management. I came to that position following a 38-year career in the US Army and eight years service in the federal government, most of which was associated with water resources management. I served for three years as District Engineer for the Corps of Engineers in Vicksburg, MS and later, for seven years as a member of the Mississippi River Commission. From 2009–2018 I served as a member of the Governor of Louisiana's Advisory Commission on Coastal Protection, Restoration and Conservation and from 2016 to date as a member of the Maryland Coast Smart Council. I am currently a member of the Advisory Board of the Center of Climate and Security, and Vice Chair of the CNA Military Advisory Board dealing with climate change and national security. In 1993 and 1994, I was privileged to be assigned to the White House to lead an interagency study, *Sharing the Challenge*, of the causes of the Great Mississippi River Flood of 1993 and to make recommendations to the President concerning the nation's floodplain management program.[1] More recently, I have had the opportunity as a member of the National Academy of Engineering to participate in two studies defining and discussing the importance of building resilience in our nation as a means of reducing the impacts of natural and anthropogenic disasters.

Our nation has been dealing with natural disasters over its entire history. As technology changes we see more opportunities for anthropogenic disasters. Over the last several decades we have witnessed an increase in the severity and length of water related disasters and while they affect all aspects of water resources infrastructure—water supply, navigation, hydropower, environmental sustainability, etc., in the interest of time, I will limit my testimony to discussing the challenges we face in dealing with flood risk and how the 21st century is and will be requiring the nation to rely heavily on resilience to deal with these increasing challenges.

In 1936, the US Congress passed a flood control act, launching the federal government into a major effort to reduce flood losses that were occurring throughout the United States. Even though millions of Americans have been protected from the disastrous consequences of floods by projects authorized and funded by the Congress, flood damages continue to increase. As we approached the present century, we began to face a turning point as the combination of pressure for development, frequently in unsuitable locations, deteriorating infrastructure, failure to complete planned flood damage reduction efforts, and changes in climate and weather threatened to place major challenges in front of us. During the last decade of the 20th century major floods in the United States and abroad caused nations around the world to move from flood control to managing flood risk and recognizing that we must be prepared to deal with these uncertain futures—to be resilient to what comes. It is time to consider new concepts that will promote our resilience in the managing our water resources infrastructure in general and of our flood risks in particular.

THE FUTURE

Driving our future will be:

- Significant changes in how the weather and climate are affecting our nation and the world. 2020 will not look like 1936 weather-wise. The areas subject to flooding are increasing as sea level rises and storm events grow in intensity and length. The 2020 Midwest Floods, Hurricanes Harvey, Irma, and Maria in 2017 and the Detroit Flood in 2014 provided vivid proof of the power of nature and how it is changing.
- Population growth and development in risk areas. Many communities and states are not controlling development in high risk areas when it is occurring and many people who move into such areas are unaware of the risks they face
- Deteriorating infrastructure. Much of the infrastructure in which we have invested is reaching the end of its usable life and we are not maintaining or updating it as needed. Many projects can no longer deal with the flood threats they face today. Some of this infrastructure was built under federal programs but much is the result of decades of local construction and operation. In many areas there is no comprehensive management of the complex system of dams,

[1] Interagency Floodplain Management Review Committee, Executive Office of the President. 1994. Sharing the Challenge: Floodplain Management into the 21st Century. Washington, GPO. (available at http://www.floods.org/Publications/free.asp)

levees and other structures that protect a watershed's residents and their economy, Thousands of miles of levees do not meet national standards.
- Growth in billion-dollar disasters. Although there have been increases in the number of floods, the value of property in high risk areas has also increased.
- Inequitable treatment in providing flood risk reduction to low-income communities This is most obvious in low-income areas across the nation and results from the criteria we use to develop and approve projects and programs.
- The growing challenge of flooding in urban areas where considerable losses occur on a repetitive basis as a result of an inability of outdated and undersized systems to handle the increasing number of heavy precipitation events as opposed to riverine flood events. In 2006, Constitution Avenue in Washington, DC, was under three feet of water from rainfall flooding the Federal Triangle. In 2014, the Detroit, Michigan metro area suffered a major rainfall event that caused over $1.8 Billion in damages.[2]

RESILIENCE AS AN ANSWER

If we accept that we do face future significant flood threats and do realize that we will not have the resources to address all flood risks with structural projects, we must turn to resilience to help us face reality. In 2009, nine federal agencies came to the National Research Council of the National Academies of Science, Engineering and Medicine (NASEM) and asked the NASEM to examine how attention to resilience might assist in the reduction of the impacts of natural disasters. In 2012, an Academy committee issued a report that defined resilience as:

> "The ability to prepare and plan for, absorb, recover from or more successfully adapt to actual or potential adverse events."[3]

Similar definitions began to shape programs of the government, business and non-governmental organizations. Resilience requires, in its preparation and planning phase, that those facing these disasters adequately identify the hazards with which they might have to address and develop the plans that they would have to make to deal with them. As you will hear this morning from other panelists, the integration of resilience into the day-to-day operations of government agencies at the state and local level, businesses, and even non-governmental organizations continues to grow.

Becoming resilient requires communities and those practicing resilience in such areas as building infrastructure to follow a path that leads to full consideration of what is necessary to be able to recover from a disaster. It all begins with identifying the risks that must be faced. You cannot be prepared to deal with a potential disaster if you don't know what it might be. in looking at risks, the tendency is to take the easiest path and deal with the "get by" approach. This just doesn't work. Risk must be defined in its complete terms and across the spectrum of consequences. In the flood world, all too often, risk consideration is limited to what flood was last seen, rather than the flood that could be most devastating. True resilience also requires consideration of the impact of a flood on all elements of the community as the interdependence of communities' health, social welfare, environment, governance and economy are all closely tied to the total well-being of the community.

The community must also develop a strategy for dealing with its risk as it seeks to mitigate the consequence of a hazard event. It frequently becomes obvious that a desired solution to deal with the potential risk, e.g. no losses, cannot be accommodated with the resources available to the community. The strategy must consider how to handle a more severe event. Plans must be developed to deal with a variety of conditions and clear decisions must be made on what is to be implemented. Even if the ultimate plan cannot be funded, communities must plan for what happens under those circumstance—e.g. the new levee is not complete or is overtopped. How will the community survive? How can steps taken ahead of time dampen these consequences to allow the community to bounce back.

All the above actions require close cooperation and coordination within the affected communities and the state and federal agencies that are assisting them. This mean everybody must be at the table as they develop their strategies and parochial turf issues must be avoided.

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[2] In 2018 and 2019, the University of Maryland and the Texas A&M University, NASEM, the Association of State Floodplain Managers, and the National Association of Flood and Stormwater Management Agencies prepared reports identifying the growing threat of urban flooding.

[3] Disaster Resilience: A National Imperative. Washington: National Academy Press. 2012

PROMOTING RESILIENCY OF OUR NATION'S WATER RESOURCES INFRASTRUCTURE

Bringing the concepts of resilience into the 21st-century management our nation's water resources infrastructure will require implementation of new ways of doing business.

Resilience requires:

- Considerably greater cooperation and coordination among federal agencies, among federal, state, tribal and local entities, and ultimately, considerably more refined all-hands effort in dealing with specific problems. In a 1989 report, the western governors identified some major causes of conflict and frustration with current federal water policies, "A principal characteristic of federal water policy is that policies are made in an ad hoc, decentralized manner. No agency of the executive branch or committee of Congress is responsible for keeping an eye on the "big picture."

  The late Chairman of this Committee, Congressman Jim Oberstar, in 2009, indicated that "the efforts of Federal agencies can overlap and at times conflict, and currently, there is no body within the Executive branch to provide substantive coordination or, if necessary, resolution of disagreements among agencies to ensure needed collaboration." He indicated that at that time, "the diverse water resources challenges throughout the United States are often studied, planned, and managed in individual "silos," independently of other water areas and projects. Generally, this has resulted in local and narrowly focused project objectives with little consideration of the broader watersheds that surround these projects." [4]
- Having program goals and objectives that reflect the needs of all sectors of the community. Chairman Oberstar also saw a need to have a "National—not a Federal—vision" on how to meet current water resource needs and how to address future water resource needs and challenges.
- Carrying out effective and inclusive planning at all levels. Every community should have a resilience plan that is developed in coordination with its partners—other government and all segments of its population, but such planning requires funding and there is little to be had.

WHAT CAN BE DONE?

If resilience is to be feasible, problems must be confronted and solved and not ignored. Following the Great 1993 Mississippi Flood considerable attention initially was placed on acting on the recommendations of the "Sharing the Challenge" report, including management of levees at all levels, development of a comprehensive plan for flood management, improving coordination of federal and state coordination, etc. However, after three years, in the face of limited support in the Congress, the Administration halted its efforts. In 2005 FEMA produced a report indicating that likely most non-federal levees did not meet standards. The 2009, National Report on Levee Safety, initiated following levee failures during Hurricane Katrina, reported a similar condition in the nation's levees.[5] Because of major flood losses resulting from levee failures or overtopping during the 2008 Midwest floods. The Senate EPW Committee directed the Assistant Secretary of the Army to prepare a report indicating the status of implementation of the recommendations of the "Sharing the Challenge report. Although the submittal indicated that considerable work still needed to be done no action was taken. Following the 2011 Midwest flood, the Committee asked again for a report and following the submittal no action was taken. Analysis of the levee failures in the 2019 Midwest flooding will likely result in a replication of previous analyses and reports. Owners and operators of non-federal levees lack the resources to deal with the aged and unsatisfactory levees, and the arguments that exist over federal or state or local responsibilities make it difficult to come up with a satisfactory solution as to where to find resources to fill funding vacuums.

Policies that create boundaries along agencies or between agencies or hinder cooperative efforts and deprive those in need the assistance they require make little sense. Action taken by Congress, in the 2018 WRDA, required review of a provision in the law that limits USACE's authority to deal with flood situations in urban

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[4] Honorable James L. 0berstar, Remarks before the USACE Conference, "Collaborating for A Sustainable Water Resources Future" August 27, 2009

[5] National Committee on Levee Safety (NCLS). 2009. Draft Report to Congress on Recommendations for a National Levee Safety Program. Washington: US Army Corps of Engineers. Available at http://www.iwr.usace.army.mil/ncls/docs/NCLS-Recommendation-Report__012009__DRAFT.pdf

areas where the flow is under 800 cubic feet/second. Removing this restriction could open problem solutions to multiple agencies and create cooperative ventures.

Continuing reliance primarily on economic justification of projects makes it difficult for those in rural and low-income areas to justify projects that would give them considerable social and conceivably health benefits. The recent NASEM studies of affordability of flood insurance gives a very clear picture of the differential level of flood protection under various economic situations and strong reason to consider all factors in project justification. Congressional restrictions on USACE use of more modern and broader based guidelines for project justification do not make sense and restrict full consideration of the flood risk reduction needs of the less fortunate.

IN CONCLUSION

There is a great opportunity ahead to incorporate resilience principles in the development of water resources infrastructure. From 1936 on Congress has worked hard to do the right thing. As we move in the 21st-century, now is the time to do it.

Mrs. NAPOLITANO. Thank you, Dr. Galloway.

Ms. Phillips, you are recognized for 5 minutes.

Admiral PHILLIPS. Thank you, Madam Chairwoman. Chairwoman Napolitano, Chairman DeFazio, Ranking Member Westerman, members of the subcommittee, thank you for the opportunity to testify to you all today on this very important topic.

My name is Ann Phillips. I serve as the special assistant to the Governor of Virginia for coastal adaptation and protection. I am a retired surface warfare officer. I drove and commanded ships for the United States Navy for 31 years, retiring in 2014 as a rear admiral and commander of Expeditionary Strike Group 2. Since then, I have been involved in multiple efforts to highlight the impacts of climate change on national security and now focus on preparing Virginia's coastal infrastructure for the impact of sea level rise and recurrent flooding.

Climate change has a significant impact on coastal communities and Federal infrastructure in Virginia today. We deal with water where we did not plan for it to be and that impedes the expected pattern of our lives, commerce, and national security in some form with increasing frequency.

This committee can help by aligning Corps planning standards, feasibility studies, benefit-cost analysis processes and by prioritizing environmental restoration and flood control projects over or separately from navigation projects and reducing the flood control project backlog to prioritize the expanding needs of coastal States dealing with rising waters and recurrent flooding.

In Virginia, we have over 10,000 miles of tidally influenced shoreline, the eighth longest in the country as defined NOAA, ranked just behind Texas. We have experienced over 18 inches of relative sea level rise in 100 years and expect to see that again by midcentury. Duration, severity, and impacts of flooding have all increased substantially. We are not simply preparing; we are already living with water.

We have a water-based economy, all at risk. Our cornerstones are our Federal presence, arguably the largest concentration in the Nation, including our largest naval base, Naval Station Norfolk; the Port of Virginia, sixth largest container port by traffic volume in the country; beach and water-related tourism; aquaculture, fisheries, waterfront properties and housing stock.

Virginia localities in the Commonwealth have partnered with the Corps on two coastal storm risk management studies, both recommended by the North Atlantic Coast Comprehensive Study in 2015. The city of Norfolk completed their feasibility study this year and has entered preconstruction engineering design phase. The northern Virginia study, which includes Potomac River from Great Falls to Prince William, started July 15 this year. These studies help to further define the needs of communities dealing with rising waters, but they do not give a complete and comprehensive understanding of the impacts across coastal Virginia. To do that, Virginia needs a full coastal study. And we have the authorization from the 2018 Water Resources Development Act. But we need Corps and this committee's support to appropriate funds ultimately for this work.

The protection of substantial critical national infrastructure is at stake. Such studies must include Federal and, in particular, DoD infrastructure, where applicable. Civil Works studies typically do not include DoD infrastructure, due to restrictions on funding sources.

Norfolk's study, as an example, did not include the impacts to or outcomes from storm surge or recurrent flooding to Naval Station Norfolk or Naval Support Activity Hampton Roads, as related to impact on city infrastructure. Both of these are within the boundaries of the city of Norfolk. Both are on the Navy's list of most critical impacted facilities.

We have a further challenge in Virginia, in that the Sewells Point tide gauge, our primary data source due to its long historic record, based on observed data, now exceeds the sea level rise projections of the Corps' preferred intermediate curve. This means that analysis using the intermediate curve can underestimate the rate of change and future impacts, which could result in underengineered and underdesigned solutions before projects get to the design and build phase. Using these conservative curves, the Corps is shooting behind the duck. It risks wasting Federal dollars in a tail chase to address an accelerating problem.

Under Governor Ralph Northam, Virginia is taking bold and substantive action to address this threat, assigning three Executive orders directing creation of a coastal master plan, establishing a council on environmental justice and setting flood plain management requirements and planning standards for State agencies. But even with strong State action, we cannot do this alone. The work of this committee is vitally important to protecting people and property.

This committee must help States organize and prioritize flood control projects with the Corps, align Corps planning standard studies and cost analysis processes, reduce the backlog, again, and prioritize coastal States dealing with the new challenges of rising waters and recurrent flooding.

Virginia is committed to building capacity for our coastal communities and to collaborating with our Federal partners to prepare for and build resilience to this threat. We have no time to waste. My favorite saying: Time and tide wait for no man.

Thank you for the opportunity to testify before this committee and I look forward to your questions.

[Ms. Phillips' prepared statement follows:]

Prepared Statement of Ann C. Phillips, Rear Admiral, U.S. Navy (Ret.), Special Assistant to the Governor for Coastal Adaptation and Protection, Commonwealth of Virginia

Chairman Napolitano, Ranking Member Westerman and distinguished Members of the Subcommittee, thank you for the opportunity to testify to you today. It is a privilege to be before you at this hearing to discuss this very important topic.

My name is Ann Phillips, and I currently have the honor to serve as the Special Assistant to the Governor of Virginia for Coastal Adaptation and Protection. I am a retired Surface Warfare Officer—I drove and commanded ships for the United States Navy for 31 years, served abroad in Guam and Lisbon, Portugal, and operated extensively with NATO and Partnership for Peace nations. I retired in 2014 as a Rear Admiral and Commander, Expeditionary Strike Group TWO. My experience in coastal adaptation and protection, along with climate and national security, stems from my work as Chair of the Surface Force Working Group for the Navy's Task Force Climate Change while still on active duty, and from my work since retiring, chairing the Infrastructure Working Group for the Hampton Roads Intergovernmental Sea Level Rise Pilot Planning Project from 2014 to 2016, as a member of the Advisory Board of the Center for Climate and Security, and on the Board of Directors for the Council on Strategic Risks.

Today, I've been asked to address the impact of the Water Resources Development Act and ensuing US Army Corps of Engineers actions and activities from the perspective of coastal states and coastal communities, and how Virginia is preparing to adapt and protect its coastal infrastructure from the impact of sea level rise and recurrent flooding. Virginia's priorities are to identify critical infrastructure that is vulnerable to rising waters and recurrent flooding; to determine the best and most practical, innovative and cost effective solutions to adapt and protect that infrastructure; to use creative and less costly green or green-gray infrastructure approaches to protect more dispersed assets and to ensure environmental equity for underserved communities; and to leverage federal, state and local funds to help make Coastal Virginia more resilient to climate change.

SETTING THE STAGE

Climate change has a significant and intensifying impact on our coastal communities in Virginia today. Rising sea levels lead to recurrent nuisance flooding, caused by high tides, accompanied by wind, and/or increased intensity and frequency of rainfall, or any combination of the three. These circumstances intensify the impact of coastal storms and hurricanes and the accompanying flooding and storm surges. Coastal Virginia deals with water where we did not plan for it to be, and that impedes the expected pattern of life, in some form, nearly every day. From October 8th to October 13th, Hampton Roads experienced above flood stage sunny-day flooding, caused in part by storms off shore and wind from the North East, for 10 consecutive high tide cycles over 5 days, impeding access and blocking traffic flow in and around the region.[1] This is our "new normal"—it affects every aspect of our lives in ways that we do not yet understand, or even realize.

In Virginia, we have over 10,000 miles of tidally-influenced shoreline.[2] Virginia has the eighth longest tidally-influenced coastline in the country, ranked just behind the state of Texas.[3] [4] We have experienced over 18 inches of sea level rise in 100 years, as indicated by NOAA Sewell's Point tide gauge at Pier Six, Naval Station Norfolk. With an average of 4.66 mm of sea level rise per year, Virginia has one of the highest rates of relative sea level rise change of any state on the East Coast

[1] "Water Levels—NOAA Tides & Currents," accessed November 12, 2019, https://tidesandcurrents.noaa.gov/waterlevels.html?id=8638610&units=standard&bdate=20191005&edate=20191015&timezone=GMT&datum=MLLW&interval=6&action=.

[2] MR Berman et al., "Virginia—Shoreline Inventory Report: Methods and Guidelines, SRAMSOE No. 450." (Comprehensive Coastal Inventory Program, Virginia Institute of Marine Science, 2016).

[3] NOAA Office for Coastal Management, "Shoreline Mileage of the United States," 1975.

[4] Berman et al., "Virginia—Shoreline Inventory Report: Methods and Guidelines, SRAMSOE No. 450."

of the United States, including the Gulf of Mexico.[5] We are also experiencing land subsidence—most evident in areas where there is heavy use of water from our aquifers. Land subsidence varies across Coastal Virginia, and can range from as much as 40% to as little as 0% of the observed relative sea level rise.[6] Since the late 1990s, the duration, severity, and impacts of flooding have all increased substantially.[7]

OBSERVED DATA SEA LEVEL RISE PROJECTIONS EXCEED USACE INTERMEDIATE CURVE IN VIRGINIA

Current scientific projections, as documented by the Virginia Institute of Marine Science Sea Level Report Card, show that our sea levels will continue to rise and the rate of rise will accelerate, such that we expect an additional 18 inches of relative sea level rise by mid-century. Of particular interest to this committee is that using VIMS Sea Level Report Card, based on actual tide-gauge analysis for Sewell's Point, current sea level rise projections through 2050 exceed those of the USACE Intermediate curve (USACE–INT), the default curve USACE uses for its analysis and Coastal Storm Risk Management Studies.[8]

What this means is that any analysis using the USACE INT Curve is, again by default, underestimating the rate of change, depth, and future impacts, which results in under engineered and underestimated solutions—before the projects enter design phase. In essence, by using these very conservative SLR scenario-planning curves, and not considering local analysis and rates of change, USACE is "shooting behind the duck"—wasting Federal dollars in a tail chase to address an ever-expanding problem and delivering under-designed and under-engineered outcomes, rather than getting ahead of them with risk-informed analysis. While localities may work with USACE to use higher sea level rise projections to accept less risk, any additional cost to designed outcomes falls to the locality and is not shared under USACE cost share provisions.

VIRGINIA'S UNIQUE RISK

We have a water-based economy in Coastal Virginia. The cornerstones of that economy are:

- *Our Federal presence, arguably the largest concentration in the nation*—in particular Department of Defense with Navy as the largest service represented, and including the substantial commercial industry surrounding military and commercial shipbuilding, maintenance and repair
- *The Port of Virginia*—large and expanding capacity with multi-modal access reaching from the East Coast to west of the Mississippi River
- *Beach and Water-related Tourism*
- *Water-adjacent and dependent agriculture, aquaculture, fisheries, commercial property, and housing stock*

All of this is supported by critical public and private utility and transportation infrastructure, as well as a substantial medical/hospital presence, and the universities, schools, and public infrastructure sustaining cities, counties and towns, along our coast.

Virginia's high military concentration is tied to the water by the very nature of its mission, and at risk from the threat of sea level rise and climate change impacts. In their 2016 report, "The Military on the Front Lines of Rising Seas," the Union of Concerned Scientists found that a 3 foot increase in sea level rise would threaten 128 coastal DOD installations in the United States, 43% of which are Navy facilities valued at roughly $100 billion.[9] In its own 2019 "Report on Effects of a Changing Climate to the Department of Defense," the Department found that 53 of its mission-critical facilities are currently vulnerable to recurrent flooding, with 60 such fa-

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[5] "Sea Level Trends—NOAA Tides & Currents. Sewell's Point VA Station.," 2019, https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8638610.

[6] D. P. S. Bekaert et al., "Spaceborne Synthetic Aperture Radar Survey of Subsidence in Hampton Roads, Virginia (USA)," *Scientific Reports* 7, no. 1 (2017): 14752, https://doi.org/10.1038/s41598-017-15309-5.

[7] T Ezer and L Atkinson, "Sea Level Rise in Virginia—Causes, Effects and Response," *Virginia Journal of Science* 66, no. 3 (2015): 355–59.

[8] "Norfolk, Virginia—Virginia Institute of Marine Science," Norfolk, Virginia Sea-Level Report Card, accessed July 17, 2019, https://www.vims.edu/research/products/slrc/localities/nova/index.php.

[9] "The US Military on the Front Lines of Rising Seas," Executive Summary (Union of Concerned Scientists, 2016), https://www.ucsusa.org/sites/default/files/attach/2016/07/front-lines-of-rising-seas-key-executive-summary.pdf.

cilities vulnerable within the next 20 years. When other hazards from climate change are considered (wildfire, drought, desertification), 79 total DoD facilities are vulnerable at present. In Virginia, five Hampton Roads area facilities are on the US Navy and US Air Force list of most vulnerable infrastructure released in June 2019, including Naval Air Station Norfolk, Naval Air Station Oceana, Naval Support Activity Hampton Roads, Naval Support Activity Hampton Roads-Northwest Annex, and Joint Base Langley-Eustis.[10] A 2008 study by the Organization for Co-operation and Economic Development, ranked the Hampton Roads metropolitan area as the 10th most vulnerable in the world related to the value of assets at risk from sea level rise.[11]

The Department of Defense and our federal partners are the largest employers in the state [12] and Virginia's percentage of gross domestic product derived from the federal presence in the state is 8.9% (the highest percentage of any state).[13] Virginia also has the highest rate of defense personnel spending of any state, and is second only to California in defense contract spending and defense-related contract spending. The Hampton Roads region hosts federal facilities that are unique and not easily replicable in other locations, including our largest Naval Base, Naval Station Norfolk, as well as the only shipyard where we build aircraft carriers and one of only two places where we build nuclear-powered submarines—Newport News Shipbuilding, owned by Huntington Ingalls Industries. The City of Portsmouth is home to Norfolk Naval Shipyard, one of only four Navy-owned and operated nuclear repair shipyards in the United States, and very vulnerable to flooding. Joint Base Langley-Eustis, with Fort Eustis in the City of Newport News and Langley Air Force Base in the City of Hampton are also vulnerable. Langley AFB, which deals with rising water as a matter of routine, and has done considerable work to make its facilities resilient, has taken up much of the overflow from the impact to aviation training for the F–22 Strike Fighter from Tyndall Air Force Base after Hurricane Michael's impact on that facility last year.[14]

The Eastern Shore of Virginia hosts NASA's Flight Facility at Wallops Island, which includes the Virginia Space and Mid Atlantic Regional Spaceport, NASA flight test facility, National Oceanographic and Atmospheric Administration and Federal Aviation Administration facilities, and the Navy's Surface Combat Systems Center Range. These facilities are unique. For example, the Navy Surface Combat Systems Center Range, the only such test range on the East Coast of the United States, supports the majority of new construction combat systems training for the Fleet.

We also are home to the Port of Virginia, the third largest container port on the East Coast and sixth busiest port by container traffic volume in the United States. A multi-modal port with facilities located in Hampton Roads in the cities of Norfolk, Portsmouth and Newport News, and with barge service to the Port of Richmond and an Inland Port intermodal transfer facility in Front Royal, Virginia,[15] the Port of Virginia is the only East Coast port with federal authorization to dredge to a 55 foot channel depth, and generates a total of $60 billion in economic activity for the Commonwealth.[16] With a focus on sustainability, the Port of Virginia works to build resilience, aligned with the surrounding communities. Much like the regions' federal facilities, however, its future resilience is inextricably linked to that of the surrounding cities and other localities that support and provide its critical utilities, transportation, logistics, and supply chain infrastructure.

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[10] United States Department of Defense, "Report on Effects of a Changing Climate to the Department of Defense," January 2019, https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT-2019.PDF.

[11] RJ Nicholls et al., "Ranking Port Cities with High Exposure to Climate Extremes—Exposure Estimates," Environment Working Papers (Organisation for Economic Co-operation and Development. 2008.), http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/WKP(2007)1&doclanguage=en.

[12] "Virginia Statewide Community Profile" (Virginia Employment Commission, 2019). https://virginiawlmi.com/Portals/200/Local%20Area%20Profiles/5101000000.pdf

[13] "Defense Spending by State, FY 2017" (US Department of Defense, Office of Economic Adjustment, March 2019).

[14] "Tyndall AFB Personnel, F–22s Temporarily Relocate to Hawaii and Alaska," U.S. Indo-Pacific Command, accessed July 17, 2019, https://www.pacom.mil/Media/News/News-Article-View/Article/1682655/tyndall-afb-personnel-f-22s-temporarily-relocate-to-hawaii-and-alaska-bases/.

[15] "NAFTA Region Container Traffic—2017 Port Rankings by TEU's" (American Association of Port Authorities, 2017).

[16] "About the Port of Virginia," accessed July 18, 2019, http://www.portofvirginia.com/about/.

Coastal Virginia's substantial tourism industry generates direct travel-related expenditures exceeding $5.2 billion in our Coastal region[17]. Virginia boasts wide beaches, access to a myriad of water sports and recreational activities, as well as natural tidal marshlands, unique barrier island structures, and we are a critical stopover on the North Atlantic migratory bird flyway, all incredible facilities and natural amenities, and all at extreme risk.

Our substantial aquaculture and wild fishing industries generate over $1.4 billion in annual sales,[18] including oysters, crabs, and the largest clam industry on the East Coast of the United States.[19] These industries are vulnerable to both sea level rise and ocean acidification and warming. The infrastructure necessary for their success ties them to low-lying areas near the water—vulnerable to flooding—and accessibility to workplaces and docks is becoming a challenge during the more frequent high tide flooding that impacts road access, as well as activities on the waterfront. Ocean acidification and warming will affect the ability of some species to survive and reproduce in Coastal Virginia waters—in particular shellfish, endangering the wild-caught and grown seafood industry treasured by the Chesapeake Bay region.[20] For Virginia, this may be only a matter of time as such impacts have already been observed in the Pacific Northwest region of the United States, costing that region over $110 million dollars and putting 3,200 jobs at risk.[21]

Finally, our waterfront property and housing stock is a challenge we share with many other coastal states. Within the next 30 years—the lifespan of a typical mortgage—as many as 311,000 coastal homes in the lower 48 states with a collective market value of about $117.5 billion in today's dollars will be at risk of chronic flooding (more than 26 times a year or about every other week). By the end of the century, 2.4 million homes and 107,000 commercial properties currently worth more than $1 trillion altogether could be at risk, with Virginia's coastal real estate significantly exposed. The expected Virginia homes at risk in 2045 currently contribute about $23 million in annual property tax revenue. The homes at risk by 2100 currently contribute roughly $342 million collectively in annual property tax revenue.[22] In an ongoing Comprehensive Sea Level Rise and Recurrent Flooding Study conducted by the City of Virginia Beach and Dewberry, the annualized losses today in that City alone result in residential damages of $26 million annually due to coastal flooding events. If no action is taken, with 1.5 feet of additional sea level rise, expected within 20–30 years, that number increases to $77 million annually, and with 3 feet of additional sea level rise, forecast within 60–70 years, to $329 million annually, a 12-fold + increase.[23]

In terms of real estate value, research reported in the Journal of Financial Economics shows homes exposed to sea level rise are selling for approximately 7% less than equivalent properties that are unexposed to sea level rise and equidistant from the beach. Broken down in more detail, homes that may be inundated with one foot of sea level rise, trade at a 14.7% discount, and properties expected to be inundated after 2–3 feet of sea level rise, at a 13.8% discount.[24] This places Coastal cities and other localities under pressure to determine solutions to not only reduce the risk to these vulnerable properties, but to reduce the risk to their property tax base, without which they cannot remain viable. Yet coastal communities face challenges from another perspective, as the Credit Ratings agencies have begun to take notice of the

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[17] "The Economic Impact of Domestic Travel on Virginia Counties 2017: A Study Prepared for Virginia Tourism Authority" (U.S. Travel Association, August 2018), https://www.vatc.org/wp-content/uploads/2018/08/2017-Economic-Impact-of-Domestic-Travel-on-Virginia-and-Localities.pdf.

[18] "Fisheries Economics of the United States 2016" (U.S. Department of Commerce, NOAA National Marine Fisheries Service, 2018), https://www.fisheries.noaa.gov/content/fisheries-economics-united-states-2016.

[19] Thomas J. Murray and Karen Hudson, "Economic Activity Associated with Shellfish Aquaculture in Virginia 2012," https://www.vims.edu/research/units/centerspartners/map/aquaculture/docs__aqua/MRR2013__4.pdf.

[20] "Virginia Is Highly Vulnerable to Ocean Acidification" (Natural Resources Defense Council adopted from Ekstrom et al., 2015, February 2015), https://www.nrdc.org/sites/default/files/state-vulnerability-VA.pdf.

[21] "New Study: Rapid Ocean Acidification Threatens Coastal Economies in 15 States," 2015. NRDC Press Release https://www.nrdc.org/media/2015/150223.

[22] "Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate" (Union of Concerned Scientists, June 2018), https://www.ucsusa.org/global-warming/global-warming-impacts/sea-level-rise-chronic-floods-and-us-coastal-real-estate-implications.

[23] CJ Bodnar, "Comprehensive Sea Level Rise and Recurrent Flood Study" (Dewberry and City of Virginia Beach, May 2019), https://www.vbgov.com/government/departments/public-works/comp-sea-level-rise/Documents/slr-update-ccouncil-5-7-19.pdf.

[24] A Bernstein, M Gustafson, and R Lewis, "Disaster on the Horizon: The Price Effect of Sea Level Rise," *Journal of Financial Economics*, 2018.

risks carried by localities exposed to rising waters. The credit rating agencies are asking for detailed plans about localities' strategies to adapt and mitigate the risk as a criterion for retaining their credit and bond rating. The paradox is that some localities find themselves unable to issue any more debt to take action to better protect themselves and build their resilience because of the risk to their credit rating, as evaluated by the same ratings agencies that demand to know what they are doing to reduce the risk and vulnerability to their resilience, in order to retain their good credit. This is a problem today, and without adequate coastal analysis and protection, it will grow worse.

There are health risks too. Combined sewer systems exist in about 860 US Cities, with three of them in Virginia (Alexandria, Richmond and Lynchburg).[25] Combined Sewer Overflow events (CSO), pose a significant threat to public health and the environment—a threat that will only increase because of climate change. An EPA study found that climate change could lead to a 12 to 50 percent increase in storm events that lead to combined sewer overflow events[26], with 70 such events releasing a combined one billion gallons of sewage occurring nationwide between January 2015 and September 2016.[27] Additionally, sea level rise is a threat to coastal localities with outflow pipes that may be inundated in the future, (and some are already) preventing discharge without costly pumping systems, and introducing seawater that could damage the mechanical and biological integrity of wastewater treatment facilities.[28]

Further, increased flooding is also a threat to septic systems in rural areas, a tremendous and growing problem in much of rural Coastal Virginia, and in fact, in many Coastal states. Inundated leach fields cause Septic systems to fail, releasing contaminated water into the ground or surface water. Failing septic systems, as well as the absence of either septic or sewer systems, cause significant public health and water quality risks for rural communities throughout Virginia.[29] The risk of septic system failure is increasing as sea level rises and flooding occurs more frequently, creating a unique challenge for the many rural homeowners and localities who lack the resources and capacity to rehabilitate or replace their systems, or install expensive sewage treatment facilities.

VIRGINIA IS TAKING ACTION

Under Governor Ralph Northam, Virginia is taking bold and substantive action to identify risk and develop a strategic vision and actionable steps to prepare our coast. He intends to build capacity for Virginia as we set standards and define how we as a coastal state will approach this existential threat, and has taken a series of executive actions, through Executive Order 24, *Increasing Virginia's Resilience to Sea Level Rise and Natural Hazards*, signed November 2nd, 2018. With this Order, Virginia is directed to determine the vulnerability of and set standards for future built infrastructure throughout the Commonwealth, to make Commonwealth holdings more resilient. We have established and implemented a series of sea level rise scenario planning curves, to ensure the resilience of state-owned infrastructure and as recommendations for local governments and regions to use in planning and preparations for the future. We have also established a series of recommendations for first finished floor elevation for future constructed state-owned buildings that may be located in floodplains. And we have incorporated substantive changes to our National Flood Plain Program oversight and implementation structure, all as directed by Executive Order 45, signed November 14th, 2019 by Governor Northam.

Executive Order 24 also directs development of a Virginia Coastal Protection Master Plan to adapt and protect our coastal region. This plan will build on and align those actions which our localities and regions have already taken to prepare themselves for their future, and will lay out a series of recommended actions and strategies for our state to develop and prioritize how it will adapt and protect our valuable

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[25] A Kenward et al., "Overflow: Climate Change, Heavy Rain, and Sewage," States at Risk (Climate Central, September 2016), file:///C:/Users/dea29868/Downloads/Overflow__sewagereport__update.pdf.

[26] "A Screening Assessment of the Potential Impacts of Climate Change on Combined Sewer Overflow (CSO) Mitigation in The Great Lakes and New England Regions (Final Report)." (Washington, DC: U.S. Environmental Protection Agency, 2008).

[27] Kenward et al., "Overflow: Climate Change, Heavy Rain, and Sewage."

[28] Ben Bovarnick, Shiva Polefka, and Arpita Bhattacharyya, "Rising Waters, Rising Threat: How Climate Change Endangers America's Neglected Wastewater Infrastructure" (Center for American Progress, October 2014), https://cdn.americanprogress.org/wp-content/uploads/2014/10/wastewater-report.pdf.

[29] Jamie Huffman, Sarah Simonettic, and Scott Herbest, "Onsite Sewage Systems: Background, Framework, and Solutions" (Virginia Coastal policy center, Fall 2018).

and vulnerable coastline. In this context we view it as essential to work with our federal partners, in particular the Corps, as we move forward to better prepare our state, regions, localities, and communities, to build trust, and demonstrate value. Finally, Executive Order 24 will serve to coordinate, collaborate, and communicate across state entities, across and with federal entities, and across our Coastal regions, communities, and localities to ensure coordinated objectives, and the best use of scarce funding dollars.

Virginia has identified four key areas of focus. First, the use of natural and nature-based solutions where feasible, as the first line of defense and to protect vulnerable built assets while also protecting sensitive coastal environments. Second, we are focused on collaborative efforts at every level, working with and across localities to expand the capacity of their dollars, of state dollars, and where possible, of federal dollars. Third, we are committed to ensure environmental justice, as underserved communities often bear the most substantial brunt of flooding challenges, and yet have the least capacity to plan, apply for grant dollars, determine or meet federal and state match requirements, and to sort out solutions to fund and implement actions to keep their communities and their histories viable into the future. Executive Order 29, establishes the *Virginia Council on Environmental Justice*, specifically to help address these issues and challenges.[30] Finally, we will facilitate the adoption of resilience practices across federal, state, and local agencies and processes.

HOW THIS COMMITTEE CAN HELP/RECOMMENDATIONS FOR CONGRESS:

The Commonwealth of Virginia works closely with the US Army Corps of Engineers across a number of programs, including the Feasibility Study 3x3x3 process and Continuing Authorities programs.[31] Both processes allow Army Corps Districts to work with local governments to study the needs of communities dealing with rising waters and storm surge. Related to recommendations from the 2015 North Atlantic Coast Comprehensive Survey—completed by USACE North Atlantic Division—the City of Norfolk and USACE Norfolk District completed a Feasibility study in February of 2019 and have proceeded to the preliminary engineering design phase.[32] The second recommended study area, Potomac River shoreline in Northern Virginia, has just started a Coastal Storm Risk Management Study (July 15 , 2019) under the auspices of the Baltimore District, USACE, with the Metropolitan Washington Council of Governments as the non-federal sponsor, and the Commonwealth of Virginia as one of several cost share partners.[33]

SUPPORT AND APPROPRIATE FUNDS FOR A FULL COASTAL STUDY IN VIRGINIA:

In 2018, the Water Resources Development Act authorized a Full Coastal Study for Virginia, to include flood risk management, ecosystem restoration and navigation. This gives the Commonwealth the flexibility to include more than one city or municipality in the study area, critical to a region such as Hampton Roads, where multiple cities, localities, and federal facilities exist in close proximity.[34]

With this full coastal authorization, Virginia and the Corps should be able to conduct a detailed analysis of the risks and impact to Coastal Virginia, including our eight Coastal Planning Districts and Regional Commissions, from the ocean to the full extent of tidal influence—as well as our critical national security and port infrastructure, our valuable tourism, aquaculture industries, and our beautiful natural resources and natural coastlines. However, in working at the District Level, we have been told the Corps has no interest in conducting a full coastal study for Virginia, as we will never meet the benefit/cost analysis requirements, and that this authorization will simply serve to allow more than one locality to participate in USACE-led studies. When considering the economic impact of our Coastal Region, as described earlier in this testimony, we find it hard to understand this logic. As we

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[30] "Commonwealth of Virginia Executive Order 29" (Office of the Governor, January 22, 2019), https://www.governor.virginia.gov/media/governorvirginiagov/executive-actions/EO-29-Establishment-Of-The-Virginia-Council-On-Environmental-Justice.pdf.

[31] "The Corps Feasibility Study—Finding a Balanced Solution," Headquarters, accessed September 16, 2019, https://www.usace.army.mil/Media/News-Archive/Story-Article-View/Article/643197/the-corps-feasibility-study-finding-a-balanced-solution/.

[32] "North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk," Study (United States Army Corps of Engineers, 2015), https://www.nad.usace.army.mil/CompStudy/.

[33] "Northern Virginia Coastal Study," accessed September 16, 2019, https://www.nab.usace.army.mil/DC_Coastal_Study/.

[34] "Water Resources Development Act of 2018," Pub. L. No. H.R. 8, § 201 (9) (2018), https://www.congress.gov/bill/115th-congress/house-bill/8/text.

work to develop our own Coastal Master Plan to protect and adapt Coastal Virginia, the top priority is to conduct a full coastal analysis, to gain a detailed and multi-layered understanding of that infrastructure that is critical and vulnerable, so that we can identify and prioritize impact, solutions, and costs. This will be true for every Coastal State, and the longer we wait, the less prepared we, as a nation, will be for this threat.

INCLUDE DOD PROPERTIES AND FEDERAL INFRASTRUCTURE IN STUDIES—THIS IS ESSENTIAL FOR VIRGINIA

The challenge for any USACE civil works study is that such studies do not include Federal property, as dictated by restrictions to funding appropriations sources, and so require additional coordination between USACE, DOD, State and local participants to align appropriated funding. As an example, the Norfolk CSRM study only includes the City of Norfolk, and did not include a similar level of effort or the impacts to or outcomes of storm surge and recurrent flooding for Naval Station Norfolk or Naval Support Activity Hampton Roads. Both facilities have extensive territory within their fence line in the Coastal, 100 year and 500 year flood plains, with watersheds that extend into the City of Norfolk—by excluding them, the study is incomplete. Further, by only doing one city and not considering regional watershed impacts broadly, the study is further incomplete. This in no way lessens the need for outcomes defined within the Norfolk Flood Control Feasibility Study, in fact, it drives home the need for a broader and more thorough full Coastal Study of Virginia by the Corps, one that engages both the civil works and military construction sides of USACE.

BEACH RENOURISHMENT MAY NOT BE A LONG TERM SOLUTION.

NASA's Wallops Island Flight Test Facility is also entirely in the Coastal Flood Plain and with billions of dollars in critical national infrastructure at risk. The current plan for protecting Wallops Island is ineffective as a long-term strategy, relying on beach renourishment every five years at a cost exceeding $50 million, and with limited consideration for sea level rise impacts.[35] [36] USACE is the contracting authority in support of the current NASA Wallops Beach renourishment project, which has State permitted approval, and this pending renourishment should be effective short term. However, current sea level rise projections show an additional 3 to 4.5 feet of sea level rise over the next 60 years for the area, which further reinforces the need for studying long term impacts, as a part of a full Coastal Study, to better understand potential damaging side effects from renourishment, and to determine options and strategies to adapt and protect this critical and important facility.

This demonstrates the problem with benefit-cost analysis in the short term, versus understanding the longer-term climate impact—and costing more in the end to taxpayers. Again, the longer we delay in determining and considering broader outcomes, the fewer options remain, and the more costly they become. We recommend that the Committee consider changes to the USACE benefit-cost formula to ensure that non-structural and long-term climate adaptation solutions pass muster.

In addition, in a recent letter, Department of the Interior Secretary David Bernhardt wrote to Congressman Van Drew (NJ) announcing the Trump administration would change a 25-year-old policy to make it easier for coastal communities to take sand from protected ecosystems to improve or renourish beaches. Destroying protected ecosystems in favor of short-term flood abatement is not in the long-term interest of Virginia or the United States. We recommend the committee reverse this rule change in the next Water Resources Development Act.

FEDERAL AGENCY FUNDING ALIGNMENT

While USACE can work for DoD and other Federal agencies, they must be funded with DOD or other agencies' appropriations for such work, which does not often happen because of a lack of coordination. In a region like Hampton Roads, or on the Eastern Shore at NASA's Wallops Island Flight Test Facility—both with billions of dollars if critical national infrastructure at risk, the failure to include Federal facili-

[35] "NASA Wallops Island Shoreline Stabilization Project," accessed November 12, 2019, https://www.nao.usace.army.mil/About/Projects/NASAWallopsShoreline.aspx.

[36] "PEIS WALLOPS FLIGHT FACILITY SHORELINE RESTORATION AND INFRASTRUCTURE PROTECTION PROGRAM," Environmental Impact Statement (Wallops Island, VA: NASA, October 2010), https://code200-external.gsfc.nasa.gov/sites/code250-wffe/files/documents/SRIPP__Final__PEIS__Volume__I.pdf.

ties in Coastal Storm and Environmental planning by the Corps is a grave oversight.

Finally, language in the draft 2020 NDAA directs DOD to fund US Army Engineering Research and Development Center (ERDC) to undertake a national study of water related risks and vulnerabilities to military installation resilience, along with an assessment of ongoing or planned projects by the Corps of Engineers that may adapt such risks. This will help mitigate this challenge, but meanwhile, the gap in federal resilience planning alignment with the USACE Feasibility Study and larger study process continues, placing communities and military facilities at risk.

PRIORITIZE AND ORGANIZE USACE MISSIONS, FLOOD CONTROL PROJECTS AND STUDIES

Within the three primary missions of the USACE Civil Works Division, Navigation, Environmental Restoration and Flood Control, often work against each other, as navigation projects are a nearer term priority, often overshadowing costlier and longer-term flood control requirements. This results in navigation projects receiving funding at the expense of flood control, which further delays critical flood and water infrastructure projects. This Committee should consider the creation of some type of "firewall" or funding limit that considers navigation projects separately, and only evaluates them against other navigation projects so that flood control projects can be prioritized with dedicated funding. The USACE also needs to find a comprehensive way to evaluate whether navigation projects may be adversely impacting flooding or environmental restoration. The National Environmental Policy Act and Clean Water Act provide some protections, and those must be maintained or strengthened.

EVALUATE AND REDUCE USACE FLOOD CONTROL PROJECT BACKLOG

The U.S. Army Corps of Engineers (USACE) has a $96 billion backlog of authorized but unconstructed projects, while annual appropriations for the USACE Construction account under Energy and Water Development appropriations bills have averaged $2 billion in recent years. Congress has also limited the number of new studies and construction projects initiated with annual discretionary appropriations, with a limit of five new construction starts using FY2019 appropriations.[37] Since only a few construction projects are typically started each fiscal year, numerous projects that have been authorized by previous Congresses remain unfunded and backlogged. This problem has worsened in recent decades as Congress has authorized construction of new projects at a rate that exceeds USACE's annual construction appropriations. This drives competition for funds among authorized activities during the budget development and appropriations process, and only a few projects make it into the President's budget each year. Non-federal entities involved in USACE projects are frustrated with the extreme effort it takes to fund the projects their localities need, and again, those processes do not include federal bases that are within or adjacent to community boundaries.

The Corps must evaluate the complete list of back-logged projects for currency recommend to Congress which projects are not addressing current or future flooding needs, or are otherwise unnecessary, or do not address resilience, pre-disaster mitigation, or infrastructure and flood plain actions. Further, the Corps must assist states in the prioritization and aggregation of flood control projects so to streamline the most effective projects and reduce projects and studies that overlap or leave gaps in coverage along jurisdictional lines. Congress must instruct The Corps to prioritize projects that provide the greatest flood risk reduction and assist regions with the greatest economic needs, as well as prioritizing projects that are part of regional comprehensive plans.

DEVELOP AND PROMULGATE GUIDANCE FOR STATES AND LOCALITIES/INCLUDE AND VALIDATE COMMERCIAL AND ACADEMIC ANALYSIS

The Corps should develop guidance on addressing Sea Level Rise and pre-disaster mitigation. As an example, the Naval Facilities and Engineering Command released an excellent *Climate Change Planning Handbook: Installation Adaptation and Resilience* planning guide in January 2017, but with little follow-up on how and when facilities should use it. This document could be a key tool in federal facility resilience planning, and the Corps could either adopt it, or incorporate it in their guid-

[37] "Army Corps of Engineers Annual and Supplemental Appropriations: Issues for Congress" (Congressional Research Service, October 2018), https://crsreports.congress.gov/product/pdf/R/R45326.

ance to States and localities.[38] As the Corps begins new Feasibility Studies, Congress should ensure the Corps will accept and validate commercial and academic study work as the basis for, or in place of, a feasibility study (for example, Virginia Beach's own Back Bay study and storm water study discussed earlier). We simply cannot delay any longer, the costs and risk are too great.

EMPHASIZE GREEN INFRASTRUCTURE, AND DEVELOP EXPANDED BENEFIT/COST ANALYSIS THAT QUANTIFIES GREEN INFRASTRUCTURE AND NATURAL AND NATURE-BASED FEATURE (NNBF) BENEFITS, AND THE NEEDS OF UNDERSERVED COMMUNITIES

The Corps must move from a grey infrastructure/hardscape focus to one that emphasizes green infrastructure and natural and nature-based features wherever feasible. While ERDC has plenty of capacity to address such infrastructure through its Engineering with Green Infrastructure Initiative, its work is rarely considered in the Coastal Storm Risk Management process.[39]

Green infrastructure and NNBF's buy time, and in many circumstances, are more effective, and more cost-effective through reducing the amount of water overall, and by absorbing, capturing and slowing down run-off and floodwaters while providing ecosystem services and co-benefits. This is particularly valuable in the context of providing services to underserved communities, and ensuring environmental equity across communities. In summary, we need a fundamental reconsideration of BCA, including strong environmental review, quantification of green and NNBF infrastructure benefits, and consideration of environmental equity, given what we now know about costs and the longer term nature of climate change as a threat.

CONCLUSION

Virginia values its relationship with the US Army Corps of Engineers and their ongoing work with State agencies and localities. Virginia wants and needs a Full Coastal Study, and looks forward to working with USACE to plan, fund and implement our authorization.

There is an urgent need to align Corps planning standards, Feasibility Study, and benefit-cost analysis processes to better serve coastal States and their communities dealing with rising waters and recurrent flooding.

Federal facilities must be included in the Feasibility Study process, and guidance from the Corps on quantifying green infrastructure and natural and nature-based features, along with reducing and prioritizing the flood control project backlog, will expedite opportunities to reduce flood risk in communities across the nation. Rising waters and recurrent flooding know no political boundaries; they know no boundaries of wealth or race; they know no boundaries of society. Coastal communities and their Federal partners across Virginia and around the country are being impacted today.

This Committee can help by recognizing the need to align Corps responsibilities with sea level rise, recurrent flooding and coastal resilience as one of the country's greatest and most immediate needs.

Virginia is committed to building capacity for our coastal communities to prepare for and build resilience to this threat, and as one of many impacted coastal and riverine states, we need the support of a coordinated federal response to make this happen.

We have no time to waste because "Time and Tide wait for no man." (The words of Geoffrey Chaucer)

Thank you again for the opportunity to offer this testimony, and I look forward to your questions.

Mrs. NAPOLITANO. Thank you very much, Ms. Phillips.

Mr. Pineda, you are recognized.

Mr. PINEDA. Chair Napolitano and Ranking Member Westerman and Chairman DeFazio and members of the full committee, thank you for the opportunity to testify today in my role as chair of the Association of State Floodplain Managers. You have my bio, but I will point out that I have been working as a civil engineer focusing

[38] "Climate Change Planning Handbook Installation Adaptation and Resilience," Final Report (Naval Facilities Engineering Command Headquarters, January 2017), https://www.fedcenter.gov/Documents/index.cfm?id=31041.

[39] "EWN, Dr. Todd Bridges, Bio," 3, accessed November 12, 2019, https://ewn.el.erdc.dren.mil/bios/bio__bridges__todd.html.

on water resources for over 39 years and in flood plain management since 2000. My comments will focus on the following four areas: strategic direction, levee and dam risk management, Public Law 84–99, and water resources principles and guidelines.

Under strategic direction, ASFPM recommends developing a significantly more robust, non-project-related technical assistance role for the Corps at the district level, either through the Floodplain Management Services program or Planning Assistance to States or a new authority. The FPMS and PAS programs could serve to substantially expand the Corps' contribution to enhancing water resources resiliency and sustainability and should be authorized and funded to at least $50 million annually. The Corps Silver Jackets program is successful, but additional technical assistance not tied to a specific project is needed at the local level. This is especially true for disadvantaged and impoverished communities.

Through the Corps' Tribal nations program, additional technical assistance and expertise should be provided to our Tribal nations to assist in finding ways to help them improve their water resources infrastructure.

Congress should set policy on decisionmaking that will result in natural infrastructure being a preferred alternative due to its multipurpose multibenefits. The Corps should continue to fully support the implementation of the Engineering With Nature initiative throughout the agency. The Corps supports the ASFPM-administered National Flood Barrier Testing Program. The Corps' nationally recognized Engineer Research and Development Center needs to be modernized to meet the testing needs for a growing number of private sector developed flood barriers. The Corps is reimbursed for the cost of testing these products.

Through the Corps feasibility study planning process, the use of nonstructural flood risk reduction measures needs enhanced consideration. The Corps National Nonstructural Floodproofing Committee has done excellent work for many years and needs continued headquarters support to incorporate nonstructural measures into selected plans.

Due to the major flood events of 2011 and three major flood events on the lower Missouri River system in 2019, the Corps needs authority and funding to study the Missouri River flood management system as an integrated system, including reservoir operations, levees and land use. Under levee and dam risk management, Congress and the Corps should adopt policies for new levees or the reconstruction of levees that encourage levees be set back from the water's edge to preserve riparian areas, reduce erosion and scour, reduce flood levels and flooding risk, recharge groundwater and allow natural flood plain ecosystems to better serve their natural functions.

ASFPM recommends full implementation of the National Levee Safety Program. ASFPM recommends the Corps activate the new National Levee Safety Committee composed of Federal agencies, State and local stakeholders, professional associations, and experts, as directed in WRRDA 2014 to develop consistent guidance for levee siting, design, construction and operations and maintenance standards.

Under Public Law 84–99, conform the Public Law 84–99 program cost sharing with other flood damage reduction programs to reduce Federal disaster costs, reduce risks and support greater use of comprehensive flood risk management and nonstructural approaches. For every project, explicitly require consideration of realigning or setting back levee segments and integrating setback levees to the fullest extent possible.

Under revisions of water resources principles and guidelines, ASFPM recommends that in developing implementation guidance for principles, requirements, and guidelines, agencies must require full accounting of ongoing long-term operations, maintenance, repair, rehabilitation and replacement costs be included in benefit-cost analyses for all structural and nonstructural projects. ASFPM recommends that the Corps and other agencies develop and transform Federal planning principles to a national economic resilience and sustainability standard.

Thank you for the opportunity to testify and I would be happy to answer questions at the appropriate time.

[Mr. Pineda's prepared statement follows:]

Prepared Statement of Ricardo S. Pineda, P.E., C.F.M., Chair, Association of State Floodplain Managers, Supervising Water Resources Engineer, California Department of Water Resources, Division of Flood Management, on behalf of the Association of State Floodplain Managers

INTRODUCTION

The Association of State Floodplain Managers (ASFPM) appreciates the opportunity to share our views and ideas for potential improvements in programs of the U.S. Army Corps of Engineers (Corps) that would help increase the resiliency and long-term health and productivity of our nation's water resources infrastructure as the Committee prepares to develop a 2020 Water Resources Development Act (WRDA).

The 19,000 members of ASFPM and our Chapters are partners of the Corps, Federal Emergency Management Agency (FEMA) and many other federal agencies along with those at the state and local levels in reducing loss of life and property due to flooding. Our 37 state chapters are active within their states and nationally as well. State and local floodplain managers and their private sector engineering and floodplain management colleagues interact regularly with the Corps at the Headquarters and District levels in developing and implementing solutions to flooding challenges.

Recent experience continues to demonstrate that the increasing variability and frequency of intense weather events and conditions, along with intensifying watershed development and aging water infrastructure underscore the need for new thinking and approaches to reduce vulnerabilities and increase resilience. 2019 is the fifth consecutive year (2015–2019) in which 10 or more billion-dollar weather and climate disaster events have impacted the United States, according to the National Climatic Data Center of NOAA. The NCDC identifies some 254 such events having occurred since 1980 with a cost of more than $1.7 trillion. Floods are—and continue to be—the nation's most frequent and costliest disasters and the costs to taxpayers continue to increase. While the Corps has often successfully engineered structural means of controlling flood waters, it is becoming more and more apparent that 1) operation and maintenance costs are exceeding the ability of communities and local sponsors to pay those costs, which is their obligation; 2) structural projects, while necessary in some instances, are expensive; 3) traditional projects can inadvertently increase flood hazards upstream, downstream and across the river; and 4) nonstructural projects can often offer a less expensive, more sustainable and affordable means of reducing flood hazards and costs.

To meet today's challenges of riverine and coastal flooding in an era of more frequent and severe storms, sea level rise, and skyrocketing disaster costs, it is important that the Corps take a broad, comprehensive and watershed-based view of over-

all flood risk management. To encourage enhanced effectiveness in addressing cost considerations, the need to protect lives and property, and recognize the multiple beneficial functions of the natural floodplain, ASFPM would like to address several areas where improvement is needed. We will address:

- Strategic Direction
- Flood Risk Management
- Levee and Dam Risk Management
- Public Law 84–99 program
- Principles and Guidelines

STRATEGIC DIRECTION

"The current trajectory of funding water resources projects is not sustainable."

This was the take-home message at the 2012 USACE Strategic Leadership Conference attended by ASFPM as well as several other Corps partners. In remarks made by senior Corps leadership—with which ASFPM is in agreement—when you look long term, the Corps must change how it is doing business. An increased focus on collaboration and problem solving with partners will be necessary as will making smarter, strategic investments in infrastructure. Given the increasing cost of operations and maintenance, funding for new starts and other projects is being proportionately reduced. Simply put, as a nation, we cannot afford to keep doing business as we have in the past. More frequent and intense disasters are making current approaches too costly or rendering them ineffective.

A more recent troubling trend is that more and more project funding is coming by way of supplemental appropriations after disasters. According to the Congressional Research Service (CRS) from FY 2005–FY 2018 Congress spent nearly twice as much ($44 billion) on recovery from flooding and other natural disasters as from regular annual appropriations for flood-related activities ($23 b). Such a piecemeal approach is nearly impossible to plan for and creates a lot of frustration at the state and local level.

The Corps is uniquely positioned, with Congressional guidance and support, to help transform itself and take a different, much more collaborative approach. Rare among agencies, the Corps allocates significant resources for research and development through entities like the Institute for Water Resources, and has a long history of expertise in all aspects of flood-loss reduction—both structural and nonstructural. Centers of expertise such as the USACE National Nonstructural Floodproofing Committee focus on measures to reduce the consequences of flooding versus reducing the probability of flooding. The successful Silver Jackets program, which is underway or forming in virtually all the states, is putting the Corps into a new "convener" role. Initiatives like Engineering with Nature and the USACE partnership with ASFPM in the National Flood Barrier Testing and Certification Program are forging new paths, leveraging new technologies and approaches to tackle long-standing flood problems.

Technical Assistance

Technical assistance should be seen as a cornerstone of Corps operations and activities. A significantly enhanced role of technical assistance and broad-based problem solving/planning for watershed wide and nonstructural solutions would more effectively deliver federal expertise to the local and state level. However, it is still nearly impossible to leverage Corps expertise on more than an ad-hoc basis, and not associated with a particular Corps project. While Silver Jackets has somewhat helped this at the state level, it is a sad reality that Corps expertise is rarely available at the local level unless there is an active project. Other federal agencies dealing with flooding issues such as FEMA, NRCS, and the USGS have staff available through their disaster cadres, capacity building programs at the state level, national call centers, or distributed staff throughout the U.S. Each is a different model for providing federal resources at the local level. Given that the Corps has 38 districts which contribute to the Civil works mission, the basic infrastructure exists to provide a much better technical assistance role than it currently provides. By having a more robust technical-assistance role at the district level that is not project related, the research, expertise and knowledge of the Corps could be made much more widely available to help locals and states accomplish their role of flood loss reduction.

The Floodplain Management Services (FPMS) program (authorized as a continuing authority under Section 206 of the 1960 Flood Control Act) theoretically addresses this need and has provided valuable and timely services in identification of flood risks and flood damage. The program enables the Corps to support state, re-

gional and local priorities in addressing flood risks through collaboration and cooperation by developing location-specific flood data, which can be used to reduce overall flood risks. Like FPMS, the Planning Assistance to States (PAS) program was also authorized to provide valuable and timely services in identification of flood risks and flood damage. This program also allows for any effort or service pertaining to the planning for water and related resources of a drainage basin or larger region of a state, for which the Corps of Engineers has expertise.

ASFPM believes that programs such as FPMS, PAS, and Silver Jackets—that are designed to provide engineering and scientific assistance to communities and states on a collaborative basis—are a critical key to fostering and developing local and state resilience planning capacity that should be a key goal for Corps transformation in the area of flood damage reduction and floodplain management into the 21st Century. These programs have been shown to provide significant benefits for a relatively small investment. By providing Corps expertise, these programs assist states and communities to make better informed decisions and to engage in more comprehensive consideration of their flood risk so they can implement the various options they have for reducing the hazard. These approaches and options can be structural, nonstructural, or a combination of the two and can often lead to less expensive and more resilient and sustainable solutions.

However, FPMS and PAS must be better managed as national programs. While our data is anecdotal, it appears that these two programs are not evenly nor consistently administered throughout the country. Certain Corps Districts have high expertise and capability with these programs and work on them vigorously and others do not. We know through our work with the Corps that there do not seem to be mechanisms or processes to comprehensively identify, collect, review and prioritize requests for FPMS/PAS services, review projects completed, and adjust program metrics in any consistent manner. ASFPM believes the demand for these programs significantly exceed available resources, but the funding does not always get to the districts who have activities that will expend the funds and help communities and states. All Corps Districts should have the level of capability as do those that regularly use FPMS and PAS. Another issue is that the Corps tends to "projectize" these services (meaning they cannot proceed unless they have a project to charge their time) versus making the technical assistance more broadly and widely available. A special focus in the next WRDA should be to make such technical assistance more readily available to help disadvantaged and impoverished communities plan for reducing flood risk, increasing flood resiliency, and improving flood risk management.

Technical assistance is especially important after flood disasters. Given the current structure and focus of the Corps—most post-disaster work has been focused on immediate response missions related to infrastructure and public works and flood response activities (flood fighting) and repair/rehabilitation work. However, given the Corps expertise and assets, they can also be brought to bear in providing technical assistance and problem-solving expertise. For example, post-Sandy, many of the affected areas had a critical need to understand the range of different nonstructural flood mitigation options available to them, however, this has been done only haphazardly in the past.

- Develop a significantly more robust and ongoing non-project related technical-assistance role for the Corps at the district level, either through FPMS or a new authority. The FPMS and PAS programs could serve to substantially expand the Corps' contribution to enhancing water resources resilience and sustainability, and should be authorized and funded at least at $50 million annually.

The Corps can play a lead role in a model where the federal government provides incentives to undertake sustainable solutions, where it provides the technical know-how and expertise to solve a flooding problem, or where it provides data and information to enable states and communities to make better decisions. This is also where the locals and states could proceed using funds outside of federal taxpayer funds. A number of states have their own mitigation grant programs, and working collaboratively with USACE expertise to fit actions within a comprehensive watershed and resilient manner could greatly benefit flood loss reduction in the nation.

Research & Development

The Research and Development function of the Corps has several promising initiatives and programs, but as we have seen with other R&D initiatives across the federal government, the difficulty lies in widespread implementation of these initiatives into an agency's operations.

The first of these is the Engineering with Nature (EWN) initiative that is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collabora-

tion. It incorporates the use of natural processes to maximize project benefits. ASFPM is very supportive of this initiative and is encouraged by its results and implementation strategy. The 2018–2022 EWN strategic plan properly focuses on expanding implementation. However, given the traction we have seen with other Corps initiatives such as the nonstructural flood mitigation, we are concerned about its ultimate success.

- Congress should set policy on decision making that will result in natural infrastructure being a preferred alternative due to its multi-benefits, working with natural processes approach.
- he Corps should commit to fully supporting the operationalization of the EWN initiative throughout the agency.

The second of these is the National Flood Barrier Testing and Certification Program (NFBTCP). A partnership among ASFPM, FM Approvals and the Corps (through the Engineer Research and Development Center (ERDC)), the NFBTC Program is a unique public-private partnership, which resulted in the development of the ANSI 2510 standard and where commercial flood abatement products (i.e., perimeter flood barriers and flood mitigation pumps) are tested against that standard. The purpose of this program is to provide an unbiased process of evaluating products in terms of resistance to water forces, material properties and consistency of product manufacturing to specify use of appropriate products that would avoid the failures we saw in the Midwest in 2019. Manufacturers pay for the cost of testing and certification and the public benefits from having flood abatement products that meet standards. While the European Union has recently adopted the ANSI 2510 standard, we have yet to have it adopted officially in the United States. This program and the Corps' participation in it aligns with Section 3022 of the 2014 WRRDA encouraging the Corps to use durable and sustainable materials and resistant construction techniques to resist hazards due to a major disaster, and aligns with Director Dalton's embrace of new technologies.

We must ensure the ERDC water testing facility is capable of testing products being demanded by the marketplace. Currently, the facility is only capable of testing perimeter barriers to a height of 4 feet, yet manufacturers are making products that would protect to heights of 8–10 feet or more. The current facility is in need of a significant upgrade and/or replacement and ASFPM would be most supportive of such an effort.

Planning and the Use of Nonstructural Flood Risk Reduction Measures

Overall, ASFPM is concerned about the lack of nonstructural, flood-risk reduction measures as part of the projects that the Corps is implementing. This is especially of concern, given the increasing intensities and impacts of storms and flooding events being experienced in many communities and regions across the nation. Nonstructural and nature-based flood risk management approaches are often capable of buffering and withstanding these impacts with far lower overall cost, while providing major economic, societal, and environmental benefits. While the Corps has the authority to implement a full array of nonstructural measures, today we are seeing very few of these measures being implemented. Yet these measures have often been well-identified in community hazard mitigation plans and other planning documents. It seems that if a project has not gone through a formal Corps planning process then it does not formally exist. Better coordination between the Corps and existing community and state plans, which have proliferated over the past 20 years (largely as a result of the Disaster Mitigation Act of 2000) is essential.

As we note later in this testimony, nonstructural, flood-risk reduction measures have an inherent disadvantage in most Corps programs whether it be through PL 84–99 or as a result of the Principles and Guidelines or current cost-sharing policies. Yet, the array of adaptation techniques that coastal and inland communities will need to respond to increasing risks and changing conditions will have to include nonstructural measures or measures that can include a combination of both. For example, relocating from a highly flood-prone area is a very popular measure and will be increasingly important in the future and could be done in combination with a structural measure. ASFPM encourages the Corps to identify and remove systemic biases against nonstructural, flood-risk reduction measures and elevate the status of such measures strategically.

Authority to study Missouri River flood management system.

ASFPM supports the recent request by Assistant Secretary of the Army for Civil Works R.D. James that Congress provide authority for the Corps to conduct a study of the Missouri River levees as part of a system-wide study that would look at reservoir operations and all levees to evaluate how the systems should be managed, especially whether levees should be rebuilt, moved back to reduce erosion and pro-

vide conveyance (room for rivers) or removed and to see if other mitigation options like buyouts or elevation of buildings, which would be more effective and less costly, could be employed. Such a study is needed to help guide major repair and rehabilitation, in particular, in response to changing water conditions in the Missouri Basin and to evaluate improved floodplain management, storage, and flood conveyance solutions for large floods and runoff events. We believe the Corps and basin management would benefit from broad based evaluations in many instances where increasing flooding is occurring or can be calculated. One emerging trend we have observed nationally that might have applicability on any Missouri River system study, for example, is concern over the flood control—including large reservoir releases—and how we might make changes in the USACE water control manuals for flood operations to reflect new conditions such as more intense storms.

FLOOD-RISK MANAGEMENT

The Corps' Flood Risk Management Program was established in 2006. The program's mission is to increase capabilities across all aspects of the agency to improve decisions made internally and externally that affect the nation's flood risk and resilience. It implements this mission through several activities including technical assistance, project planning and construction, promotion of nonstructural flood risk reduction, flood fighting, post flood disaster support, and assessing potential climate change impacts and consideration of adaptation measures.

Operationally, we would like to share our observations and suggestions for improvement.

ASFPM believes that overall the Silver Jackets program has proven to be successful and should continue with maximum flexibility to address individual states needs and issues. There have been many benefits to the Corps, and states, tribes, and local governments from the Silver Jackets program, including better coordination and understanding of the various programs and agencies involved in comprehensive flood-risk management, identification and coordination of resources, and development and undertaking of collaborative projects. It is important; however, that all Silver Jackets POCs from the Corps embrace the role and vision of the program.

As mentioned above, the Corps is a partner in the NFBTC (barrier testing) Program. One step to facilitate the recognition and adoption of the standard would be for the Flood Risk Management Program—through the National Flood Fight Material Center—to require the standard in future contracts when purchasing flood fighting materials (there are several manufacturers that now have certified products). While we have had promising talks with Director of Civil Works Dalton and Chief Delp in the Rock Island District, we are concerned about support of the program and use of the standard operationally within the Corps' Flood Risk Management program overall given our lack of progress to date.

- Encourage the adoption of and operational use of the ANSI 2510 standard by the USACE for flood abatement products

The center of expertise for the Corps for nonstructural flood-risk reduction rests with the National Nonstructural Committee within the Planning Community of Practice. While we are encouraged after a brief dissolution and reconstitution of the NNC the past couple of years, that there is at least some interest in maintaining this function within the Corps, we continue to be alarmed about its significant lack of human resources, the stove-piping of the committee (within the Planning Division) and the seeming lack of agency headquarters support/champion.

LEVEE & DAM RISK MANAGEMENT

ASFPM has developed positions on structural flood control, including the position that levees should never be seen as the only flood mitigation tool, but part of a mix of tools that include nonstructural measures like buyouts, building elevations and flood proofing, as well as levee setback or realignment, and designed overflow spillways in levees and floodways, such as those on the lower Mississippi River that provide "room for rivers." Furthermore, all levees and other flood control structures must be designed for future conditions that can be expected during the life expectancy of the structure. If the levee has a 50-year life, it must be able to handle the design flood expected in 50 years. All structural projects can result in adverse impacts. It is important that the Corps examines and enforces requirements to prevent or mitigate any adverse impacts (social, economic, environmental) from construction, repair and rehabilitation of structural projects), prior to or concurrent with the construction of projects.

As we reflect back on past levee-related policies, we are reminded of the many recommendations from the Sharing the Challenge: Floodplain Management into the

21st Century Report of the Interagency Floodplain Management Review Committee led by General Gerald Galloway after the 1993 Mississippi River floods. One recommendation never enacted was a new law to define the flood risk management responsibilities of federal, state and local governments, including the levee districts that build and maintain locally-funded levees. This could best be done by directing the Federal Interagency Floodplain Management Task Force (FIFM–TF) to do it.

Despite enormous public investment in flood "control" structures, this spending has been outpaced by development in risky areas and development in the watersheds that increases runoff and flooding, resulting in the gradual deterioration of the protection provided by those structures. As the public grows to recognize the risks associated with levees, communities are working to evaluate the various actions they can take in response to those risks: levees can be repaired and improved or set back a further distance from the river to relieve pressure and erosion on the levee; homes, businesses and infrastructure at risk can be relocated to reduce risk and restore floodplain function. Waters can be detained upstream or adjacent to the stream by re-opening areas closed to flood storage and conveyance, such as Napa, California did. And measures can be combined to achieve the most effective results with scarce public dollars, with a particular eye to reducing the long-term operations and maintenance (O&M) costs for communities and taxpayers.

- Congress and the Corps should adopt policies for new or reconstruction of levees that encourage levees are set back from the water's edge to preserve riparian areas, reduce erosion and scour, reduce flood levels and flooding risks, and to allow natural floodplain ecosystems to better serve their natural functions of flood storage and conveyance as well as providing valuable habitat.

We have entered an era of levee "triage"—the process of prioritizing federal response to flood risks associated with levees and rationing scarce federal taxpayer dollars on multiple-objective risk reduction projects that may include floodplain restoration, reconfiguration of structural systems, and combinations of approaches to make the best use of limited public resources.

Generally speaking, any new federal taxpayer funding program for flood risks associated with levees should be reserved for the top performers (communities and regions) that have demonstrated nonfederal leadership in the identification and reduction of flood risk associated with levees. Projects need to address those risks by leveraging more fully state and local authorities over land use, infrastructure protection, development standards and robust building codes. Additionally, eligibility for a new levee risk management fund should require that nonfederal partners take specific steps to address flood risk associated with levees in the following ways:

1. Participate in the National Flood Insurance Program;
2. Adopt a FEMA approved Hazard Mitigation Plan that includes emergency action and planning for residual risk areas associated with all levees and residual risk areas in their jurisdiction, including post-flood recovery and resiliency;
3. Prevent the construction of critical facilities (such as hospitals, schools, fire stations, police stations, storage of critical records, etc.) in areas subject to inundation in the 0.2%-chance floodplain, and require that all existing CFs be protected, accessible and operable in the 0.2%-chance flood;
4. Evaluate the full array of nonstructural measures to reduce risk, implement effective nonstructural measures in combination with any structural measures that are selected, and adopt standards to prevent any post-project increase of risk (including probability and consequences), prior to any commitment of public funds toward levee work;
5. Demonstrate binding and guaranteed financial capacity and commitment to long-term operations and maintenance, rehabilitation and management of all levee structures and system components in the community's jurisdiction;
6. Adopt short- and long-range flood risk reduction planning in residual risk areas as part of the community's mitigation, development and land use planning;
7. Communicate with property owners in residual risk areas, including spillway easement areas, to notify them of their risk, advise them of the availability of flood insurance, update them on emergency action plans, report on levee operations and maintenance over the past year, and for other public notification and engagement activities; and
8. Consideration of flood insurance behind levees either through individual policies or with a communitywide policy. The rate should be commensurate with the risk (higher levee protection, lower cost policies).

ASFPM would like to note some positive developments in recent years regarding levee and dam risk management. The first of those has been the development of and

public access to the National Levee Database (NLD) and National Inventory of Dams (NID). ASFPM was pleased to see the opening of the NLD for public access in 2018 (this follows the public access to NID, which occurred in 2015). This is an important evolution in the levee risk management to ensure the public has access to essential information regarding these flood-risk management structures. According to the NLD, there are nearly 30,000 miles of levees with over 46,000 levee structures having an average age of 55 years.

Another positive development was the Corps' new policy on Emergency Action Plans (EAPs) and required inundation mapping (EC 1110–2–6074). This policy standardizes inundation mapping and establishes inundation mapping requirements for dams and levees. In theory, having inundation mapping available to the public can help avoid debacles like those we witnessed around Barker and Addicks Reservoirs post-Hurricane Harvey when thousands of homes in inundation areas of those structures were impacted. Had local land use planners, property owners and others been aware of these risks, steps could have been taken to better guide development and reduce that risk. However, the new EAP policy includes the following statement: EAP maps are considered sensitive data and must be marked "For Official Use Only" according to AR 380–5 and DoDM 5200.01. In other words, inundation maps associated with EAPs are not publicly available. Why would we be withholding this vital information on flood risk? The ASFPM would urge clarification in the next WRDA that identification of potential inundation areas from levee or dam operation or failures should be made widely available to help inform the public in making a wide range of economic and life-safety decisions and plans.

The above policy seems to be an artifact from post 9/11 that neither the Corps (DoD) nor FEMA (DHS) are willing to overcome. The Technical Mapping Advisory Council (TMAC), a congressionally-authorized advisory committee helping FEMA oversee the nation's flood mapping program, in its 2016 report National Flood Mapping Program Review, identified a legacy DHS policy through its Security Classification Guide for the Protection of Critical Infrastructure and Key Resources, which listed dam failure inundation maps as "For Official Use Only." However, this policy conflicts the National Flood Mapping Program Congressional requirements that such areas be shown on Flood Insurance Rate Maps and on publicly-available databases such as NLD and NID. As noted in the report, a Virginia law passed in 2008 essentially requires that all inundation mapping developed for state-regulated dams be made available to communities and the public. This has now been implemented for a decade without issues and state officials there believe in supporting wider public availability of these data. More recently, when speaking to federal agency officials, there has been a mistaken belief that this issue had been dealt with. It is clear to ASFPM that it has not and the unwillingness of agencies to act on it demands congressional intervention.

- Congress should mandate that inundation mapping developed by the federal government and/or associated with federal programs for dams and levees be made publicly available.

Let's not have a recurrence of the Oroville dam situation from a couple years ago where a 190,000 people were told to evacuate very quickly because the dam's integrity was threatened, and none of them had been told or even knew they would be inundated if the dam were to fail. This is a critical public safety issue that must be addressed.

Moving from an inventory to a program to address the safety of levees and to get a handle on the funding needed to ensure the safety of levees is not a simple process, yet this may be among the most important issues to help many communities consider and develop effective flood risk management and infrastructure resiliency. Evaluating how safe a levee is can be easier if actual engineering plans exist and there is a record of the operation and maintenance of that levee.

Unfortunately, many of the non-federally built levees have neither good plans nor O&M records. Engineers can do a field evaluation of a levee that includes a visual inspection, but that does not tell us what the material is inside the levee to determine if it will withstand flood levels at a design flood or a larger flood. It is also questionable if the Corps should conduct evaluations beyond visual for non-federal levees using federal taxpayer funds.

All the above evaluations are complicated because so many nonfederal levees are simply dirt piled up to keep water from farm fields, with more dirt added to the levee over time to make it higher, especially when housing or other development occurred behind the levee. Just because such a levee has not failed over the years does not mean it will not fail in the next flood. Requiring levee owners to perform an analysis of the levee to determine its adequacy and to develop a plan to properly operate and maintain the levee cannot be done by the Corps because the federal

government does not have land use authority. States do, but many states to not regulate, or do not have adequate regulations to ensure levees are adequate.

As a nation, we know little about the condition or risks associated with levees outside the Corps portfolio. Managing risks associated with levees in the United States will require diligence and cooperation among all levels of government, private sector and the public. Further, the national program must be integrated into and work seamlessly with other flood-risk management efforts through other agencies. That is why the implementation of the National Levee Safety Program is urgently needed. ASFPM participated in the multi-year effort to develop recommendations for a National Levee Safety Program culminating in a report with 20 recommendations made in 2009. The 2014 WRRDA first authorized the program, which was subsequently reauthorized in America's Water Infrastructure Act of 2018 through federal fiscal year 2023. Among other things, this program will:

1. Establish comprehensive national levee safety guidelines for uniform use by all federal, state, tribal and local agencies (which would also provide for adaptation to local conditions);
2. Require better coordination and use of consistent standards and guidelines among federal agencies;
3. Establish a hazards classification system for levees;
4. Assist states, communities and levee owners in developing levee safety programs including identifying and reducing flood risks associated with levees;
5. Focus on educating the public of risks living in leveed areas; and
6. Establish a levee rehabilitation program that is integrated with ongoing community hazard mitigation programs/plans and requires a practical floodplain management plan to address adverse impacts of flooding in leveed areas.

ASFPM is pleased to see that finally, the House passed "minibus" spending bill, H.R. 2740 included increased funding for the National Levee Safety Program, and the Senate Appropriations Committee has reported a similar level. While it does not fund the program at its full authorization of $79 million, it does provide $15 million.

- ASFPM recommends full implementation of the National Levee Safety Program and require that national levee safety guidelines fully account for future flood conditions based on the levee's anticipated service life (as opposed to design life) and suggests appropriate land-use standards to manage the intensification of risk behind levees.
- Activate a new National Levee Safety Committee (NLSC) of federal agencies, state and local stakeholders, professional associations, and experts as directed in WRRDA 2014 to assist the secretary to develop consistent guidance for levee siting, design, construction, operating and maintenance standards, to enhance levee performance, set appropriate protection levels, and to build-in resilience and adaptability for existing and future levee-based systems, (e.g., freeboard, spillways, setbacks, etc.).

An effective National Levee Safety Program would mandate or incentivize states to have levee safety programs. This could be done by providing federal taxpayer funding to repair levees on some cost sharing basis, but it should have provisions indicating the funding will only be available in states with adequate levee safety programs where the state can regularly inspect levees and has the authority to order repairs or removal of inadequate levees so that people and businesses behind the levee are safe and do not have a false sense of security that the levee will protect them. The authorized Corps Levee Safety programs need to be implemented with these provision included.

We want to point out one recommendation contained in the 2009 National Levee Safety Program report that was not implemented in the 2014 WRRDA, but that ASFPM still fully supports: A requirement for the purchase of risk-based flood insurance in leveed areas to reduce economic loss, flood damage, and increase understanding of communities and individuals that levees do not eliminate risk from flooding. Had such a requirement been in place, the effects from this year's flooding in the Midwest, especially where levees overtopped and failed, would have been far less consequential.

It has come to light in recent years that many levees on the Mississippi River have been raised above their authorized height. The problem with that is the higher levees at one point in the river will result in more flooding across the river or upstream and downstream of that higher levee because the water has to go somewhere. This can lead to "leapfrog levee," where levee owners on the other side of the river then raise their levee even higher, and the cycle continues.

- ASFPM urges strong continued federal oversight of levees to maintain levees at authorized levels. This should be done by the Corps or FEMA, and it must be adequately enforced.

We were pleased to see that ASA R.D. James and Deputy Commanding General for Civil and Emergency Operations Maj. Gen. Scott Spellman understand the issue. Gen. Spellman indicated that changes to any one levee on the system could cause more problems downstream, or across the river.

One final note regarding the High Hazard Dam Rehabilitation Program—ASFPM strongly supports the floodplain management planning requirement to obtain funding and integration of the dam rehabilitation with other mitigation efforts. We believe that such plans must be practical and implementable so that those impacted better understand flood risk and can take steps to mitigate against the residual risk.

ADJUSTMENTS TO PL 84–99

PL 84–99, the Corps' disaster assistance authority, is legislatively built on language that was first adopted in 1941. In recent WRDAs, we have generally seen only incremental changes, while at the same time costs of flood disasters are increasing dramatically, while we are recognizing our overall approaches to flood-risk management require substantial new direction. As an example, PL 84–99 provides by far the most generous cost-sharing formula of all the Corps' activities, to assist in repair and rehabilitation of disaster-damaged levees and hurricane and storm damage reduction projects. In many cases the repairs are coming at high federal taxpayer expense and are being repeated over and over without serious review because current policy constrains or bars the Corps from studying and recommending changes (and makes even the consideration of nonstructural approaches subject to a non-federal sponsor's consent).

Under PL 84–99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to undertake activities including disaster preparedness, advance measures, emergency operations (flood response and post flood response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source. PL 84–99, which is the principal Corps program to repair and rehabilitate, incorporates a significant bias against nonstructural and integrated approaches (combining structural and nonstructural approaches) to rehabilitation and repair of flood control works (FCWs). ASFPM understands that Engineering Regulation 500–1–1, which is the operational guidance for PL 84–99, has been on-again-off-again process of being under consideration for updating for several years. ASFPM believes that it is essential this guidance be updated and for the program to incorporate a much greater focus on nonstructural approaches.

The Rehabilitation and Inspection Program (RIP) provides for inspections of FCWs, the rehabilitation of damaged FCWs, and the rehabilitation of federally-authorized and constructed hurricane or shore protection projects. Any eligible FCW that was damaged by water, wind or wave action due to a storm is eligible for repair under RIP, either at 100% or 80% federal taxpayer cost. RIP assistance is available to federally- and non-federally-built FCWs. Operation and maintenance is the responsibility of the local sponsor, and so long as there is proper and timely maintenance, the FCW can be included in the program. Currently, the following FCWs can be included, provided they meet the eligibility inspections:

1. Federally-authorized and constructed hurricane or shore protection projects (HSPPs).
2. Federally-constructed, locally maintained levees and floodwalls.
3. Non-federally constructed, locally-maintained levees and floodwalls that provide a minimum of a 10-year level of protection with 2 feet of freeboard to an urban area, or a minimum of a five-year level of protection with 1 foot of freeboard to an agricultural area.
4. Federally-constructed, locally-maintained flood control channels.
5. Non-federally constructed, locally-maintained flood control channels that provide a minimum of a 10-year level of protection. [NOTE: Interior drainage channels within the protected area of a levee system are not flood control channels.]
6. Pump stations integral to FCW.
7. Federally-constructed, locally-maintained flood control dams.
8. Non-federally constructed, locally-maintained flood control dams.

This is a very broad range of infrastructure for which the Corps takes responsibility after declared disasters, much of which is provided through supplemental appropriations through the Flood Control and Coastal Emergencies account. An unfortunate side effect of the current eligibility standards is that non-federal entities responsible for operations, maintenance and repairs are driven to defer maintenance until after the system is damaged by a flood event. PL 84–99 eligibility needs to be modified to assure that any federal investment in levee work targets structures that pose the greatest public safety risk, and incentivizes responsible nonfederal actions in levee operations, maintenance and repair.

- Conform this program's cost-sharing with other flood-damage reduction programs to reduce federal disaster costs, reduce risks, and support greater use of comprehensive flood-risk management and nonstructural approaches.

Since this program provides significant federal taxpayer dollars for repair and rehabilitation of levees and dams for which local entities have signed operation and maintenance agreements, it seems entirely appropriate to associate a set of requirements to be met by those entities in order to qualify for federal assistance. ASFPM recommends that eligibility for PL 84–99 be available only after the following steps have been taken:

- The entity responsible for operation, maintenance and repair (OM&R) has adopted and demonstrated compliance with an approved OM&R plan.
- Responsible entity must communicate annually with property owners in residual risk areas, including dam or levee failure and spillway easement areas, to notify them of their risk, update them on emergency action plans, report on levee operations and maintenance over the past year, and for other public notification and engagement activities.
- Responsible entity must demonstrate binding and guaranteed financial capacity and commitment to long-term operations and maintenance, rehabilitation, and management of all levee structures and system components in the community's jurisdiction;
- Jurisdictions in residual risk areas must:
  - Participate in the NFIP,
  - Adopt a FEMA approved hazard mitigation plan that includes emergency action and planning for residual risk areas associated with all levees and residual risk areas in their jurisdiction, including flood-fighting, post-flood recovery and resiliency, and
  - Prevent wherever possible the construction of new critical facilities (CFs) in areas subject to inundation in the 0.2%-chance floodplain, and require that all new and existing CFs be protected, accessible and operable in the 0.2%-chance flood.

Data and Information on PL 84–99 costs and repetitive levee and flood control repair/rehabilitation costs.

In addition, ASFPM is concerned that we have seen no work products nor results, despite Congress' direction in Section 3029 of WRDA 2014 that the Corps of Engineers should provide reports to Congress and the public on the implementation of PL 84–99 (33 U.S.C 701(n)), including an evaluation of alternatives available to the Secretary to ensure the USACE is effective meeting of program goals, and including regular biennial reports under WRDA 2014 Sec. 3029(c) on the specific expenditures and costs, work required, and actions of the Secretary, under PL 84–99.

It appears there are levees which repeatedly fail or are overtopped and are simply get repaired to the same situation time and again, largely with federal taxpayer funding.

Without accurate data and information regarding past emergency actions and the repair and rehabilitation of levees and other flood control works, Congress and the public cannot evaluate the effectiveness of PL 84–99, or the program's contribution to water resource resiliency.

In addition, the Corps initiated a public inquiry Advance Notice of Proposed Rulemaking regarding PL 84–99 in February of 2015 (COE–2015–0004), but the Corps has never since responded to public comments nor completed the Rulemaking exercise. We strongly urge Congress to immediately insist on the Corps' completion of the required reports and insist the Corps to assemble and make publicly available Corps' data and information on expenditures by project and watershed, and identify any instances of repetitive repair and rehabilitation costs and locations under PL 84–99.

PL 84–99's treatment of nonstructural options is limited. ER–500–1–1 indicates: Under PL 84–99, the Chief of Engineers is authorized, when requested by the nonfederal public sponsor, to implement nonstructural alternatives (NSAs) to the reha-

bilitation, repair, or restoration of flood control works damaged by floods or coastal storms. The option of implementing an NSA project (NSAP) in lieu of a structural repair or restoration is available only to non-federal public sponsors of FCWs eligible for Rehabilitation Assistance in accordance with this regulation, and only upon the written request of such non-federal public sponsors.

Unfortunately, this is consistent with the underlying statutory language, first adopted in WRDA 1996. The result? Little or no consideration of nonstructural measures, even when such measures could be more cost effective, and more consistent with the Corps' re-released Environmental Operating Principles and subsequent policy guidance from Corps leadership.

The reality is that funded work should evaluate the full array of nonstructural measures to reduce risk, implement effective nonstructural measures in combination with any structural measures that are selected, and adopt standards to prevent any post-project increase of risk (both probability and consequences), prior to any commitment of public funds toward levee work. Since nonstructural options are only considered on an "as requested basis," the requirement that the repair or rehabilitation approach be the "least cost to the government" alternative cannot logically be met because in the vast majority of the cases, not all alternatives are being evaluated. We can no longer afford to ignore possibly less expensive nonstructural alternatives. Specific modifications needed include:

- For every project, explicitly require consideration of realigning or setting back levee segments, and integrating setback levees to the fullest practicable extent in any federally-funded levee work, including repairs under PL 84–99.

Levee setbacks, in many instances, can be a critical resiliency and sustainability adjustment to improve public safety and environmental management and to help account for and mitigate current and future uncertainties and reduce the risk of failures, as well as improve floodplain and natural ecological functions.

In Sec. 1160 of WRDA 2018 Congress added "realignment" as a potential PL 84–99 rehabilitation option, but, again, has left this up to local sponsors whether even to consider such an approach. We specifically urge removing the present constraint requiring the Chief of Engineers to obtain a sponsor's consent to study or recommend such alternative actions. Generally, we would urge establishment of a clear authority for the Secretary or the Chief of Engineers to study the feasibility of making adjustments, and where appropriate, considering nonstructural, use of natural infrastructure, and/or nature-based features as alternatives or additional actions to address levee and flood project rehabilitation. We would also urge that funding be made available to conduct such alternative analyses wherever appropriate, particularly in any situation with a history of repetitive PL 84–99 repairs. This important modification to PL 84–99 can help reduce "pinch-points" in levee systems and bridge crossings that are often damaged or fail in repeated flood events, resulting in continued property loss, economic disruption and federal spending on repairs and disaster payouts. In cases of repeated levee failures or where existing levee alignments create significant pinch points or other risks, the Chief of Engineers should be able to initiate consideration of options to reduce long-term risks and repair costs.

Amendments Regarding Cost-sharing for Feasibility studies and construction of Natural Infrastructure and Nature-based flood damage reduction projects.

As we have said previously, ASFPM continues to be concerned that despite Congress' efforts in successive WRDA's and Corps program oversight to encourage greater use of non-structural and nature-based approaches in flood damage reduction, we see far too little on-the-ground progress, due to numerous areas of policy bias towards traditional structural approaches. We believe that, given ongoing hydrologic, climate, and development changes in watersheds, a concerted effort is needed to reduce historical biases and to better incentivize the use of these effective risk reduction tools.

In addition to authorizing and directing the Chief of Engineers to regularly apply the Corps' science and engineering data and expertise to consider non-structural and natural infrastructure alternatives in appropriate PL 84–99 repairs and rehabilitations, ASFPM would also recommend the following two amendments regarding cost-sharing rules to better incentivize and support potential for natural infrastructure and nature-based features to be considered as alternatives in Corps development or modification of flood damage reduction projects.

- Modify cost sharing and guidance to level playing field for natural infrastructure and nature-based features with construction of nonstructural projects compared to structural projects.

This first amendment would extend the current cap on non-Federal construction costs for nonstructural projects to natural infrastructure alternatives and natural

and nature-based features. Present law caps "nonstructural" flood damage reduction and ecosystem restoration projects non-Federal cost shares at 35 percent. However, "natural features" "nature-based features" and "natural infrastructure alternatives" are subject to 50 percent non-federal cost share caps, if the costs of "LERRDS" (lands, interests, rights of way, relocations, and disposal areas) raise a project's costs to above 35 percent, which often may be the case, even though such projects may be less expensive than traditional projects. The amendment brings nature-based, natural features, and natural infrastructure alternatives, which are terms added in recent WRDA's to receive the same 35 percent construction cost-share cap that is now afforded for nonstructural and ecosystem restoration measures, and would provide an entirely appropriate incentive for these generally similar and compatible approaches.

This could be done in 33 USC 2213(b) by adding "and measures employing natural features, nature-based features and natural infrastructure alternatives, as defined in Section 1184 of WRDA 2016 (33 USC 2289a) and Section 1149 of WRDA 2018 (P.L. 115–270)" after "nonstructural flood control measures" where it appears in 33 USC 2213(b), and by adding "and storm and hurricane damage reduction" after "flood control" where it appears in 33 USC 2213(b).

- Fully fund federal feasibility study cost for nonstructural, natural infrastructure and nature-based features approaches studies to flood damage reduction.

ASFPM has long supported a requirement that all USACE projects must consider the full range of nonstructural and structural alternatives before the project is implemented. Unfortunately, the current law requires the local sponsor to consent to looking at alternatives. This language should be changed.

The second amendment proposal is intended to provide an alternative to this suggestion, where it would provide the Chief of Engineers discretionary authority to study feasibility of all alternatives at full federal cost for nonstructural, natural infrastructure, and nature-based approaches to flood damage reduction. It would give the Chief of Engineers [or the Secretary] discretion to do feasibility and detailed report studies for flood damage reduction and hurricane and storm damage reduction projects that consider nonstructural, natural infrastructure and nature-based features at full Federal study cost. This would happen where the Chief determines that current or reasonably expected future conditions may warrant such expenditures to provide for appropriate flood or storm damage reduction on a cost-effective or substantial life-cycle federal cost savings basis and/or where nonstructural or natural infrastructure or nature-based features would be considered to provide at least 50 percent of total flood damage reduction benefits in one or more of the final array of considered alternatives. In this instance, due to the full Federal cost, a particular advance consent of a non-Federal sponsor would not be required. This would give the Corps of Engineers the ability to consider such natural infrastructure alternatives where warranted, which often is not done due to refusal of a non-Federal sponsor to request and/or consent to (and pay 50 percent of study costs) the consideration of such measures.

We believe such authority would be responsive to the requests of Corps leaders in the Committee's May Corps oversight hearing for authority to consider broader sets of water resource and hydrologic concerns than they currently can.

Applicability: Where the Chief of Engineers believes potential may exist for nonstructural, natural infrastructure and/or nature-based approaches could result in cost-effective or substantial life-cycle taxpayer savings.

Feasibility Study Cost Share: Communities could receive full federal funding for feasibility studies for flood and storm damage reduction projects that may have potential to utilize nonstructural, natural infrastructure and/or nature-based approaches with potential savings at discretion of the Chief of Engineers.

Study Requirements: One or more of the final array of proposed alternatives evaluated in a covered feasibility study must incorporate nonstructural or natural infrastructure features as a significant component of the project. Feasibility studies carried out under this subsection must incorporate natural infrastructure features that reduce flood or storm damages or flood or storm risks by at least [50 percent] in one or more of the final array of proposed alternatives evaluated.

The feasibility study cost share is seen as a major hurdle for meaningfully assessing natural infrastructure regardless of the relative wealth of a community. Current law and guidance require the Corps to request and receive a non-federal sponsors consent to study nonstructural alternatives, which would not be required when studies are fully paid for at federal expense.

Some lower income communities have been unable to pay the cost shares of such studies and therefore do not receive Corps assistance to look at a full range of options for flood damage reduction. Congress has established an ability to pay provi-

sion (33 USC 2213(m)); however, the Corps has not meaningfully implemented that provision and (as best as we can tell) continues to rely on extremely restrictive guidance from 1989, despite having been directed to update that guidance in WRDA 2007.

- Congress and the Corps should remove bias towards structural projects and against nonstructural projects.

This includes consideration of nonstructural measures in every instance and not solely at the request of the sponsor; removal of funding caps for nonstructural measures; reconsider the present policy which requires local sponsor to provide all lands easements, rights of way, relocations and disposal areas (LERRDs) for nonstructural projects to allow federal funding for lands for nonstructural project rehabilitations; provide greater equivalency in repairs to nonstructural measures after a subsequent flood event; and require consideration of benefits and costs over the long term, which should recognize and incorporate the non-commercial and societal benefits of nonstructural and nature-based design approaches in PL 84–99. Other ASPFM recommendations include:

- Including a provision for expedient buyouts of structures and land under PL 84–99. Due to the existing bias against nonstructural measures, this is not now currently feasible. However, these should be pursued with the same expediency as levee repairs just after a flood has occurred, versus through the normal project development process.
- Requiring the Corps to identify and report on frequency and losses associated with repetitive loss levees and other PL 84–99-supported flood control works.
- Requiring a full suite of flood-risk mitigation options (including relocation or realignments, setbacks and nonstructural approaches to reduce costs and risks) for PL 84–99 assistance (similar to NFIP and Stafford Act repetitive loss mitigation).

Consideration should be given to reducing federal subsidies in PL 84–99 as the repetitive costs and disaster assistance claims rise.

Revision of USACE Principles and Guidelines (P&G)

Federal activities and Corps investments in water resources and flood-control projects have been guided by a process that has remained largely unchanged for 30 years, despite a growing record of disastrous floods. The first set of "Principles and Standards" was issued in September 1973 to guide the preparation of river basin plans and to evaluate federal water projects. Following a few attempts to revise those initial standards, the currently utilized principles and guidelines went into effect in March 1983. Since then, the national experience with flood disasters has identified the need to update federal policy and practice to reflect the many lessons learned and advancements in data, information and practice.

Section 2031 of the Water Resources Development Act of 2007 (WRDA 2007) called for revision to the 1983 Principles and Guidelines (P&G) for use in the formulation, evaluation and implementation of water resources and flood control projects. WRDA 2007 further required that revised principles and guidelines consider and address the following:

1. The use of best available economic principles and analytical techniques, including techniques in risk and uncertainty analysis.
2. The assessment and incorporation of public safety in the formulation of alternatives and recommended plans.
3. Assessment methods that reflect the value of projects for low-income communities and projects that use nonstructural approaches to water resources development and management.
4. The assessment and evaluation of the interaction of a project with other water resources projects and programs within a region or watershed.
5. The use of contemporary water resources paradigms, including integrated water resources management and adaptive management.
6. Evaluation methods that ensure that water resources projects are justified by public benefits.

In general, these requirements represented important goals for updating the P&G to respond to changes in the nation's values and increasingly looming concerns for our water resources nationally. In December 2014, the Obama Administration published an updated set of guidelines called the Principles, Requirements and Guidelines, which some federal agencies have implemented, but since the FY 2015 Consolidated Appropriations legislation, the Corps has been barred from implementing the revised P&G, or to make much in the way of needed changes in approaches or

technical aspects of project planning. While Congress had some questions about the specific proposed revisions, we believe that an updating of project planning and evaluation procedures continues to be a strong current and future need to respond to present and changing priorities.

As an example, a major weakness of past benefit-cost analysis for water resources projects has been the failure of project planners to realistically account for the full life-cycle project costs over project lifetimes. This results in a bias for structural projects that require significant long-term O&M and rehabilitation costs, whereas nonstructural designs often have little or no maintenance, masking the true costs of alternatives.

- ASFPM recommends that in developing implementation guidance for the P&R, agencies must require a full accounting of long-term operations, maintenance, repair, rehabilitation and replacement costs be included in benefit-cost analyses for all structural and nonstructural projects, and identify which costs are a federal responsibility or the responsibility of non-federal sponsors or other interests.

The 1983 P&G require selection of water resources projects that maximize net National Economic Development (NED), regardless of total costs to taxpayers or the social or environmental impacts.

- ASFPM recommends that the Corps and other agencies develop and transition federal planning principles to a National Economic Resilience and Sustainability standard instead of the current National Economic Development standard to explicitly incorporate the values of multiple ecosystem services, including the non-market public values provided by the nation's floodplains and ecosystems.

Floodplain management, public safety and long-term environmental quality and sustainability would, in many instances, improve by expanding to a resilience/sustainability standard approach.

Another major concern with water resources projects is that they should be designed and analyzed on conditions that will exist at the end of their design life. This should be a fundamental principle of planning for community and water infrastructure resiliency. For example, if a levee is designed for a 50-year life, the level of protection it will provide must be calculated using the hydrology (rainfall and runoff) and sea level rise that can be projected for the end of that design life. As extreme rainfalls increase and sea level rises, it is foolhardy to not use these future conditions in design and BCA analysis. We are currently seeing levees that no longer provide the design level of protection because design rainfalls have increased from 25–45%, thus the design flood height is much higher. In those cases, levee overtopping and failure result in excessive damage because development in the "protected area" now experiences flooding at great depths and damages. Nonstructural options like elevation of buildings or relocation would not experience that catastrophic damage. All such information needs to be factored in the BCA analysis.

During the dozen years since WRDA 2007 was enacted, costly and disruptive floods have continued to plague nearly all parts of the nation, with the extended Midwest flooding in 2019, and with major Gulf Coast and Eastern Seaboard flooding, from 2017, 2018 and 2019 hurricanes providing the latest reminders of the extent of the nation's vulnerability. ASFPM believes that the nation can no longer afford to continue on its current path of authorizing and funding projects through a process that is so heavily biased toward structural approaches without comprehensive review of environmental impacts and consideration of nonstructural alternatives, and without fully leveraging state and local authorities in land use, infrastructure maintenance, and building codes. While the 1983 P&G need to be retired and replaced by a modern and updated P&G as soon as possible, we note also that in Section 2032 of WRDA 2007, Congress had called for a report on the nation's vulnerability to flooding, including risk of loss of life and property, and the comparative risks faced by different regions of the nation. The report was to include the following elements:

- An assessment of the extent to which programs in the U.S. relating to flooding address flood risk reduction priorities;
- The extent to which those programs may be encouraging development and economic activity in flood-prone areas;
- Recommendations for improving those programs with respect to reducing and responding to flood risks; and
- Proposals for implementing the recommendations.

Unfortunately, while started, this study was never completed, yet the need for these analyses and recommendations in this area continues and is more urgent now

than ever. We urge the Committee to redouble its efforts to bring forward these or similar initiatives into focus and move them to completion to help guide the nation forward to meet critical water resources and flood-related challenges ahead.

Federal policy initiatives such as the update of P&G and making investments through regular and supplemental appropriations that are underway could be informed by the findings and recommendations anticipated to emerge from this report. We urge Congress to insist on a timely completion and delivery of this report.

Again, thank you for the opportunity to share our observations with you, and we applaud the Committee for considering our nation's water resources infrastructure, especially in light of long-term resiliency concerns. If you have any questions, please contact me, Ricardo Pineda, PE, CFM, Chair, ASFPM or ASFPM Executive Director Chad Berginnis.

Mrs. NAPOLITANO. Thank you very much, Mr. Pineda.

I will next go to Mr. Gritzo. You are recognized.

Mr. GRITZO. Chairwoman Napolitano, Chairman DeFazio, Ranking Member Westerman and honorable members of the subcommittee, thank you very much for the opportunity to testify today.

My name is Dr. Louis Gritzo. I am a mechanical engineer who serves as vice president of research for FM Global, one of the world's largest commercial industrial property insurance companies, headquartered in Rhode Island. One of every three Fortune 1000 companies looks to FM Global to engineer down their risk against all hazards, including fire, natural hazards and even cyberattacks.

With approximately 10,000 company locations that are FM Global clients located in flood zones, our clients, who are also our owners as a mutual company, realize the critical importance of protecting flood risk for their well-being and our Nation's. FM Global has been working to do this since 1835. The founder of the company was a Rhode Island millowner, who realized he could do smart engineering things to reduce against the catastrophe of his times, devastating mill fires. He did these measures, still needed insurance, and banded together with other millowners to form a mutual company. These principles are still the operations of which FM Global acts today.

With over 1,300 engineers located worldwide, performing 100,000 risk assessments of client locations each year, we know that efforts to reduce risk and improve resilience are most successful when they are complemented by local, State and Federal initiatives. As the world's most frequent flood hazard, nowhere is this approach more important and no time is it more important than now. The science is clear; we know flood risk is increasing due to a warming climate and due to an increasingly hardened landscape and additional development.

Examples of public-private partnerships that can be successful are the development of ANSI Standard 2510 for temporary flood barriers. These temporary flood barriers are tested at the Army Corps of Engineers Research Center. These are also part of the National Flood Barrier Program with the Association of State Floodplain Managers.

These measures work. In Hurricane Harvey, locations that used them reduced their loss by 80 percent. However, not all loss is preventable. We know that insurance is still needed.

We work with our clients to implement the fraction of insurance available from the National Flood Insurance Program and then un-

derwrite based on scientific and engineering risk assessments, not actuarial methods, to cover the remaining risk. This is increasingly important, as we know the future is not going to be like the past.

Unfortunately, even the most comprehensive insurance program is not enough. When companies experience flood losses, they lose market share, they lose shareholder value, supply chain integrity. It damages their reputation, it damages investor confidence in growth and, most importantly, businesses suffer regional damage, including families that depend on those businesses for paychecks for their livelihood. In aggregate, long-term losses to U.S. business erode our country's economic competitiveness.

For many commercial properties, the first line of defense is levees. We support work with clients' local authorities to assess levees and other flood management options, including environmental ones. Well-designed and maintained levees are obviously very effective at preventing losses. However, maintenance is severely lacking.

There are two other unmet needs. When looking at the ability to temporarily install barriers to protect a client facility, as of now, any solutions that protect for waters over 3 feet are considered experimental. Of the 10,000 U.S. business locations that have been identified by FM Global engineers as having flood exposure, one in four of them experiences flood water greater than 3 feet and there is currently no way to test these at the U.S. Army ERDC. We therefore support an improvement in the ERDC laboratory to enable testing of solutions to address higher flood waters. We also support general improvements in the use of cost-effective sensors, technologies, networks and communication to improve early flood warning, better respond to floods in progress, and improve long-term planning by collecting and assembling data for use by authorities and the private sector for their own benefit.

In summary, the risk to American businesses from flood is real. It's vital that we improve our flood resilience. Insurance is not enough. Sound science and tested engineering solutions, as well as strong and sustained public-private and academic partnerships, we believe, are the answer.

Thank you for this opportunity. I look forward to your questions.

[Mr. Gritzo's prepared statement follows:]

Prepared Statement of Louis A. Gritzo, Ph.D., Vice President of Research, FM Global

Dear Chairman Napolitano, Ranking Member Westerman, and Honorable Members of the Subcommittee:

Thank you very much for the opportunity to join you today as you consider the Water Resources Development Act of 2020, and as you weigh priorities for mitigating flood-related threats to American communities and businesses. I hope you find this testimony helpful as you make far-reaching decisions that benefit American businesses today and into the future.

My name is Dr. Louis Gritzo. I am vice president of research for FM Global, one of the world's largest commercial property insurers, headquartered in Johnston, Rhode Island. My doctoral degree is in mechanical engineering and mathematics, and I oversee a team of more than 120 scientists and engineers who focus on property-loss prevention with the aim of keeping our clients resilient, and therefore, in business.

Approximately 1 of every 3 Fortune 1000 companies turns to FM Global for protection against property loss and business interruption related to fire, natural haz-

ards, equipment failure, and cyber attack. Since we are a mutual insurer, every client is also an owner of our company.

FM Global and its policyholders are deeply concerned about the serious and growing risk of flooding to U.S. businesses. It is a big priority for our clients, especially because more than 10,000 of the commercial properties they insure with us in the U.S. are located in flood zones.

FM Global has been working to prevent, and insure for, commercial property loss since 1835, when mills sprouted along the nation's rivers at the dawn of the U.S. industrial revolution. Our founder, Zachariah Allen, was a Rhode Island textile mill owner who joined forces with other like-minded mill owners who insured one another in a mutual company and collectively reduced their property risks by engineering resilience into their business locations and operations.

We take a unique engineering approach to understand and reduce risk, giving us unparalleled insight into the threats and opportunities that businesses face with respect to today's perils. We embrace this property-loss prevention role and have shared our proprietary research and data publicly for use by property owners, code enforcement bodies and product developers. Our efforts are most successful when they complement investment by local, state and federal government. When structured correctly, such public-private partnerships can be extremely successful.

FLOODWATERS' RISING THREAT TO AMERICAN BUSINESS

Flooding, as has been painfully evident in the past few years, is a serious threat to the nation's economic well-being and the livelihoods of its citizens. The risk is getting worse due to heavier rains from a warming climate and an increasingly developed and hardened landscape.

Nonetheless, FM Global believes that much of the loss caused by nature's hazards is preventable, not inevitable. History confirms this premise in cases where the risks are recognized, understood and properly addressed.

Our loss-prevention approach for flood and all other property risks throughout the world is uniquely rooted in developing engineering solutions that drive out risk for commercial property owners. Our 1,300 engineers around the world make upwards of 100,000 visits to client properties every year, conducting thorough risk assessments and providing solutions tailored to each site.

When this work relates to flood risk in the United States, our engineers apply flood maps created by FEMA, as well as our own physics-based flood maps, to address the hazard. Then we drill into the details: Which properties are exposed? Which parts of each exposed property are threatened? How deep could the water get? What damage would it do? How much would the damage cost? And how much would eliminating or mitigating the risk cost?

We underwrite the risk based on scientific principles and engineering assessments, not actuarial tables. It has been a successful business model that our client-owners appreciate and from which they have benefited financially. Science and engineering are also superior to actuarial tables because the future of the climate and business world will be very different from the past.

QUANTIFY THE RISK

For each location of every business we insure, and every hazard that each property faces, we create a loss expectancy. For example, our engineers may determine that seven out of 10 buildings on a client's corporate campus lie in a flood zone. The loss expectancy will include a dollar amount associated with that flood risk (e.g., that a flood will likely cause $10 million in property damage and business interruption to an affected building).

Then we make recommendations to help clients cost-effectively mitigate their risk. Our flood-related recommendations for a client may involve many different loss-prevention actions as detailed in the loss-prevention engineering guidelines [1] we make freely available on our website. These data sheets include advice on how to site new construction (e.g., on higher ground), better manage stormwater runoff, elevate key equipment, install flood protection valves/gates, or acquire temporary protection systems, such as barriers or inflatable dams. In order for a business to implement these recommendations, they must be cost-effective.

Our recommendations must also significantly reduce the loss, as was borne out during Hurricane Harvey. In that storm, clients who followed our recommendations for physical improvements to prevent flood losses experienced losses that were 80% lower than those of clients who did not. We believe this approach, as part of a pub-

[1] https://www.fmglobal.com/research-and-resources/fm-global-data-sheets

lic-private partnership, can inform public efforts to significantly reduce loss to American business on a national scale.

Of course, not all loss is preventable. That's why we work with our clients to capture whatever fraction of coverage is available through the National Flood Insurance Program, and then to use our own insurance to transfer any remaining risk.

Unfortunately, even the most comprehensive insurance policies fail to cover the total financial loss when flood damage disrupts a business. A disruption not only affects immediate revenue. It takes a longer-term toll on market share, shareholder value, supply chain integrity, reputation, investor confidence and growth. In aggregate, these long-term losses to U.S. businesses erode our country's economic competitiveness.

Furthermore, any disruption at any company is a serious setback that affects not only the business owners, but the regional economy and community, including families depending on paychecks from an employer.

Since insurance alone is not enough to make a company and community fully whole again, the best solution is minimizing loss in the first place.

FLOOD LOSS PREVENTION INFRASTRUCTURE POLICY UPDATE NEEDED

A wide range of strategies is available to mitigate flood damage, including wise urban planning and environmental solutions such as conserving wetlands. For many commercial properties, the first line of prevention is levees. FM Global frequently works with clients and local authorities to assess levees and other flood management solutions. When these measures are well-designed and maintained, they are quite effective in preventing loss. Maintenance, however, is often underfunded, jeopardizing people who depend on these prevention measure for protection. Building on high ground is always best, though it's not always available or affordable.

Our experience working with business is consistent with the 2017 Infrastructure Report Card[2] published by the American Society of Civil Engineers (ASCE), which says an estimated $80 billion is needed in the next 10 years to maintain and improve the nation's levees. We and our clients understand the solution is not a simple case of federal funding for federally owned levees: More than half of levees we encounter are owned by states and localities, which have limited budgets for repair and maintenance.

Levees and other flood solutions need to be strategically developed. The U.S. needs a cohesive flood-loss prevention policy for designing, implementing and maintaining regional systems for our largest flood-exposed areas. Whatever the cost of developing this policy, it is likely to be offset by avoided loss and economic stability for flood-prone regions.

BUSINESS ACTIONS MITIGATE FLOOD RISK

When flooding is imminent, the property owner must act. Much of the flood-mitigation equipment a Fortune 1000-size company might use to protect its property from floodwaters is tested and certified by FM Approvals,[3] an FM Global business unit and global leader in third-party product testing and certification services.

FM Approvals, a Nationally Recognized Testing Laboratory by OSHA,[4] has developed the widely adopted industry standard for flood barriers, the American National Standard for Flood Abatement Equipment, ANSI/FM 2510,[5] and conducts testing in part for these products at the U.S. Army Corps of Engineers' U.S. Army Engineer Research and Development Center in Vicksburg, Mississippi. This activity is a central part of the National Flood Barrier Testing and Certification Program.[6] The program—a partnership between the U.S. Army Corps of Engineers, the Association of State Floodplain Managers and FM Approvals—assures property owners that certified flood-loss prevention products meet the highest property-protection performance standards and, hence, will perform as intended.

To date, FM Approvals has certified more than 60 flood barrier products according to the ANSI/FM 2510 standard. These products—typically superior to sandbags in ease of use, performance and reliability—are allowed to be labeled by the manufacturer as FM Approved.

Flood-loss prevention solutions that can be tested and certified to ANSI/FM 2510 include:

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[2] https://www.infrastructurereportcard.org/wp-content/uploads/2017/01/Levees-Final.pdf

[3] https://www.fmapprovals.com/products-we-certify/products-we-certify/flood-mitigation-products

[4] https://www.osha.gov/dts/otpca/nrtl/nrtllist.html

[5] https://www.fmapprovals.com/approval-standards

[6] https://nationalfloodbarrier.org/

- *Perimeter barriers*—Emergency structures that when deployed, are intended to protect buildings and equipment from rising water. These temporary perimeter barriers have been evaluated for their ability to control riverine- or rainfall-related flood conditions.
- *Opening barriers*—Permanent or temporary devices, such as flexible walls or stackable aluminum gates, that prevent floodwater passage through doors, windows, vents and other openings in a building.
- *Flood mitigation valves*—Devices that block floodwaters from entering buildings through overwhelmed drainage systems. These valves prevent buildings from flooding from the inside out.
- *Flood mitigation pumps*—Devices that remove water that has already entered buildings, and that help mitigate damage from corrosion and mold.
- *Penetration sealing devices*—Products that are used to seal small openings in a building.
- *Flood glazing*—Reinforced glass structures used in urban settings, that serve as flood barriers.

CONTRIBUTING TO THE PUBLIC DOMAIN

FM Global contributes research-related resources freely to the public to help businesses beyond our own clients mitigate flood risk.

Among our contributions:

- *Flood maps*—Our Global Flood Map[7] is a strategic planning tool that helps American businesses address flood exposure at all their locations. Based on hydrologic and hydraulic models, it uses past and current climate data, including rainfall, evaporation, snowmelt and terrain—not just event history. The online interactive map provides a view of high- and moderate-hazard flood zones across the globe, including in previously uncharted territories. In the United States, we use FEMA's flood map as the primary source and our Global Flood Map as a secondary source.
- *Property loss prevention data sheets*—We have produced more than 350 engineering guidelines[8] based on our own research, loss experience and engineering knowledge. These data sheets give businesses proven engineering solutions and recognized standards to help them mitigate a wide range of property risks, including flood, fire, natural hazards and cyber attack, and also to inform national and global building codes and standards.
- *Research, testing and education*—We study flood dynamics and protection at our 1,600-acre FM Global Research Campus[9] in West Glocester, Rhode Island. It's the world's premier center for property-loss prevention scientific research and product testing. The Research Campus includes a Natural Hazards Laboratory for assessing hazards and developing loss- prevention solutions for hurricanes, hailstorms, earthquakes and floods. Much of this work is shared with governments to inform building and fire codes around the world. The Research Campus is also a resource for manufacturers seeking third-party certifications of their products through FM Approvals. Finally, we conduct extensive computational and fundamental research and educational activities in Norwood, Massachusetts, where we have offices, laboratories, a learning center for employees and clients, and the SimZone, which is a collection of experiential learning labs.

UNMET NEEDS

We believe private sector efforts like these are most effective when supported by congruent government policy, planning and resources. Thus, we deeply value our collaboration with the federal government, including the U.S. Army Corps of Engineers and FEMA. As FM Global looks to the future of increasing flood risk, we see two major unmet needs: 1) protections against higher flood depths; and 2) the improved use of technology for flood monitoring and mapping.

Of the over 10,000 U.S. business locations that have been identified by FM Global engineers as being exposed to flood hazards, more than 1 in 4 may experience flood depths greater than 3 feet, the limit of flood barriers tested at the U.S. Army Engineer Research and Development Center. Thus, we consider any flood mitigation device intended to withstand floodwaters above 3 feet experimental, and, by definition, risky to use. Accordingly, we would support an improvement in the U.S. Army Engi-

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[7] http://www.fmglobal.com/globalfloodmap

[8] http://www.fmglobaldatasheets.com/

[9] https://www.fmglobal.com/research-and-resources/research-and-testing/fm-global-research-campus

neer Research and Development Center laboratory to enable testing of solutions to address higher floodwaters. Such a capability would enable significant enhancements to the resilience of American businesses.

TAKING ADVANTAGE OF NEW TECHNOLOGY

Another potential area of collaboration is improving the ability to apply current and future advanced technology to improve early flood warning, to better respond to floods in progress, and to improve long-term planning. These improvements include deployment of both on-the-ground and remote sensing at greater scale, the ability to transfer and openly communicate information, and the ability to allow more innovation in loss prevention products based on greater real-time insight.

Achieving this goal will require investment in sensors and systems, and better data and imaging technology, to be used in conjunction with geographic information system (GIS) technology to make businesses more agile and successful in their loss-prevention efforts. We believe a strategic public-private-academic partnership to fully develop and deploy improved technology at scale will better allow the country to control its fate as it becomes more vulnerable to flood risk.

CHOOSING RESILIENCE

When it comes to our nation's flood resilience, the risk for American businesses is real. Insurance is not enough. Yet, through science and tested solutions, as well as strong and sustained public-private partnerships, together we can better assess risks and develop a national strategy to reduce them, thereby preserving and enhancing U.S. economic competitiveness.

Elected officials are uniquely positioned to make far-reaching risk-reducing policy based on research. In partnership with American business, they can choose prevention over wishful thinking, and continue supporting the U.S. Army Corps to engineer flood resilience into every corner of our nation—and to drive risk out.

Driving risk out before catastrophe occurs: That's what the savviest, most successful businesses do.

These savvy businesses realize that resilience isn't luck. It's a choice our country has to make, and if we choose wisely and work together, our nation will continue to thrive in the face of an increasing threat.

Thank you for considering my testimony, and for the opportunity to meet you today in person.

Mrs. NAPOLITANO. Thank you, sir, your testimony is very nice.

We will move on to Ms. Samet. You are recognized.

Ms. SAMET. Chair Napolitano, Chairman DeFazio, Ranking Member Westerman and members of the subcommittee, I want to thank you for the opportunity to testify before you today.

My name is Melissa Samet. I am the senior water resources counsel for the National Wildlife Federation, which is the Nation's largest education and advocacy organization, conservation education and advocacy organization.

I want to start by highlighting a reality that often does not get the attention it requires. Our Nation's water resources infrastructure does not consist only of locks, dams, levees and other man-made structures, it also includes our rivers, streams, flood plains and wetlands, those systems that form our vital natural infrastructure, which is so essential for people and wildlife.

Protecting and investing in natural infrastructure from coastal wetlands to rivers and their flood plains is a win for wildlife and our communities. Natural infrastructure makes communities safer and more resilient by absorbing flood waters and buffering storm surges. Natural infrastructure reduces the need for new, often expensive structural projects and provides an important extra line of defense when levees or other structures are required.

The diverse environmental benefits provided by sustainable and cost-effective natural infrastructure can be particularly valuable for

underserved communities suffering from flooding and multiple other environmental assaults. Natural infrastructure has long been recognized as both highly effective and cost effective.

A 1972 Corps of Engineers study of the Charles River in Massachusetts concluded, and I am quoting, "nature has already provided the least-cost solution to future flooding in the form of extensive riverine wetlands which moderate extreme highs and lows in streamflow," end quote. The Corps then found that it was both prudent and economical to protect these wetlands instead of building a new flood control dam. And that is exactly what the Corps did at a fraction of the cost of the structural project.

The value of natural infrastructure was on display during Hurricanes Katrina, Sandy and Harvey. The horrific impacts of those storms would have been even worse without the coastal and inland wetlands and green spaces that provided significant and demonstrable protections.

A study released last year shows that natural infrastructure would be far more cost effective than levees and dikes for reducing coastal flood risks in Texas, Louisiana, Mississippi and Florida. The average benefit-cost ratio for nature-based solutions was found to be 3.5, compared to just 0.26 for levees and dikes. Restoring wetlands in this region could prevent $18.2 billion in losses while costing just $2 billion to carry out.

While structural flood projects are absolutely necessary and appropriate in some cases, they should be the option of last, not first resort; an option that is used only if a comprehensive assessment demonstrates that natural infrastructure either alone or in combination with structural projects will not work.

Our written testimony details a number of recommendations that would improve the resilience of our natural infrastructure and help prevent Corps projects and operations from undermining that resilience. First, we recommend that the Congress create natural infrastructure incentives for communities and other non-Federal sponsors, with a special focus on at-risk and underserved communities. Second, we recommend planning reforms that would help the Corps better identify impacts to natural infrastructure and better mitigate those impacts if they cannot be avoided, as has long been required by Federal law. Third, we recommend improvements to the way the Corps accounts for project costs and benefits, including accounting for lost ecosystem services as a project cost, and increases in ecosystem services as a project benefit, to make sure that natural infrastructure is properly accounted for in the benefit-cost analysis. Fourth, we recommend creation of an ecological services directorate within the Office of the Chief of Engineers to increase the Corps' capacity to take full advantage of existing programs, authorities and operations to protect natural infrastructure and minimize expenditures for emergency response and rebuilding. And notably, some of the Corps' actions actually increase flooding in some areas and increase drought in other areas and those issues really do need to be addressed.

The National Wildlife Federation respectfully urges the committee to adopt these recommendations that will provide important benefits that will run across all of the Corps' business lines.

I want to thank you for the opportunity again to present this testimony and I look forward to your questions.

[Ms. Samet's prepared statement follows:]

Prepared Statement of Melissa Samet, Senior Water Resources Counsel, National Wildlife Federation

Chair Napolitano, Ranking Member Westerman, and Members of the Subcommittee, thank you for the opportunity to testify before you today on the vital issue of improving the resilience of our nation's water resources infrastructure.

The National Wildlife Federation is the nation's largest conservation education and advocacy organization with 6 million members and supporters, and affiliate conservation organizations in 52 states and territories. Our members represent the full spectrum of people who care deeply about wildlife: they are bird and wildlife watchers, hikers, gardeners, anglers, hunters, foresters, and farmers. The National Wildlife Federation has championed clean and healthy rivers and streams since our founding in 1936. Conserving our wetlands, streams, rivers, and shorelines for wildlife and communities is at the core of our mission.

The National Wildlife Federation has extensive experience with all aspects of U.S. Army Corps of Engineers (Corps) planning, including ecosystem restoration, flood damage reduction, navigation, and reservoir operations. We also have the benefit of understanding needed water resources project and policy improvements from hundreds of organizations across the country. The Federation leads the Water Protection Network, a coalition of more than 250 local, regional, and national organizations working to ensure that America's water resources policies and projects are environmentally and economically sound. The Federation also has a long history working on large-scale ecosystem restoration efforts around the country that involve the Corps, including in the Everglades and Mississippi River Delta.

Healthy rivers, floodplains, wetlands, and shorelines are essential for resilient communities, resilient populations of fish and wildlife, and a vibrant outdoor economy. These natural systems also reduce the need for structural flood and storm damage reduction projects and improve the effectiveness and resilience of levees and other water resources infrastructure. As we anticipate more frequent and severe storms and weather events, it is essential that we consider all tools at our disposal, including the use of natural systems to help absorb floodwaters and buffer communities.

The value of natural systems for protecting communities is well recognized. In a 1972 study evaluating options to reduce flooding along Charles River in Massachusetts, the Corps concluded:

> "Nature has already provided the least-cost solution to future flooding in the form of extensive [riverine] wetlands which moderate extreme highs and lows in streamflow. Rather than attempt to improve on this natural protection mechanism, it is both prudent and economical to leave the hydrologic regime established over millennia undisturbed." [1]

Wetlands prevented $625 million in flood damages in the 12 coastal states affected by Hurricane Sandy, and reduced damages by 20 to 30 percent in the four states with the greatest wetland coverage.[2] Coastal wetlands reduced storm surge in some New Orleans neighborhoods by two to three feet during Hurricane Katrina, and levees with wetland buffers had a much greater chance of surviving Katrina's fury than levees without wetland buffers.[3] As aptly noted by the Reinsurance Association of America: "One cannot overstate the value of preserving our natural systems for the protection of people and property from catastrophic events." [4]

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[1] American Rivers, Unnatural Disasters, Natural Solutions: Lessons From The Flooding Of New Orleans (2006) (quoting USACE, from Massachusetts Department of Fish and Game, *Functions of Riparian Areas for Flood Control*, http://www.mass.gov/dfwele/river/pdf/riparian_factsheet_1.pdf.)

[2] Narayan, S., Beck, M.B., Wilson, P., et al., The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. Scientific Reports 7, Article number 9463 (2017), doi:10.1038/s41598-017-09269-z (available at https://www.nature.com/articles/s41598-017-09269-z).

[3] Bob Marshall, *Studies abound on why the levees failed. But researchers point out that some levees held fast because wetlands worked as buffers during Katrina's storm surge*, The New Orleans Times-Picayune (March 23, 2006).

[4] Restore America's Estuaries, *Jobs & Dollars BIG RETURNS from coastal habitat restoration* (September 14, 2011) (http://www.estuaries.org/images/81103-RAE_17_FINAL_web.pdf).

Through our extensive experience with Corps projects across the country—and with communities affected by those projects—it is clear that the Corps must do much more to protect, restore, and use healthy natural systems. To help ensure that the Corps can achieve these vital goals, the National Wildlife Federation respectfully urges Congress to continue to advance important ecosystem restoration projects and enact the following new policy reforms to:

- *Mainstream the Corps' Use of Natural Infrastructure*: Natural infrastructure is a critical, but underused, tool for reducing flood and storm damages while also increasing resilience. Congress should create incentives for non-federal sponsors to increase consideration of natural infrastructure solutions by: (1) clarifying that natural infrastructure solutions are subject to the decade-old limitation on the total non-federal cost share for non-structural measures, which eliminates the potential for excessive land-related cost burdens on non-federal sponsors; and (2) facilitating full consideration of cost-effective flood and storm damage reduction solutions for at-risk communities by adopting targeted criteria for waiving the non-federal cost share for feasibility studies while also requiring that those studies fully evaluate natural infrastructure solutions that can provide sustainable and less expensive protections.
- *Ensure Effective Mitigation and Analysis of Fish and Wildlife Impacts in Accordance with Long-Standing Legal Requirements*: Congress should ensure projects properly account for and address harm to fish and wildlife by: (1) clarifying the types of project studies that trigger the civil works mitigation requirements to ensure application of these requirements as Congress unquestionably intended; and (2) directing the Corps to evaluate and develop mitigation for fish and wildlife resources in a manner that is consistent with recommendations developed by federal and state fish and wildlife experts pursuant to the Fish and Wildlife Coordination Act that derive from the special expertise of these experts (e.g., methods and metrics for evaluating fish and wildlife impacts and needed mitigation). Failure to adequately mitigate impacts significantly undermines the resilience of the nation's fish and wildlife.
- *Accurately Account for Project Costs and Benefits, Including Ecosystem Services Lost and Gained*: Congress should modernize the criteria used to assess costs and benefits when planning federal water resources projects, including by accounting for increased ecosystem services as a project benefit and lost ecosystem services as a project cost. Fully accounting for costs and benefits is critical for making effective decisions regarding the planning, construction, budgeting, prioritization, and authorization of Corps projects to increase resilience. Ecosystem services are the direct and indirect contributions that ecosystems provide to our well-being, including benefits like flood control, water purification, and habitat for wildlife.
- *Increase the Corps' Capacity to Improve the Resilience of Water Resources Infrastructure, Including By Taking Full Advantage of Existing Authorities*: Congress should establish a Directorate of Ecological Services within the Office of the Chief of Engineers tasked with ensuring that the Corps takes full advantage of existing programs, authorities, and operations to use natural systems to protect communities from floods, minimize expenditures for emergency response and rebuilding, improve wildlife habitat, and strengthen the outdoor-based economy. This Directorate should have significant budgeting authority. Corps planning is hampered by an organizational structure that prevents the agency from creating and taking advantage of critical opportunities to effectively utilize the extensive public safety and wildlife benefits provided by healthy natural systems.

Protecting the nation's waters and increasing the resilience of the nation's water resources infrastructure will also require Congress to defend the integrity of the laws that drive these outcomes, including the National Environmental Policy Act, the Clean Water Act, and the Endangered Species Act. We also urge this committee to carefully oversee the Corps' compliance with the letter and spirit of these laws when planning, constructing, and operating projects.

In our testimony below, we describe the multiple benefits provided by healthy natural systems that are essential for resilient communities, wildlife, and water resources infrastructure. We then highlight the need to advance key ecosystem restoration projects to restore healthy systems, and provide more detailed explanations of the policy reforms outlined above.

1. HEALTHY NATURAL SYSTEMS PROVIDE MULTIPLE BENEFITS FOR PEOPLE AND WILDLIFE

Healthy natural systems provide multiple benefits for communities, wildlife, and the outdoor economy. Protecting, restoring, and using healthy systems to protect communities will increase the resilience of the nation's water resources infrastructure.

Healthy Natural Systems Protect Communities

As highlighted earlier in this testimony, natural healthy natural systems provide critical protections for the communities. Healthy rivers, floodplains, wetlands, and shorelines can significantly reduce the need for new flood and storm damage reduction projects, and provide important protections for structural projects like levees and floodwalls.

For example, wetlands act as natural sponges, storing and slowly releasing floodwaters after peak flood flows have passed, and coastal wetlands buffer the onslaught of hurricanes and tropical storms. A single acre of wetland can store one million gallons of floodwaters.[5] Just a 1 percent loss of a watershed's wetlands can increase total flood volume by almost seven percent.[6] Restoring a river's natural flow and meandering channel, and giving at least some floodplain back to the river, slows down floodwaters and gives the river room to spread out without harming homes and businesses.

Wetlands prevented $625 million in flood damages in the 12 coastal states affected by Hurricane Sandy, and reduced damages by 20% to 30% in the four states with the greatest wetland coverage.[7] Coastal wetlands reduced storm surge in some New Orleans neighborhoods by two to three feet during Hurricane Katrina, and levees with wetland buffers had a much greater chance of surviving Katrina's fury than levees without wetland buffers.[8] California's wetlands provide an estimated $16.6 billion in benefits each year (in 2013 dollars) by reducing flood damages, recharging groundwater, purifying water supplies, providing recreational opportunities, and supporting healthy populations of fish and wildlife.[9]

Healthy Natural Systems Sustain Wildlife

Healthy rivers, floodplains, and wetlands provide vital fish and wildlife habitat and allow people and wildlife to benefit from natural flood cycles. In a healthy, functioning river system, precipitation events and other natural increases in water flow can deposit nutrients along floodplains creating fertile soil for bottomland hardwood forests. Sediment transported by these increased flows form islands and back channels that are home to fish, birds, and other wildlife. By scouring out river channels and riparian areas, these events prevent rivers from becoming overgrown with vegetation. They also facilitate breeding and migration for a host of fish species, and provide vital connectivity between habitat areas. In the deltas at the mouths of rivers, increased flows release freshwater and sediment, sustaining and renewing wetlands that protect coastal communities from storms and provide nurseries for multibillion dollar fisheries.

Wetlands are some of the most biologically productive natural ecosystems in the world, and support an incredibly diverse and extensive array of fish and wildlife. America's wetlands support millions of migratory birds and waterfowl. Up to one-half of all North American bird species rely on wetlands. Although wetlands account for just about 5 percent of land area in the lower 48 states, those wetlands are the only habitat for more than one third of the nation's threatened and endangered species and support an additional 20 percent of the nation's threatened and endangered at some time in their life. These same wetlands are home to 31 percent of the nation's plant species.[10]

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[5] Environmental Protection Agency, *"Wetlands: Protecting Life and Property from Flooding." EPA 843–F–06–001.* (2006) (factsheet).

[6] Demissie, M. and Abdul Khan. 1993. "Influence of Wetlands on Streamflow in Illinois." Illinois State Water Survey, Contract Report 561, Champaign, IL, Table 7, pp. 44–45.

[7] Narayan, S., Beck, M.B., Wilson, P., et al., The Value of Coastal Wetlands for Flood Damage Reduction in the Northeastern USA. Scientific Reports 7, Article number 9463 (2017), doi:10.1038/s41598–017–09269–z (available at https://www.nature.com/articles/s41598-017-09269-z).

[8] Bob Marshall, *Studies abound on why the levees failed. But researchers point out that some levees held fast because wetlands worked as buffers during Katrina's storm surge*, The New Orleans Times-Picayune (March 23, 2006).

[9] Harold Mooney and Erika Zavalata (editors), Ecosystems of California, University of California Press (2016) at 684.

[10] Environmental Protection Agency, Economic Benefits of Wetlands, EPA843–F–06–004 (May, 2006) (factsheet).

Healthy Natural Systems Drive the Outdoor Economy

Healthy rivers, floodplains, and wetlands are economic drivers for outdoor recreation and commercial fishery-based economies. Projects that restore those resources are also an important creator of jobs that are by necessity local and cannot be exported.

For example, wetlands are an economic driver for fish and wildlife associated recreation. Hundreds of species of birds, waterfowl, and wildlife and 90 percent of fish caught by America's recreational anglers are wetland dependent. In 2016, fishing, hunting, and other wildlife-associated recreation contributed $156.3 billion to the national economy. "This equates to 1% of Gross Domestic Product; one out of every one hundred dollars of all goods and services produced in the U.S. is due to wildlife-related recreation." Anglers alone spent "$46.1 billion on trips, equipment, licenses, and other items to support their fishing activities" while people who "fed, photographed, and observed wildlife," spent $75.9 billion on those activities.[11]

Ninety five percent of commercially harvested fish and shellfish are wetland dependent. Healthy coasts "supply key habitat for over 75% of our nation's commercial fish catch and 80–90% of the recreational fish catch."[12] Healthy rivers are equally important to these fisheries and the economic benefits they provide. Commercial fishing in the Apalachicola River and Bay (which relies on river flows to remain healthy) contributes $200 million annually to the regional economy and directly supports up to 85 percent of the local population.

Projects that restore natural systems also create jobs. Restore America's Estuaries reports that coastal restoration "can create more than 30 jobs for each million dollars invested" which is "more than twice as many jobs as the oil and gas and road construction industries combined."[13]

In Louisiana, a proposed $72 million project to restore a 30,000-acre expanse of degraded marsh near downtown New Orleans known as the Central Wetlands Unit would create 689 jobs (280 direct jobs and 400 indirect and induced jobs) over the project's life.[14] Implementation of the entire $25 billion dollars of restoration in Louisiana's Master Plan over the next fifty years would multiply those jobs hundreds of times over. In Florida, restoration of the Everglades will produce more than 442,000 jobs over the next 50 years and almost 23,000 short- to mid-term jobs for the actual restoration work. Restoring the Everglades is also predicted to produce a return of four dollars for each dollar invested.[15]

Coastal restoration projects carried out under the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and Coastal Program in FY2011 returned $1.90 in economic activity for every dollar spent on restoration. In California, the rate of return was $2.10 for every dollar spent.[16] The Department of the Interior's FY2010 investment of $156 million for ecosystem restoration activities in the Chesapeake Bay, Great Lakes, and Everglades supported more than 3,200 jobs and contributed more than $427 million in economic outputs.[17] The Department of the Interior supported 12 to 30 jobs for every million dollars spent on restoration in FY2018.[18]

In Oregon, a $411 million investment in restoration from 2001 to 2010 generated an estimated $752 to $977 million in economic output. The 6,740 restorations projects completed during that time supported an estimated 4,600 to 6,500 jobs, including jobs in construction, engineering, wildlife biology, and in supporting local businesses such as plant nurseries and heavy equipment companies. On average,

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[11] U.S. Fish and Wildlife Service, *2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: National Overview*, Issued August 2017. This study is the source for all quotes and data in this paragraph.

[12] Restore America's Estuaries, *Jobs & Dollars BIG RETURNS from coastal habitat restoration* (September 14, 2011) (http://www.estuaries.org/images/81103-RAE__17__FINAL__web.pdf).

[13] *Id*.

[14] Environmental Defense Fund, Profiles in Restoration: The Central Wetlands Unit, Part VI (May 3, 2010) (http://blogs.edf.org/restorationandresilience/category/central-wetlands-unit/).

[15] Everglades Foundation, Everglades Restoration a 4-to-1-Investment (http://everglades.3cdn.net/79a5b78182741ae87f__wvm6b3vhn.pdf).

[16] U.S. Fish and Wildlife Service, *Restoration Returns—The Contribution of Partners for Fish and Wildlife Program (PFW) and Coastal Program Restoration Projects to Local US Economies*, February 2014 (http://www.sfbayjv.org/resourcedocs/usfws-restoration-returns.pdf).

[17] The Department of the Interior's Economic Contributions (Department of the Interior, 2011) at 5, 106 (http://www.doi.gov/news/pressreleases/upload/DOI-Econ-Report-6-21-2011.pdf).

[18] U.S. Department of the Interior Economic Report FY2018 (Department of the Interior, 2019) at 4 (https://doi.sciencebase.gov/doidv/files/2018/pdf/FY%202018%20Econ%20Report.pdf).

$0.80 of every $1 spent on a restoration project in Oregon stays in the county where the project is located and $0.90 stays in the state.[19]

2. Congress Should Mainstream Use of Natural Infrastructure to Reduce Flood Damages

America faces significant water resource challenges, driven in part by more intense coastal storms, more frequent and severe flooding, unprecedented droughts, and the unintended consequences from many already-constructed water resources projects. Natural infrastructure is a critical—but underused—tool for solving many of these challenges, while also increasing resilience by protecting and improving the health of the nation's rivers, floodplains, wetlands, and shorelines.

Natural infrastructure, both alone and in conjunction with structural projects, provides important protections from storms and floods. Natural infrastructure avoids the risks of catastrophic failure and overtopping of levees, a risk that has caused the Association of State Floodplain Managers to urge communities to use nonstructural measures whenever possible instead of constructing new levees, which should be limited to the option "of last resort."[20] Natural infrastructure can also provide important buffers that increase the effectiveness and resilience of structural measures.

Many approaches to water resources planning can restore and protect vital natural infrastructure. These include re-establishing the natural form, function, hydrology, and inundation of rivers, floodplains, and wetlands by removing or modifying levees (including moving levees further away from the river, i.e., levee setbacks), dams, river training structures, cut offs, and culverts. Other approaches include purchasing flood or flowage easements; relocating flood-prone properties; using wetland buffers to protect levees; placing protections on wetlands and floodplains; utilizing water conservation and efficiency measures; establishing a navigation scheduling process; and improving management of existing water resources projects.

Living shorelines are an important example of natural infrastructure. Living shorelines are constructed with natural materials including vegetation, fiber logs, and marsh sills to protect coasts from erosion.[21] Living shorelines enhance coastal habitats, including by creating nursery grounds for fish and shellfish, providing feeding grounds for shorebirds and wading birds, and helping reduce water pollution. Living shorelines can be more effective at preventing erosion than structural projects and are highly resilient to storms, as demonstrated by a substantial body of scientific literature. A survey of the North Carolina coast after Hurricane Irene showed no visible damage in living shoreline projects, while 76 percent of bulkheads suffered damage.[22]

There is ample evidence that natural infrastructure solutions can provide highly effective flood and storm damage reduction for communities. For example:

- In the Gulf Coast regions of Texas, Louisiana, Mississippi, and Florida, nature-based solutions to reduce coastal flood risks are significantly more cost effective than structural solutions. A 2018 study shows that in this region, the average benefit-cost ratio for nature-based solutions is 3.5 compared to 0.26 for levees/dikes and 0.73 for home elevations. Restoring wetlands could prevent $18.2 billion of losses while costing just $2 billion to carry out. Restoring oyster reefs

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[19] Whole Watershed Restoration Initiative, Oregon's Restoration Economy, Investing in natural assets for the benefit of communities and salmon (2012) (http://www.ecotrust.org/wwri/downloads/WWRI__OR__brochure.pdf).

[20] Association of State Floodplain Managers White Paper, National Flood Policy Challenges, Levees: The Double-edged Sword, Adopted February 13, 2007.

[21] While living shorelines may not be appropriate everywhere, they are a demonstrably viable, often more effective, and environmentally-preferable alternative to traditional structural projects like bulkheads.

[22] S. Sharma et al., *A Hybrid Shoreline Stabilization Technique: Impact of Modified Intertidal Reefs on Marsh Expansion and Nekton Habitat in Northern Gulf of Mexico*, 90 Ecological Engineering, 339–50 (2016); Amanda S. Lawless et al., *Effects of shoreline stabilization and environmental variables on benthic infaunal communities in the Lynnhaven River System of Chesapeake Bay*, 457 J. of Experimental Marine Biology & Ecology, 41–50 (2014); J. E. Manis et al., *Wave Attenuation Experiments Over Living Shorelines Over Time: A Wave Tank Study to Assess Recreational Boating Pressures*, 19 J. of Coastal Conservation, 1–11 (2015); S. Crooks & R. K. Turner, *Integrated coastal management: sustaining estuarine natural resources*, in 29 Advances in Ecological Res., 241–289 (Nedwell, and Raffaelli., eds. 1999); Rachel K. Gittman et al., *Marshes with and without Sills Protect Estuarine Shorelines from Erosion Better than Bulkheads During a Category 1 Hurricane*, 102 Ocean & Coastal Mgmt., 94–102 (2014).

could prevent $9.7 billion in losses while costing just $1.3 billion. Restoring barrier islands could prevent $5.9 billion in losses while costing just $1.2 billion.[23]

- In southern California, the Surfers' Point Managed Shoreline Retreat Project is restoring 1,800 feet of shoreline with cobble beach and vegetated sand dunes east of the mouth of the Ventura River to "provide resilience and offset risk from sea level rise and storms for 50 years" while maintaining beach access and other coastal resources. Since the project began, Surfers' Point has become Ventura County's most visited beach. Even with only one of two phases completed, the restored beach and dunes withstood 2015–2016 winter high wave conditions without damage, while other locations such as the Ventura Pier and promenade were damaged and the Pierpont neighborhood east of the project site was inundated.[24]
- In northern California, the Napa Valley Flood Control Project is using a community-developed "living river" plan to reduce flood damages along the flood-prone Napa River. This plan replaces the Corps' originally-proposed floodwalls and levees with terraced marshes, wider wetland barriers, and restored riparian zones. The Project will restore more than 650 acres of high-value tidal wetlands of the San Francisco Bay Estuary while protecting 2,700 homes, 350 businesses, and over 50 public properties from 100-year flood levels, saving $26 million annually in flood damage costs.[25] Though only partially complete, the project was credited for lowering flood levels by about 2 to 3 feet during the 2006 New Year's Day flood.
- In Florida, the Corps is using wetland restoration in the Upper St. John's River floodplain to provide important flood damage reduction benefits. The backbone of this project is restoration of 200,000 acres of floodplain which will hold more than 500,000 acre-feet of water—enough to cover 86 square miles with 10 feet of water—and will accommodate surface water runoff from a more than 2,000 square mile area. The Corps predicts that this $200 million project will reduce flood damages by $215 million during a 100-year flood event, and provide average annual benefits of $14 million. This project was authorized by Congress in 1986 to reduce flood damages along the river.
- In Illinois, a 2014 study conducted for the Chicago Wilderness Green Infrastructure Vision, found that natural systems are the least costly and most efficient way to control flooding. Wetlands in the seven-county Chicago metropolitan area provide an average $22,000 of benefits per acre each year in water flow regulation. This study also found that watersheds with 30 percent wetland or lake areas saw flood peaks that were 60 to 80 percent lower than watersheds without such coverage, and that preventing building in floodplain areas could save an average of $900 per acre per year in flood damages.[26]
- In Iowa, the purchase of 12,000 acres in easements along the 45-mile Iowa River corridor saved local communities an estimated $7.6 million in flood damages as of 2009. The easement purchase effort began after the historic 1993 floods when river communities in east-central Iowa recognized the need for a more effective approach to reducing flood damages.
- In Massachusetts, a 1972 Corps study showed that upstream wetlands were playing a critical role in reducing flooding in the middle and upper reaches of the Charles River by storing millions of gallons of water and preventing $17 million each year in flood damages. This led the Corps to preserve 8,000 floodplain acres to ensure future flood storage, at a cost of just one-tenth of the structural project it had previously planned to build. This approach was sanctioned by Congress in 1974 when it authorized the Charles River Natural Valley Storage Area. These floodplain wetlands are credited with reducing major floods, including in 1979, 1982, and 2006. The Corps estimates that this project

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[23] Borja G. Reguero et al., "Comparing the Cost Effectiveness of Nature-Based and Coastal Adaptation: A Case Study from the Gulf Coast of the United States," PLoS ONE 13, no. 4 (April 11, 2018), https://doi.org/10.1371/journal.pone.0192132.

[24] Jean Judge et al., "Surfers' Point Managed Shoreline Retreat Project," in *Case Studies of Natural Shoreline Infrastructure in Coastal California: A Component of Identification of Natural Infrastructure Options for Adapting to Sea Level Rise (California's Fourth Climate Change Assessment)*. (The Nature Conservancy, 2017), 9–15, https://scc.ca.gov/files/2017/11/tnc__Natural-Shoreline-Case-Study__hi.pdf.

[25] Napa County California website at https://www.countyofnapa.org/1096/Creating-Flood-Protection.

[26] Will Allen, Ted Weber, and Jazmin Varela, *Green Infrastructure Vision: Version 2.3: Ecosystem Service Valuation*. (The Conservation Fund: 2014), 13–15, https://datahub.cmap.illinois.gov/dataset/c303fd2e-beaf-4a75-a9ec-b27c6da49b69/resource/028c9b69-bb19-425e-bb92-3d33656bea4c/download/tcfcmapgiv23ecosystemservicesfinalreport201412v2.pdf.

has prevented $11.9 million in flood damages while providing recreational benefits valued at between $3.2 and $4.6 million.[27]

- In New York, restoration of wetlands and lands adjacent to 19 stream corridors in Staten Island "successfully removed the scourge of regular flooding from southeastern Staten Island, while saving the City $300 million in costs of constructing storm water sewers."[28] Some 400 acres of freshwater wetland and riparian stream habitat has been restored along 11 miles of stream corridors that collectively drain about one third of Staten Island's land area. A 2018 study commissioned by the City of New York found that using "hybrid infrastructure" that combines nature, nature-based, and gray infrastructure together could save Howard Beach, Queens $225 million in damages in a 100-year storm while also generating important ecosystem services.[29]
- In Oregon, the Portland Bureau of Environmental Services restored 63 acres of wetland and floodplain habitat, restored 15 miles of Johnson Creek, and move structures out of high risk areas to reduce flood damages in the Johnson Creek neighborhood. In January 2012, when heavy rainfall caused Johnson Creek to rise two feet above its historic flood stage, the restored site held the floodwaters, keeping nearby homes dry and local businesses open. An ecosystem services valuation of the restored area found that the project would provide $30 million in benefits (in 2004 dollars) over 100 years through avoided property and utility damages, avoided traffic delays, improved water and air quality, increased recreational opportunities, and healthy fish and wildlife habitat.[30]
- In Texas, restoration of a 178-acre urban wetland—formerly an abandoned golf course—acted as a sponge to store 100 million gallons of water during Hurricane Harvey, protecting 150 homes in Houston's Clear Lake community from serious flooding. This project will store up to a half billion gallons of water and protect up to 3,000 homes when it is completed in 2021.[31]
- In Vermont, a vast network of floodplains and wetlands, including those protected by 23 conservation easements protecting 2,148 acres of wetland along Otter Creek, saved Middlebury $1.8 million in flood damages during Tropical Storm Irene, and between $126,000 and $450,000 during each of 10 other flood events. Just 30 miles upstream, in an area without such floodplain and wetland protections, Tropical Storm Irene caused extensive flooding to the city of Rutland.

While sometimes necessary and appropriate, large scale structural projects, on the other hand, typically cause significant harm to the environment and can have negative secondary effects. For example, such projects often increase flooding downstream, induce development in high risk areas, and come with the very real risk of catastrophic failure and overtopping endangering surrounding communities.

The National Wildlife Federation appreciates the WRDA 2018 provision that directs the Corps to consider the use of natural infrastructures, alone or in combination with structural measures, whenever those solutions "are practicable."[32] Despite this, the Corps continues to fail to adequately consider natural infrastructure solutions where they are practicable for storm and flood damage reduction.[33]

As a result, it is clear that Congress will need to take additional steps to ensure that the Corps mainstreams the use of natural infrastructure solutions. One approach is to create natural infrastructure incentives for non-federal sponsors by: (1) clarifying that natural infrastructure solutions are subject to the decade-old limitation on the total non-federal cost share for non-structural measures, which eliminates the potential for excessive land-related cost burdens on non-federal sponsors; and (2) facilitating full consideration of cost-effective flood and storm damage reduction solutions for at-risk communities by adopting targeted criteria for waiving the non-federal cost share for feasibility studies while also requiring that those studies

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[27] American Rivers, Unnatural Disasters, Natural Solutions: Lessons From The Flooding Of New Orleans (2006) (Charles River Valley Natural Storage Area case study); and https://www.arcgis.com/apps/MapJournal/index.html?appid=0bf97d033a8642b18c2e8075d4b5ecfe.

[28] Cooper Union, Institute for Sustainable Design, *The Staten Island Bluebelt: A Study In Sustainable Water Management* (http://cooper.edu/isd/news/waterwatch/statenisland). These effort was started in 1990.

[29] The Nature Conservancy, *Urban Coastal Resilience: Valuing Nature's Role*. (2015), https://www.nature.org/content/dam/tnc/nature/en/documents/urban-coastal-resilience.pdf.

[30] "Johnson Creek Restoration, Portland, Oregon," Naturally Resilient Communities, accessed November 12, 2019, http://nrcsolutions.org/johnson-creek-restoration-portland-oregon/.

[31] Exploration Green, 2018, https://www.explorationgreen.org/.

[32] America's Water Infrastructure Act of 2018, Pub. Law 115–270, § 1149(c).

[33] The Corps' implementing guidance states that this WRDA 2018 provision requires no changes at all in the way the Corps plans projects. U.S. Army Corps of Engineers, Implementation Guidance for Section 1149 of the WRDA of 2018 (April 12, 2019).

fully evaluate natural infrastructure solutions that can provide sustainable and less expensive protections.

3. Congress Should Ensure Continued Progress on Ecosystem Restoration Projects

The National Wildlife Federation greatly appreciates the committee's role in overseeing the Corps' implementation of important projects designed to restore the nation's waters. We urge Congress to ensure that the Corps continues to advance important ecosystem restoration projects, including those designed to restore coastal Louisiana and America's Everglades.

Restoring Coastal Louisiana

As a partner in the Restore the Mississippi River Delta Coalition, the National Wildlife Federation has worked for years to restore critical habitat in coastal Louisiana. The Louisiana Coast is in the midst of a land loss crisis with dramatic implications for our national economy and world class natural resources. Since the 1930s, the state has lost about 1,900 square miles of land to the Gulf. Recent catastrophes, such as Hurricanes Katrina and Rita, and the Deepwater Horizon oil disaster, exacerbated the coastal crisis. Without action, Louisiana is projected to lose up to another 4,000 square miles within the next 50 years.

In Title VII of the Water Resources Development Act of 2007, Congress authorized the Louisiana Coastal Area program, consisting of high priority projects for slowing the current trend of coast-wide wetland loss and resource degradation. Despite the fact that these projects were found to be in the federal interest, very little federal money has been appropriated to the Louisiana Coastal Area program since its authorization. Instead, several of the projects it contains, though renamed, have been advanced by the state with oil spill settlement dollars.

Title VII of WRDA 2007 also tasked the Corps with developing, in concert with the state of Louisiana, a comprehensive coastal management plan "for protecting, preserving, and restoring the coastal Louisiana ecosystem." To date, the Corps has not engaged in such a process. In the meantime the state of Louisiana has produced two successive Coastal Master Plans, in 2012 and 2017, based upon a widely lauded scientific and stakeholder engagement processes, which propose fundamental changes to the management of the lower Mississippi River. Among these are diversions of river water into the collapsing Mississippi River delta at Ama on the west bank of the river, and Union on the east bank.

Louisiana's 2017 *Comprehensive Master Plan for a Sustainable Coast* (CMP), based upon a science-based selection process, propose diversion projects upriver from New Orleans at Ama and Union that could fulfill the goals of the CMP and reduce the flood threat downriver. Ama would divert water that would otherwise need to be carried by the Bonnet Carre Spillway, away from the Lake Pontchartrain basin in Louisiana and Mississippi Sound in Mississippi and Alabama. The Union Diversion would divert water into the Pontchartrain Basin upriver from Bonnet Carre, allowing it to pass through the swamps surrounding lakes Maurepas and Pontchartrain, where wetlands would reduce the amount of excess nutrients reaching Mississippi Sound and Lake Pontchartrain, reducing harmful algal blooms.

The state of Louisiana submitted proposed Ama and Union Diversion feasibility studies for inclusion in the Section 7001 report that Congress will soon receive. The National Wildlife Federation urges Congress to authorize these proposed studies, and to examine outcomes from other ongoing studies to improve overall flood control, navigation, and ecosystem restoration of the lower Mississippi River. We also encourage an increased federal investment in and commitment to the goals of the Louisiana Coastal Area program, as we work to restore a coastal ecosystem that is facing some of the highest rates of sea level rise and subsidence in the world.

Restoring America's Everglades

The National Wildlife Federation appreciates the committee's continued support for efforts to restore America's Everglades. The "River of Grass" is an ecological treasure, supporting a vast array of threatened and endangered plants and wildlife. It provides the drinking water for 8 million people and is a vital source of Florida's commercial and recreational fishing, outdoor recreation, and tourism. Located along the southern tip of Florida, the Everglades' network of mangroves and wetlands, along with the surrounding coral reefs and seagrasses, function as the first line of defense against hurricanes, storms, and flooding, reducing storm surges and absorbing floodwaters.

The best tool we have to make Florida more resilient is Everglades restoration. Centuries of draining Florida's wetlands and altering the flow of water have limited water management flexibility in parts of South Florida, causing recurring sea grass

die-offs and toxic algae outbreaks that wreak havoc on Florida's economy and wildlife. Key Everglades restoration projects aim to help capture and clean water from Lake Okeechobee and send it south to the Everglades and Florida Bay, where it is desperately needed. This will reduce the volume and frequency of damaging discharges and toxic algae outbreaks in Florida's delicate coastal estuaries.

The Comprehensive Everglades Restoration Plan, authorized in WRDA 2000, laid out a roadmap to restore America's Everglades, with both the federal government and the state responsible for 50 percent of project costs. In recent years, the state of Florida has funded Everglades restoration at more than $200 million a year, while federal appropriations have significantly lagged behind. In order to maximize the benefits of, and advance the progress made towards, restoring America's Everglades, the federal government must invest at least $200 million in Army Corps Everglades restoration efforts each year. In addition to robust, consistent funding for Everglades restoration to proceed, it will be important that component projects with the Comprehensive Everglades Restoration Plan are not prevented from advancing due to any new construction starts limitations.

Brandon Road Lock and Dam Project

The National Wildlife Federation has worked for many years on protecting the Great Lakes and all of our nation's waters from the ongoing threat and harm of aquatic invasive species, specifically the invasive Asian carp. Asian carp have devastated iconic fisheries throughout the country and now threaten the Great Lakes and their connected inland lakes and rivers, too. Asian carp are not just a Great Lakes problem, or a Mississippi River problem, or a Kentucky Lake problem. They are an American problem, and it will take a united national effort to stop them.

Specifically in the Great Lakes, invasive Asian carp will undermine fisheries throughout the Great Lakes region—as filter feeders with no native predators, they reproduce rapidly and consume the base of the food chain, starving out forage, native and sport fish. Silver carp are a safety threat to boaters and anglers, leaping out of the water when disturbed by boat motors, and even paddles, threatening tourism-reliant communities.

The Corps submitted a Chief's Report for the Brandon Road Lock and Dam project in the summer of 2019. This Lock is about 50 miles south of Chicago and represents our best opportunity to provide a long-term structural deterrent to Asian carp. The Brandon Road plan would install a gauntlet of smart technologies to stop invasive Asian carp while allowing commercial navigation to continue. All the Great Lakes governors and the Ontario and Quebec premiers have signed on to a resolution supporting the plan. In addition, over 200 hunting, fishing, outdoor recreation industry and conservation organizations support the Brandon Road plan. This project is essential to help protect the fishery, the economy and quality of life in the Great Lakes region.

4. Congress Should Ensure that the Corps Effectively Analyzes and Mitigates for the Adverse Impacts of Corps Projects on Fish and Wildlife

For decades, Congress has required mitigation for adverse impacts to fish and wildlife caused by Corps water resources projects. Congress established detailed planning requirements to ensure effective mitigation in WRDA 2007, where it also clearly stated that the mitigation requirements must be met whenever the Corps selects a project alternative in "any report."[34] The Act's legislative history reiterates that the "increased mitigation requirements apply to all new studies and any other project that must be reevaluated for any reason."[35] Rather than follow these clear directives, the Corps has explicitly limited its compliance with the WRDA 2007 mitigation requirements to reports submitted to Congress for authorization.[36]

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[34] 33 U.S.C. § 2283(d)(1) ("the Secretary shall not submit any proposal for the authorization of any water resources project to Congress in any report, *and shall not select a project alternative in any report*, unless such report contains" the detailed mitigation plan required by WRDA 2007) (emphasis added).

[35] Congressional Record Senate, S11981 September 24, 2007 (Consideration of Water Resources Development Act of 2007—Conference Report, Senator Barbara Boxer Environment and Public Works Committee Chair).

[36] U.S. Army Corps of Engineers, Implementation Guidance for Section 2036 (a) of the Water Resources Development Act of 2007 (WRDA 07)—Mitigation for Fish and Wildlife and Wetlands Losses (August 31, 2009). The Corps' interpretation violates the most fundamental principles of statutory construction by: (1) ignoring an entirely independent clause in the statute ("and shall not select a project alternative in any report"); and (2) failing to give meaning to the adjective "any" that qualifies the term "report" in that independent clause. See, e.g., *TRW Inc. v. Andrews*, 534 U.S. 19, 31 (2001); *U. S. v. Nordic Village*, 503 U.S. 30, 36 (1992); *Perrin v. United States*, 444 U.S. 37, 42 (1979); *United States v. Manasche*, 348 U.S. 528, 538–539 (1955).

To assist the Corps in properly evaluating fish and wildlife impacts and needed mitigation, the Corps is also required to consult with the U.S. Fish and Wildlife Service on fish and wildlife impacts from individual Corps projects and on opportunities for mitigating any such impacts. State fish and wildlife agencies are also encouraged to consult with the Corps on project-specific impacts and mitigation opportunities. The Corps is required to give "full consideration" to these expert recommendations.

Regrettably, the Corps often fails to adhere to these important requirements, leading to projects and long-term project operations that cause profound harm to the nation's fish and wildlife. For example, both of these requirements were ignored during the Corps' recent update to the Apalachicola-Chattahoochee-Flint (ACF) water control manual with devastating consequences.

For decades the Corps' operation of the ACF system has starved Florida's vitally important Apalachicola River and Bay of essential freshwater flows. The impacts have been so devastating that the state of Florida advised Congress that "the ecosystem and, indeed, the very way of life for generations of Floridians will be devastated" if flow patterns that mimic the historic flow regime are not restored for the Apalachicola River.[37] However, instead of improving conditions in the Apalachicola River and Bay, the Corps' new water control manual will make the already dire conditions even worse by holding significantly more water back for upstream water supply, initiating drought restrictions earlier and more frequently, and severely restricting flows to the Apalachicola River more often and for longer periods of time.[38]

Many of the problems with the new ACF water control manual could have been avoided had the Corps addressed the important recommendations made by the U.S. Fish and Wildlife Service in the project's Final Fish and Wildlife Coordination Act Report. These recommendations included utilizing a different approach for analyzing impacts and for developing alternatives that would reduce the adverse environmental and wildlife impacts *without* jeopardizing other authorized purposes.

In this update, the Corps also refused to adopt a mitigation plan for "substantially adverse" damage to fish and aquatic resources in the Chattahoochee River. The Corps argued that it is not required to mitigate for this significant harm because the new water control manual does not have to be submitted to Congress for approval.

To address these problems, Congress should: (1) clarify the types of project studies that trigger the civil works mitigation requirements to ensure application of these requirements as Congress unquestionably intended; and (2) direct the Corps to evaluate and develop mitigation for fish and wildlife resources in a manner that is consistent with recommendations developed by federal and state fish and wildlife experts pursuant to the Fish and Wildlife Coordination Act that derive from the special expertise of these experts (e.g., methods and metrics for evaluating fish and wildlife impacts and needed mitigation).

5. Congress Should Modernize the Corps' Benefit-Cost Analysis Process to Better Account for Project Costs and Benefits, Including by Accounting for Ecosystem Services

The Corps' benefit-cost analysis process is biased towards the approval of costly, large-scale structural projects even when less costly, natural infrastructure or nature-based solutions are available. This bias can lead to the construction of projects that significantly and unnecessarily undermine resilience.

Among many other problems, Corps cost analyses do not account for costs associated with detailed technical design specifications; full life-cycle costs; or costs associated with delays due to lack of funding and/or sub-optimal funding streams. As a result, Corps cost estimates can dramatically understate the actual costs to both taxpayers and non-federal sponsors to construct a project. Importantly, Corps cost analyses also fail to account for the costs of lost ecosystem services.

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[37] Testimony of Jonathan P. Steverson, Executive Director of the Northwest Florida Water Management District, "Effects of Water Flows on Apalachicola Bay: Short and Long Term Perspectives", United States Senate Committee on Commerce, Science and Transportation Field Hearing, August 13, 2013 at 4.

[38] The excessive damage that would be caused by the new water control manual has forced the state of Alabama and conservation organizations, including the National Wildlife Federation, to challenge the manual in court.

Examples of Projects With Grossly Inaccurate Original Cost Estimates

Project	Original Estimate (millions)	2010 Estimate (millions)	Percentage Increase
Louisiana Hurricane Protection	$85	$738	768%
Sacramento Flood Protection	$57	$270 to $370	374% to 549%
Rio de Flag River	$24	$85	254%
Monongahela Locks & Dam	$556	$1,700	206%
Olmstead Lock & Dam	$775	$2,124	174%
Folsom Dam Flood Gates	$215	$450 to $650	109% to 202%
McAlpine Locks & Dam	$220	$427	94%
Marmet Lock	$223	$406	82%
South Florida Ecosystem Restoration	$1,540	$1,970	28%
Oregon Inlet Jetty (annual costs)	$4.5	$5.5	22%

A 2013 GAO report found that at least two-thirds of the 87 Corps flood control projects budgeted for construction between FY2004 and FY2012 experienced cost increases. One project cost $10 million more than the authorized estimate because the construction site could not be accessed without carrying out major rehabilitation of a tunnel access point. The cost of a pumping plant required by a second project increased from the original estimate of $800,000 to $10.7 million due to design changes required to handle the actual site conditions.[39]

The Corps' benefit analyses are equally problematic. They fail to account for benefits resulting from increases in ecosystem services; often lack justifications for claimed benefits; and include benefits that would be derived from activities that are contrary to law, policy, and sound resource management. For example, Corps benefit analyses may include: (1) agriculture and development benefits created by draining wetlands; (2) development benefits resulting from new or intensified use of floodplains or wetlands, including future induced development; (3) flood damage reduction benefits from new or intensified use of lands subject to flood easements or permanent conservation easements; and (4) benefits from draining wetlands on federally owned lands.

Corps benefit-cost analyses are also plagued by invalid assumptions, inaccurate data, and basic math errors. The Government Accountability Office (GAO) found that a number of major Corps studies "understated costs and overstated benefits, and therefore did not provide a reasonable basis for decision-making" because they "were fraught with errors, mistakes, and miscalculations, and used invalid assumptions and outdated data."[40] GAO also found that these problems were pervasive at the Corps, concluding that "the Corps' track record for providing reliable information that can be used by decision makers . . . is spotty, at best."[41] In one case, the Department of the Army Inspector General found that the Corps had deliberately and intentionally manipulated data to achieve a positive benefit-cost ratio that would support large scale construction of longer locks on the Upper Mississippi River.[42]

The many problems with Corps benefit-cost analyses may result in the approval of projects whose actual costs and benefits bear little to no relation to the benefit-cost ratio used to obtain congressional approval. To help the Corps accurately account for project costs and benefits, Congress should modernize the criteria used to assess costs and benefits—and level the playing field for natural infrastructure—including by requiring the Corps to account for increased ecosystem services as a project benefit and lost ecosystem services as a project cost.

6. Congress Should Increase the Corps' Capacity to Improve the Resilience of Water Resources Infrastructure, Including By Taking Full Advantage of Existing Authorities

Many existing programs and projects can be modernized to increase resilience while still satisfying authorized project purposes. Changes can be initiated through supplemental environmental impact statements, general or limited reevaluation

[39] Government Accountability Office, Army Corps of Engineers, Cost Increases in Flood Control Projects and Improving Communication with Nonfederal Sponsors, GAO–14–35 (December 2013) at 11, 14, 15.

[40] Government Accountability Office (GAO–06–529T), Corps of Engineers, Observations on Planning and Project Management Processes for the Civil Works Program, March 2006.

[41] *Id.*

[42] U.S. Department of the Army Inspector General, *Report of Investigation*, Case 00–019, 2000, at 6.

studies, or through congressional adoption of a "study resolution" that allows the Corps to examine a particular water resources problem in a specific area that has already been investigated.

Water control manuals, operating plans, and operations and maintenance activities can readily be reevaluated through the National Environmental Policy Act (NEPA) review process—and many of these activities likely require a supplemental review as a matter of law. At a minimum, these types of studies should be used to ensure that Corps projects do not inadvertently increase flood risks, divert flood waters onto other communities, or create ecosystem-wide harm to vital natural systems.

For example, the NEPA process should be used to evaluate alternatives to the Corps' use of river training structures to reduce dredging costs in the middle Mississippi River to reduce this project's inadvertent impacts. The Corps' extensive use of river training structures to maintain navigation in the middle Mississippi has increased flood heights by 6 to 15 feet in this portion of the river and destroyed vital fish and wildlife habitat.[43] Importantly, navigation can be readily maintained even if many of these structures would modified or removed to reduce flood risks.

Updating out-of-date water control manuals can improve the health of the environment and reduce flood risks. Many water control manuals have not been updated in decades and as a result, they cannot account for current needs or environmental conditions, including changes in rainfall, flood levels, snowmelt patterns, and land use patterns. Outdated plans also fail to use modern scientific tools or state-of-the-art management approaches that can both ensure effective operation of federal projects and protect the environment. The impacts can be devastating.

Outdated operating procedures and flawed planning aggravated already horrific flooding in Houston during Hurricane Harvey. During Harvey, the Corps of Engineers released at least 13,000 cubic feet of water per second from the Addicks and Barker reservoirs to reduce the risks of overtopping and to protect homes upstream.[44] But those same releases caused extensive flooding downstream in Buffalo Bayou, flooding some 4,000 homes that would otherwise have remained dry despite Harvey's onslaught.[45] More than 5,000 of the 14,000 homes located inside the reservoirs also flooded. The in-reservoir homes were built on some 8,000 acres of land that the Corps opted not to buy when the reservoirs were constructed in the 1940s, even though the Corps knew the land would flood during large flood events. At least 4,000 homes were built inside the reservoirs since Tropical Storm Allison devastated large areas of Houston in 2001.[46]

Updating the management plans for these reservoirs and quickly completing critical structural upgrades would help protect Houstonians during future flood events.[47] These reservoirs have been classified as two of the six most dangerous flood control dams in the United States for many years. Storage capacity could be restored by removing silt and sediment that have accumulated over the last 60-plus years of operation, and public safety would be improved by upgrading gages and other tools that track the quantity of water released from the reservoirs and by ensuring that the public is fully aware of the potential for flood risks from both typical and emergency reservoir operations.

The importance of improving reservoir management and safety is not limited to Houston. The Corps operates 707 dams that it owns across the country, operates 75 hydropower facilities, and manages flood control operations at 134 dams constructed or operated by other federal, nonfederal, or private agencies. Many of these dams have operating plans that date back 50 years, including many of central California's 35 federal flood control dams where outdated plans are damaging rivers and wildlife and threatening community safety.

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[43] The middle Mississippi River is the 195-mile segment between the confluence of the Missouri River (located north of St. Louis, MO) and the confluence of the Ohio River (located near Cairo, IL). The middle Mississippi is the first section of free-flowing River below the River's lock and dam navigation system. The middle Mississippi, like the rest of the River, has been severely degraded by the Corps' approach to maintaining navigation on the river.

[44] Preliminary U.S. Geological Survey data suggests that the actual releases were much higher than what was supposed to be a maximum release of 13,000 cubic feet per second because the gages measuring the releases were not working properly (https://af.reuters.com/article/africaTech/idAFL2N1LQ0IL).

[45] KHOU.com, Houston Texas, *Buffalo Bayou to remain at record level; Barker, Addicks reservoirs have peaked* (September 1, 2017) (http://www.khou.com/weather/hurricanes/hurricane-harvey/controlled-release-of-barker-addicks-reservoirs-to-impact-thousands/468348109).

[46] Al Shaw, Lisa Song, Kiah Collier, Neena Satija, *How Harvey Hurt Houston, in 10 Maps*, ProPublica (January 3, 2018) (https://projects.propublica.org/graphics/harvey-maps).

[47] A 2009 master plan limits releases from the reservoirs to 2,000 cubic feet per second. http://www.swg.usace.army.mil/Portals/26/docs/2009%20Addicks%20and%20Barker%20MP.pdf at 8.

Updating operations and maintenance plans can also produce significant improvements to river health and resilience. For example, the vast majority of operations and maintenance plans for the Mississippi River navigation system are more than 40 years old.[48] As a result, the Corps continues to carry out the same operation and maintenance activities that have devastated the ecological health of the Mississippi River and the species that rely on it. These outdated operations and maintenance activities are destroying critical backwater, side channel, wetlands, and instream habitats; altering water depth; destroying bathymetric diversity; causing nonnative species to proliferate; and severely impacting native species.[49] Modern approaches exist for operating this system that would both maintain a vibrant navigation system and improve the health of the river.

Where multiple studies are authorized or required for a river or coastal system, those studies could be used to inform a comprehensive review of potential improvements to the system. For example, multiple planning process are underway, should be initiated through new environmental reviews, or are authorized for the Mississippi River, including:

(a) Studies examining whether and how the Corps should dispose (i.e., transfer ownership to a non-federal interest/recommend removal) of the Upper St. Anthony Falls, Lower St. Anthony Falls and Lock and Dam 1—these studies are underway.
(b) Updates to the water control manuals, and required environmental impact statements, for the Upper Mississippi River lock and dam system—these studies should be initiated through a new environmental review with a goal of establishing a more natural hydrologic regime for the River that includes regular periods of lower flows to allow regeneration of wetlands and wildlife habitat.
(c) A new update to the Corps' navigation maintenance actions for the middle Mississippi River between St. Louis, MO and Cairo, IL—this study should be initiated through a new environmental review with a goal of significantly reducing flood height increases caused by excessive construction of river training structures designed to reduce navigation dredging costs.
(d) An assessment of alternative management regimes for the Old River Control Structure, which controls the amount of water diverted from the Mississippi River to the Atchafalaya Basin—this study was authorized in WRDA 2018.
(e) A study examining whether to increase the height of significant portions of the Mississippi Rivers & Tributaries Project mainline levee system—this study is underway.
(f) Lower Mississippi River Restoration feasibility studies that will look at restoration projects for eight separate reaches—these studies were authorized in WRDA 2018.
(g) Assessment of projects to restore Louisiana's coastal wetlands, including through Mississippi River sediment diversions—these studies are underway.

These studies could—and should—be used to inform a comprehensive plan for increasing the resilience of the Mississippi River and its extensive water resources infrastructure. This could be achieved by evaluating and adopting alternatives that protect and restore the natural functions of the Mississippi River, as required by the National Water Resources Planning Policy. This policy, which was established in WRDA 2007, requires that "all water resources projects" are to protect the environment by "protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems."[50]

Congress should increase the Corps' capacity to improve the resilience of the nation's water resources infrastructure by establishing a Directorate of Ecological Services within the Office of the Chief of Engineers tasked with ensuring that the Corps takes full advantage of existing programs, authorities, and operations to use natural systems to protect communities from floods, minimize expenditures for emergency response and rebuilding, improve wildlife habitat, and strengthen the outdoor-based economy. This Directorate should have significant budgeting authority.

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[48] As a result of extensive pressure, the Corps recently reassessed some, but not all, of its management activities for a segment of that system known as the Middle Mississippi River.

[49] U.S. Geological Survey, Ecological Status and Trends of the Upper Mississippi River System 1998: A Report of the Long Term Resource Monitoring Program (April 1999); Johnson, B. L., and K. H. Hagerty, editors. 2008. U.S. Geological Survey, *Status and Trends of Selected Resources of the Upper Mississippi River System*, December 2008, Technical Report LTRMP 2008–T002 (Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin).

[50] 42 U.S.C 1962–3 (established by § 2031(a) of the Water Resources Development Act of 2007, and immediately applicable to all water resources projects).

CONCLUSION

The National Wildlife Federation calls on the committee and Congress to enact the common sense reforms outlined in this testimony that would promote the resilience of the nation's waters and water resources infrastructure. We also respectfully ask the committee to continue to advance critical ecosystem restoration projects, defend the integrity of the nation's vitally important environmental laws, and oversee the Corps compliance with the letter and spirit of these laws when planning, constructing, and operating projects.

Mrs. NAPOLITANO. Thank you very much, Ms. Samet. Thank you.

Yes, Ms. Ufner, you are recognized for 5 minutes.

Ms. UFNER. Good morning, Chairwoman Napolitano, Chairman DeFazio, Ranking Member Westerman and members of the subcommittee. I am honored to testify before you today on the potential next steps for the Water Resources Development Act that may be considered by Congress next year.

My name is Julie Ufner. I am president of the National Waterways Conference, which represents a full spectrum of water infrastructure stakeholders, many of whom are non-Federal sponsors of U.S. Army Corps of Engineers Civil Works projects and are responsible for significant financial commitments for construction and maintenance of those projects.

We appreciate the subcommittee holding this hearing, recognizing the critical importance of resilient infrastructure so that these investments can deliver their benefits as intended. As we look to how to accomplish this goal, we would respectfully suggest that any solutions included in WRDA must be built upon the experiences of those on the front lines, on the ground, so to speak, including flood control districts, levee boards, emergency managers and port operators, to name a few.

As the subcommittee works to understand how to make infrastructure more resilient, a common understanding of the term "resilient" ought to be a first step in the process. Resilience is not a rigid, monolithic set of standards that can be easily applied to every situation in every place. It is not a one-size-fits-all solution. Rather, resiliency is a broad concept. It can be achieved by choosing among an array of viable solutions developed through careful consideration of feasible alternatives that have been rigorously and scientifically examined. The ultimate goal is to protect local communities and infrastructure.

As the committee knows, the Corps is required to go through an extremely extensive assessment in its planning process. As described in more detail in our written testimony, it can be difficult to quantify multiple project benefits, including establishing the value of nature-based alternatives in the analysis. You have heard other witnesses express similar concerns.

As described in our written testimony, NWC has expressed serious concerns about the attempt to update the P&G as directed by WRDA 2007. Given that the resulting work products from the ill-fated effort are fundamentally flawed, we would recommend a study by the National Academy of Sciences to provide better tools to quantify the multiple benefits that can be reaped.

It is important to remember that Civil Works projects are developed to address a local problem. The planning process is designed to analyze and formulate solutions to that problem. Any suggestion

to mandate a particular course of action upfront ought to be rejected out of hand. Moreover, any attempt to disregard the priorities of the non-Federal sponsor and the communities that they represent must not be supported.

Two recent studies, the Norfolk Coastal Storm Risk Management Study and the Yolo Bypass detailed in my testimony, provide examples on how to better address multiple purpose benefits. This includes better quantification and demonstration of all benefits accruing from these projects and better utilizing non-Federal sponsor resources, capabilities and knowledge. We can likewise reap multiple benefits in ongoing maintenance activities.

The Little River drainage system in southeast Missouri has taken a proactive approach to long-term project management by planting native and warm season grasses in its drainage infrastructure, enhancing environmental benefits as part of its flood control project.

In conclusion, it must be remembered that we are in a resource-constrained environment. Before good ideas are required, we must be sure that these approaches work, and that the Federal taxpayer and the non-Federal sponsor can afford to bear the cost. However we define the term "resiliency," we need to define it together, to make sure that it is workable and viable on the ground. We look forward to doing this with you in the next WRDA bill.

Thank you for your time.

[Ms. Ufner's prepared statement follows:]

Prepared Statement of Julie A. Ufner, President, National Waterways Conference

Thank you, Chairwoman Napolitano, Ranking Member Westerman, and members of the subcommittee for the opportunity to testify on the "Concepts for the Next Water Resources Development Act: Promoting Resiliency of our Nation's Water Resources Infrastructure."

My name is Julie Ufner. I am President of the National Waterways Conference, Inc. (NWC or Conference). Prior to coming to the Conference, I served as the Associate Legislative Director for Environment, Energy and Land Use at the National Association of Counties (NACo) for the past 17 years. NWC would like to thank both Chairwoman Napolitano and Ranking Member Westerman for their leadership, along with this subcommittee for its long tradition of cooperation and collaboration in addressing the nation's critical water resources needs. On behalf of NWC, we are pleased to weigh in on the importance of a robust water resources infrastructure for our nation and to address potential next steps for a Water Resources Development Act (WRDA) that may be considered by Congress in 2020.

ABOUT NWC

Established in 1960, NWC is the only national organization to advocate in favor of national policy and laws that recognize the vital importance of America's water resources infrastructure to our nation's well-being and quality of life. Supporting a sound balance between economic and human needs and environmental and ecological considerations, our mission is to effect common sense policies and programs, recognizing the public value of our nation's water resources and their contribution to public safety, a competitive economy, national security, environmental quality and energy conservation.

Conference membership is comprised of the full spectrum of water resources stakeholders, including flood control associations, levee boards, waterways shippers and carriers, industry and regional associations, port authorities, shipyards, dredging contractors, regional water supply districts, hydropower producers, engineering consultants and state and local governments. Many of our members are non-federal sponsors of U.S. Army Corps of Engineers (USACE or Corps) civil works projects,

responsible for significant financial commitments for the construction and maintenance of these projects. They work diligently and collaboratively with our federal partners to ensure the nation can reap the multiple benefits provided by these investments. To that end, our membership is keenly interested in the enactment of comprehensive water resources legislation and we look forward to working with the Committee as it moves forward in this process.

WATER RESOURCES INFRASTRUCTURE HELPS KEEP COMMUNITIES SAFE AND STRENGTHENS NATIONAL AND LOCAL ECONOMIES.

Across the country, our water resources infrastructure provides life-saving flood control, needed water supplies, valuable shore protection, water-based recreation, environmental restoration and hydropower production, all of which are essential to our economic well-being. Moreover, waterways transportation is the safest, most energy-efficient and environmentally sound mode of transportation.

We appreciate the subcommittee holding this hearing, recognizing the critical importance of a "resilient" infrastructure, so that these investments can deliver their benefits as intended. As Congress and stakeholders grapple with how to accomplish this goal, in view of the lessons learned, and indeed that we continue to learn, from recent devastating floods, we would respectfully suggest that any solutions included in WRDA must be built upon the experiences of those on the front lines, on the ground, including flood control districts, levee boards, emergency managers, port operators, to name a few. A common understanding of "resilience" ought to be a first step in this discussion. In that way, local communities, stakeholders, non-federal sponsors and federal leaders will be better poised to address local infrastructure needs. We know from experience that where infrastructure is in place, communities tend to experience a lesser degree of physical harm and economic damage. Our shared goal ought to be that ensuring appropriate investments are made up front to prevent, or at least lessen, the need for disaster relief after the fact. Not only will such an approach save taxpayer money, it will also mitigate the difficult decisions later on how to address devastation, and whether and where to rebuild. Stated another way, an ounce of prevention is worth a pound of cure. The cycle we are in—failing to invest adequately at the front end only to require significant disaster relief funding later—is simply unsustainable.

A good example of this approach can be gleaned from the Mississippi River and Tributaries (MR&T) project that was authorized in 1928 after the devastating floods in 1927 to provide a comprehensive approach to flood control and ensure an effective navigation channel. The project's four major features include levees and floodwalls; channel improvement and stabilization; tributary basin improvements and a system of floodways, that work together to provide flood control and navigation and foster environmental protection and enhancement. To date, the MR&T has prevented more than $1.27 trillion in flood damages since 1928, $80 for every dollar invested. In considering the value of this investment, it's essential to remember what is being protected by this critical infrastructure—homes, schools, fire and police stations, hospitals, power plants, oil refineries, highways, rail, ports, and cropland.

As the nation considers how to make its infrastructure more resilient, some context and background are helpful. The Corps is responsible for the development, maintenance and oversight of much of the nation's water resources infrastructure through its Civil Works program. This includes flood risk management, navigation, ecosystem restoration, hydropower, water supply, recreation, and environmental stewardship, as well as providing emergency response services. As part of the project development process, the Corps includes environmental decision-making primarily in the planning phase. The planning program provides a structured approach to the formulation of projects that is responsive to local, state and national needs, premised upon the project's contribution to national economic development while protecting the environment. In addition to the complex, and often lengthy internal review process, Corps' studies are also subject to extensive external reviews, including under the National Environmental Protection Act, at the first stage of the process.

The concept of resilience has taken on greater significance in the Corps' planning program. It frames our aspirations for managing our water resources. It allows communities to enhance the quality of lives of our families and the viability of our businesses and industries. Key to this concept—resilience is not a rigid, monolithic set of standards that can be easily applied to every situation and every place. Rather, it can be achieved by choosing among an array of viable solutions developed through careful consideration of practicable alternatives. The feasibility report produced at the end of the planning process is the investment prospectus for a tailored project that will meet the needs—environmental, financial and safety—of the community

that participates in the feasibility study. Congress maintains the power to authorize the ultimate investment and make a commitment to its implementation.

There has been an increased call for the use of nature-based and natural infrastructure alternatives to be included in the planning process. To be sure, the process should include consideration of a full array of viable solutions. Federal investment decisions are grounded upon the net economic benefits to the nation, using a cost-benefit analysis, as set forth in the 1983 Principles and Guidelines (P&G) which governs project planning and development. NWC has been a vocal critic of the attempted update to the P&G as directed in WRDA 2007, resulting in the Principles and Requirements and Implementing Guidelines, as those products are undisciplined, and lack any degree of consistency and predictability needed for the development of proposals to guide federal investment decisions. A key area of concern is the inability to quantify multiple project benefits, including establishing the value of nature-based alternatives in that analysis.

In order to achieve multiple benefits from the civil works portfolio, we would recommend a rigorous, disciplined, scientific-based examination of this issue. Going forward, achieving water resources resilience will demand that our planners adopt new technical approaches to forecast water resources needs and problems and identify viable alternatives. In addition to nature-based solutions, the planning process ought to consider water resources as an integrated system, where multiple purposes can be addressed and multiple benefits achieved. To get there, we must engage in a productive discussion of how the basic objectives of economics, environmental protection, regional development and social well-being can address resilience concerns, and how that analysis can be grounded in a disciplined, thoughtful, predictable process. WRDA is, of course, not the only platform for this discussion. We are encouraged by work going on at the Corps' Engineer Research and Development Center to develop a method for evaluating and quantifying benefits beyond the scope of the traditional benefit cost ratio used in project formation.

We would like to offer a few examples to illustrate the discussion above.

The Sacramento Area Flood Control Agency (SAFCA) has been working to obtain authority to widen the Yolo Bypass, which was originally built in 1917. The Yolo Bypass was constructed as a single-purpose federal flood facility which has evolved into a multipurpose system that deals with issues such as flood control, water supply, ecosystem restoration, drainage and agricultural enhancements. Since construction, the region has had eight events larger than the system was designed to handle. The Corps recently conducted a feasibility study on the widening project but was unable to justify a federal interest based on the current cost-benefit analysis, which only looks at flood protection, rather than the multipurpose benefits of a systemwide approach.

The Yolo Bypass proposal—a comprehensive, system-wide, multi-purpose approach designed to protect a sizable population at risk—at its core embodies the concept of resiliency. Moreover, this approach is integral to the Corps' Revolutionize civil works initiative. A review of the lessons learned throughout the study process offers some suggestions for improvement, including better quantification and demonstration of all benefits accruing from these projects; improved quantification of multi-purpose benefits as well as improved quantification of urban flood protection benefits, taking into consideration such things as benefits to economically distressed areas; and better utilizing non-federal sponsors' resources, capabilities, and knowledge. Building upon provisions in the most recent WRDAs, non-federal partners' technical, project management and other capabilities must be better recognized and utilized.

The recently issued Chief's Report on the Norfolk Coastal Storm Risk Management Study offers another example of achieving multiple benefits and working collaboratively with the local community. The study is a comprehensive investigation of flood risk management problems and solutions in the City of Norfolk which came about as a result of findings from a larger effort, the North Atlantic Coast Comprehensive Study, which was authorized by Congress after Hurricane Sandy in October 2012, to identify and address flood risks of vulnerable coastal populations in that region. The Chief's Report recommends $1.4 billion in investments in the City of Norfolk, providing structural, nonstructural, and natural and nature-based solutions to reduce storm damages in the event of coastal storms, while accounting for sea level change.

The Corps partnered with the city to assess not only how to reduce coastal storm risk, but also to build resiliency by implementing strategic approaches that address frequent tidal flooding risk, major storms and the impact on residents and economic activity. A few key takeaways from the process can instruct future planning efforts. First, quantifying green infrastructure was difficult, as discussed previously; further research is needed to justify the inclusion of some options in a federal project. In

response to this challenge, the city intends to move forward on community resilience efforts on a local scale, addressing needs beyond the scope of the Corps study. For instance, in addition to the infrastructure improvements proposed in the study, the city plans to use nonstructural measures such as increased freeboard requirements for new structures and floodproofing. Equally important is the recognition that coastal resilience planning and preparedness do not end with the Chief's Report, but must continue to evolve, in a proactive rather than reactive approach.

It's important to note that investments in infrastructure include not only new construction, but also include both maintenance and recapitalization of existing infrastructure. Starting with a blank slate to develop a solution to a water resources problem better lends itself to incorporate many features into the project. We shouldn't, however, overlook opportunities to incorporate environmental benefits into ongoing maintenance opportunities.

By way of example, The Little River Drainage District (LRDD) in Southeast Missouri has taken a proactive approach to long-term project management by partnering with the Missouri Department of Conservation (MDC) to maximize the environmental benefits of projects by planting native and warm season grasses that provide increased wildlife habitat, superior erosion control (added resiliency), and cost effective/environmentally-friendly yearly maintenance by utilizing fire rather than mechanical mowing. Within this partnership between LRDD and MDC, the project purpose, flood control and drainage, will continue to be paramount to the overall mission of the partnership. Nonetheless, the partnership has yielded a win-win situation, by enhancing the resiliency of flood control and drainage projects along with providing a very important secondary benefit of environmental enhancements to fully maximize the benefits of the project footprint.

The partnership's success hasn't been without challenges though. There is concern that under traditional USACE review processes, the focus is on mitigation and/or preservation rather than on enhancing the multiple benefits to be accrued by the overall project footprint. These processes could be revised to allow inclusion of additional benefits as part of routine and ongoing maintenance, and not treating the process to add benefits as a new project.

Since the Water Resources Reform and Development Act of 2014, there has been a heightened focus on the beneficial use of dredged material, recognizing the mutual benefits that can be accrued between navigation and ecosystem restoration. In fiscal year 2019, the USACE New Orleans District worked to maintain the authorized channel dimensions on the Mississippi River Ship Channel during months-long high water, yielding 87 million cubic yards (mcy), well above the 51 mcy average. The District beneficially used 25.6 mcy of dredged sediment creating approximately 2,048 acres of wetlands below Venice, Louisiana, in the environmentally sensitive bird's foot delta. These sediment recycling efforts have beneficially utilized over 132 mcy of materials to create or restore 9,598 acres. This is equal to approximately 15 square miles of marsh in that area since 2009, which represents an equivalent of more than 13 million dump trucks. This result was achieved due to the adaptive approach to sediment management supported by the collaborative efforts of the Corps and its federal partners (U.S. Coast Guard, U.S. Fish and Wildlife), along with the industry stakeholders on the ground (including the Big River Coalition, dredging contractors, and local river pilots).

CONCLUSION

Throughout the testimony, we highlighted projects where our non-federal partners have successfully collaborated with the Corps to achieve multiple benefits and increase resiliency from water resources projects, and also pointed out some challenges to accruing those benefits. The Corps brings needed technical expertise to the table, and in return, our members can offer valuable feedback on strategies and policies that can work on the ground. We encourage the Corps to continue utilizing non-federal sponsors' resources, capabilities, and knowledge, as we tackle new challenges to support the resiliency of civil works projects.

We live in a world with resource and data constraints. However we define the term "resilience," we'd do well to observe the need for fiscal soundness. That is, the costs of policy, programs and projects should be less than the comparative budgetary savings they achieve. It must be demonstrated, as part of the investment decision process, that over the long term, these investments will serve as the optimal approaches to lessen future weather-related damages.

Thank you for the opportunity to appear today to discuss the foundations for a Water Resources Development Act. We look forward to working with the subcommittee as it is moves forward with developing this important legislation.

Mrs. NAPOLITANO. Thank you for your testimony, Ms. Ufner. Thank you, all our witnesses.

And we will now begin questions for you from the Members. And we will use the timer to allow 5 minutes for the questions from each Member. If there are additional questions, we might have a second round as necessary.

So I will begin by asking Mr. Galloway, Mr. Pineda, Ms. Samet, what are the steps the Corps can take now under existing authority to factor resiliency in their projects and what are the gaps to those authorities?

General GALLOWAY. Madam Chairwoman, the Corps of Engineers is trying diligently to work with resilience and to work with local communities. What can they do to improve that? It's reach out, again, as has just been said, to the local authorities, the people that are on the ground, who know what are the challenges they face. So resilience requires cooperation from top to bottom and everybody having a seat at the table. That becomes terribly important.

It also requires us to have seats at the table for all the Federal agencies, so that when one agency has a solution, it can be brought into the solutions used by the Corps.

Mrs. NAPOLITANO. In other words, that they talk to each other.

General GALLOWAY. Yes. It is difficult to do that, and we need that ability to partner, to be readily available and not a labor of great, I guess, problem to get through to any of these to have any waivers. It has got—the 21st century has to be fast moving; it has to have everybody at the table, and it has to deal with the challenges that the locals see as well as the Federal.

Mrs. NAPOLITANO. Thank you.

Mr. Pineda. Your mic, pull up your mic to your——

Mr. PINEDA. I will pull it closer. OK, thank you.

Mrs. NAPOLITANO. That is it.

Mr. PINEDA. The first one is through work with the State of Louisiana and the levee districts in New Orleans, the Corps, in rebuilding the levees of New Orleans after Hurricane Katrina, through the Hurricane Storm Damage and Risk Reduction System, designed resiliency into the 100-year design that Congress authorized. So we knew that was not really the ideal standard to rebuild the levees to, it should be built to a much higher level of protection. But the Corps incorporated levee overtopping into the design based upon input from the State and local jurisdictions. And on the dry side of the levee, the side that we don't want the water to go over, the Corps, working with Louisiana State University, designed a high-performance turf reinforced mat, essentially a super grass that could withstand erosion from levee overtopping.

Also, in California, so that is an example of working with the locals to come up with a resilience method. Also in California, looking at the Yolo Bypass, which is a major overflow for the Sacramento River, in working with the Sacramento Area Flood Control Agency, the California Central Valley Flood Protection Board, and my agency, the Department of Water Resources, using State funds and local funds, we are setting back multiple miles of levees in the Yolo Bypass.

Essentially, this is not a Corps process. It did not pan out with the benefit to cost ratio. But with strong local, State and local participation, we did the engineering, essentially using the Dutch concept, room for rivers. So we are moving more water from the Sacramento River to the overflow bypass and making the bypass have a greater capacity.

Also, after Hurricane Katrina, we have a lot of levees in California. And we responded to the increased threat to our urban areas that are along the Sacramento River and San Joaquin Rivers and State Senator Machado passed a bill, we call Senate bill 5, that established a 200-year level of protection standard for urban levees. So we have been working since that time to come up with the funds for design and construction.

Mrs. NAPOLITANO. Mr. Pineda, thank you very much. You have extensive records and I would like to hear them. But I would like to go on to Ms. Samet. Thank you.

Ms. SAMET. Thank you. Yes, I would highlight that Congress has directed the Corps on multiple occasions to consider nonstructural and natural approaches to addressing water resources problems which, as we have testified, we believe will strongly increase resiliency. They also have longstanding laws that say protect the environment as appropriate, right? Protect the environment and restore the environment, in numerous laws.

They have the ability to reevaluate multiple projects through the environmental review process and through other processes. So I think that nothing actually stands in the Corps' way to doing better work with respect to natural infrastructure. But they clearly need more of a push and more guidance, and I think also, clearly, more capacity to be able to look across their business lines to see the best use that they can make of natural infrastructure and making sure that they are not damaging it inadvertently or creating inadvertent problems.

So that is why we have proposed an ecological services directorate and other reforms that would help drive the Corps to create the incentives to drive the Corps to do a better job.

Mrs. NAPOLITANO. Thank you very much. My time is up.

Mr. Westerman.

Mr. WESTERMAN. Thank you, Chairwoman Napolitano. And again, thank you to the witnesses for being here today. Many of you have testified in support of a strong preference or even a requirement that nature-based features be employed as solutions to address resiliency challenges. And I am supportive of looking beyond brute force and traditional gray infrastructure to increase the use of natural and green infrastructure designs.

I do not remember who used the phrase, but it is one that I have often used that we need to design with nature instead of against nature. And I am an engineer. So that is coming from more the brute force, gray infrastructure type background.

But Ms. Ufner, what are some of the challenges that we face with the Corps when evaluating nature-based alternatives?

Ms. UFNER. Thank you for your question. As you know, we live in a resource-constrained environment. And so it is really important for us as non-Federal sponsors to work closely with the Corps

to meet the goals of our local communities, for example, to address flooding concerns.

So the planning process is intended to address a lot of these concerns and hopefully they're met within the planning process. When looking at green infrastructure or natural infrastructure specifically, right now there is not a strong mechanism within the planning process to really quantify that. And that can be somewhat of a challenge.

Ultimately, at the end of the day, our communities and our non-Federal partners need to come together with the Corps and better discuss these challenges. And we would recommend that the Army Corps of Engineers utilize the non-Federal sponsors more to meet these challenges. They have a lot of knowledge on the ground that would be very valuable to the Corps.

Mr. WESTERMAN. OK, several of you used examples and talked about types of natural infrastructure and how you can obtain resiliency with it. And, you know, in hindsight, looking back at the massive levee systems that we have in our country, we could probably be critical and say that we should have done a better job of making those flood plains wider and not putting the levees so close to the rivers. But if you look back historically, some of these flood plains were miles and tens of miles off of the river channel when the flooding happened.

So if we were to try to widen some of the levees and widen the distance off of the river, is there enough research to know the sweet spot, where to put the levees, and can we tie those levees into existing levees? Because now you have got development up close to the levees and it could be very expensive to move some of the levees.

But, you know, exactly how do you do that? And I will ask the engineers on the panel. How would you suggest we do that?

Mr. GRITZO. Thank you very much for your question. As one engineer to another, and to the others, these kinds of design approaches we believe can be effective if well designed for the application. However, we have to recognize that when implemented by U.S. businesses, they are giving up valuable real estate for the space. That will be a challenge. What will mitigate those challenges is having some good design standards, as available in our publicly available data sheets or other standards, to guide them to how to implement these kinds of measures in their businesses. Because for a business, the worst-case scenario is to make an investment, sacrifice their real estate and hope something is going to work and have it not be effective, and their business suffer a flood loss anyway.

We believe with good standards that apply to a wide variety of scenarios, these can be improved, and these measures can be effectively implemented.

Mr. WESTERMAN. So who would develop those standards?

Mr. GRITZO. Those standards would need to be developed by a public-private and academic partnership. We believe there are technical subject matter experts available in all of those arenas that could contribute to this discussion. Ultimately, obviously, they have to be practical for businesses and local State and Federal entities

to implement. And we would want to take advantage of the wealth of knowledge in our universities as well.

Mr. PINEDA. If I could add that to do any type of levee setback to move water away from the rivers into adjoining areas to reduce water levels, the process kind of first begins with simulation modeling. And the Corps of Engineers Hydrologic Engineering Center, located in Davis, California, have been the developers of world-recognized computer software programs. So the modeling world has advanced substantially from when I first started doing it with punch cards in the late 1970s. So essentially you develop a computer model that simulates the existing system and then you start, design additional models that simulate your proposed alternatives and then run lots of scenarios to determine how it would best work. So that is one technical part of the planning process.

Mr. WESTERMAN. Thank you for your graciousness, Madam Chair, and I will yield back.

Mrs. NAPOLITANO. Thank you, Mr. Westerman.

Next, we will go to Mr. Garamendi. You are recognized for 5 minutes.

Mr. GARAMENDI. Thank you, Madam Chair. Let's see, super floods, super hurricanes, atmospheric rivers, climate change. This is the reality of today and even more so in the future. Do all of you agree with that? No disagreement. Then we are going to need to do things differently.

Mr. Pineda, in your testimony, you spoke to Public Law 84–99 and the way in which it restricts us to think big about the future, to think differently about the future. You have made several recommendations in your testimony which, interestingly, line up perfectly with Melissa Samet's testimony.

We are going to have to think differently here in this year's or next year's Water Resources Development Act. We need to provide the kind of flexibility and new mandates for the Army Corps of Engineers and local flood control agencies to adjust to the realities of climate change and more flooding. That means, in my view, setbacks. And I would like to get into this in more detail.

You make several recommendations, Mr. Pineda, in your testimony about what we must do differently. Could you please take the top three and explain what they are to us?

Mr. PINEDA. With Public Law 84–99, you know, it is a repair program after a declared disaster. So there is usually a rush to fix the levees as soon as possible. Other infrastructure could be repaired under Public Law 84–99 but sometimes we have to take a pause to determine for each of the damaged sites which is the best alternative. And many of the sites have been damaged before. So you have to kind of analyze each one and determine if there is a better solution for that particular problem.

After a significant high water flood event in 1997 on the San Joaquin River system, there were a series of levees in three levee districts, which we call reclamation districts in California's Central Valley that the Corps of Engineers, through their planning process, determined that it would be best to decommission those levees and let the flood waters move into the area and essentially purchase a flowage easement in those areas. And so that took a long time to

implement but that project eventually was done, so the levees were essentially decommissioned out of the Federal-State system.

Again, you go back to the kind of the modeling process and kind of having run simulations about what is the best way to improve the system. And when an event comes and damages levees, be ready to make proposals about the best way to make those repairs. Which may not necessarily mean repairing the existing levee in its current alignment. It may mean moving it back a little bit.

Mr. GARAMENDI. So if we take the after event with Public Law 84–99, could we, should we apply that before the event? Should we apply before any project, any improvement to a levee, any strengthening, any raising of a levee? Should we also analyze the opportunity to do setbacks, expanding the flood control of the flooded area to provide a surge capacity? And if you will answer that quickly and then we will go to Ms. Melissa Samet for a response.

Mr. PINEDA. I agree with that proposal, sir, and that's essentially part of the very detailed planning process that the Corps and its partners do, or that its partners do and then implement through the Corps of Engineers 408 process, which means you are building a project ahead of the Corps of Engineers. And the State of California working with its partners in the Valley have done various levee setbacks and we have one underway right now on the Yolo Bypass.

Mr. GARAMENDI. I thank you.

Mr. PINEDA. So it is being done in the field right now but it takes a lot of effort and technical expertise, but that expertise is out there throughout the United States.

Mr. GARAMENDI. Ms. Samet, very quickly.

Ms. SAMET. Yes, I would say preplanning is essential and you can start by looking at critical pinch points and really documenting the repetitive levee failure so we know right away those are the problem areas and start right there. Preplan for what you are going to do in case of disaster, or ideally actually just go ahead and set those back initially.

Mr. GARAMENDI. So as we write our new law, Madam Chair, I would recommend that we build into it incentives and specificity that this be taken into account in the 408 as well as in repair process. I yield back.

Mrs. NAPOLITANO. Thank you, Mr. Garamendi. Mr. Babin, you are recognized.

Dr. BABIN. Yes, ma'am, thank you, Madam Chair. Thank you Madam Chair and Ranking Member Westerman for convening this important hearing on our Nation's water resources and the governing legislation that forms its policies, the Water Resources Development Act. I would also like to thank you, witnesses, distinguished guests, for testifying today.

As this committee knows, my congressional district, the 36th Congressional District of Texas, is home to three highly important Civil Works projects of great economic benefit to the United States. Number one, a project to deepen and widen the Houston Ship Channel currently undergoing a review by the U.S. Army Corps of Engineers. Number two, a federally funded project to deepen and widen the Cedar Bayou Navigation Channel. And number three, a

federally funded project to deepen and widen the Sabine-Neches Waterway.

Starting with number one, the Port of Houston, this ship channel is the busiest, deep-draft waterway in the Nation with approximately 22,000 deep-draft vessel transits each and every year, and more than 20,000 barge movements. This waterway supports more than 200 industrial facilities that make up the Port of Houston which is the Nation's number one export region, a leading port for foreign commerce, and the top U.S. energy port. The Port of Houston is also home to the largest petrochemical manufacturing complex in America. National energy security relies on the Port of Houston where 27 percent of U.S. gasoline and 60 percent of aviation fuel is produced. This activity sustains nearly 3 million U.S. jobs, generates more than $617 billion in economic impact, and provides $35 billion in tax revenues each and every year.

Number two, we have the Cedar Bayou Navigation Channel. It is an 8-mile channel which feeds into the Houston Ship Channel. It is used by barges and other vessels to serve the chemical aggregate and metal industries along the channel, including several aggregate and steel companies.

And lastly we have the Sabine-Neches Waterway, which Congressman Weber and I share. The Sabine-Neches Waterway is one of the most critical energy and military transit assets of our Nation. The waterway is home to the Port of Beaumont which is the largest strategic military port in the country holding 55 percent of the Nation's oil reserves. This ongoing deepening and widening project will increase jobs by nearly 61 percent in Texas and our Nation. It will increase our Nation's annual GDP by nearly $58 billion and provide $1.6 billion and $6 billion in increased tax revenue for Texas and the Nation, respectively.

I have been a member of the House Transportation and Infrastructure Committee for the past 5 years where I was proud to help in the passage of a Water Infrastructure Improvements for the Nation Act in 2016 and America's Water Infrastructure Act in 2018, and both WRDA 2016 and 2018, respectively. Both of these bills advance critical water resources in U.S. Army Corps of Engineers policy to help strengthen our Nation's flood and storm surge protection, deepen and widen our Nation's critical economic engine waterways, and provide much needed reforms to the Corps' project delivery processes.

The reason I highlight these immensely important projects is that as we develop a WRDA over the next few months, we need to address changes to key Army Corps policies that would provide better efficiency and effectiveness in the delivery of hurricane and storm damage protection while ensuring the viability of critical economy-driving projects like the ones that I just mentioned. While these projects provide great economic value to Texas and the Nation as a whole, the real value is the many men and women who work at or along these waterways. Not providing a necessary level of resilient protection, that would be doing them a huge disservice.

So my question this morning is in what ways, and I direct this to Ms. Ufner if you don't mind, my question to you is in what way should we improve collaboration with infrastructure agencies like the Corps going forward to make sure that vital projects of this

country's infrastructure and economy are completed in a timely manner? Yes, ma'am.

Ms. UFNER. Thank you for that question, Congressman. First, we need to break down barriers among agencies so they can communicate. And then it goes back to the stakeholders. As we discussed earlier, we live in a resource constrained environment, correct?

Dr. BABIN. Absolutely.

Ms. UFNER. We have a limited amount of money. Stakeholders, including the non-Federal sponsors who are responsible for the projects and making sure communities are safe, they work closely with the Army Corps of Engineers to make sure that these projects meet the demands as intended by their communities.

We would also recommend as we move forward in a next WRDA that Congress authorize a study in the National Academy of Sciences on natural-based infrastructure to see the role that they may play in projects. Typically as part of such studies, the Academy's Water Science and Technology Board holds open meetings and they invite non-Federal sponsors and other stakeholders to come and present their views.

Additionally, as the Corps moves forward, any time that there is an opportunity to provide public comment on any of these ideas, we would welcome the opportunity.

Dr. BABIN. OK, thank you, and I yield back, Madam Chair.

Mrs. NAPOLITANO. Thank you, Mr. Babin. Next I will recognize Mr. Carbajal. You have 5 minutes.

Mr. CARBAJAL. Thank you, Madam Chair, and first let me start by congratulating Julie Ufner in her post with the NWC. I worked with Julie for many years when I was in local government with the National Association of Counties, so congratulations on your new post, Julie, and good to see you again.

Mr. Pineda, thank you for coming today as we begin the reauthorization process for the Water Resource Development Act, also known as WRDA. From my time serving as county supervisor in Santa Barbara County, California, I know that one of the biggest issues local governments face when working on Federal projects is the need for technical expertise from Federal agencies. In your testimony, you specifically mention the need for the Army Corps of Engineers to take on an enhanced role in providing technical assistance and problem solving to help with local needs.

Can you elaborate further on what you mean by this? And two, are there any existing programs the Corps could expand to further this goal? I know you discussed the Floodplain Management Service, FPMS program, as a potential solution.

Mr. PINEDA. Yes, thank you, Congressman. The Corps has three programs: Planning Assistance to States, Floodplain Management Services, and one that started a couple years ago called Silver Jackets. So those are existing programs, but I can't comment on specific funding, but we believe that funding could be substantially increased.

I think the main point that I would make is throughout the country I believe there are 37 or 38 Corps district offices, and three in California—San Francisco, Los Angeles, and the biggest one, Sacramento—and the level of technical expertise of engineers, scientists and planners within those districts is tremendous. There's

a strong esprit de corps and, but small communities, Tribal nations, need that technical assistance from the Corps, which is essentially right now in many cases, outside of these small assistance programs, PAS, FPMS, and Silver Jackets, they need another source of funding. It is essentially they can't really help unless they can charge it to a project.

So the technical expertise is there; the desire of the employees to help small communities and other communities solve their problems is there; but a lot of times it is getting the delivery to the communities and being able to charge it to an appropriate program.

Mr. CARBAJAL. Thank you. Mr. Pineda, as you are probably well aware, the Army Corps of Engineers has a significant backlog. In my district alone, the Mission Creek Flood Control Project has been in the works since the late 1960s. Let me repeat that: the late 1960s. However, this project has struggled with receiving Federal construction dollars. Despite the numerous benefits the project would provide, in your testimony you mentioned that the Corps has operated on a restrictive framework that has not allowed it to modernize how we calculate benefit-cost ratios.

Do you have any suggestions on how Congress can help tackle this problem to ensure we are accounting for the numerous environmental benefits a project may bring as well as accounting for resiliency?

Mr. PINEDA. Thank you, Congressman. I think I mentioned in my testimony, and others talked today about the benefit-cost ratio and essentially that would be under the principles and guidelines, otherwise known as P&G, and I believe previous Washington administration put forth kind of an update to those called PR&G, principles, requirements, and guidelines, and implementation guidance was being developed, and for a reason I am not totally clear on, it did not proceed. So I believe those new, at the time a couple years ago, those PR&G guidance took into account trying to quantify the nontraditional benefits that the Corps doesn't explicitly recognize right now such as the ecosystem and life safety.

So right now we essentially generally calculate reduction to damage to structures, houses and nonresidential structures, but it needs to be expanded. This is not a new issue; it has been going on for a long time, and that's why many States and organizations working with the Corps sometimes build projects on their own they believe have a positive benefit to cost ratio calculated using a different methodology factoring into account those other benefits.

Mr. CARBAJAL. Thank you. Ms. Ufner, does NWC have any thoughts on how to account or provide input on how to account for environmental benefits that might raise the ratios with the Army Corps?

Ms. UFNER. Thank you, Congressman. It's always good to talk to you. We are encouraged by the work that is currently ongoing in the Army Corps of Engineers Research and Development Center to develop methods to evaluate and quantify these benefits. It is a good first start. But we also are encouraging Congress to move forward with a study through National Academy of Sciences to really rigorously examine this because what works in one part of the country, for example, what would work in California may not work on the east coast. So we want to make sure that we have a full

study of the types of infrastructure that is available and a good understanding about where it will work.

Mr. CARBAJAL. Thank you very much. Madam Chair, I yield back.

Mrs. FLETCHER [presiding]. Thank you. I will now recognize Mr. Graves for 5 minutes.

Mr. GRAVES OF LOUISIANA. Thank you, Madam Chair. I want to thank members of the committee. General Galloway, it is nice to see you again. Mr. Pineda, I appreciate the opportunity to see you again as well, and I appreciate both of your all's efforts in Louisiana in recent years.

A couple of questions. You both, or I guess many members of the panel, talk about the need to improve our resiliency standards. I couldn't agree more. Last Congress we passed the Disaster Recovery Reform Act where, for the first time, we actually established a resiliency definition and standard within FEMA for how we rebuild and try to provide ample funds to do so. We tried to break down some barriers or walls among different funding sources to ensure that projects can actually be built. For example, the Hazard Mitigation Grant Program under FEMA which comes in the aftermath of a flood. We allowed for those funds to be used to build Corps projects because there is a $100 billion backlog of Corps projects.

Admiral Phillips, if Virginia is hit with a hurricane, if you receive those funds and you determine that a Corps authorized project is your best use of dollars, I want you to be able to use those funds, and this Congress agreed and so we changed that law. Do you agree that recovery dollars—we should knock down walls that allow you to prioritize projects like flood protection projects that are authorized through the Corps of Engineers for you to build them if that is what your priorities are, Admiral?

Admiral PHILLIPS. So we certainly were heartened by the Disaster Recovery Reform Act of which you speak and some of the processes that are changed there that give options not only to use recovery dollars but also shuttling some funds, 6 percent I believe, into predisaster mitigation projects which we are also very interested in doing though FEMA. So certainly that opportunity is there. Where States have the capacity to take advantage of this, they absolutely will do it, and so when Virginia is in a position, should it find itself in that position, we would absolutely want to be able to have this option or opportunity.

I think some of the challenges for coastal States is getting themselves to the point where they have projects that are Corps-ready and approved so that they can move on. And of course we have seen in Virginia as we worked with these feasibility studies, that is the intent and that concept to get Corps-approved projects ready to go and on the books so that then we could use them if we had to.

The challenge for Virginia is we have had two feasibility studies, one is done, one is underway, and we have a whole State's worth of coastline that is at extreme risk. So hence the interest in perhaps expediting that by looking at full coastal study for the State.

Mr. GRAVES OF LOUISIANA. Thank you. Does anybody on the panel object to the concept of giving you more flexibility in recovery

dollars and being able to use those for a Corps of Engineer authorized project that otherwise doesn't have funding? I mean, again, recognizing there is a $100 billion backlog in Corps of Engineer projects. You have a disaster, this project is going to help you with resiliency, it is going to help give confidence to your community to rebuild. Does anybody object to being able to have that flexibility?

Mr. GRITZO. Certainly no objections. In fact, we advise businesses that it is always cheaper to avoid a loss than recover from one afterwards, and in many cases some of those businesses never recover.

Mr. GRAVES OF LOUISIANA. Thank you.

General GALLOWAY. Could I just make the point that unfortunately if you don't give time-sensitive funding to these projects, many of them will just slip by the wayside and they will never get taken care of. So speeding things up, giving the solution there rather than have somebody come up with some alternative solution that just doesn't work is going to make a big difference. You are going to get things done that need to be done and it is driven by the local level.

Mr. GRAVES OF LOUISIANA. Thank you. Thank you, General. And Madam Chair, I want to make note that every member of the panel agreed—I am sorry, were you going to——

Ms. SAMET. I was just going to add, if I may, that we do support the need to leverage funding across the funding streams, but it is important to make sure that the same standards and environmental reviews are applying and that the money that is being directed to resilient projects is actually going to resilient projects.

Mr. GRAVES OF LOUISIANA. Absolutely, couldn't agree more, and keep in mind that any project that is authorized by Congress through the Corps of Engineers would have to go through a NEPA process prior to.

But Madam Chair, I want to make note, every member of the panel agreed, yet just yesterday we passed a bill that would actually prevent community development block grant disaster recovery funds from being used for Corps of Engineer projects. It doesn't make sense and it is contrary to what this committee has been doing. It wasn't our bill, as you know, but contrary to what this committee has been doing.

General Galloway, I want to ask you this, all of you, and I want to ask this question for the record because I am out of time. All of you talked about the need to build more resilient projects. Couldn't agree, better resiliency standards. We have a $100 billion backlog. General, you worked with the Corps for decades. To add new standards doesn't do any good if we can't actually deliver projects. The Corps is taking decades in some cases to deliver projects. I would love your all's recommendations on how to improve the Corps project delivery process.

I yield back.

General GALLOWAY. It is a challenge to figure out how you deal with that.

Mr. GRAVES OF LOUISIANA. It is, but I would appreciate if you all could submit in writing just your thoughts if you have any on how to improve it, I would appreciate it. Thank you, Madam Chair.

Mrs. FLETCHER. Thank you. The gentleman's time is expired so I will now recognize Mr. Lowenthal for 5 minutes.

Mr. LOWENTHAL. Thank you, Madam Speaker. Or Chair.

Mrs. FLETCHER. I will take it.

Mr. LOWENTHAL. I will take it. I'll give it.

[Laughter.]

Mr. LOWENTHAL. You know, I have been really fascinated by following the discussion on the use of natural infrastructure by the Corps, and so I am going to go to Ms. Samet. You haven't chimed in yet. We have had others specifically, although it was in your testimony very, very completely, and I am interested in following up on your testimony on the use of natural infrastructure in Army Corps projects. And you know I am a member of SEEC and vice chair and we have advocated that the Congress include policy to increase the use of natural infrastructure for stormwater management, coastal protection, water filtration, storage.

And you mentioned in your testimony these projects can help meet the needs of our communities while also benefiting the fish and wildlife. But too often they face significant hurdles due to, as has already been pointed out, the Army Corps benefit-cost analysis. That is really what we are going to be looking at specifically. And in a recent GAO report, the Corps stated that it has launched a project to develop better information and research to make sure that its analysis captures all the benefits associated with natural infrastructure. As you mentioned in your testimony, small investments in nature-based solutions like oyster reefs and wetlands can provide billions in flood protection.

So my first question is, has the Army Corps consulted with you or any of the National Wildlife Federation folks about these efforts to better measure the benefits of natural infrastructure? Have you been consulted in any way or do you know of organizations like it who have been consulted by the Corps to get input?

Ms. SAMET. I have not been consulted. As far as I know, the National Wildlife Federation has not been consulted in this way. I think it is great that the Corps wants to look into this. I would also highlight a couple of things. One, there is a robust knowledge base out there on how to value ecosystem services, and so that should be, from our perspective, a part of it. This whole improvements to the cost-benefit analysis, and not just looking at project benefits but also looking at project costs because if a project, if the actual cost of a big structural project isn't properly accounted for, you can't make a reasonable assessment of whether in fact it may be more cost effective to go with a natural infrastructure solution. So fixing both the cost side problems with the Corps, BCR, and also the benefits side is very important.

And I do think there is—it is great that the Corps is engaging in this, but there is a lot of information out there that they can draw from. They don't have to create the wheel on this.

Mr. LOWENTHAL. Well, that gets me to the second part. What actions should we be taking here, then, in Congress in the next WRDA bill to address these challenges in the benefit-cost analysis?

Ms. SAMET. Well, we would strongly recommend that you actually tell the Corps in law what they have to account for, and things that they can't account for. And so if you say you have to look at

Corps of Engineers, and of course this is written into law in some sections on how you do benefit cost, so in addition to the new PR&G, which are very valuable, Congress, from our perspective, should actually tell the Corps what they should look at. That would include accounting for ecosystem services gained as a benefit, ecosystems services lost as a project cost. Also prohibiting the Corps from accounting for benefits that derive from draining wetlands, that derive from encouraging people to come into harm's way and adversely impact healthy, natural systems. So there are the things that should be added and things that should be excluded.

And also fully accounting for project costs, and I think you have heard that. The Corps does its cost benefit analysis based on 50 to 80 percent of engineering design, and the detailed technical specifications can add a significant amount to the actual cost, and it could be much more effective to be looking at some of that upfront instead of waiting afterwards to then hit the local sponsor and the taxpayers with a whole lot of extra costs associated with the project.

Mr. LOWENTHAL. Thank you, and I yield back.

Mrs. FLETCHER. Thank you. I will now recognize Mr. Weber for 5 minutes.

Mr. WEBER. Thank you, Madam Chair. General, I want to go to you first. You said in your comments that a lot of this infrastructure is outdated and undersized to systems. And we are talking about backlog of the Corps now. If you looked at the backlog of the Corps, if we could do a lot of those projects—have those projects been on the books so long that those projects could be deemed as outdated?

General GALLOWAY. Yes, sir. They certainly need another look because so much has changed. We know that the conditions that we have to operate under have changed, and what would be satisfactory in 1996 won't be satisfactory today. So you almost start with a need to look at the risk. But I would suggest that the Corps tries its best to see these projects and continue to monitor to see if there is any extremely significant changes that occur. You can't have a backlog that long and for that long a period and not have problems.

Mr. WEBER. And still be considered current.

Melissa Samet, is that how we say that, Ms. Samet? OK, I am over here. It's OK. So and this might be for you as well. So General or Ms. Samet, am I saying that right?

Ms. SAMET. Samet.

Mr. WEBER. Samet, OK. If you could take those backlog of projects and you could say, look, some of those could be merged with natural infrastructure, would that be a way to get some of those accomplished? I will go with you first and then her second.

General GALLOWAY. Well, I think you would certainly want to go to the locals and find out what is—here are some options, here is what you have now in the project, and here is what it might be if you were to consider other things, because we have learned a lot in the last 30 years, especially about nature-based projects, and to see what they want to do. The problem with driving ahead with what you had, is the population has changed; the nature of the threat has changed. And so you really need to take the time to do

it quickly but do it right, and then come up with the project that is necessary.

Mr. WEBER. Right. And how about you, Ms. Samet?

Ms. SAMET. I definitely agree with that. Going back and taking another look could give you a whole new approach—come up with a whole new approach to address your problem but in a much less costly and less destructive way at the end of the day with a healthier and happier community as an end result.

Mr. WEBER. So many natural disasters are occurring, as John Garamendi alluded to, and I am thinking about Katrina in New Orleans, and the Army Corps got in gear and Congress—I wasn't here then—got in gear and they did some things around New Orleans, I mean out of pure necessity of course, and they acted quickly. What could we learn from that, General?

General GALLOWAY. Well, it is interesting. That is what resilience means, that you are ready when something happens to move ahead in the next phase into something that is better than what you have got right now. And all too often we finish the project and say we are done, and it will take care of itself. But it turns out that nature is stronger than that. We have seen that in Texas with Harvey. Things that we thought would work didn't work and we hadn't thought through what would be the next step afterwards. So it is planning ahead for the fact that you are taking a hit and you want to get up and be better, but you have thought about how will you be better; do you really want to occupy that area that you are in right now; could we have thought about that ahead of time.

Mr. WEBER. Well, I have been here 6 years, 11 months, and 17 days, not that I am counting, and so my district was ground zero for Harvey when it hit. I wasn't here during Ike or Katrina. And there is a law, and I am trying to remember the name of it for the life of me, that says you can't do more than what was there. Can anybody help me with that? There is a bill that says, you know, you can't build it back better, basically. I am talking about disaster relief with houses and stuff like that. Do you know the law I am talking about? I will find it.

General GALLOWAY. Well, there is some in the issue of, Mr. Pineda has already talked about, the Public Law 84–99 where you can go with that; how much more you can improve. Because they don't want that to be the source of a new project. On the other hand, it doesn't make sense, as you have said in Houston, you had areas that certainly were subject to flooding that nobody thought were going to flood.

Mr. WEBER. Right. And I live south of Houston, about 25 miles.

Mr. Pineda, you said in your comments that the Corps in California, I forget what part, has designed a model that is world-renowned in a simulation—where was that in California, the Corps?

Mr. PINEDA. Congressman, that was the hydrologic engineering center in Davis and——

Mr. WEBER. Davis, California.

Mr. PINEDA [continuing]. So they developed software and that is part of the Sacramento district.

Mr. WEBER. When did they do that?

Mr. PINEDA. I think they introduced, and General Galloway may be able to help answer it, I was first exposed to it in the late 1970s, but I think the computer programs came out earlier.

Mr. WEBER. OK. Mr. Gritzo, you are shaking your head as if you might know.

Mr. GRITZO. I don't know the details, Mr. Congressman, but I certainly know of these kinds of tools.

Mr. WEBER. OK.

Mr. GRITZO. And they are available today.

Mr. WEBER. OK. Well, thank you. Madam Chair, before I yield back, I want to wish our friend, Bruce Westerman and Salud Carbajal, both of them, a belated happy birthday yesterday. I yield back.

Mrs. FLETCHER. Thank you, Mr. Weber. Happy birthday, Mr. Westerman. I will now recognize Ms. Craig for 5 minutes.

Ms. CRAIG. Thank you so much, Madam Chair. And thank you to all of the witnesses for being here today.

As you all know, the first 8 months of 2019 were some of the wettest on record for the Nation. Flooding levels were unprecedented in the Missouri, Mississippi, and Arkansas River watershed, including the river towns in my district in Minnesota, such as Hastings and Red Wing and Wabasha.

After spring floods subsided, snow melt added even more water and sediment to the system, sediment buildup that is required to be dredged by the Army Corps.

Heightened sediment levels continue to be a challenge for the entire inland waterway system. The Corps are faced with a yearly feat: how to dredge quickly enough to allow the river to function on the economic engine that our business community and farmers depend on, and now in Minnesota everything is starting to freeze a little earlier than normal. So it has been quite the season.

This fall I led a letter asking for the release of emergency funding for around-the-clock dredging that was needed to keep the river operational. I am told that next year's dredging will likely be even more severe.

So I am going to broadly address this to all of the panelists. The Corps operates and maintains critical flood control, navigation, and environmental restoration projects throughout the Midwest. What do you think about whether the Corps has the resources they need to overcome this increased flooding activity and correspondingly increased dredging?

And with what we are seeing with the change in weather patterns all over, give me just some thoughts on what we need to be thinking about from a forward-thinking perspective.

And then I will just add to that. How would passage of H.R. 2440, the Full Utilization of the Harbor Maintenance Trust Fund, help with readiness and resiliency?

General GALLOWAY. I am willing to jump in——

Ms. CRAIG. Thank you, General.

General GALLOWAY [continuing]. And say that Mr. Pineda made a comment initially that we need to have a comprehensive look at the Mississippi and Missouri. We have been talking about it. We have tried to.

In the 1993 report, the big floods there, we have said this area has not had the full inspection that it needs and the plan developed to move it forward. That is still the case now, and it is getting worse, as you have just said.

And so it means, too, we have to bring together our navigation systems, our flooding systems. We have to think of these as a concrete hole for the Upper Midwest.

And so I would support taking action to give the Corps the responsibility to do a more comprehensive study that would involve the issues that you are raising.

Ms. CRAIG. Would anyone else like to tackle that?

Mr. PINEDA. Congresswoman, Ricardo Pineda here from Association of State Floodplain Managers.

So, yes, the upper Missouri River system or the Missouri River system, consisting of big dams on the main stem and some dams on the tributary system, is very complex, but every State and sometimes multiple States have river systems that flow through multiple States.

So sometimes it is hard to find one partner to partner with a study, and as General Galloway said, it is time for the Corps with their engineering and scientific know-how in the various districts in the Midwest to do some comprehensive systemwide studies.

They have computational tools, and they have the talented staff, and they can also reach out to universities and consultants, as they have done in multiple studies throughout the United States.

So you first kind of have to kind of study it, look at all the benefits and what these existing, authorized projects provide and how they were authorized and go through kind of a detailed planning process in a very collaborative fashion with State stakeholders and regional stakeholders.

Thank you.

Ms. SAMET. If I could add, especially for the Mississippi, I definitely agree. It needs a comprehensive look, and that is going to include a really careful assessment of things that the Corps is doing now that are working against its various missions.

So that some of the navigation structures built in the middle Mississippi River, for example, are increasing flood height significantly. A lot of other activities are harming habitat even though there is a restoration authority.

So the Corps' projects often work at cross-purposes. So unless they are actually looking holistically at the system to see what is the best way to let the system ideally act as a river that is deep enough to carry navigation—we recognize that—but let the system act like a river to the extent that it can still address your concerns.

I think a lot of times less is more and people do not really recognize that in the construct even of ecological systems.

Ms. CRAIG. Thank you so much.

I think I am out of time, Madam Chair. So I will yield back. Thank you.

Mrs. NAPOLITANO [presiding]. Thank you very much.

Mr. LaMalfa, you have 5 minutes, sir.

Mr. LAMALFA. Thank you, Madam Chair. I appreciate it.

I want to just launch into, with a couple of our witnesses here, the condition in California and its storage. As I look at an updated

number, our two largest projects being Lake Shasta and Lake Oroville, Shasta has drawn down to a number, oh, right around two-thirds of its capacity, and Lake Oroville is approaching a number of about just about 50 percent of its capacity.

We are seeing the reports. Now we are looking for a condition. We are seeing a condition in California called "abnormally dry," where, again, we topped off the reservoirs pretty well last year.

So my concern is, and Mr. Weber was asking you, Mr. Pineda, and maybe you toss that to Mr. Galloway and Mr. Gritzo there, on the modeling that we are doing for flood or for rain, you know, precipitation events in the coming winter here.

And so would you touch on what Mr. Weber's question was, or did you have information on that?

You said a simulated model was developed in the 1970s or 1960s. Was it based on flood impact or how broad-based was the modeling we are looking at for these conditions?

Mr. PINEDA. Thank you, Congressman.

Ricardo Pineda here from Association of State Floodplain Managers.

So essentially, the Corps of Engineers experts at the Hydrologic Engineering Center, and I am sure they had contributions from Corps districts from throughout the country, developed a suite of models.

And in my day of modeling, it started with punch cards, they were called. HEC–1, which is kind of the rainfall on the ground, and how does that convert to flow in the river?

And then HEC–2 was how high does the water get in the river, and then there was HEC–5 that dealt with reservoir simulations.

So many of those have all been combined into suites of models, and now they use GIS. So those models are there, and those help along with our Federal partners, with the National Oceanic and Atmospheric Administration, the River Forecast Centers; they help predict the inflow to the reservoirs, like the Shasta and Oroville and the contributing reservoirs downstream.

And then we run models to determine how high the river is going to get, and then that allows us for what we call coordinated operations for all of the management of those reservoirs if you have got multiple reservoirs feeding into the river.

So there is a lot of software, and there is a lot of experience required. And that has been going on for a while, and it keeps on advancing way past the skills that I developed in the early part of my career.

Mr. LAMALFA. OK. So what era were these developed here?

I thought I heard you say the 1970s for some of this modeling.

Mr. PINEDA. I think HEC–2, which was my first exposure to the models, that was probably developed. The math has been around for a while, and we used to do—when I took the class in graduate school, we did the computations by hand, and then we used the computer program with punch cards.

So I think that started in the 1960s, and maybe General Galloway has more exposure to the history of the Hydrologic Engineering Center.

But they have continuously evolved, and they are essentially world leaders in the software.

Mr. LAMALFA. OK. Let's let him speak because I am running short of time. Thank you.

Mr. Galloway, what would you add?

General GALLOWAY. HEC is the world leader. People all over the world are looking for it. What we have in this country is highly talented consulting engineers that take some of the HEC models and they put them into a specific application.

But, again, it is that HEC is leading the pack, and their models are up to date. That is not the challenge. The challenge is——

Mr. LAMALFA. With regards to the mapping of what is a flood plain or how the reservoirs affect the flood plain, the releases, then how full the reservoirs are kept during the year?

General GALLOWAY. Yes, they have, as Mr. Pineda mentioned, they have a suite of models that deal with all aspects, including some of the benefits and costs of having activities take place in reservoir operations.

So they are a full-service hydrologic modeling organization that is focused and——

Mr. LAMALFA. I am sorry. I have got to cut to the chase here, sir.

And so how modern is it compared to the meteorology we have available?

My understanding is that Scripps down in San Diego has a tool to further update weather patterns and better predict how much water we can carry.

My concern is we let all of the water out in the fall in anticipation of we need the flood space, and we let too much water out because we have old models. We are maybe overly cautious.

And I do not want to say that disrespectfully of what the flood control people have to do, but how are we going to monitor that?

Mr. Gritzo, I saw you nodding your head on it. Please jump in there.

Mr. GRITZO. Yes, sir, Mr. Congressman.

The computational fluid dynamic models do a very good job of modeling where the water goes once it comes out of the sky. The challenge is determining the seasonal variation of climate and the precipitation rates locally that affect the exact problem I believe you are trying to discuss.

There is a number of climate models that are used by the Intergovernmental Panel on Climate Change. Those ensemble calculations are the best possible.

But it boils down to a seasonal forecast of climate and local weather conditions, right down to precipitation rates as a function of time, a key technical challenge.

Mr. LAMALFA. OK. So are we keeping up with the availability of technology in the governing of our water supply?

Are they staying together or are we on the cusp of that?

Mr. GRITZO. Yes, sir. I believe there are opportunities to make a better connection between those dots and to better integrate those systems.

Mr. LAMALFA. Are we doing those? Something called the "forecast-informed reservoir operations," a description.

Mr. GRITZO. I cannot speak to the details of that program. I would have do some additional research.

Mr. LAMALFA. OK. I have got to bang through here.

Mr. Pineda?

Mr. PINEDA. Yes, sir. You mentioned forecast-informed reservoir operations. I am aware that that was done on Scripps Institute, working with the Corps of Engineers for a reservoir on the Russian River.

Mr. LAMALFA. Is this something we wish to be integrating into the State water projects full speed?

Mr. PINEDA. I believe we currently have for the State water project in California forecast coordinated operations, and with the needs assessment after the Oroville Dam incident, you know, better hydrologic forecasting for the inflow to the reservoir, which then dictates how you operate the reservoir as far into the future as you can is definitely on our list.

And the FIRO, or the forecast-informed reservoir operations, has been incorporated into the Folsom Dam.

Mr. LAMALFA. I wish I could get faster answers.

Thank you. I have got to yield back.

Mrs. NAPOLITANO. Thank you, Mr. LaMalfa.

We go to Mrs. Fletcher. You are on for 5 minutes.

Mrs. FLETCHER. Thank you very much, Chairwoman Napolitano and Ranking Member Westerman, for holding this hearing.

Thank you to the witnesses for being here today.

Of course, the Army Corps of Engineers has one of the most critically important jobs in the country, and the WRDA 2020 bill that we are working on in this committee is one of the most critically important bills in this Congress for my constituents in Texas' Seventh Congressional District, as well as the entire Houston region.

So I do want to associate myself with the comments of my colleague and neighbor, Mr. Babin, about the incredibly critical importance of the project to widen the Port of Houston and the Houston Ship Channel.

And we are very much working on that anticipated project, and I look forward to working with the committee on that as we work on this bill.

In addition, on the West Side of town that I represent, the Army Corps is responsible for essential infrastructure as it is across the country, whether it is the port and the ship channel, to dams and the reservoirs in my district, and that is one of the things that I want to ask you all about today.

As many of you know, we have been talking just now about weather, and the threats that the Corps' infrastructure receives are changing, and the challenges to managing it I think we are seeing increasing from the extreme weather events that are continuing to grow.

The stress that it puts on the existing Corps infrastructure is across the country, as you no doubt know. In my own district, we were devastated by Hurricane Harvey, and it was the single largest rainfall event in the United States history.

We saw massive flooding, some of which took place only after the Army Corps was forced to do a controlled release from the Addicks and Barker Reservoirs because the existing infrastructure could not keep up with the incredible amount of rainfall.

At the same time, we have seen rainfall levels nearly that high just this past fall. So we know that it is not an aberration but a new reality that we have to be prepared for that level of rainfall.

And I think it is important to understand how the Corps looks at ways of carrying out its duties that reflect that reality, that some of the infrastructure was designed at a different time and for a different purpose.

I think, Mr. Pineda, you touched on this briefly, and I want to revisit it, but one thing that we discuss in Houston extensively is how the Corps calculates the benefit-to-cost ratio, the BCR.

In certain watersheds it can be difficult to identify projects that meet BCR requirements, even though the projects would do structural flooding, and that is a critical issue that we have got to tackle.

So this question really goes to anyone on the panel who wants to address it.

What can the Corps do to revisit the BCR calculations to allow for additional considerations that reflect the new realities that our communities are facing in this changing weather environment?

General Galloway.

General GALLOWAY. I think I mentioned earlier that we have the PR&G that came from the response to the Congress, produced it, and it is now on hold.

You have real problems figuring out what the benefits are for lower income for environmental issues when you ban that sort of an activity, looking at the complete panoply of benefits that exist.

And we know there is a lot already written about that, 10 years' worth of work on identifying what is happening, and as we saw in the areas you are talking about in Houston, they do not get a fair shake when you do not get the opportunity to look at what benefits could accrue to them and how they are different than the benefits that might be in the western part of the city or somewhere else.

So we have it on the plate. It is here. It is sitting, but it is held up in its use because of, I guess, objections to the fact that it includes heavy reliance on environmental and social costs and benefits which are necessary to deal with the issues you are raising.

Ms. UFNER. Congresswoman, if I could just jump in, we demand an enormous amount from our infrastructure, but we do not fund it significantly enough, and as we are seeking more resilient infrastructure, it would do better to fund it upfront.

And just a note. A study into BCR was required in WRDA 2018, but it has not started yet.

Thank you.

Mrs. FLETCHER. Thank you.

Would anyone else like to weigh in with the few seconds I have left?

Ms. SAMET. Yes, I would just add, if I could, Congresswoman——

Mrs. FLETCHER. Yes. Thank you.

Ms. SAMET [continuing]. That giving some clear direction to the Corps on what they can and cannot count as benefits I think would go a long way, and then asking them to reevaluate them on an occasional basis.

And if I could also just add that this applies both to the situation at the Addicks and Barker Reservoir and the reservoirs in Cali-

fornia. The Corps has the capacity and the responsibility to update those water control manuals and take advantage of the information and hydrologic models that are out there.

But many of those operating plans are decades old.

Mrs. FLETCHER. Thank you very much.

Madam Chair, I yield back. Thank you.

Mrs. NAPOLITANO. Thank you, madam, Mrs. Fletcher.

On the updating of the manuals, I ran into that problem with the Whittier Narrows. Those manuals are five, six decades old.

And when I asked them would they update them, they said it would not be practicable for them. That would take a lot of time and money.

So anyway, the question is: do they update them with the new information? That is something that we have got to delve into.

Thank you.

Mr. Palmer, you are next.

Mr. PALMER. Thank you, Madam Chairman.

A couple of things, a lot of things that have been said in the hearing that I think make a lot of sense, but there are some things that I think that we need to address.

Dr. Gritzo, I appreciate your perspective from an engineer's outlook on these things.

You said something in your written testimony. I think you repeated it in your verbal testimony, that the risk is getting worse due to heavier rains from warming climate and an increasingly developed and hardened landscape.

I think obviously the climate is changing. The geologic record shows that, but it is interesting that the last International Panel on Climate Change report, the AR5, did not include changes in flooding to anthropogenic influence from reported detectable changes in flooding magnitude, duration, or frequency.

What they are saying is in the context of climate change, they do not see that. I take exception to part of it, in that at the end of your point here of hardened landscape, that some of the big problems that we are facing with flooding is development, the hardening of the landscape, land use, the failure to use natural resources to mitigate flood.

And I want to point that out and then suggest to you that if we understand fully what is happening in the climate, again, go back and look at the geologic record. We have gone through multiple periods of climate change when the temperature is warmer than it is now.

And you see in the record that you have had major weather events like flooding or extreme temperatures. Yet we need to be prepared to adapt and mitigate. I think we have the technological ability and the engineering ability to do that, whether it is sea level rise, whether it is extreme weather.

Would you like to comment on that?

Mr. GRITZO. Well, certainly in terms of looking at individual events, it is not possible to attribute any individual event to any single effect. We know that there are a number of effects that occur.

But we can say that we——

Mr. PALMER. It is a multitude of things.

Mr. GRITZO. Exactly.

Mr. PALMER. And that is the point that I think concerns me about the whole debate around climate change is we get so wrapped up in CO2 that we miss the other things that are actually happening that we are going to have to deal with.

Go ahead.

Mr. GRITZO. I agree. All of these things are contributors.

What you can say with certainty is that warmer air holds more water, and when warmer air releases that water, it typically comes at higher precipitation. That is a basic thermodynamic law.

How that manifests itself in precipitation rates in different areas will strongly vary. We know the hardening of the landscape, the change in land use and increased development are exacerbating losses significantly.

So there are contributing factors, all of which lead us to the point where we have to be able to manage the change in not only the hazard and the flood hazard, but also the vulnerability to losses.

Mr. PALMER. If you do not properly define what is causing the change though, it is a fairly simple engineering principle if you get the definition wrong, the solution probably is not going to work.

Mr. GRITZO. Yes, sir. I certainly agree with that. I think the best resource in that is the reanalysis data, the 35 years of NOAA reanalysis data that we have.

We certainly should not hang our hats on 100- and 500-year events from 35 years of data.

Mr. PALMER. Right, and that is a great point, and that is the thing that concerns me about where we are heading, is that we are using really miniscule historic data when we need to be looking at epochs in terms of the data to prepare for this.

One example of failure to mitigate, and I do not want to be disparaging toward the Corps of Engineering, but they studied building a diversion canal from the Comite River over to the Lilly Bayou in Louisiana for 30 years and never put a shovel in the ground.

And then we had that 100-year flood, cost us billions of dollars, lost lives, and now the Corps is building that diversion canal. That is the type of mitigation, forward-thinking mitigation and adaptation that I think we need to be doing to prepare for what we know eventually is going to occur in the terms of climate change that we cannot do anything about.

Madam Chairman, I thank you for the time, and I yield back.

Mrs. NAPOLITANO. Thank you, Mr. Palmer.

Mr. Malinowski, your 5 minutes.

Mr. MALINOWSKI. Thank you, Madam Chair.

Ms. Samet, you mentioned in your written testimony the toxic algae outbreaks in Florida's coastal estuaries and elsewhere. I was struck by that partly because I spent much of yesterday in my district in New Jersey on the banks of Lake Hopatcong, which is the largest lake in New Jersey, a place that is beloved by people in the district that I represent as a place of recreation, a place where folks spend their summers.

It was mostly shut down last summer because of a harmful algae bloom outbreak. Other lakes in New Jersey experienced similar things, Budd Lake, also in my district, and others.

So I wanted to ask you or any other members of the panel who might wish to comment if you can go into any more detail on how we might be able to use the upcoming WRDA bill to tackle this challenge of harmful algae blooms that so many of us, I think, are dealing with back home.

Ms. SAMET. Well, it is definitely a complicated problem for sure. I think from the Corps' perspective across the country, it seems from my perspective it goes back to the value, that multiple value of natural infrastructure.

If you have robust wetlands systems, you have healthy small streams feeding into those systems, and you have rivers that function the way or at least attempt to mimic the way that they historically have functioned, that a lot, not everything, but a lot of the problems with algae blooms will actually wind up being assimilated through the wetlands system itself and help ameliorate that disaster.

And also by holding more water on the landscape it will keep runoff from coming down all at once and creating massive algae blooms at one time.

So I think, again, from the Corps' perspective, protecting the wetlands that we have, restoring those that have been degraded, and mainstreaming use of natural infrastructure as the approach to addressing our flood problems will go a long way to addressing some of those problems. It definitely will not solve it all.

Mr. MALINOWSKI. Any other comments from anyone on the panel?

[No response.]

Mr. MALINOWSKI. Maybe just staying on this subject then for a moment, if you could maybe say a little bit about the role that a changing climate has played in creating these outbreaks.

I mean, my understanding, at least talking to local folks who manage these lakes in New Jersey, is that the harmful bacteria have generally been killed over cold winters, and that is not happening anymore simply because the temperature has been warming.

Is that a fair assessment would you say?

Ms. SAMET. That is my understanding. I am not quite an expert in that, but on top of that issue of temperature, which definitely plays into the situation, climate change with increasing floods and increasing runoff and faster storms, you are getting larger influxes into the system as well to begin with, and then you have to deal with what the water temperature will or will not address.

Mr. MALINOWSKI. Thank you.

Admiral Phillips, you and others discussed the larger challenge of extreme weather events, antiquated stormwater infrastructure leading to flooding. I think a lot of us have local problems.

In my district, several communities along the Rahway River Basin, the Green Brook sub-basin in New Jersey have experienced extreme flooding related to weather events, and we have been working with the Corps in terms of building up resiliency.

You may have seen the Chairman Pallone of the Energy and Commerce Committee who represents a coastal district in New Jersey where a lot of my constituents spend their vacations. He has introduced the Living Shorelines Act, a bill that supports projects

that use natural materials and systems, like dunes and oyster reefs, to support the natural flood resilience of shoreline ecosystems.

Can you elaborate a bit on how green infrastructure can be more cost effective, number one, and also better suited for slowing down runoff and floodwaters compared to traditional gray infrastructure?

Admiral PHILLIPS. Certainly, Congressman. Thank you for the opportunity to comment, and I will be brief.

First of all, in Virginia, natural and nature-based features as our first line of defense is our top priority as we work to develop a coastal strategy and a plan for the State.

So we value that as a way to buy us time, to buy property owners time, to buy businesses time as we figure out what other kinds of infrastructure may be required in the future.

These are also things that can be implemented, as you have pointed out and as others have pointed out on this committee, for substantially reduced cost in many cases and that can be given opportunities to evolve, to migrate over time so that the benefits remain even though water and weather challenges and climate influences continue to occur and continue to change the infrastructure.

So we find them to be of particular import in our case in Virginia because we are so low, because there is so much there already, and the opportunity to build on and expand that is of significant value to us.

Mr. MALINOWSKI. Thank you.

I yield back.

Mrs. NAPOLITANO. Thank you.

Mr. Woodall, you have 5 minutes.

Mr. WOODALL. Thank you, Madam Chair.

And I appreciate all of you being with us today.

I want to shift gears a little bit because of this expertise here. General Galloway, you had the privilege of noting that someone had the audacity in 1993 to recommend that all the States along the Mississippi River get together and talk about a comprehensive plan.

It has been a little while since then. Ms. Samet, I think you all are parties to a lawsuit over a new water control manual that affects my State. It was last updated in the 1950s.

You were absolutely right in your testimony when you said we need to use new data and update these manuals though. As we have seen in our case, as soon as we update one, lots of different stakeholders are involved, and it is hard as a Corps of Engineers employee to have everybody applaud job well done. Generally, there are a few disparate voices out there.

Admiral Phillips is working with entire communities of human beings who have been in place since the 1800s that are being dislocated. Maryland is struggling with families that have been there since the 1700s. My friends from Louisiana have folks losing their land at the highest rate in the country.

So delay is a real problem here, not just in environmental and wildlife terms, but in human terms.

You all have made a very compelling collective case that we can do better, and I think every member on this panel agrees with that.

What I do not understand is how we can do better, whether it is 100 percent better or 10 percent better or 1 percent better, and then get everybody onboard so that we can move forward because I believe we are all disadvantaged by delay.

Hearing the collective support for using our very best science for resiliency planning, how can I move the timeline forward?

How can I bring this panel together to avoid that next lawsuit, not because folks do not have a right to say this was wrong, but because certainty advantages us all?

Does anybody have any guidance for me there?

And this is a good panel. We have both engineers and nonlawyers on because of that.

Ms. Samet, do you have any guidance?

Ms. SAMET. Yes, I do. And, yes, we are suing over the water control manual so that everybody is aware.

There are a couple of things. One, the key to updating water control manuals or any navigation operation plans is really basing things on the best possible science and also using the expertise of other Federal and State experts so that the Corps has that input and then can rely on the kinds of information that are provided.

If at the end of the day you have an environmental impact statement on a new water control manual that is actually looking at ways to improve the conditions for everybody while still meeting project purposes, you will find that you are not going to get a lawsuit.

So doing a better job upfront, and one of the things in particular with respect to the ACF——

Mr. WOODALL. Let me interrupt you, and I apologize for that.

Among the different timing issues I would like to fix is that we only have 5 minutes because your expertise requires more than 5 minutes.

But as you noted earlier, the Corps is tasked with cross-purposes. It is very difficult to do remediation and flood control simultaneously. These things are sometimes categorical opposites which will always allow for someone to file the lawsuit to say, "You did not parse the baby correctly."

I need to get beyond that because we have got limited resources here both in time and money, and we are flushing a lot of them parsing babies that we all want to get parsed correctly.

In your experience, General, did you have folks come back and say, "Job well done. One hundred percent we are good"?

We have had the Supreme Court speak out and say stop the lawsuits, but it is very rare that we have found a way to come together ahead of time to prevent the lawsuit, as Ms. Samet accurately says would be the goal.

General GALLOWAY. I think it is critical that we get together ahead of time to try and do it. It is very difficult now because there are so many roadblocks, barriers that you cannot deal with this agency; you cannot deal with these people.

We have got to find out what they are and eliminate them because in reality, the EPA and the Corps and FEMA all want to work together, but we cannot because of this or that.

So we need to find out what it is, get people at the table together, and create the situations where we can work out new

manuals, new approaches, new plans that bring everybody into the act and allow them to do that under the law.

What you are doing with the 800 cubic feet/second and WRDA 2018 is a great step forward like that.

Mr. WOODALL. Well, I will close in that space since we are practically in the circle of trust. Just five Members of Congress are here, and the six of you all. We will not tell our secrets.

Is there a reason that any of those walls exist that we would not want to tear them down?

Is there a functional engineering reason, environmental reason, States' rights reason?

Is there a reason we would not want to tear down those walls?

I will assume there is not a reason, and we will keep going forward. If there is a reason, if you would please submit that in writing, I would be grateful and partner with you to get that done.

Thank you for your indulgence, Madam Chair.

Mrs. NAPOLITANO. Thank you, Mr. Woodall.

Mr. Rouda, you are now recognized for 5 minutes.

Mr. ROUDA. Thank you, Madam Chair.

Thank you to the panel for coming here today and providing testimony.

I am Harley Rouda. I am from Orange County, California. I represent about 80 percent of the coastline of Orange County, including Seal Beach, Huntington Beach, Newport Beach, Laguna Beach, a really wonderful area, but like other parts of the country and around the world, we are experiencing on a regular basis the impact of climate change and rising oceans.

But, fortunately, we are working hand in hand with the Corps in addressing numerous issues, including projects that include the Surfside-Sunset Beach nourishment project, dredging at Newport Harbor, the Westminster at East Garden Grove Channel, and Westminster Channel study, and the Santa Ana River mainstream project.

I am going to start with you, Mr. Pineda. We have experienced in California and, I think, have done a very good job of understanding the value of bringing together both natural barriers as well as man-made barriers.

And can you talk a little bit about how you have seen that work in California and what are the opportunities to leverage that across the U.S.?

Mr. PINEDA. Thank you, Congressman.

So kind of natural solutions, I think, starts with giving rivers room to grow relative to protecting beaches from erosion. I think that has more been done on the east coast where there have been a lot of studies in Louisiana and other places and projects implemented where dune and marsh grass restoration have been implemented and have helped reduce shoreline erosion.

Also, in the Sacramento-San Joaquin Delta, in areas that are not part of our main channels, there are 1,100 miles of levees in the delta. So there are a lot of side channels. They have used a lot of brush mats, vegetation mats to prevent erosion, and many times once you put those adjacent to the levee, these are not Corps levees. So we have a little bit more flexibility. They attract sediment and then vegetation grows and provides erosion protection.

So those are a few examples of nature-based solutions. I think the most important one is slowing the water down, getting it out into the flood plains, which right now is kind of a new method of recharging our very depleted groundwater in many areas of California.

Mr. ROUDA. In many cases the use of natural infrastructure is actually more effective and less expensive than man-made structures; is that correct?

Mr. PINEDA. Generally so. I think the issue becomes, and General Galloway and some of the other people on the panel could comment. Putting your engineer stamp on some of the nature-based approaches sometimes may be a difficult thing. So we need to kind of get over that kind of hurdle.

But they generally are less costly, and they can be very, very effective.

Mr. ROUDA. General Galloway and Ms. Samet—am I pronouncing that correctly? Thank you.

For the two of you, and this is closely aligned with that question I just had, is mitigation. Right now the Army Corps is meeting 58 percent of its required annual mitigation, which means 42 percent is not being met.

Can you elaborate a little bit as to what that impact means for our ability to address properly the issues we are trying to handle?

General GALLOWAY. I can only say I am not familiar with where those are not taking place, but it is very clear, and this has happened over a long period of time, that when you get into a priority list or either a shortage of dollars or there is a shortage of time, that tends to slip.

There is a push for the concrete to go in, but there is not the push for nature-based or mitigation projects to go simply because you can see the results of the concrete. You can have a ribbon cutting, but the others are going to take several years to do, and they may be wonderful when they get there, but people are still skeptical.

And it becomes an issue of dealing with the skepticism of those that may control or influence the decisions.

Mr. ROUDA. Ms. Samet as well, just very briefly.

Ms. SAMET. Yes. I would also say, I mean, by not doing the mitigation, you are actually losing the resilience that we are all talking about trying to increase. Mitigation is just going to take you, if it works, to zero or no net loss or no loss.

The Corps, unfortunately, has a history of not prioritizing mitigation as it should, and also in some cases for longstanding operation projects, they are not actually implementing or requiring mitigation at all.

Mr. ROUDA. Great. Thank you very much.

And I yield back. Thank you.

Mrs. NAPOLITANO. Thank you, Mr. Rouda.

Miss González-Colón, you are on for 5 minutes.

Miss GONZÁLEZ-COLÓN. Thank you, Madam Chair.

Today is the 526th anniversary of the Europeans arriving to America, specifically Puerto Rico. Still, 2 years ago, a major disaster made many in the U.S.A. discover that Puerto Rico is part of America.

Still 2 years after that, we are still struggling with many of the losses regarding mitigation in Puerto Rico and without adding the beach erosion, which is a big issue around the island.

I actually got several suggestions to the new amendment to the WRDA Act, specifically, with the qualifying years, when we talk about the limits of what can be completed as long-term projects and immediate ones.

One of the issues is that for projects to be authorized under the bipartisan Budget Act and the supplementals regarding acquisition of land, easements, rights-of-way, revocation, disposable areas that now can allow non-Federal sponsors or municipalities or even States may request that the Corps perform a decision required on their behalf.

The full Federal share allows this to be done directly all throughout the allowance made by the bipartisan act, and this is one of the main issues we got back home when we were looking to the $2.5 billion that has been allocated just for mitigation under the Corps of Engineers.

But yet the local non-Federal sponsors got several problems to actually manage to get the money because of this.

The second issue will be the section 103 and increasing the project limit for section 205, the flood and damage mitigation, and section 103, beach erosion from $10 million to $20 million.

Section 14, which is the emergency streambank, from $5 million to $10 million for continuing authorities program, or the CAP Projects in the areas impacted by Irma and Maria for periods, or even Harvey, for 5 years.

And why is this? I mean, we do have several projects that are being studied, investigated, authorized, even planned, but they exceed the amount of the cap of the money in those two sections.

So we do have a lot of those areas that are still having the problems in the communities, and then we face another situation that actually General Galloway mentioned during his presentation or his statement.

Specifically, when we are talking about the areas, in many cases they do not meet the cost-benefit cap, and in our case, the need to include resilient infrastructure, not just digging and dredging, but at the same time losses of other projects in towns big and small are not being approved in many cases because they just do not meet with the criteria of the cost-benefit.

And that takes me to a direct question to General Galloway. In your testimony, you know that continuing reliance primarily on economic justification of projects makes it difficult for those in rural and low-income areas to justify projects that will give them considerable social and health benefits, and that a broader range of factors should be considered in project justification. I totally agree with you.

So how can we use another term of what risk reduction in rural and low-income areas is?

I mean, what is a specific recommendation we can include, General Galloway?

General GALLOWAY. The specific accommodation is to move back to the PR&G, which gives greater flexibility to considering health and other social costs and benefits of projects, and where you can

identify the project as a whole and find that there is a social benefit that rises to the same level as an economic benefit.

Miss GONZÁLEZ-COLÓN. You also state in your testimony, and I can be a witness of this, many Federal agencies have a shared interest in mitigating against future floods and storms, including the Army Corps of Engineers, FEMA, HUD, USDA, Department of the Interior, among others.

And they do have many barriers between them. What can we do? How do you recommend this committee address this overlap of functions that many times actually stop the help getting to those communities?

General GALLOWAY. I have watched this for many years. It goes back to the 1993 flood and all the floods that have been since, and the agencies go out and want to accomplish the work. Their lines are very narrow.

What we do not do is at the end of the operation come back and say, "What could we have done better? What is the report on the event and the recovery? What could we have done better? What barriers should we knock down? And how could we, for example, have HUD and the Corps of Engineers work together using an exchange of money that would be authorized by the Congress?"

Miss GONZÁLEZ-COLÓN. Thank you.

And thank you to the rest of the witnesses. I will submit the rest of my recommendations and questions for the record.

Thank you, Madam Chair.

Mrs. NAPOLITANO. Thank you, Miss González-Colón.

We will go to Mr. Espaillat.

Mr. ESPAILLAT. Thank you, Madam Chair.

And thank you to the witnesses for being here today.

Exactly 7 years ago New York City was recovering from the worst natural disaster in its history, Super Storm Sandy. The storm did not just cause flooding in predictable low-lying areas, such as the Rockaways off the South Shore of Staten Island.

It also brought up seawater into downtown Manhattan and the financial district. I will never forget the photograph of the southern part of Manhattan being dark without energy.

And in my district in East Harlem, a comparatively low-lying area, they also saw severe flooding, the likes of which residents had never experienced in a generation. New York is still working to repair the damage the storm caused to our infrastructure, particularly subway tunnels under the East River and long neglected bulkheads and seawalls.

But the truth is climate change is real, and the likelihood that we will see another Sandy in the next few years is uncomfortably high. Historic flooding is happening everywhere, as many of my colleagues have reported.

And we just saw the newspaper accounts of what is happening in Venice, Italy, many of the streets flooded at record high.

But I feel the approach to all of this is too piecemeal. Oftentimes the answer to addressing this climate crisis is based on upfront costs rather than long-term savings. Meanwhile we will end up spending billions of dollars rebuilding standards that do not foresee the worsening of the climate over the coming years.

Currently, the Army Corps of Engineers is looking into ways to protect New York City's harbor, and the main option being explored is a giant underwater seawall that will come up at times of extreme storm surge to protect the low-lying areas around the harbor from flooding.

However, many have criticized this as unable to meet the problem at hand. New York's comptroller, Scott Stringer, recently released a comprehensive resilience report where he cites concern with the project.

As I understand it, authorization for the study dates back to the Eisenhower era, authorizing to protect areas from large coastal storms. But that policy never envisioned really sea level rise from climate change. It was never really considered.

When critics like Comptroller Stringer and others have raised that concern, the Corps has often cited the narrow authorization as the reason they cannot explore a broader array of options.

I also feel that no matter what we come up with, the sheer sticker shock of this critical resiliency project will prevent us from taking the right actions before it is too late.

So I ask any of the panelists the following two critical questions.

First, what kinds of changes can we make in the upcoming WRDA to address this problem because, as we have all heard here today, New York clearly is not the only place facing this challenge?

And second, would you say that the way the Federal Government currently addresses resiliency projects is pennywise and pound foolish?

What do you think should be the change? What do we need to do to change the way we approach these critical investments?

Anybody on the panel can answer any of the two questions.

Mr. PINEDA. Congressman, let me chime in just a second, and I mentioned in the written testimony and the oral testimony about the Corps Silver Jackets Initiative. To a certain degree, that initiative was working before it was called Silver Jackets, where the Corps was partnering with FEMA and States and other Federal agencies.

But essentially, as I understand it, the main focus of Silver Jackets is to bring the Federal partners together to work with the State and regional partners. So greater funding of Silver Jackets and giving it stronger direction for the Federal agencies to work together kind of at the beginning level could help look at problems like the one you were describing and better define what each agency's role then would be for a comprehensive system.

So they are not authorized to build projects, but they can get together and talk together with the locals and better define who does what and how; what is the optimal way to work together with the Federal agencies.

Mr. ESPAILLAT. What about the consideration of the sea level rise aspect of any new project that will prevent these kinds of impacts by the next Super Storm Sandy?

General GALLOWAY. Congressman, being from Maryland where, as you know, we have the Eastern Shore across the Chesapeake Bay Bridge, and it is facing the tremendous problems with sea level rise. What that does each and every day, it gives us new benefits and new costs of having to deal with this.

I think in the case of New York City, that is the challenge going back to how you establish the benefit-cost ratio. If, in fact, you only include those things that make great economic sense, and that is not to say you should not consider that, but if you are not considering that the people that live in these areas, that the people are part of the solution.

The people need to be protected. There needs to be something done for them. You are never going to get that kind of a project in a low-income area funded.

It has got to have the support of what is in this PR&G that says you can consider that that is as important, that health and welfare is going to be as important as having a robust city, but we need to do them both.

Mr. ESPAILLAT. Thank you, Madam Chair.

Mrs. NAPOLITANO. Thank you, Mr. Espaillat.

Ms. Finkenauer, you have 5 minutes.

Ms. FINKENAUER. Thank you, Chairwoman.

And thanks so much for all of the folks that came to testify today. It means a lot that you took the time.

I know, Dr. Galloway, in your testimony as we look to make meaningful investments in resilient infrastructure, one of the barriers that you mentioned in your testimony are policies that make it harder for Federal agencies, as well as cities and States, to work together on solutions.

Many of the communities in my district have flood control projects that were funded by the Army Corps of Engineers, but some are now struggling to get Federal assistance to make improvements or repairs in these projects.

For example, the city of Waterloo was actually just disqualified for a FEMA hazard mitigation grant to upgrade their station or build a new levee around their riverfront stadium because it is part of an existing levee system that was constructed by the Army Corps.

I understand that the city is responsible for the cost associated with the operation and maintenance of this project, but blocking Federal financing from going towards important flood project infrastructure does not make sense.

Mr. Galloway, how would lifting this prohibition and allowing communities like Waterloo to use Federal grants to upgrade Army Corps flood control projects help promote investments in resiliency?

General GALLOWAY. It is a move toward common sense, and when you talk to the agencies, and we have gone around Washington. We have gone around these communities where it is a problem. We are told the same thing. We would like to help but we cannot. We would like to get together, but we cannot.

The silo does exist, and the people are very busy. So they do not necessarily walk across the street to see even in their own community another agency, stormwater versus flood control.

The way it has got to be is something has to be in the culture of resilience that says you want to work together. When you find a way that prevents you, something that prevents you from doing that, let us know, and we will track it down.

I do not think that that is what we see certainly here in Washington, cries from Waterloo that, well, we have this problem where

they do not get together and they cannot get together or they say that is not authorized. We need to figure out how we solve that.

And I believe these are solvable because the people that are doing this work really want to do it.

As Mr. Pineda said, we have this planning assistance with the States and the Corps of Engineers Floodplain Management Services. Back in 2005, right before Katrina, the Assistant Secretary of the Army and FEMA were together in Alaska for a conference, and they said, "We really need to get more money into this so we can get out and help people solve these problems and work them." And they said they would get them.

When you look at the amount of money we have put into these now, including Silver Jackets, it has not grown. We have got to find a way to get the help to the people to help them solve the problem together and then move ahead with what is a more logical approach to some of these issues.

Ms. FINKENAUER. Absolutely, and I would love to open this up to you. I just have a few minutes left so if anybody wants to jump in.

If you can touch on, you know, what would the change mean and what would that impact feel like for our smaller and our rural communities at places like Iowa-1 where I represent quite a few of.

Admiral PHILLIPS. Congresswoman Finkenauer, I will jump in please. Thank you for the opportunity, and I understand the timeline.

So in coastal Virginia, we have a number of underserved, lower income communities who are parts of cities, who are working very hard to try to find solutions to deal with their flood impacted future.

And what we are finding is that in some cases, one agency's cost-benefit analysis, HUD under the CDBG program, will meet cost benefits that will support these communities and allow us to do work in these communities using that opportunity, whereas an Army Corps cost-benefit for the same kinds of circumstances will not.

So the challenge is how do we pull together the nuances of whatever HUD is using that allows us to get an adequate cost-benefit and apply it to Corps projects in a way that perhaps will develop some sort of shared system where different agencies are allowed to come together.

It is disappointing to hear that CDBG money is prevented from supporting Army Corps projects. That is not helpful because those are key critical opportunities available to the underserved that we, at least in Virginia, take a lot of advantage of, and so do other coastal communities.

Thank you.

Ms. FINKENAUER. Well, thank you, everybody. I really appreciate it.

And with that, I yield back.

Mrs. NAPOLITANO. Thank you, Ms. Finkenauer.

Ms. Wilson, you have 5 minutes. You are recognized.

Ms. WILSON. Thank you, Madam Chair.

Today's hearing is very timely as Floridians are actively fighting the effects of climate change and working to improve the resiliency of our water infrastructure. Extreme hydrological events have laid

bare many of the challenges impacting Florida's water infrastructure.

They have overwhelmed the State's aging stormwater and wastewater treatment facilities which are in desperate need of maintenance and repair and have caused massive overflows and extensive flooding.

As such, resiliency planning has become a cornerstone of our efforts to bolster our ability to withstand and respond to increasingly severe hydrological events.

The U.S. Army Corps of Engineers has been working very closely with the communities in my district to help improve this. Recently the Army Corps partnered with Miami-Dade County to facilitate a discussion with experts, officials, and concerned citizens as part of a 3-year study to help reduce risk from storms and sea level rise.

In addition to sharing ideas for tackling sea level rise challenges that are unique to south Florida, stakeholders have also urged the Army Corps to reevaluate projects like the 70-year-old central and south Florida flood control system for opportunities to strengthen resiliency from increasingly intense hydrological events.

Local leaders have committed significant resources to combatting sea level rise and improving resiliency, but the Federal Government must be more supportive.

It is my hope that the next WRDA bill will contain additional provisions to help tackle climate change and improve the resilience of vulnerable communities like those in south Florida.

I look forward to working with my colleagues to do just that.

I have a couple of questions. Ms. Samet, as you noted, the Federal Government has lagged in its funding commitment to restore the Everglades. Beyond economic and health impacts of restoring the Everglades, how important is full Federal funding for the Everglades to properly managing resiliency against negative weather impacts?

Ms. SAMET. As you know, the Everglades Restoration Project is a top priority for the National Wildlife Federation. We certainly appreciate the committee's longstanding commitment to moving that process forward, and it does address not just wildlife habitat, but storm risk reduction, drinking water supply. It really covers the full panoply of issues that you need to address for resiliency.

So I think, you know, at this point it does seem that the best thing the Federal Government can do is to make sure it is matching the State's commitment and providing at least $200 million each year towards a comprehensive ecosystem restoration plan to make sure that that gets implemented.

Ms. WILSON. Thank you.

General Galloway and Admiral Phillips, my district traditionally has higher levels of poverty that serve as limiting factors to building resilience against the impact of negative weather events.

First, those in my district have a difficult time affording flood insurance.

Second, communities with fewer resources are less able to engage in the kind of planning necessary to building this kind of resiliency against negative weather events.

Do you advocate for planning of this kind to include analysis, how poverty impacts the community's ability to plan for and survive negative weather events?

Either one of you?

Admiral PHILLIPS. Congresswoman, thank you for the opportunity to comment.

We absolutely advocate the inclusion of poverty and environmental equity and environmental justice in the consideration of how we plan for and prepare for the impacts of flooding on underserved communities across coastal Virginia.

It is absolutely critical. If we do not drive it in at the Federal and State level, it will be ignored. We cannot let that happen.

Thank you.

Ms. WILSON. Thank you.

General GALLOWAY. I would just comment that FEMA and the Texas A&M University are working hard in the Houston area after Harvey to get the data that can make that case more strongly so that we can show and they can show where there are shortfalls in giving support to the people that need it the most.

Why they have the problem, the affordability issue has been covered by reports done by the National Academy and point out that it just does not make sense to continue the way we are in dealing with some of these projects.

So people are doing it, but it is going to take a while for them to go through the process and get that set up. It is obvious it is there. We just cannot make the case of how to do something about it immediately.

Ms. WILSON. Thank you.

Mr. Pineda, you suggest in your testimony that any new Federal taxpayer funding program for flood risk associated with levees be reserved for top performers. How would you suggest budget strapped communities meet your top performers criteria while balancing other needs?

Should the Congress allocate additional funding for planning and performance?

Mr. PINEDA. Thank you, Congresswoman.

When levees are built, they have to be operated and maintained, repaired and reconstructed. We have to enter into an agreement with the Corps of Engineers to provide those services, OMR&R, and so we have to think, when we build new levees, we have to think of the long-term operations, maintenance cost, and repair and reconstruction.

So that has to kind of go into the local planning process. You know, there is a cost share for new projects, new studies. Public Law 84–99, usually it is just the land easements and rights-of-way.

So we want, the association and groups across the country want, to make sure our levee system is as safe as ever, and that means the locals taking the responsibility to appropriately operate and maintain, repair and reconstruct, and seek the assistance of the Federal agencies.

Thank you.

Ms. WILSON. Thank you, Madam Chair, and I yield back.

Mrs. NAPOLITANO. Thank you, Ms. Frederica Wilson.

We will go to just two more questions, for myself and my ranking member.

The question I had for Admiral Phillips: in your testimony on the flood protection project for the city of Norfolk, it highlights a concern facing many members of this committee when the potential cost of protecting small or disadvantaged communities may outweigh the monetized benefits.

But does the kinds of water processes meaningfully allow the court to help communities at risk of flooding that may also have lower property values or are located in rural areas where a lower benefit-cost ratio may affect the viability of the project to proceed?

And do you recommend any changes on that?

Admiral PHILLIPS. Madam Chairwoman, thank you for the opportunity to answer that question.

We do not believe that the current WRDA process adequately addresses the impact to underserved communities. What we found in work that we have done with the Corps in Virginia, who are fulfilling the standards of their obligations and following the processes they have been directed to follow, is that underserved communities, lowered value properties, agriculture in particular, in addition I would say, is not appropriately quantified or valued in the cost-benefit analysis.

Mrs. NAPOLITANO. Well, what would be your recommendations?

Admiral PHILLIPS. I think, going back to General Galloway's comments on adequately incorporating the principles, requirements, and guidelines, including ecosystem opportunities in communities, including safety and health benefits, including volume of people protected, not just property value of that that is protected, and then looking beyond in a more holistic and resilient view of the community writ large and not just tying it to flood impact on infrastructure and the value of that infrastructure.

Mrs. NAPOLITANO. Mr. Galloway, have you a comment on that?

General GALLOWAY. I could not agree more. It is something that we do not recognize it is there, and for lots of reasons we cannot see it because we are not allowed to or the Corps is not allowed to bring it forward as a reason for moving this project ahead and to consider this: just the issue of the volume of population versus the economic value of the population.

Mrs. NAPOLITANO. But what effects are you already seeing on these communities during the large flood events?

General GALLOWAY. Well, what is interesting is that you go back now after a big flood event, whether it is a Harvey or those that are in Puerto Rico or other places. You can see that no matter what you start with, if you are behind and you are underrepresented and low income, catching up to where you were and even moving ahead is almost impossible because there are so many things in the insurance program, in the infrastructure you already had, where you protected it all, in most cases it is not.

You are starting behind, and we need something to get people to move ahead.

Mrs. NAPOLITANO. Well, what I am learning is that FEMA is wording in law that they can reconstruct the same as before, whereas in Puerto Rico, they would need to build resiliency for future events.

But they do not do that.

General GALLOWAY. I agree with you. The idea that you want to get back to where you were and you are then OK does not work, and in Puerto Rico, I happen to have gone to the first grade in Santurce in San Juan. I have great memories of that country or that Commonwealth, and it is amazing to me that we have not been able to help the lower income people move forward in dealing with these infrastructure issues.

Mrs. NAPOLITANO. We must do something about it.

I yield myself no more time, and I will recognize Miss González-Colón.

Miss GONZÁLEZ-COLÓN. Thank you, Madam Chair.

And I am going to do a piggyback on that last question because I do believe we need to prioritize as well those small communities and little projects.

And one of the questions directly regarding that is the maintenance. I mean, we do have a lot of Army Corps of Engineers inactive projects, the lack of maintenance for many years, waiting until the next disaster to happen, and that has happened in Puerto Rico.

I mean, many of them were built to manage flood situations, but because of the lack of maintenance, they may not be up to date when the next hurricane happens because in our case, we are in the path of all hurricanes.

So my question will be: if we should authorize in the new legislation that small projects have their definition expanded and the cap increased so that the community resiliency improvement can benefit and can be covered within the limits.

I mean, what are your comments on that, Mr. Galloway and Ms. Phillips?

General GALLOWAY. Anything that allows attention to be paid to people who may not even know of the challenge, this goes back to the squeaky wheel issue.

If you do not know to complain, if you do not know what to ask for, you are not going to get it, and so, again, anything that allows the Corps or the people that are dealing with the particular issues to have more flexibility is good.

Money is certainly one way to do that.

Miss GONZÁLEZ-COLÓN. Thank you.

Ms. Phillips, do you want to add something?

Admiral PHILLIPS. Yes, ma'am. Thank you very much.

I would also say that in coastal Virginia, and I will speak specifically to the city of Norfolk where I am also a resident, there has been a tremendous effort to focus on the revitalization of underserved communities, and in nearly every case, a tremendous part of their challenges is flooding, coastal flooding, rain flooding, high-volume flooding.

And so what this does to them, and this gets to the point of, you know, how do we keep them from falling further behind. They are right on the edge with no safety net now. If their car is flooded, then they cannot get to work. If they cannot get to work, then they lose their job. If they lose their job, then they lose their apartment. If they lose their apartment, then they are out on the street.

And so we have this sequence of events that takes place or could take place with a very small trigger, and the challenge for many

coastal communities now is those triggers are coming more and more frequently because of climate impact, rising waters, sea level rise, intense rainfall, and the degrading infrastructure that is there to support all of these circumstances that cannot keep up with it over time.

So our challenge is it gets to the point of resilience and preparing for resilience. How do you look at this in a holistic way that gives communities opportunities to plan collaboratively to move forward?

The cost-benefit that the Corps is using does not support that kind of view. A holistic Federal review and collaborative process will be necessary to move these kinds of issues forward.

And as many of the panel have said today, rooting out the impediments to that and eliminating them and removing them will be key to that process.

Miss GONZÁLEZ-COLÓN. Thank you.

And before yielding back, I want to just notice Mr. Gritzo. I read about Mylan, or as we say in Puerto Rico, Mylan Pharmaceutical, getting ahead of the hurricanes, but because of the resiliency problems, you implemented there so the facility would withstand the winds of the hurricane.

And I am glad that facility did not suffer, and as you notice in your website, I think it is important. I mean, 54 percent of the economy of the island is the pharmaceutical industry, and so having those facilities being covered by debt resiliency programs just helps that out.

Thank you, and with that, thank you, Madam Chair.

Mrs. NAPOLITANO. Thank you, ma'am.

So far, we have had tremendous input from you, and I think some of the Members are very glad that we had this hearing because it sheds light on some of the things that we need to look at.

But now I ask unanimous consent that the record of today's hearing remain open until such time as witnesses have provided answers to any questions that may be submitted to them in writing.

And I also ask unanimous consent that the record remain open for 15 days for any additional comment and information submitted by Members or witnesses to be included in the record of this hearing.

If we missed anything, please let us know.

Without objection, so ordered.

I would like to thank our witnesses for their testimony, and if there are no other Members—is everything good? No more? The committee stands adjourned.

Thank you.

[Whereupon, at 12:44 p.m., the subcommittee was adjourned.]

SUBMISSIONS FOR THE RECORD

Prepared Statement of Hon. Eddie Bernice Johnson, a Representative in Congress from the State of Texas

Madam Chairwoman, it is with great interest that I attend and participate in today's hearing on concepts for the next Water Resources Development Act: promoting resiliency of our nation's water resources infrastructure.

This hearing will be one of several related to the formulation of a new water resources development act (WRDA) for 2020. The next WRDA reauthorization allows us the opportunity to address many important issues relating to our nation's water resources, including infrastructure.

The role of resiliency in the construction, operation and maintenance of projects carried out by the U.S. Army Corps of Engineers (Corps) is an issue that we must examine.

The Dallas area falls within the Southwestern Division of the Army Corps of Engineers. Flooding and flood control continue to be issues that are ever-present on the minds of residents along the Trinity River. I have held several meetings on flooding in the Dallas area.

This hearing is intended to examine how concepts of resilience are incorporated in the planning, design, construction, and operation and maintenance of existing projects. Improving the performance of public infrastructure in response to major disruptive events like hurricanes, floods and tornadoes, all of which affect the Dallas area, must be a priority. Mitigation is necessary to avoid a repeating cycle of destruction-reconstruction-destruction. Mitigation involves retrofitting existing infrastructure or making new construction more resilient.

Resiliency design and criteria should meet the best quality standards possible. For engineered infrastructure, "resilience" is the capacity to maintain a level of functionality or performance over the design lifecycle of the infrastructure following a significant disruptive event.

Resilient design criteria should be developed for projects. The criteria should include and be based on two primary dimensions of resiliency: robustness and rapidity.

Robustness is the inherent design strength of a structure and its ability to reduce initial loss or degradation resulting from a disruptive event like a hurricane or tornado.

Rapidity is the rate of recovering functionality to an acceptable level of performance following a disruptive event.

The resilient design criteria should identify infrastructure type, including initial design and retrofits; hazard type; hazard magnitude; and the maximum acceptable time to return a structure to functionality following a disruptive event.

The criteria should, at a minimum, apply to structures and facilities that if they failed, would have a debilitating impact on national or regional public safety; economic security; energy security; and any combination of these factors.

In Dallas, the focus of our efforts with our water resources stakeholders and groups (made up of water providers, their local government members, the development community, and environmental professionals) revolve around regional partnerships that promote and collaborate on the following:

- Providing adequate water and wastewater infrastructure to meet the demands, given the rapid pace of growth and development in our area;
- Promoting water conservation and reuse by businesses and residents, including native/drought tolerant outdoor landscaping;
- Addressing maintenance needs, human behaviors that create sewer overflows, and replacing aging infrastructure;
- Developing successful asset management accounting, tracking, and software;
- Maintaining or improving water quality, including education and outreach on human behaviors, wildlife and pets;

- Reducing flooding and other hazards associated with water flows; and
- Improving or maintaining open space linkages, availability, and habitat quality.

Madam Chairwoman, we have the opportunity to improve the performance of public infrastructure by developing resilient design criteria that helps us make our construction stronger and last longer.

Letter of November 18, 2019, from Sean O'Neill, Senior Vice President, Government Affairs, Portland Cement Association, Submitted for the Record by Hon. Grace F. Napolitano

PORTLAND CEMENT ASSOCIATION,
200 MASSACHUSETTS AVE., SUITE 200,
Washington, DC, November 18, 2019.

The Honorable GRACE F. NAPOLITANO,
Subcommittee Chair,
Subcommittee on Water Resources and Environment,
Washington, DC.

The Honorable BRUCE WESTERMAN,
Subcommittee Ranking Member,
Subcommittee on Water Resources and Environment,
Washington, DC.

DEAR SUBCOMMITTEE CHAIR NAPOLITANO AND SUBCOMMITTEE RANKING MEMBER WESTERMAN:

Thank you for holding a hearing on "Concepts for Next Water Resources Development Act: Promoting Resiliency of our Nation" focused on steps that can be taken to improve the resiliency of water infrastructure as the subcommittee works on a Water Resources Development Act (WRDA). The cement industry supports the committee's efforts to ensure the WRDA bill continues to direct the U.S. Army Corps of Engineers to build more resilient infrastructure.

The Portland Cement Association (PCA) represents 91 percent of U.S. cement production capacity with manufacturing plants in 73 congressional districts and a presence in all 50 states. PCA promotes safety, sustainability, and innovation in all aspects of construction, and fosters continuous improvements in cement manufacturing and distribution.

Over the past several years, the United States has experienced an increase in natural disasters ranging from hurricanes to flooding that have devastated communities across the country. Last year, the United States was impacted by fourteen individual billion dollar disaster events, resulting in the 4th highest total damage costs ever recorded. As we take steps to reduce the damage caused by these disasters, it is critical to enhance the resiliency of the nation's water infrastructure to increase its durability, longevity, disaster resistance, and safety. Using more resilient building materials offers environmental advantages by conserving resources needed for the production of replacement materials, and by lessening waste, and economic advantages by reducing costs associated with repairs or replacements.

Passage of WRDA provides an opportunity to place greater focus on building resilient water infrastructure across the country. As water infrastructure is built or repaired, the cement industry supports taking steps to ensure improved durability to the nation's water infrastructure to better take into account the changing climate. Concrete is a critical building material to contribute to improved resiliency.

Additionally, passage of WRDA next year is important for continuing the two-year cycle of passing water infrastructure authorizations and advancing new Army Corps of Engineers projects. Additionally, passage of WRDA is important to improving the nation's navigational and flood protection infrastructure. Across the country there are approximately 100,000 miles of levees with 25,000 miles of inland and intercoastal waterways. Annually, the cement industry ship approximately 35 percent of our product from plants to terminals by barge demonstrating these systems are vital for American commerce.

We thank you again for holding a hearing focused on improving the resiliency of water infrastructure. We look forward to working with you to pass a WRDA bill next year.

Sincerely,

SEAN O'NEILL,
Senior Vice President, Government Affairs.

APPENDIX

QUESTION FROM HON. GARRET GRAVES TO GERALD E. GALLOWAY, P.E., PH.D., BRIGADIER GENERAL, U.S. ARMY (RET.), ACTING DIRECTOR, CENTER FOR DISASTER RESILIENCE, A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND

Question 1. How can we improve the Corps' project delivery process?
ANSWER:

a. A funding policy that doles out project funds on an annual basis makes it almost impossible to act efficiently in planning or construction and during those operations to avoid rising costs. Policies that create boundaries along agencies or between agencies or hinder cooperative efforts among agencies make little sense. Legislation that would encourage USACE, when it identifies means to cooperatively work with other agencies in the interest of time or economics to seek and obtain rapid-turnaround approval from Congressional committee of such multi-agency work should be considered. Also, during feasibility studies the USACE should be encouraged to seek out logical opportunities frog such partnerships and cooperate efforts. An action taken by the T&I committee in the 2018 WRDA required review of a provision in the law that limits USACE's authority to deal with flood situations in urban areas where the flow is under 800 cubic feet /second. This limitation illustrates the potential for restriction removals to assist agencies in working together to accelerate project execution.
b. Continuing reliance primarily on economic justification of projects makes it difficult for those in rural and low-income areas to justify projects that would give them considerable social and conceivably health benefits. The recent National Academies studies of affordability of flood insurance gives a very clear picture of the differential level of flood protection under various economic situations and strong reason to consider all factors in project justification. Without removal of Congressional restrictions on USACE use of the federal Principles, Requirements and Guidelines it will be unlikely that projects in support of low-income population will move quickly through the planning process. This will result not only in delays to these projects but may also result in slowdown of projects that have a higher economic utility.
c. 38 years ago, I, as a Consultant to the Water Resources Council was asked by the Chair of the Council to examine the reasons behind the extremely long time required then to move a federal water resources development project of the USACE, BOR, USDA from inception to completion. The results of this review were provided to the Chair of the Water Resources Council, herds of the concerned agencies, and the Chairs of the relevant Congressional Committees. In the years following, some progress was made in addressing the issues identified, however, I believe that many of the roadblocks to speeding up project delivery remain and could be addressed. Even though somewhat 'ancient,' I am providing the Committee a copy of the report, Impediments in the Process for Development of Federal Water Resource Projects, as part of my answer to this question.

[Editor's note: The 114-page report entitled "Impediments in the Process for Development of Federal Water Resource Projects: Why All the Delay and What Can We Do About It?" is retained in committee files.]

QUESTIONS FROM HON. GARRET GRAVES TO ANN C. PHILLIPS, REAR ADMIRAL, U.S. NAVY (RET.), SPECIAL ASSISTANT TO THE GOVERNOR FOR COASTAL ADAPTATION AND PROTECTION, COMMONWEALTH OF VIRGINIA

Question 1. Will the Commonwealth carry out the $115 million natural disaster resiliency competition grant within the authorized timeline or do you anticipate needing an extension?

Question 1.a. If an extension is needed, could you please help the Committee to understand what reforms may be needed to expedite project development and delivery for resiliency projects?

ANSWER. Congressman Graves, Thank you for the opportunity to testify and to answer Questions for the Record. The Commonwealth of Virginia and the City of Norfolk are diligently working together in order to carry out the Virginia Natural Disaster Response Competition grant within the authorized timeline. The Commonwealth and city do not anticipate the need for an extension to meet the national objectives at this time, but will continue to monitor the timeline as the project progresses into full implementation.

Question 2. How can we improve the Corps' project delivery process?

ANSWER. Virginia values its relationship with the US Army Corps of Engineers and their ongoing work with State agencies and localities. There is, however, an urgent need to align Corps planning standards, Principles and Guidelines, Feasibility Study, and benefit-cost analysis processes to better serve Coastal States and their communities dealing with rising waters and recurrent flooding.

PRIORITIZE AGENCY MISSIONS AND FUNDING ALIGNMENT

The three primary missions of the US Army Corps of Engineers (USACE) Civil Works Division, Navigation, Environmental Restoration and Flood Control, often work against each other, as navigation projects are a nearer term priority, often overshadowing costlier and longer-term flood control requirements. This results in navigation projects receiving funding at the expense of flood control, which further delays critical flood and water infrastructure projects. Navigation projects should be evaluated, and funded, separately from flood control projects. Navigation projects also need a comprehensive evaluation process to consider and determine potential for adverse effects, including flooding or negative impact to environmental restoration. The National Environmental Policy Act (NEPA) and Clean Water Act provide some protections in this regard; those must be maintained, and strengthened.

FUNDAMENTAL REVIEW OF USACE PRINCIPLES, REQUIREMENTS AND GUIDELINES—AND BENEFIT/COST ANALYSIS PROCESSES:

The current BCA process deserves fundamental reconsideration, including (as previously stated) strong environmental review and NEPA process, quantification of green and natural and nature-based (NNBF) infrastructure benefits, and consideration of social and environmental equity and long-term regional climate adaptation solutions, given what we now know about costs and the longer-term nature of climate change as a threat.

The 2007 Water Resources Development Act directed the Secretary of the Army to revise Principles and Guidelines for the Corps, which was completed and finalized in 2013, but not fully implemented.[1] [2] [3]

As a result, there remains a need to better balance economic, social and environmental goals and impacts across the process, and to include regional impact, as well as impact to federal facilities and in particular DOD facilities in the watersheds evaluated by the Corps, where applicable. Without this broader analytical perspective, preferred alternatives skew to grey/hardened solutions, with value driven by the value and content of structures protected, and with little to no quantified consideration of social, environmental, or regional economic long-term benefit or value.[4]

PRIORITIZATION OF PROJECTS

The U.S. Army Corps of Engineers (USACE) has a $96 billion backlog of authorized but unconstructed projects, while annual appropriations for the USACE Con-

[1] Council on Environmental Quality, "Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies," The White House, accessed December 19, 2019, https://obamawhitehouse.archives.gov/node/5321.

[2] "Water Resources Development Act of 2007," Pub. L. No. 110–114, § 2031, 33 USC (2007), https://www.congress.gov/110/plaws/publ114/PLAW-110publ114.pdf.

[3] "DRAFT Water Resources Policies and Authorities IMPLEMENTATION OF EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT, AND EXECUTIVE ORDER 13690, ESTABLISHING A FEDERAL FLOOD RISK MANAGEMENT STANDARD AND A PROCESS FOR FURTHER SOLICITING AND CONSIDERING STAKEHOLDER INPUT," DEPARTMENT OF THE ARMY EC 1165–2–217 (DRAFT 9 DEC 2016) (US Army Corp of Engineers, December 9, 2016), https://www.iwr.usace.army.mil/Portals/70/docs/frmp/eo11988/EO11988EC__Draft12Dec16.pdf.

[4] "Risk Assessment for Flood Risk Management Studies," Engineer Regulation (Washington, DC: U.S. Army Corp of Engineers, July 17, 2017), https://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER__1105-2-101.pdf.

struction account under Energy and Water Development appropriations bills have averaged $2 billion in recent years. Congress has also limited the number of new studies and construction projects initiated with annual discretionary appropriations, with a limit of five new construction starts using FY2019 appropriations.[5] Since only a few construction projects are funded each fiscal year, numerous projects authorized by previous Congresses remain backlogged. This problem has worsened in recent decades as Congress has authorized construction of new projects at a rate that exceeds USACE's annual construction appropriations. The Corps must evaluate the complete list of back-logged projects for currency and recommend to Congress which projects are not addressing current or future flooding needs, are otherwise unnecessary, or do not address resilience, pre-disaster mitigation, or infrastructure and flood plain actions. Congress must instruct the Corps to prioritize projects that provide the greatest flood risk reduction and assist regions with the greatest economic needs. This aggregation and prioritization will help reduce overlap in project and study areas and reduce gaps along jurisdictional lines.

Given the limits placed on the Corps for new project starts, and Corps funding limitations, Congress should also ensure the Corps has a smooth process to accept and validate commercial and academic study work as the basis for, or in place of, a feasibility study. (For example, Virginia Beach's own Back Bay study and storm water study discussed in my testimony).

EMPHASIZE GREEN INFRASTRUCTURE, AND DEVELOP EXPANDED BENEFIT/COST ANALYSIS THAT QUANTIFIES GREEN INFRASTRUCTURE AND NATURAL AND NATURE-BASED FEATURE (NNBF) BENEFITS, AND THE NEEDS OF UNDERSERVED COMMUNITIES

Again, the Corps must move from a grey infrastructure/ hardscape focus to one that emphasizes green infrastructure and natural and nature-based features and economic and social benefits wherever feasible. The U.S. Army Engineer Research and Development Center (ERDC) has plenty of capacity to address such infrastructure through its Engineering with Green Infrastructure Initiative, however, its work is rarely considered or included in the Coastal Storm Risk Management process.[6]

Green infrastructure and NNBF's buy time, and in many circumstances, are more effective, and more cost-effective through reducing the amount of water overall, and by absorbing, capturing and slowing down run-off and floodwaters while providing ecosystem services and co-benefits to communities. This is particularly valuable in the context of providing services to underserved communities, and ensuring environmental equity across communities.

In summary, the Corps' project delivery process can be improved by a fundamental review of Principles and Requirements—and by implementing the Principles and Requirements for Federal Investments in Water Resources guidelines completed in March 2013.[7] It can be further strengthened by a fundamental review of BCA processes, by including strong environmental review, quantification of green and NNBF infrastructure benefits, consideration of environmental equity, and regional economic benefits. Given what we now know about costs and the longer-term nature of climate change as a threat—we have no time or federal dollars to waste.

QUESTIONS FROM HON. GRACE F. NAPOLITANO TO RICARDO S. PINEDA, P.E., C.F.M., CHAIR, ASSOCIATION OF STATE FLOODPLAIN MANAGERS, SUPERVISING WATER RESOURCES ENGINEER, CALIFORNIA DEPARTMENT OF WATER RESOURCES, DIVISION OF FLOOD MANAGEMENT, ON BEHALF OF THE ASSOCIATION OF STATE FLOODPLAIN MANAGERS

Question 1. What do you see as the role of existing infrastructure in meeting future challenges and meeting future needs?

ANSWER. Existing flood infrastructure includes, but is not limited to, urban drainage infrastructure including pumping plants, dams that provide dedicated flood storage and are controlled by USACE Water Control Manuals, and levees, floodwalls and bypasses. To meet future challenges due to larger flood events due to climate change (including hydrologic changes, changes in sea levels, and other changes within watersheds), the existing infrastructure needs to be assessed by operation entities to determine the level of flood protection the facilities or project works currently pro-

[5] "Army Corps of Engineers Annual and Supplemental Appropriations: Issues for Congress" (Congressional Research Service, October 2018), https://crsreports.congress.gov/product/pdf/R/R45326.

[6] "EWN—Dr. Todd Bridges—Bio," 3, accessed November 12, 2019, https://ewn.el.erdc.dren.mil/bios/bio_bridges_todd.html.

[7] Council on Environmental Quality, "Updated Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies."

vide, and what levels of flood protection would likely be provided under expected future conditions. The infrastructure also needs to be operated and maintained to the highest standards possible. Operating entities and the communities they serve need to assess new protection standards and design hydrology they need and intend to achieve to reflect increased flood flows due to the expected future conditions. ASFPM recommends that, at a minimum, future conditions which extend for the full useful life of facilities or project designs must be considered.

A gap analysis should be performed and studies undertaken to determine how and where the existing infrastructure should be improved to protect communities against larger and more frequent floods. Special attention should be paid to aging dams with dedicated flood control storage to examine the need for expanded outlet works, including the potential for new auxiliary spillways or modified spillways. Urban drainage systems need to be examined for the potential of additional storm water storage, and separating storm water drainage from sewage flows in existing combined storm and sewer water systems. Existing levee systems can be raised and strengthened via levee lifts, floodwalls, seepage cutoff walls and stability berms, and consideration should be made of levee setbacks to increase flow conveyance capacity, reduce erosion, improve groundwater recharge, and to provide open space for habitat restoration. Improvements and establishment of new floodways or expanded floodways which divert floodwaters from rivers need to be considered. To complement improvements to the existing flood infrastructure, communities should adopt a portfolio approach to flood risk reduction that includes risk-informed land use restrictions, increased purchase of NFIP flood insurance, and flood mitigation, including buyouts and structure elevation, where appropriate.

Example projects of note along these lines:

- Corps' SELA Project (Southeast Louisiana Urban Drainage Project). This project is improving storm water drainage in the New Orleans for protection against the 10-year rainfall event.
- Providing Urban Level of Flood Protection (200-year protection) for California urban communities along the Sacramento and San Joaquin River Systems. Existing federal levees protecting urban areas of Yuba City, Sacramento, West Sacramento, Stockton, Lathrop and Manteca are being improved or planned to be improved to a 200-year level of flood protection. These projects have been funded by the State of California, regional flood control agencies, and some funding from the USACE through a variety of partnerships. They include the setback of federal levees and the planned widening of the Sacramento Weir, which diverts floodwaters into a flood bypass. The projects have been planned to provide multiple public benefits.
- Folsom Dam modifications. A new emergency spillway at Folsom Dam located upstream of Sacramento will allow the dam to safely pass the updated "probable maximum flood" and make larger reservoir releases with the reservoir at lower water levels to support Flood Informed Reservoir Operations (FIRO) and maintain flood flows in the American River below the maximum flow capacity. This project is referred to as the Folsom Dam Joint Federal Project was led by the USACE and supported by the U.S. Bureau of Reclamation, the State of California, and the Sacramento Area Flood Control Agency. The USACE Water Control Manual was updated to reflect the updated probable maximum flood and forecast informed reservoir operations.
- Existing dams that provide dedicated flood control storage should be examined for feasible improvements to their outlet works and spillways and updates to their USACE Water Control manuals to ensure that they can and will function at an optimum level for the 21st Century.

Question 2. How do you see this playing out in California, especially with the need to balance water supply for communities?

ANSWER. In California, post-Hurricane Katrina and after a Five-year Drought, the voters have been willing to approve multiple state bonds to fund flood risk reduction infrastructure and regional water supply projects. These funds have been used to improve flood protection along the existing Sacramento and San Joaquin Flood Control System to a 200-year level of flood protection for six urban areas. The California Department of Water Resources and the California Central Valley Flood Protection Board have sought and continue seeking to maximize federal participation in each of our structural flood protection projects. Many urban flood protection projects have been started prior to the Corps' beginning construction and were classified as "Early Implementation—"No Regrets"" projects. Some of the State-funded projects focused on levee repairs that had been waiting for Corps repairs for many years and were delayed in part due to federal environmental permitting. Two existing federal dams have been improved to provide a greater level of flood protection through improve-

ments of an existing floodwater spillway in one and the construction of a new spillway and Water Control Manual in another. Flood Control and seismic improvements are also being designed for a third dam.

While California implements with its federal and local partners much needed improvements to its structural flood risk reduction system, it is has also maintained an active and essential floodplain management program, including carrying out FEMA NFIP mapping and extensive development of digital terrain models, and hydrologic and hydraulic studies that can be used by local, state, tribal, and federal partners. California maintains an active flood forecasting operation in cooperation with NOAA, reservoir operations units who've helped develop forecast-coordinated operations procedures and forecast-informed reservoir operations, and flood emergency response teams.

None of California's flood risk reduction actions are seen as incompatible with existing water supply infrastructure; in fact, they are complimentary. Of course, each new flood risk reduction project needs to be evaluated for all its potential impacts on other property and the environment, including water supply impacts. California flood risk reduction project cost-sharing advocates for projects that provide multiple benefits, including environmental benefits, open-space/recreation, and floodwater-managed aquifer recharge, when possible.

The California Water Plan Update 2018 identifies a new water supply management strategy, referred to as "FloodMAR," which advocates the use of floodwater for managed aquifer/groundwater recharge. Groundwater banks, large and small, are in place and under development in the South San Joaquin Valley and Southern California. Flood waters are being diverted as much as possible to the groundwater banks as a source for groundwater replenishment.

The bottom line is, California's water infrastructure is extensive and complex and incrementally is being improved for the challenges we anticipate in the 21st Century. A key policy is to strive to ensure each project provides multiple benefits and improves/supports regional water management at the local level. The California Department of Water Resources works closely with its federal and local partners, including, but not limited to, the USACE, USBR, FEMA, USGS, NRCS, NOAA, NMFS and USFWS, to ensure water policy and environmental alignment resulting in well-coordinated projects to meet the needs of our state based on a changing climate.

Question 3. What steps can the Corps take under existing authorities to factor resiliency into their projects, and what are the gaps with these authorities?

ANSWER. These are a series of ASFPM recommendations for both actions under existing authorities and where authority gaps may exist to help the Corps of Engineers make progress toward building toward resilient communities and infrastructure:

- We need to have clearer direction and clear authorities and procedures to update Corps (and, where appropriate, USBR) reservoirs and their operations with dedicated federal flood control storage that should be reflected in regularly updated Corps of Engineers' Water Control Manuals.
- We must also leverage nature-based approaches, natural infrastructure design features and green infrastructure. This begins with removing every single barrier in statute and policy so that we *automatically consider these approaches* in part or in whole, in each situation where decisions must be made regarding the current and future resiliency of the water resources and their affected environments (i.e., mandate that nature-based approaches and natural infrastructure approaches be considered in conjunction with P.L. 84–99 repair and rehabilitation projects and in all flood risk reduction project feasibility or project modification studies).
- We should increase and broaden the implementation of the Corps of Engineers' Engineering With Nature Initiative.
- In ASFPM's testimony we have emphasized that Congress and the USACE should provide a significantly greater level of water resources management and flood damage reduction technical assistance through the Planning Assistance to States Program, the Floodplain Management Services Program, and the Silver Jackets program, or possibly a new, expanded continuing technical assistance authority or authorities. Currently, only a handful of Corps' District Offices regularly utilize these technical assistance authorities, partly because the scale of funding is so limited that it has not even been an option for many districts. The Corps needs a substantial initiative to expand its technical assistance to communities, states, and tribes, where the end results may not be new large Corps civil works projects, but in order to help communities and states develop some of their own projects to address flooding problems, with potential assistance from multiple federal, state, local and other sources contributing. Historically,

the USACE produced Flood Information Studies and these studies were used by communities as a basis to develop alternatives for flood risk reduction, including the implementation of floodplain management measures and nonstructural flood risk reduction. Such assistance should be brought back in one form or another with greater focus on longer-term resiliency. In addition we urge that cost-sharing policies be harmonized and updated so as not to bias against utilizing nonstructural, nature-based, or natural infrastructure approaches where these approaches may make the greatest overall sense.

- We would also urge adoption of the Principles, Requirements, and Guidelines, and would urge movement toward greater identification of the multiple benefits associated with wise floodplain management and nonstructural approaches to flood risk reduction, as directed in WRDA 2007, Sec. 3021. We also would strongly support adoption of a National Economic Resilience Standard in planning for future flood risk reduction and improved floodplain management. This could be greatly assisted by implementation of the previously adopted Federal Flood Risk Management Standard, including the requirement that new critical infrastructure be protected against at least the 500-year flood event. In addition, we would support completion of the WRDA 2007, Sec. 3022 Water Resources Priorities study of flood risk, which would provide the Corps and Congress with critical information evaluating risks, costs, and options to address future resiliency challenges and opportunities. The study was begun, but never completed by the Corps.
- ASFPM also urges greater cooperation between FEMA and the USACE on flood risk assessment, including large-scale, full-risk mapping. FEMA should consult with the USACE Hydrologic Engineering Center on the methodology and potential to carry out large-scale, full-risk mapping across the nation for advisory flood risk information.
- WRDA 2016 and 2018 both included direction for greater inclusion of nonstructural measures in project plan formulation, yet the Corps of Engineers WRDA guidance has thus far failed to implement and institutionalize this direction. We urge the Committee to continue considering ways to bring such planning into all flood risk management studies, and we would further urge the Committee to follow up and insist on completion of the WRDA 2014 authorized Sec. 3029 studies identifying data and program effectiveness in P.L. 84–99, and biases against and impediments to utilization of nonstructural approaches to flood risk reduction. An area for potential legislative focus for WRDA 2020 could be improved coordination with other federal agencies to adopt a flood risk reduction portfolio that maximizes flood risk reduction utilizing nonstructural measures in some cases to be carried out or led by other federal agencies.
- As ASFPM has emphasized in our oral and written testimony to the Committee, we urge the Committee and Congress to authorize and carry out a Missouri River System Study that will examine the management and operation of the 6 Corps Dams on the mainstem of the Missouri River and the Missouri River federal and nonfederal levee system, in light of the long and growing history of repetitive levee breaches and failures, pinch points and road and bridge closings and repairs, rural and urban flood damages, and repetitive flooding where there are clear needs for greater floodwater conveyance than is now available in large flood events, going into the future. Besides the critical importance of such a study in Midwest states where enormous losses have already been experienced, and major challenges and costs for repairs and disaster damages and assistance will be faced for years to come, ASFPM believes such a general system review authority is needed for the Corps to identify and promote water resources community and infrastructure resiliency into the 21st Century.
- We urge the Committee to support adoption and utilization of the ANSI 2510 Standard for Flood barriers and to improve and upgrade the capability of barrier testing facilities at the Corps' ERDC facility. This was further discussed in our written testimony.
- We also would urge adopting standards to Protect Urban Areas to a level at least equal to the 'Standard Project Flood' (this was a recommendation of the Galloway Committee report from 1994, and we believe makes even greater sense in light of current experience).
- Finally, I reemphasize our view at ASFPM that the Committee should ensure the Corps has authority to consider building acquisition/relocation and utilization of levee setbacks and/or realignment as alternatives in all flood loss reduction programs. These are and will be critically important tools for infrastructure and community resiliency going into the future, but they are currently far under-utilized approaches that could save the U.S. taxpayers huge sums going into the future.

QUESTION FROM HON. GARRET GRAVES TO RICARDO S. PINEDA, P.E., C.F.M., CHAIR, ASSOCIATION OF STATE FLOODPLAIN MANAGERS, SUPERVISING WATER RESOURCES ENGINEER, CALIFORNIA DEPARTMENT OF WATER RESOURCES, DIVISION OF FLOOD MANAGEMENT, ON BEHALF OF THE ASSOCIATION OF STATE FLOODPLAIN MANAGERS

Question 1. How can we improve the Corps' project delivery process?

ANSWER. Recognizing that one of the critical path actions in project delivery is funding: the Corps' needs to think about taking a fundamentally different approach to project formulation and technical assistance. Dr Gritzo who also testified during the hearing talked about FM Global model where FM Global engineers provide technical assistance to their insured clients—through risk assessments and identification of flood loss reduction alternatives. Then the business implements the mitigation. What would happen if the Corps took a more technical assistance-oriented approach with a foundational understanding that they may, or may not, be the entity actually funding and constructing the project, engage the community with a solution or range of solutions that could be implemented by the community, regardless of the Corps' participation?

In so many cases, just by having feasible alternatives presented, communities can proceed with their own project, if it doesn't appear a Corps project will be funded by Congress. Isn't the goal to get protection in communities as quickly as possible? Who cares who is funding it? States and communities will step up and ASFPM has seen examples of this occur. The current model and expectation that the Corps will study, design, and build a project just doesn't line up with reality and the $100+ billion backlog of authorized, but unconstructed projects that exists. Not every USACE study needs to recommend an expensive structure-based project that is difficult to economically justify, pay for, and maintain. In a more flexible approach (which might also include looking at smaller flooding issues), the Corps could serve far more at-risk residents, communities, and businesses of our nation than they do now.

QUESTION FROM HON. GARRET GRAVES TO LOUIS A. GRITZO, PH.D., VICE PRESIDENT OF RESEARCH, FM GLOBAL

Question 1. How can we improve the Corps' project delivery process?

ANSWER. Here, respectfully, are our suggestions:

The U.S. Army Corps of Engineers is an essential partner to residents and businesses in communities affected by flood. We at FM Global, one of the world's largest commercial property insurers, recommend the following three-pronged approach to improving the Corps' project delivery process as it relates to protecting the value of companies doing business in the U.S.:

1. *Reprioritization and allocation of funds*: Federal appropriations for post-disaster recovery and pre-disaster risk mitigation should, to the extent possible, be thought of as a single combined resource. All non-emergency projects should be objectively analyzed, evaluated under current and expected future conditions, prioritized accordingly and funded on a comprehensive cost/benefit basis. Prioritization should be informed by the facts that it's far more cost-effective to prevent a flood loss than rebuild or recover afterwards.

   Funding priorities should also consider the value of flood-related loss prevention not merely in terms of property value, but rather in terms of the overall contribution to a community's economy and quality of life.
2. *Evaluate levee alternatives*: Although levees are a proven defense against flooding, they are a somewhat blunt one. FM Global encourages the study and use of alternative flood mitigation approaches, including but not limited to expanded wetlands, permeable landscapes, and inland waterways. As part of this work, the Army Corps should deploy state-of-the-art hydrological models and implement technically sound standards for design, inspection, and maintenance developed through public-private-academic partnerships.
3. *Strengthen research and testing capabilities*: Implementing the aforementioned recommendations to improve decision-making and project delivery will require the Corps to expand its engineering services and support them with a strengthened research and testing capability, presumably at its U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi. The ERDC has been a valuable partner in flood mitigation efforts and needs to be expanded and updated to meet evolving challenges. Of particular importance is providing laboratory improvements that enable certification testing of temporary flood barrier solutions to address higher floodwaters beyond the lab's current three-foot limit. Tested and certified temporary barriers provide solu-

tions that protect structures from damage when permanent flood protection measures are not possible, or during times of excessive local precipitation.

In summary, we urge improving the Corps project delivery through:

- the reprioritization and allocation of federal flood mitigation and recovery funds,
- a comprehensive evaluation of levee alternatives, and
- stronger research and testing capabilities at the ERDC.

We hope these recommendations are helpful. Thank you again for your consideration. FM Global is eager to continue this dialogue for the benefit of American communities facing the growing and grave threat of flood loss.

QUESTION FROM HON. GARRET GRAVES TO MELISSA SAMET, SENIOR WATER RESOURCES COUNSEL, NATIONAL WILDLIFE FEDERATION

Question 1. How can we improve the Corps' project delivery process?

ANSWER. Thank you for the opportunity to share the National Wildlife Federation's views on improving the Corps' project delivery process. At the outset we wish to stress that efforts to improve the project delivery process should focus as much on producing more effective and ecologically sound water resources projects as it does on reducing the amount of time it takes to plan and construct those projects.

To produce more effective and ecologically sound projects, the Corps must fully account for the vital importance of the nation's rivers, streams, floodplains, and wetlands. These natural infrastructure systems are essential for resilient communities, resilient populations of fish and wildlife, and a vibrant outdoor economy. The Corps should take full advantage of these natural systems to help absorb floodwaters and buffer communities, improve the effectiveness and resilience of levees and other structural water resources infrastructure, and reduce the need for new structural flood and storm damage reduction projects.

The Corps' project delivery process has not been—and will not be—improved by eliminating planning steps; curtailing, diminishing, or undermining robust review under the National Environmental Policy Act; or imposing arbitrary time limits on project planning and environmental review. We strongly urge Congress and the Administration to refrain from advancing any such changes.

To help produce more effective and ecologically sound projects and improve the Corps' project delivery process, the National Wildlife Federation recommends the following changes.

First, the Corps' planning process should be restructured to promote the development of innovative, ecologically sustainable solutions to water resources problems. Corps planning should begin with a comprehensive assessment of the root causes of the underlying problem. The Corps should then search for the most ecologically sustainable avenues for addressing those root causes. All projects should be designed to work with, and maintain, the integrity of natural systems (including a rivers' natural instream flow) to the maximum extent possible. Far too often, the Corps' current planning process is focused on attempting to justify pre-determined, structural solutions that often increase flooding in other locations and destroy vital wetlands that protect communities and allow wildlife to thrive.

Project delivery for complex Corps projects can be improved by active coordination across federal agencies and this type of coordination should be encouraged. Such coordination can assist in efficiently sequencing appropriate reviews and in anticipating and working to resolve issues that may arise before they result in delay.

The Corps must also meaningfully account for technical comments provided by other federal agencies, state agencies, independent experts, independent external peer review panels, and the public. The Corps often ignores many of the recommendations provided by others, even when they are highly informed and detailed. Using the information provided by others in a meaningful way would improve the quality of Corps projects (including in some cases, driving fundamental changes to the suite of alternatives being considered) and the timeliness of project delivery.

To help implement these needed changes, Congress should:

- *Mainstream the Corps' Use of Natural Infrastructure*: Natural infrastructure is a critical, but underused, tool for reducing flood and storm damages while also increasing resilience. Congress should also create incentives for non-federal sponsors to increase consideration of natural infrastructure solutions by: (1) clarifying that natural infrastructure solutions are subject to the decade-old limitation on the total non-federal cost share for non-structural measures, which eliminates the potential for excessive land-related cost burdens on non-federal sponsors; and (2) facilitating full consideration of cost-effective flood and storm damage reduction solutions for at-risk communities by adopting targeted criteria for waiving the non-federal cost share for feasibility studies while also re-

quiring that those studies fully evaluate natural infrastructure solutions that can provide sustainable and less expensive protections.

- *Ensure Effective and Efficient Analysis of Fish and Wildlife Impacts*: Federal and state fish and wildlife experts provide vital input into Corps projects through the Fish and Wildlife Coordination Act, but this input is often ignored or given short shrift by the Corps. To improve the project delivery process, Congress should direct the Corps to evaluate fish and wildlife impacts, and develop mitigation for fish and wildlife resources, in a manner that is consistent with recommendations provided pursuant to the Fish and Wildlife Coordination Act that derive from the special expertise of our state and federal fish and wildlife experts (e.g., methods and metrics for evaluating fish and wildlife impacts and needed mitigation).
- *Ensure Mitigation in Accordance with Long-Standing Legal Requirements*: Mitigation for adverse impacts caused by construction and operation of Corps projects is an important tool for increasing the resilience of communities and the nation's fish and wildlife resources. Currently the Corps is failing to comply with long-standing civil works mitigation requirements for many projects, including ongoing operation and maintenance of the Mississippi River navigation system and ongoing operation of the Apalachicola-Chattahoochee-Flint river system. Congress should clarify the types of project studies that trigger the long-standing civil works mitigation requirements to ensure application of those requirements as Congress unquestionably intended.

Second, Congress should modernize the criteria used by the Corps to calculate project benefits and costs, including by requiring the Corps to account for increased ecosystem services as a project benefit and lost ecosystem services as a project cost. Fully accounting for costs and benefits is critical for making effective decisions regarding the planning, construction, budgeting, prioritization, and authorization of Corps projects to increase resilience. Ecosystem services are the direct and indirect contributions that ecosystems provide to our well-being, including benefits like flood control, water purification, and habitat for wildlife.

Third, Congress should increase the Corps' capacity to improve the resilience of the nation's water resources infrastructure by establishing a Directorate of Ecological Services within the Office of the Chief of Engineers. This Directorate should be tasked with ensuring that the Corps takes full advantage of existing programs, authorities, and operations to use natural systems to protect communities from floods, minimize expenditures for emergency response and rebuilding, improve wildlife habitat, and strengthen the outdoor-based economy. This Directorate should have significant budgeting authority. Corps planning is hampered by an organizational structure that prevents the agency from creating and taking advantage of critical opportunities to effectively utilize the extensive public safety and wildlife benefits provided by healthy natural systems.

Fourth, Congress should direct the Corps to develop and apply modern planning tools, including particularly modern hydrologic models that allow for 21st Century project planning, and ensure adequate funding to support this effort. The Corps should work closely with the academic community in developing new models. Far too many Corps models are outdated relics from the past, and far too many Corps projects rely on models and management plans that are decades old and simply cannot account for modern conditions. Updated models would greatly facilitate improvement of the Corps' project delivery process.

Fifth, Congress should carefully consider changes to the Corps' budgeting process. The long-standing practice of funding Corps staff through project-specific appropriations creates a perverse incentive to: drag-out project planning and project delivery; plan and recommend larger and costlier projects; and continue the status quo approach to managing navigation and other projects instead of looking for new, more innovative and ecologically sound approaches. All of these types of actions are rewarded with more funding under the Corps' current budgeting process.

QUESTIONS FROM HON. BRUCE WESTERMAN TO JULIE A. UFNER, PRESIDENT, NATIONAL WATERWAYS CONFERENCE

Question 1. During the hearing, you mentioned the multiple benefits that can be accrued from Corps civil works projects, but you've also pointed out the challenges in incorporating these benefits, including natural infrastructure, into the traditional planning model. What recommendations do you have to address these concerns?

ANSWER. Ranking Member Westerman, thank you for your question. The members of the National Waterways Conference (NWC) include non-federal sponsors who have significant financial responsibilities for water resource projects and are accountable to the residents who the projects benefit and protect. The Corps' planning

program provides a structured approach to the formulation of projects responsive to local, state and national needs, premised upon the project's contribution to national economic development while protecting the environment. In addition to the complex, and often lengthy internal review process, Corps studies are also subject to extensive external reviews, including under NEPA. It is important to note that the Corps' study process is grounded upon solving problems raised at the local or basin-wide level, whether combatting a flooding issue or ensuring a competitive navigation channel.

As non-federal sponsors seek to incorporate additional benefits in projects, the planning framework must provide for the flexibility to include those additional benefits. No doubt, there may be opportunities where multiple benefits—and a willing non-federal partner—will lead to a higher return on investment. An example below will further explain this concept. However, imposing requirements on a non-federal sponsor does not reflect the reality of project development, and could result in a waste of scarce resources. As this committee knows too well, we live in a resource-constrained environment, with significantly more demand for important water resource projects than funding available. As such, the process to modify and update the program must be open and transparent, accounting for the feedback and expertise from nonfederal sponsors, while not imposing unwanted burdens and obligations.

In my testimony, I referenced an example from the Sacramento Area Flood Control Agency (SAFCA) as illustrative of the current constraints on the planning process and how additional benefits may be incorporated. SAFCA was formed in 1989 to address the Sacramento area's vulnerability to catastrophic flooding. An integral part of the system, the Yolo Bypass, encompasses 5,900 acres and extends 41 miles through both urban centers and one of the most productive farmlands in the world. Constructed by the Corps as a single-purpose flood control facility, the entire three-mile-wide bypass is in a floodplain and is 75 percent privately owned. During the non-flood season, most of the bypass is used as farmland, such as rice farming, which contributes to the nation's agriculture output. But during rainy seasons, SAFCA has flood easement rights to the land.

To address concerns with endangered species, recently SAFCA proposed an ecosystem restoration plan that allowed salmon to grow on the fallowed bypass farmland during flood season, which would complement the bypass's use as a flood control facility. Numerous studies have shown that salmon and other threatened and endangered species grow eight to ten times larger on bypass lands than on the main stem of the river. However, under the current Corps processes, the plan was not allowed since Corps administrative policy requires all bypass land to be purchased in a fee title. Since the cost to purchase the fee titles is much greater than the Corps' assigned benefits to raise the endangered fish, this made the benefits unattainable. So, while it was acceptable for the Corps to claim a primary flood control benefit using the easement, a secondary ecosystem benefit was not acceptable based on internal Corps decisions.

Building upon the lessons learned from this example, we would recommend that the current Corps process for examining multiple benefit projects be reassessed, as well as internal decision-making that prevents the Corps from crediting other multi-purpose benefits within projects. One approach would be to not require a fee title to claim ecosystem benefits. Instead, those additional benefits could be treated similar to the way current obligations for mitigation sites and the operations and maintenance are handled.

We would recommend a rigorous, disciplined, scientific-based examination of the issue such that water resource planners have additional tools at their disposal to incorporate a full array of feasible alternatives, satisfying the basic objectives of economics, environmental protection, regional development and social well-being, which by definition can address resilience concerns at the local level.

We would also recommend that in the next WRDA, Congress authorizes a study by the National Academy of Sciences. Typically, as part of such studies, the Academy's Water Science and Technology Board holds open meetings and invites non-federal sponsors to offer their views for consideration in the final study. The inclusion of the views of the non-federal sponsors, who are responsible for significant financial commitments for construction and maintenance, is imperative to the integrity of this process.

Question 2. As you mentioned in your testimony, the Corps is still operating on cost-benefit principles from 1983, and their most-recent update was met with widespread resistance. Additionally, in WRDA 2018, Congress called on the Corps to contract with the National Academy of Sciences to review the Corps' economic principles and analytical methodologies when evaluating water resources projects. Cen-

tral to the concerns we heard during the hearing is how the Corps must do better to quantify multiple project benefits, including establishing the value of nature-based alternatives, as well as how to quantify resilience.

Question 2.a. As we look towards WRDA 2020, how can we further lean on the Corps to properly update these principles and guidelines?

Question 2.b. Additionally, how do you recommend that the Corps properly update the Principles and Guidelines?

ANSWER (2.a. and 2.b.). There has been an increased call for the use of nature-based and natural infrastructure alternatives to be included in the planning process. To be sure, the process should include consideration of a full array of feasible alternatives. Federal investment decisions are grounded upon the net economic benefits to the nation, using a cost-benefit analysis, as set forth in the 1983 Principles and Guidelines (P&G) which governs project planning and development.

WRDA 2007 (P.L. 110–114) included a requirement for the Corps to consider how they interface with the P&G. The Council on Environmental Quality (CEQ) took over the process that had been started by the Corps and eventually issued two documents—the Principles and Requirements and the Implementing Guidelines (collectively referred to as the PR&G). NWC has been a vocal critic of the attempted update. As we described in the testimony, those products are fundamentally flawed. They are undisciplined, and lack any degree of consistency and predictability needed for the development of proposals to guide federal investment decisions.

A key area of concern is the inability to quantify multiple project benefits, including establishing the value of nature-based alternatives in that analysis. We would urge the Committee to not simply direct the Corps to dust off the PR&G, but instead to take a fresh look at this issue.

We are encouraged by work currently ongoing at the Corps' Engineer Research and Development Center to develop methods for evaluating and quantifying benefits beyond the scope of the traditional planning model, including natural and nature-based infrastructure. When such information is developed to the point that public input is appropriate, we would urge the Corps to solicit stakeholder input, including providing the opportunity for notice and comment. This input will be critically important to discern what is workable and feasible on the ground.

QUESTION FROM HON. GARRET GRAVES TO JULIE A. UFNER, PRESIDENT, NATIONAL WATERWAYS CONFERENCE

Question 1. How can we improve the Corps' project delivery process?

ANSWER. Thank you for your question Congressman Graves. Congress has already started this process when they enacted numerous changes in WRRDA 2014, WRDA 2016 and WRDA 2018, which the Corps is working to implement. Concurrently, the Corps has also been focusing on streamlining its project delivery process through its "revolutionize civil works" initiative. We are encouraged by the progress we have seen this far, including adopting milestones for the feasibility process, integrated review of planning documents, and the establishment of a single policy and legal team for planning studies or budget decisions, along with the implementation of risk-informed decision-making. Additionally, the Corps has moved to better incorporate the input and expertise of non-federal project sponsors and partners. Furthermore, the Corps is considering alternative funding and financing opportunities, which opens up more opportunities for non-federal sponsors and their communities to move forward with projects. But, as with any complex project, this is an ongoing process, and it is going to take time and learned experience to determine which changes work on the ground. To that end, we would urge caution before enacting further legislative directives—the new approaches underway ought to be given a chance to work before we work to change them.

At the end of the day, we all want the same thing—strong, resilient and affordable infrastructure that can protect residents and businesses as well as the environment and economy—while making sound fiscal decisions. We look forward to working with you, Congress and the Corps to achieve these goals.

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