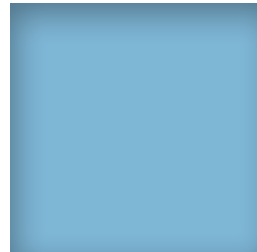
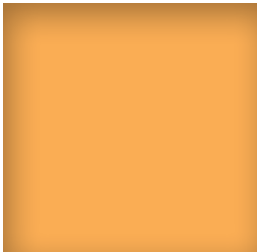
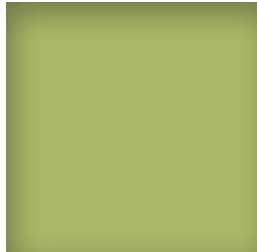


Transformation and Innovation in the Wake of Devastation

An Economic
and Disaster
Recovery Plan
for Puerto Rico



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and Disaster
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for Puerto Rico



LEFT | MARIA
TREE SEEDLINGS
CULTIVATED
FOR PLANTING
ACROSS THE
ISLAND, MARCH
2018



BELOW | CRUISE
SHIPS RETURNED,
BRINGING
THOUSANDS
OF TOURISTS
A WEEK,
DECEMBER 2017



ABOVE |
STUDENTS' FIRST
DAY OF SCHOOL
FOLLOWING
HURRICANE
MARIA, OCTOBER
2017



RIGHT | OVER
15,000 POLES
DELIVERED
TO RESTORE
ELECTRICITY TO
THE ISLAND,
JANUARY 2018



CONTENTS

Foreword From the Governor	ii
Executive Summary.....	iv
1 Introduction.....	1
2 Puerto Rico: An Island Undergoing Transformation	14
3 Puerto Rico's Challenge	22
4 Puerto Rico's Opportunity.....	44
5 Start with a Strong Foundation	52
6 Build Resilient Communities, Modernize Infrastructure and Restore the Natural Environment	62
7 Focus on the Future	114
8 Estimated Costs and Funding for Puerto Rico's Recovery	128
9 A Commitment to Transparency	142
10 Plan in Action.....	150
11 Conclusion	158
12 Detailed Actions.....	160
13 Detailed Look at How the Plan Was Developed.....	371
14 Acknowledgments	385
15 Abbreviations.....	387



**Ricardo Rosselló
Nevaes, Governor**

FOREWORD

From the Governor

The final draft of the Governor's foreword is pending and will be included in the final recovery plan.



Image via HSOAC

PRELIMINARY DRAFT—JULY 9, 2018

EXECUTIVE SUMMARY

In September of 2017, Puerto Rico suffered catastrophic damage as Hurricane Irma passed just north of San Juan. Hurricane Maria made a direct hit on the Island as a massive category 4 hurricane two weeks later. The hurricanes' devastating effects on people's health and safety cannot be overstated. Damage to critical infrastructure resulted in cascading failures of lifeline systems of energy, transportation, communications, and water supply and wastewater treatment. With the events occurring at the end of a very active hurricane season, federal resources for disaster response were stretched. Moreover, aid from other states was not easily available due to a lack of mutual compacts and geographical separation across a vast ocean. Because the resources available for response were inadequate for the scale of the disaster, the failure of the lifeline systems meant that emergency services were severely compromised and residents lacked electricity, food, and water for a prolonged period. And with roads impassable, residents had limited access to medical care. After the hurricanes, people lost their jobs, schools were closed, government services and private enterprise could no longer operate effectively, landslides caused flooding hazards, and wastewater polluted marine environments. Older adults, children, individuals with disabilities or chronic illnesses, and women were all disproportionately affected by this disaster.

Catastrophic hurricanes and the resulting disasters are not unique to Puerto Rico. Coastal communities affected by Hurricane Katrina in 2005 and Hurricane Sandy in 2012 also suffered widespread damage, severe interruption of essential services, and deep economic losses. However, Puerto Rico has experienced a much longer period of post-disaster failure, and



Kenneth Wilsey/FEMA

The Government of Puerto Rico views the recovery effort as an opportunity to transform the Island by implementing solutions that are cost effective and forward looking, harness innovative thinking and best practices, and revitalize economic growth.

the Island now faces a lengthier recovery than other regions of the United States that have faced the aftermath of similar disasters. Critically Puerto Rico has been grappling with an economic crisis spanning more than a decade; structural demographic, health, social, and infrastructure stresses; and a history of limited government transparency—these preexisting conditions exacerbated the impact of the hurricanes. Puerto Rico’s population is aging, and an increasing number of young people and working-age adults have been migrating away from the Island. Poverty rates are higher than in any U.S. state. Import prices in Puerto Rico, as well as the prices of the goods and services produced from these imports, are high. A lack of clarity about ownership of and responsibility for various infrastructure assets and public buildings complicates repair and prevents adequate maintenance. Puerto Rico is also somewhat unique in its relationship with the U.S. federal government: Although Puerto Ricans are U.S. citizens, they cannot vote in U.S. presidential elections, have only a nonvoting Resident Commissioner in the U.S. House of Representatives, and have no representation in the U.S. Senate.

The Government of Puerto Rico views the recovery effort as an opportunity to transform the Island by implementing solutions that are cost effective and forward looking, harness innovative thinking and best practices, and revitalize economic growth. The Governor of Puerto Rico is sharing this economic and disaster recovery plan consistent with his vision:

To build the new Puerto Rico to meet the current and future needs of the people through sustainable economic development and social transformation; transparent and innovative approaches to governance; resilient modern, and state-of-the-art infrastructure; and a safe, educated, healthy, and sustainable society.

To achieve this ambitious vision, this recovery plan is focused on four primary goals:

1. Ground the new Puerto Rico in the needs of its people by promoting a society that is educated, healthy, and sustainable.
2. Enhance Puerto Rico’s ability to withstand and recover from future disasters through individual, business, and community preparedness; redundant systems; continuity of operations; and improved codes and standards.
3. Ensure rebuilding and restoration efforts promote sustainable economic growth and social transformation, and contribute to a more vibrant and competitive economy that can provide

opportunities for job growth; and promote personal advancement that produces benefits for Puerto Rico’s residents for generations to come.

4. Strengthen Puerto Rico’s critical infrastructure by rethinking its design and reconstruction to be more modern, sustainable, and resilient than before the hurricanes, and to effectively support people, industry, and the economy.

The Government of Puerto Rico—in particular the Central Recovery and Reconstruction Office (CRRO), established by executive order in 2017 and now also known as the Central Office of Recovery, Reconstruction, and Resilience (COR3)—was supported by Federal Emergency Management Agency (FEMA) and the Homeland Security Operational Analysis Center (HSOAC—a federally funded research and development center [FFRDC] operated by the RAND Corporation under contract with the Department of Homeland Security) to develop this recovery plan in response to the “Further Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2018” (Public Law No. 115-123). The effort involved extensive outreach to and collaboration with a broad group of federal agencies, state-level and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and those most affected by the hurricanes—the people of Puerto Rico.

The plan was developed over the course of three dynamic and—given the urgency—overlapping phases:

1. Identifying damage, needs, and priorities for recovery
2. Identifying potential courses of actions (and their related costs)
3. Aligning the plan objectives and courses of action and identifying funding sources.

Since the 2017 hurricanes, Puerto Rico has been working to restore services, reopen schools and other public buildings, and help residents return to normal life, but much work remains to be done. These are the most-immediate key priorities for Puerto Rico in the short term (1 to 2 years):

1. **Reestablish lifeline systems** to provide reliable energy, water, communications, and transportation. These are important to the economy, but also necessary to ensure the functioning of government, hospitals, and other critical infrastructure and services.
2. **Improve emergency preparedness** infrastructure and develop the government workforce so that all residents and businesses are better protected in advance of a future disaster.

- 3. Clarify ownership and responsibility** for various infrastructure, assets, and services so that repairs can be completed efficiently and rebuilding reduces risk.

In the longer-term (3 to 10 years), the key priorities for Puerto Rico's recovery are to

- 1. Stem outmigration from the Island and encourage economic growth** by lowering the costs of doing business, incentivizing formal labor force participation, broadening the tax base, and increasing fiscal discipline.
- 2. Revitalize urban centers** to focus economic recovery efforts.
- 3. Scale social services, health, education, and infrastructure systems** to meet the health, social, and economic needs of the current and future population.
- 4. Rebuild infrastructure to meet modern codes and standards**, and enforce the laws and regulations governing construction, water supply connections, and electricity metering.
- 5. Establish modern methods for providing both the public and private sectors timely, accurate, and comprehensive information** to make effective decisions about recovery and day-to-day operations.

To meet these priorities, the Government of Puerto Rico is focusing on nine areas of physical, natural, and human **capital investments** of approximately \$118 billion (80 percent for upfront costs and 20 percent for operations and maintenance costs over an 11-year period from 2018–2028). This total amount, of which some has already been provided by federal disaster relief, private insurance, private sector, and philanthropic sources, is required to restore and strengthen

- the four lifeline systems (energy, communications, water, and transportation)
- housing and public buildings
- health and education
- the natural environment.

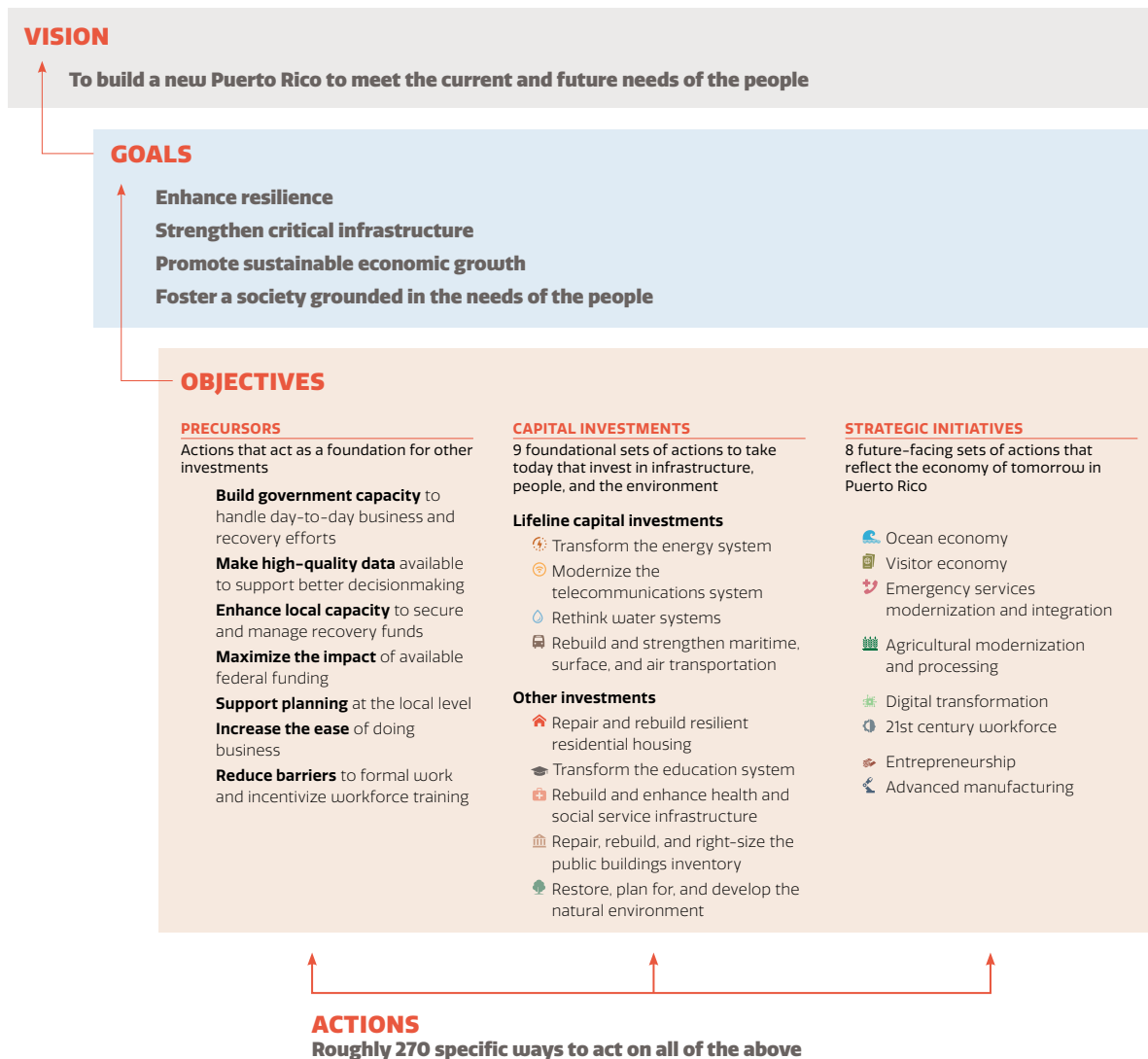
Building upon these capital investments, the Government of Puerto Rico has identified eight **strategic initiatives** that capitalize on Puerto Rico's unique assets and strengths. These will take advantage of the fundamental capital investments described above, and thus approximately \$6.4 billion in estimated marginal costs is required for initiatives to build the ocean and visitor economies; modernize and integrate emergency services;

modernize agriculture; transform digital capabilities; develop a world-class workforce; and increase opportunities for entrepreneurship and public-private partnerships.

Roughly 270 specific recovery actions have been linked with these capital investments and strategic initiatives; estimated costs, possible funding sources, and potential implementers are detailed for each action.

The figure below illustrates the key elements of *Transformation and Innovation in the Wake of Devastation: An Economic and Disaster Recovery Plan for Puerto Rico*. More details on the goals, objectives, and specific actions aligned with each objective are available in the plan.

Funding Puerto Rico’s economic and disaster recovery will require substantial resources—total costs are estimated at approximately \$125 billion for the capital investments and strategic initiatives described in this plan. The recovery will need to be supported by multiple federal agencies





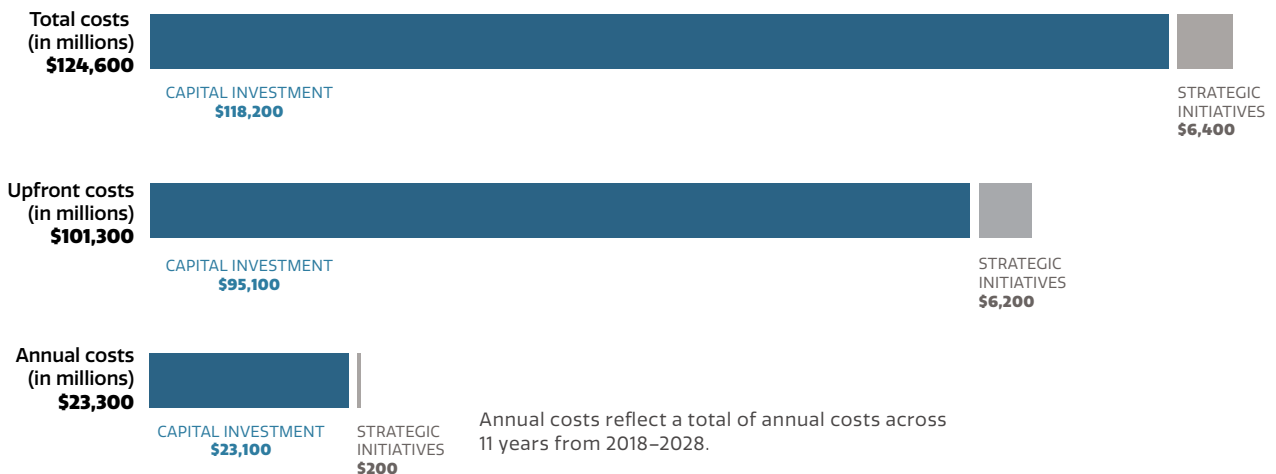
Flickr Commons

Transformation and Innovation in the Wake of Devastation builds on this work in fundamental ways, proposing a path to a more equitable and prosperous society for all Puerto Ricans.

and nonfederal programs, including the Disaster Relief Fund; Congressional Supplemental Appropriations; steady-state federal programs; and nongovernment sources such as private insurance claims, philanthropic private and corporate foundations, and venture capital. Significant philanthropic and voluntary support is already actively assisting Puerto Rico.

To ensure fiscal transparency in investments and promote global best practices in accountability and coordination of recovery efforts, COR3 plans to use third-party assistance to manage recovery funds and optimize the long-term reconstruction process. Web-based portals offer another opportunity to share information about recovery funds with the public. The Government of Puerto Rico will employ a dashboard of recovery indicators—organized around key themes such as economic growth and quality of life—for tracking progress, identifying areas of strength and weakness, supporting economic growth, and building community resilience to future shocks.

In recent years, Puerto Rico has been creating and putting to work plans to transform itself. *Transformation and Innovation in the Wake of Devastation* builds on this work in fundamental ways, proposing a path to a more equitable and prosperous society for all Puerto Ricans. The voices of citizens and mayors, agency heads, representatives from supporting federal agencies, subject-matter experts, and other stakeholders have been brought together to build this plan. Together with research and thoughtful analysis, Puerto Rico has developed a comprehensive plan that goes far beyond simply building back what was destroyed by the hurricanes, and instead looks to a future that is resilient to shocks, be they economic or natural.



2017



SEPTEMBER 6-7
Center of Hurricane Irma passes 50 nautical miles north of San Juan, PR.

SEPTEMBER 10
President issues a Major Disaster Declaration for PR (FEMA-4336-DR).



SEPTEMBER 20
Hurricane Maria makes landfall on PR. President signs Major Disaster Declaration (DR-4339) under Stafford Act.



SEPTEMBER 23
FEMA's critical response teams arrive in PR.

OCTOBER 23
Executive Order 2017-065 authorized the creation of the Central Recovery and Reconstruction Office as a division of the P3 Authority, to centralize control and oversight of the recovery and reconstruction of Puerto Rico

OCTOBER 26
Additional Supplemental Appropriations for Disaster Relief Requirements Act (PL 115-72) signed.

DECEMBER 6
The Puerto Rico P3 Authority Board formalizes the creation of the Central Recovery and Reconstruction Office (original CRRO; now COR3).

SEPTEMBER 8
Continuing Appropriations Act, 2018 and Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (PL 115-56) signed into law. Law includes \$1.5B in CDBG-DR funding appropriations for PR.

SEPTEMBER 18
President approves PR emergency declaration.

SEPTEMBER 21
FOMB approves reallocation of up to \$1B of Territory Budget funding for emergency response.

SEPTEMBER 28
President waives Jones Act for 10 days.



NOVEMBER 13
Government of Puerto Rico submits Build Back Better Puerto Rico: Request for Federal Assistance for Disaster Recovery.



FEBRUARY 9
Further Additional Supplemental Appropriations for Disaster Relief Requirements Act (PL 115-123) signed into law requiring economic and disaster recovery plan be submitted within 180 days. Additional funding, including \$28B in CDBG-DR funding, appropriated.

MARCH 7
FEMA reports that \$1.1B in grants for individuals and families have been approved.



MARCH 19
180-day damage status report presented by Government of Puerto Rico in the *New Fiscal Plan for Puerto Rico*:

- 99% of electricity generation restored
- 99% of telecommunications restored
- 99% of PRASA customers have water
- 100% of hospitals operating.

MARCH 20
Government of Puerto Rico establishes priorities for the selection of mitigation projects to receive \$3B in HMGP funding.

APRIL 19
FOMB releases and certifies the *New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity*.

JUNE 6
U.S. Small Business Administration has approved 45,086 loans, totaling nearly \$1.60B.

APRIL 10
HUD announces allocation of \$18.4B in CDBG-DR funds for Puerto Rico, including: \$10.1B for recovery and \$8.3B for mitigation.



MAY 3
FEMA extends Transitional Sheltering Assistance program to June 30.

JUNE 14
Action Plan for \$1.5B CDBG-DR funds due to HUD.

2018

CDBG-DR | Community Development Block Grant Disaster Recovery
Stafford Act | Robert T. Stafford Disaster Relief and Emergency Assistance Act
FOMB | The Financial Oversight and Management Board for PR
P3 | Public-Private Partnerships
HUD | U.S. Department of Housing and Urban Development



Image via HSOAC

INTRODUCTION

Late in the night on September 6, 2017, the southern eyewall of Hurricane Irma passed just north of San Juan. Less than two weeks later, Hurricane Maria made a direct hit as a Category 4 storm. The combined effects of the two hurricanes were widespread and catastrophic, causing many deaths, a complete failure of the power system, extensive housing and infrastructure damage, and leading to a months-long interruption of essential services to the people of Puerto Rico. The hurricane's devastating effects on people's health and safety cannot be overstated.

Compounding the situation caused by the hurricanes, Puerto Rico has been facing an economic crisis spanning more than a decade, coupled with structural demographic, health, social, and infrastructure stresses (including significant migration of people away from the Island) and limited government transparency. Together, these factors combined to exacerbate the impact of the hurricanes and led to a broader, long-term disaster. The scope of these many challenges also constrains near-term recovery options and will necessitate transformative changes and investments for years to come.

As Puerto Rico looks to the future, the recovery effort is an opportunity to not just rebuild—or even build back better—but to use recovery investments to help transform the Island by implementing solutions that

- ✓ are cost-effective and forward-looking
- ✓ harness innovative thinking and best practices from around the world
- ✓ contribute to greater economic development, revitalization, and growth (in alignment with broader Government of Puerto Rico efforts to achieve fiscal and economic stability) as well as enhanced human capital.

A resilient and sustainable Puerto Rico could contribute important lessons learned about the process needed for this type of transformation to occur and how to reduce future costs of disaster relief.

VISION

To build the new Puerto Rico to meet the current and future needs of the people through enduring economic development and social transformation; transparent and innovative approaches to governance; resilient, modern, and state-of-the-art infrastructure; and a safe, educated, healthy, and sustainable society.

“

“[The hurricanes have] changed my community because it brought unity within the people ... Everything in life has a purpose. And this purpose was to unite us as a community as one.”

— FOCUS GROUP PARTICIPANT
FROM CAYEY MUNICIPALITY
(AUTHOR TRANSLATION)

A Transformational Vision for Puerto Rico

Puerto Rico is facing a turning point, an opportunity to translate the difficulty of recovery into a better future with a plan that

- targets both economic and social progress
- tackles current needs yet looks to the future
- demonstrates transparency and innovation in governance
- will lead to resilient, state-of-the-art infrastructure
- promotes a safe, educated, healthy, and sustainable society.

It will be important to clearly identify priorities that can contribute to this ambitious vision and to ongoing disaster and economic recovery efforts. Having priorities gives focus to pursuing limited disaster relief funds and to addressing the most significant challenges to recovery.

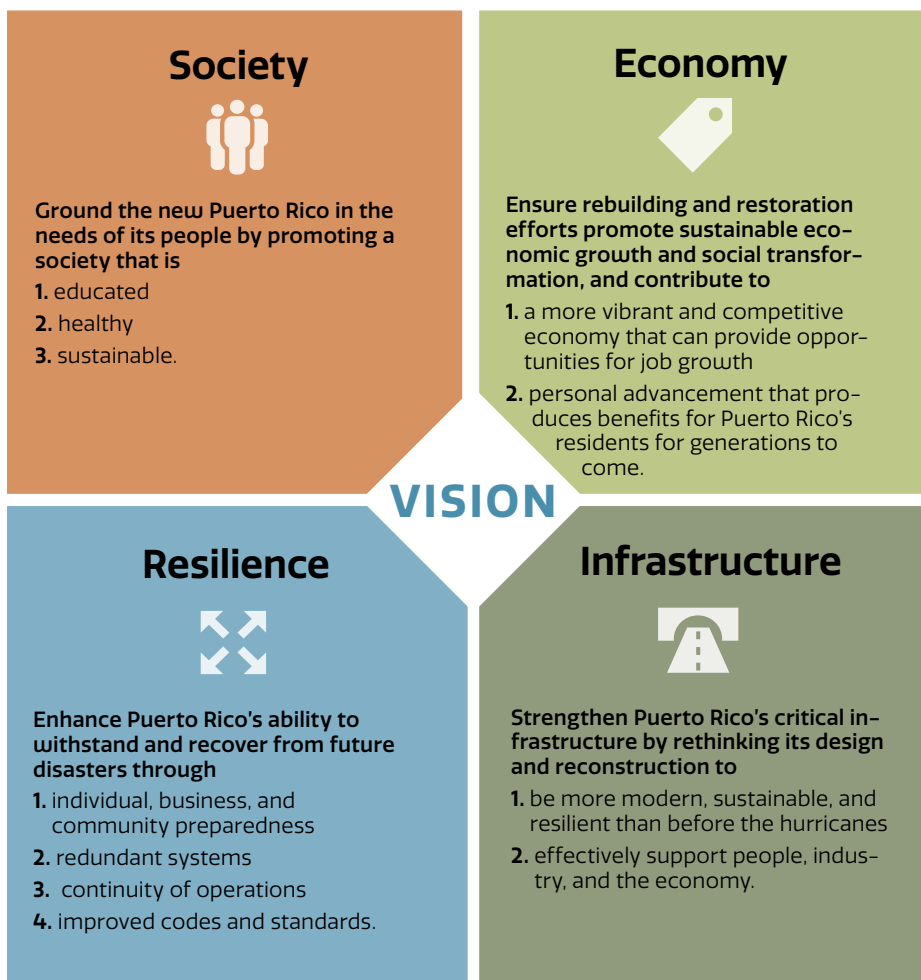
The recovery from hurricanes Maria and Irma is an opportunity to address the needs of the people of Puerto Rico, not only in the immediate term, but also in the mid- and long-terms, making Puerto Rico a stronger, better, 21st-century society.

To this end, Puerto Rico’s recovery plan sets out a path to help guide recovery investments toward this broader transformational vision by

- defining what recovery means for Puerto Rico
- establishing principles for how the Government of Puerto Rico, nongovernmental, private, and nonprofit agencies should work together towards recovery
- describing the phases the recovery will progress through
- identifying the most pressing recovery issues and the priority actions, as well as potential partners and resources to address each issue
- committing to measuring and reporting on the progress of the recovery.

Goals of the Plan

To achieve this ambitious vision, the plan focuses on rebuilding, strengthening, and improving four core areas: infrastructure, the economy, resilience, and society. The last of these—a healthy and vibrant society—will be built on the foundation set by the others. Together, these goals address the most pressing recovery needs while also ensuring that Puerto Rico uses this unique recovery as a springboard to future prosperity and well-being. To create enduring economic growth and an educated, healthy, and sustainable society, Puerto Rico must and will strengthen infrastructure, improve policy and regulations, and build up the resilience of all systems (e.g., health, education, energy, transportation). Success will mean a Puerto Rico that is better positioned to address the future needs of all of its people, as well as future challenges that will most certainly arise. It will also mean opportunities for job growth and personal advancement that will benefit generations of Puerto Ricans to come, encouraging people to stay—or return to—a stronger, safer, and more prosperous and resilient Puerto Rico.



FEDERAL LEGISLATION SUPPORTING THE DEVELOPMENT OF THIS PLAN

In the aftermath of Hurricanes Irma and Maria, the President signed Major Disaster Declarations on September 10, 2017 (FEMA-4336-DR) and on September 20, 2017 (DR-4339), respectively, under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act). These declarations mobilized Federal Emergency Management Agency (FEMA) efforts to restore services to Puerto Rico, in close coordination with the Government of Puerto Rico and the Island's municipalities; other federal agencies having responsibility under the National Disaster Recovery Framework (NDRF); private-sector entities; and voluntary, faith-based, and community organizations.

Given the devastation caused by the hurricanes, response operations have required an enormous lift from all stakeholders. In this unprecedented situation, the implementation of the NDRF has been further challenged by the prolonged and complex recession and debt crisis facing Puerto Rico.

In response to both near- and long-term needs, Congress passed the "Bipartisan Budget Act of 2018" on February 9, 2018 (Public Law No. 115-123). This legislation requires the Governor of Puerto Rico, with support and contributions from the Secretary of the Treasury, the Secretary of Energy, and other federal agencies having responsibilities defined under the National Disaster Recovery Framework, to produce within 180 days an economic and disaster recovery plan that defines the priorities, goals, and outcomes of the recovery effort. Congress specified that the plan include the following sectors: housing; economic issues; health and social services; natural and cultural resources; governance and civic institutions; electric power systems and grid restoration; environmental issues; and other infrastructure systems. In addition, the legislation calls for the plan to be based on an assessment of the damage.

Congress also required that Puerto Rico's recovery plan be developed in coordination with and certified by the Financial Oversight and Management Board (FOMB) established under the Puerto Rico Oversight, Management, and Economic Stability Act (PROMESA); federal agencies; and key partners from private and nongovernmental entities.

Although Congress called for a recovery plan focused on the 12-month and 24-month horizons, many of the challenges facing Puerto Rico are complicated, and efforts to build back better with built-in resilience require a long-term approach. Therefore, this plan includes actions that must be pursued into the future to meet the promise of this transformative moment, as well as those that must be undertaken in the next 12 to 24 months. In addition to restoration of critical infrastructure there are a number of actions needed to build a strong foundation of support for the priorities in this plan and so should be prioritized in the short-term. These include improving emergency preparedness, increasing the ease of doing business in Puerto Rico, strengthening government capacity in day-to-day service provision as well as during disasters, making available high-quality data to guide decisionmaking and support transparent governance, and promoting formal work and workforce training.

Federal Agencies Coordinating Disaster Recovery Under the National Disaster Recovery Framework

Under the Recovery Framework, Recovery Support Functions (RSFs) bring together the knowledge, skills, and resources of federal departments, agencies, and other organizations to focus on the recovery. The RSFs are organized into the following six functional components, each coordinated by a federal agency (shown in parentheses):

- Community Planning and Capacity Building (DHS/FEMA)
- Economic Recovery (U.S. Department of Commerce)
- Health and Social Services (U.S. Department of Health and Human Services)
- Housing (U.S. Department of Housing and Urban Development)
- Infrastructure Systems (U.S. Army Corps of Engineers)
- Natural and Cultural Resources (U.S. Department of the Interior)

Guiding Principles

Innovation, transparency, accessibility, transformation, and sustainability are the principles that will shape the Government of Puerto Rico's investment decisions and inform the planning and implementation of the goals outlined in this plan. Good governance will be necessary to ensure these principles are actively integrated into decisionmaking structures.

Transformation: The Government of Puerto Rico's vision for economic and disaster recovery is transformative—in that its goal is to build back hurricane-damaged systems in a way that is driven by and for the greater, longer-term needs of the people of Puerto Rico. By necessity, the recovery effort must be flexible and responsive enough to endure over time. But the Government of Puerto Rico has also developed this plan with an eye toward ensuring that, to the greatest extent possible, investments in recovery from hurricanes Irma and Maria also align to tackle the longer-term challenges facing the Island. This means applying a mindset, processes, and human resources that allow for a thorough and ongoing calibration of recovery investments, in weighing the short- and long-term benefits of particular choices and their interdependencies, as well as how each addresses the long-standing economic, infrastructure, and societal challenges that Puerto Rico faced even before the disaster brought about by the hurricanes.

Sustainability: Recovery investments must be evaluated to ensure that returns—both capital and strategic—can be sustained over the longer term. Puerto Rico may experience a growth in economic activity spurred by recovery investments to repair or rebuild damaged infrastructure. The Government of Puerto Rico will develop and deploy recovery investments in a way that ensures that capital improvements can be sustained in the long term, and also that related economic and societal improvements are not fleeting. This means, as just one example, not building infrastructure without a way to maintain it, including sustaining the human and economic benefits brought about by immediate capital investments.

Innovation: There should be a place for innovation in recovery efforts—whether it is in how investments are identified, crafted, or implemented. Innovation means turning ideas into solutions that improve Puerto Rico's capabilities by leveraging emerging technologies and methods and integrating those with expert advice. Innovative solutions are problem-oriented, usable,

forward-looking, and adaptive. They emphasize doing things more equitably, efficiently, less expensively, or in a way that is more environmentally sustainable. Being innovative means not shying away from novel or unprecedented approaches to solving problems. At a minimum, an innovative solution cannot simply repeat what has been done in the past, especially if that path has proved to be unsuccessful.

Transparency: Transparency means effectively managing recovery investments and tracking their impacts on economic and social outcomes. In keeping with the International Monetary Fund's *Fiscal Transparency Code*, the Government of Puerto Rico will prioritize recovery activities that support fiscal transparency through the pillars of fiscal transparency: fiscal reporting, forecasting and budgeting, risk analysis and management, and resource revenue management. Transparency also includes clear and open decision-making processes, and the Government of Puerto Rico will take steps to ensure that timely and accessible information on recovery efforts is available to the public throughout the recovery.

Accessibility: Recovery investments need to be considered within the context of how the most vulnerable people gain access to services and goods to ensure that they are available to all residents when needed. This will include investments targeted at equal access to services and goods and diminishing barriers to access created by financial, social, health, cultural, and functional limitations. It also will include investments that increase the affordability, availability, or appropriateness of existing services or goods.



FEMA

A Roadmap to Long-term Recovery

The scale of effort needed for successful recovery in Puerto Rico requires an unprecedented mobilization of diverse resources. Determining the necessary sequence of actions in such a complicated undertaking hinges on the immediacy of needs at the Island level.

The most immediate needs are to ensure that people are safe and have access to the services and resources they need to start rebuilding a relatively normal life. With the 2018 hurricane season under way as this plan is being finalized, there is also a critical and immediate need to prepare infrastructure and people to weather another emergency. In addition, coordinating multiple efforts across diverse sectors and a complex topography requires efficient and clear communication and sharing of information. Government agencies, businesses, and individuals need to know who owns or is responsible for rebuilding infrastructure, assets, and services. Therefore, in the short-term (1–2 years), this recovery plan is focused on

1. Reestablishing lifeline systems to provide reliable energy, transportation, communications, and water
2. Improving emergency preparedness infrastructure and developing a resilience-oriented workforce
3. Clarifying ownership and responsibility for various infrastructure, assets, and services.

As a part of the longer-term recovery (3–10 years), Puerto Rico looks to build sustainable social and economic growth. This growth will need diverse efforts at multiple levels to strengthen individuals and communities, businesses, and governance. The migration of people from the Island can be stemmed



Eduardo Martinez/FEMA

With the 2018 hurricane season under way as this plan is being finalized, there is also a critical and immediate need to prepare infrastructure and people to weather another emergency.

The migration of people from the Island can be stemmed by making Puerto Rico an attractive place to live—a society with resilient lifeline systems and a modern standard of living, communities that are connected and healthy, and good educational and job opportunities.

by making Puerto Rico an attractive place to live—a society with resilient lifeline systems and a modern standard of living, communities that are connected and healthy, and good educational and job opportunities. And beyond the population, business and enterprise will be attracted to a Puerto Rico that has lower costs of doing business, a trained workforce, and accountable governance. With more timely, accurate, and comprehensive information to inform their decisionmaking, both the public and private sectors will be better positioned to support growth. In the longer-term, the priorities for Puerto Rico’s recovery are to

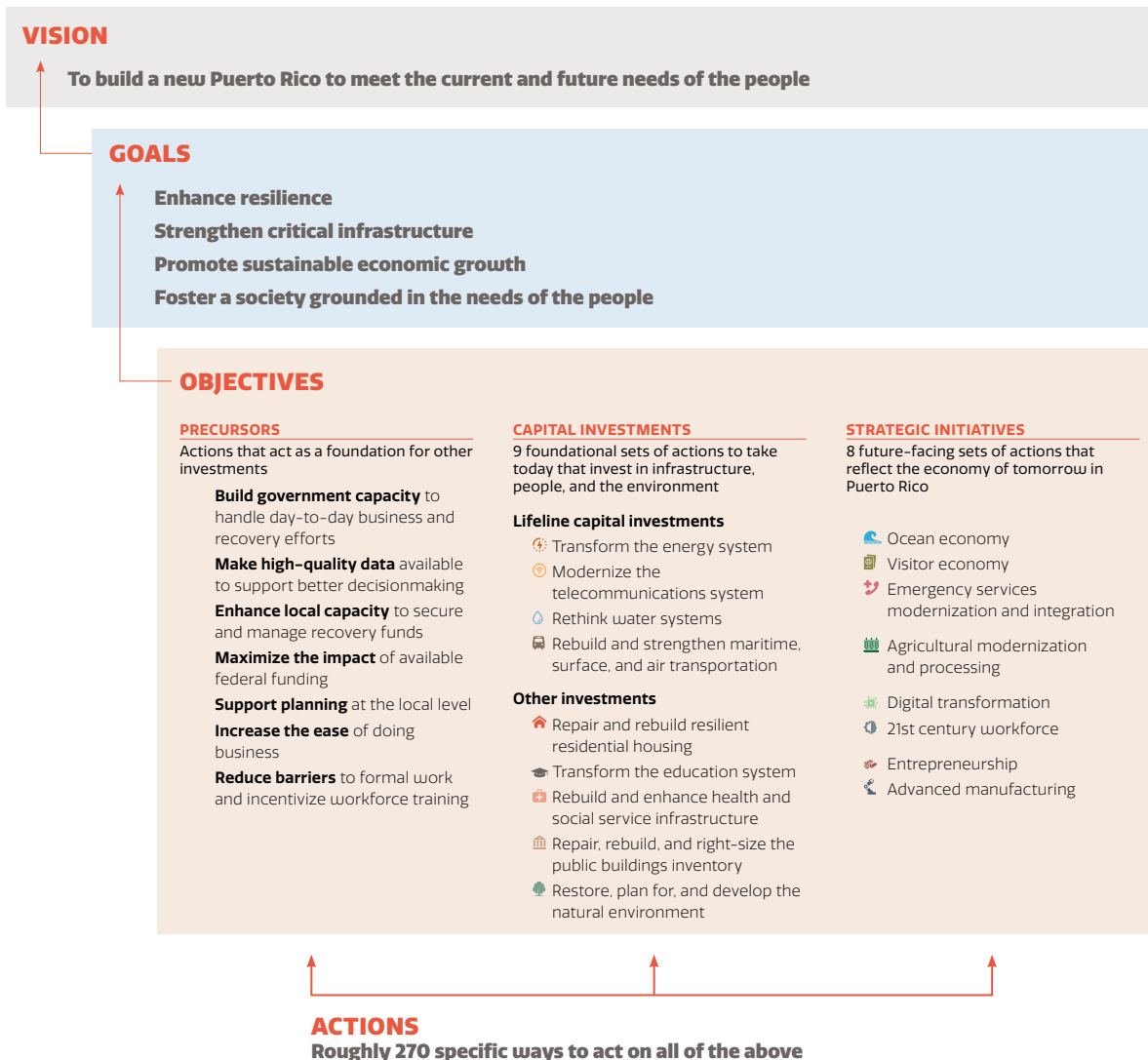
1. Stem the migration away from the Island and encourage economic growth by lowering the costs of doing business, incentivizing formal labor force participation, broadening the tax base, and increasing fiscal discipline
2. Revitalize urban centers to focus economic recovery efforts
3. Scale social services, health, education, and infrastructure systems to meet the health, social, and economic needs of the current and future population
4. Rebuild infrastructure to meet modern codes and standards, and enforce the laws and regulations governing construction, water supply connections, and electricity metering
5. Establish modern methods for providing both the public and private sectors timely, accurate, and comprehensive information to make effective decisions about recovery and day-to-day operations.

A wide selection of potential courses of action designed to address these short- and long-term priorities are described within the rest of this recovery plan. These actions span multiple sectors and are interconnected. However, they are presented in the plan in an order that reflects (1) actions that must come first because they provide critical support to ensure the success of all other actions—these are the precursor actions (“Start with a Strong Foundation” section), (2) capital investments in lifeline and other systems that support social and economic growth (“Build Resilient Communities, Modernize Infrastructure, and Restore the Natural Environment” section), and (3) strategic initiatives that build on the first two and capitalize on unique assets or fill critical gaps for Puerto Rico (“Focus on the Future” section).

The figure below illustrates the key elements of the plan and reflects how this plan is organized. Guiding the plan is Governor Ricardo Rosselló’s vision and goals described above. A series of high-level objectives—the precursors, followed by the lifeline and other capital investments, then the strategic initiatives—provide anchor points for critical recovery priorities. The plan concludes with a “Detailed Actions” section describing various actions that align with each of the objectives. Many of these actions contribute to more than one objective and thus have multiple benefits for achieving the objectives, goals, and vision of this plan.

TRACKING COURSES OF ACTION

Each course of action presented in this plan has an identifier based on a) the sector in which it was developed, and b) an arbitrary number used for tracking (e.g., TXN 3). All courses of action included in the *Detailed Actions* chapter include their respective tracking identifiers for easy reference.



Developing the Plan

The Government of Puerto Rico—in particular the Central Recovery and Reconstruction Office (CRRO), also known as the Central Office of Recovery, Reconstruction, and Resilience (COR3)—was supported by FEMA and the Homeland Security Operational Analysis Center (HSOAC—a federally funded research and development center [FFRDC] operated by the RAND Corporation under contract with the Department of Homeland Security) in the development of this recovery plan. The effort involved extensive outreach to and collaboration with a broad group of federal agencies, state-level and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and those most affected by the hurricanes—the people of Puerto Rico.

The plan was developed over the course of three dynamic and—given the urgency—overlapping phases:

1. Identifying damage, needs, and priorities for recovery
2. Identifying potential courses of actions (and their related costs)
3. Aligning the plan objectives and courses of action and identifying funding sources.

The intensive **assessment of the damage from the disaster and remaining needs** across the Island conducted in phase one provides the baseline needed to define, compare, and prioritize courses of action. The damage and needs assessment documents conditions before the hurricanes, the damage caused by Irma and Maria (both direct physical damage and the effects on Puerto Rico’s population and economy), conditions six-to-nine months after the hurricanes, and remaining needs. The damage and needs assessment drew on myriad data sources, as well as stakeholder interviews and roundtables, literature reviews, and media reporting. At the same time, the Government of Puerto Rico developed the vision and goals for the recovery plan, which was then laid out for the team that FEMA convened to aid in the plan’s development. Working with the FEMA and HSOAC teams in an iterative process involved a series of coordination meetings and interactive workshops, along with a review of completed and forthcoming plans for Puerto Rico. Work during this phase also drew from and built upon the many plans, critical guidance, and other documents—relevant to the Island as a whole or directed toward specific sectors—that were produced before and in parallel to the recovery plan.

The second phase involved **identifying and defining potential courses of action**—a collection of potential activities, policies, and other actions that could contribute to recovery—and estimating the associated costs. Dedicated teams of experts, each focused on a specific sector such as energy or economic activity, conducted background research, engaged with sector stakeholders and subject-matter experts in Puerto Rico and beyond. They also reviewed existing plans, proposals, and the literature to identify strategies, best practices, and possible innovations to meet those needs. While cost-benefit and feasibility analyses for each course of action were not possible, when developing courses of action the teams considered their responsiveness to needs, level of innovation, and alignment with the evidence base (e.g., based on best or promising practices). As a part of this process, some courses of action were eliminated from consideration or adjusted to try and roughly align the costs and benefits. For example, a course of action to create a microgrid to improve the resilience of Tren Urbano was eliminated because of the prohibitive costs, and another proposing to turn some roads from paved to gravel was eliminated because the estimated costs of maintaining the gravel road over time exceeded the potential savings from the modification.

For each proposed course of action, the relevant sector team also established rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. These include both the initial upfront costs (e.g., construction investment) and future costs (e.g., operations and maintenance) over an 11-year period (i.e., 2018–2028 to align with the fiscal plans). Even though ranges and point estimates are given for courses of actions depending on the methods and information used, the cost information presented in this plan should be regarded as preliminary because more-specific cost estimates will require more specificity regarding implementation choice, as well as the completion of ongoing damage assessments. Based on future policy choices, different levels of implementation for some courses of action may also be established to constrain costs.

The third phase of the recovery plan development effort involved **aligning the courses of action with plan objectives and identifying funding sources**. The recovery plan team sorted these actions into broadly defined objectives that aligned with the overall plan vision: precursors needed to start the recovery off with a strong foundation, nine objectives focused on capital investments (such as water and telecommunications), and eight



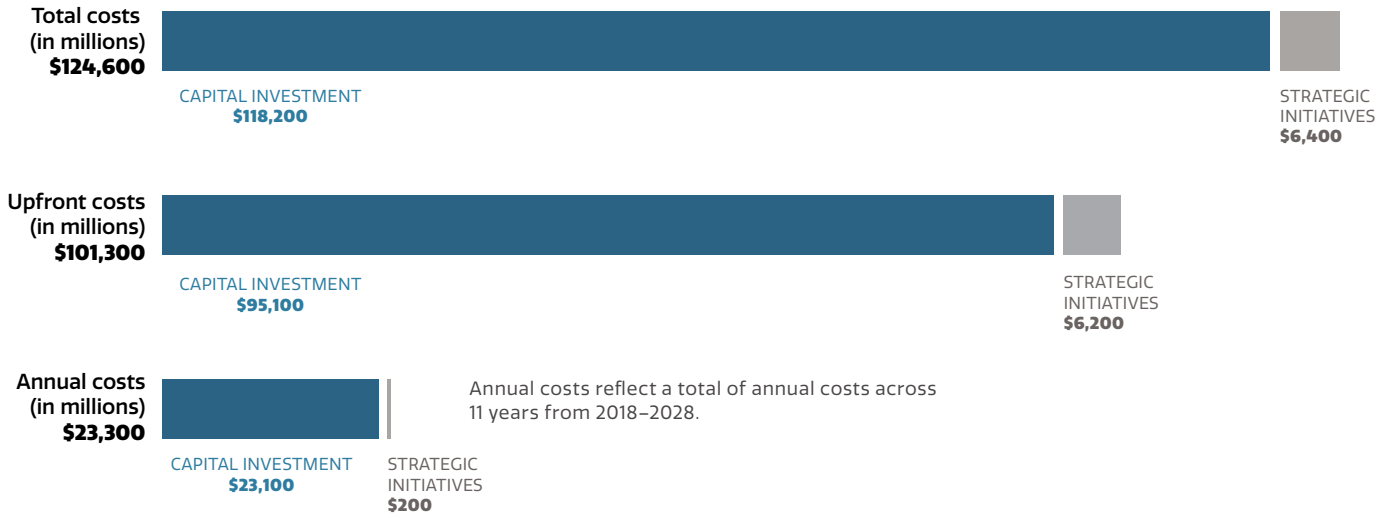
Yuisa Rios/FEMA

In identifying funding sources for the courses of action, the sector teams considered both U.S. government aid and nongovernmental funding sources.

objectives on strategic initiatives (such as enhancing the visitor economy). Then, two to six portfolios (sets of actions) were developed for each objective based on themes that aligned with the objective (e.g., more resilience, lower cost). The Government of Puerto Rico selected portfolio(s) for each objective. Courses of action that were fundamental to the success of all capital investments (known as precursors) were moved into their own portfolio. The total set of approximately 270 actions from the selected portfolios provided the basis for total cost estimates for the plan.

Most of these actions (roughly 90 percent) are focused on the capital investments needed for Puerto Rico to recover. To meet the plan objectives will require approximately \$125 billion over the 2018-2028 time period, of which some has already been provided by federal disaster relief, private insurance, private sector, and philanthropic sources. The figure on the next page provides the breakdown of costs (the initial upfront and annual operations and maintenance). A more detailed description of costs by sector is included in the “Estimated Costs and Funding for Puerto Rico’s Recovery” section, and a list of the selected portfolios are presented at the end of this plan (“Detailed Actions” section).

In identifying funding sources for the courses of action, the sector teams considered both U.S. government aid and nongovernmental funding sources. Funds from the Disaster Relief Fund, special appropriations for disaster relief and recovery, and steady-state federal programs funded via normal annual program budgets were estimated and refined with FEMA and other outside experts. Nongovernmental funders (charitable and corporate foundations, institutional investors, and venture capitalists) were also examined as potential funders for recovery actions. But eligibility requirements for many of the supplemental funding elements are still unspecified, so the possible funding sources are notional at this time. More detail is provided in the section “Funding Puerto Rico’s Recovery” of this plan.





PUERTO RICO: AN ISLAND UNDERGOING TRANSFORMATION

Puerto Rico holds a unique position. Among its Caribbean neighbors, it stands alone in its special relationship with the United States. But Puerto Rico also stands apart from the continental United States, with a distinct geography, history, culture, and demographic profile. At times, these distinctions have benefitted Puerto Rico; at other times, they have led to, or exacerbated, vulnerabilities.

Location, Hazards and Geography

Situated approximately 1,100 miles east-southeast of Miami, Florida, between the Atlantic Ocean to the north and the Caribbean Sea to the south, Puerto Rico's location puts it at relatively high risk for hurricanes. The main island's steep slopes and narrow valleys mean that damage from storms—especially flooding and landslides—is often severe. Furthermore, the mountainous terrain and hot, moist, densely vegetated environment make maintenance of critical infrastructure, such as electrical transmission systems, a challenge. Puerto Rico's mountainous island location makes disaster logistics especially challenging because people are not able to evacuate, or easily relocate to areas where needed services are available, and the delivery of aid requires functioning seaports and airports which



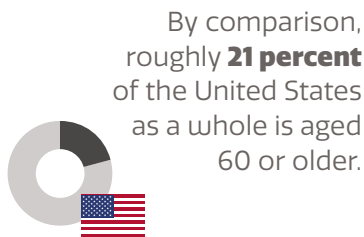
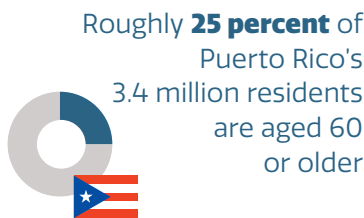
if damaged create a logistical bottleneck until they can be repaired.

Relationship with the U.S. Government

Given Puerto Rico's status as a U.S. territory, Puerto Ricans are U.S. citizens and may travel and migrate freely to the rest of the United States. As U.S. citizens who share a common currency with the the continental United States, Puerto Ricans pay payroll taxes and are eligible for federal social service programs, including Social Security and Medicare, though importantly, program benefits are allocated differently than in U.S. states. Puerto Rico is eligible for the same federal disaster relief available to states under the Stafford Act.

Puerto Rico sends a nonvoting resident commissioner to the U.S. House of Representatives, but has no representation in the U.S. Senate. Residents of Puerto Rico also cannot vote in U.S. presidential elections, but may vote in presidential primaries for both parties.

Puerto Rico has become one of the oldest populations in the region



Population Demographics

In the span of approximately three decades, Puerto Rico's population has transformed—from a primarily young, rapidly growing, and urbanizing demographic to an older population in which deaths outnumber births. An increasing number of young people and working-age adults have been migrating away from the Island.

In part, the economic contraction that began affecting Puerto Rico in 2006 has led to some of these demographic changes, with the lack of economic opportunities decreasing childbearing and encouraging migration. And in 2006, the birthrate in Puerto Rico was already well below the level that is required for a population to replace itself within a generation. A decade later, childbearing had declined far enough to place Puerto Rico's birthrate among the lowest worldwide: 1.2 births per woman. Over the same period (2006–2016), a net of 525,000 people migrated away from the Island. The continuing loss of people from Puerto Rico, particularly school-aged children and working adults, has added to the stress on its economy and created a shortage of professional workers in many sectors.

As a consequence, Puerto Rico has become one of the oldest populations in the region. According to the figures reported in the 2016 American Community Survey (ACS), roughly 25 percent

of Puerto Rico's 3.4 million residents are aged 60 years or older. The fraction of elderly residents is a higher proportion than anywhere else in the Caribbean or Latin America except for the U.S. Virgin Islands. By comparison, roughly 21 percent of the United States is aged 60 or older.

More than 98 percent of Puerto Ricans self-identify as a member of the Hispanic/Latino ethnicity. By race, roughly 69 percent identify as white, 9 percent as black or African-American, and 7 percent as two or more races. These racial and ethnic distributions vary by municipality, however, with the percentage who self-identify as black or African American over 30 percent in several municipalities (Loiza, Las Piedras, Yabucoa, Maunabo, and Patillas). Although both Spanish and English are official languages in Puerto Rico, 2016 ACS data indicate that fewer than one quarter of residents speak English "very well," while over 90 percent of Puerto Ricans report speaking Spanish at home.

Poverty and Vulnerability

In 2016, the median per capita income in Puerto Rico was \$11,688. Forty-five percent of residents had an annual income below the federal poverty level, with high rates of poverty among those under 18 (57 percent) and those over 65 (approximately 40 percent). Poverty rates in Puerto Rico are higher than in any U.S. state, and twice as high as the poorest state, Mississippi.

High unemployment (above 10 percent) and low incomes have been persistent for the past two decades, and with them, a significant amount of federal assistance was being provided even prior to the hurricanes. In 2016, nearly 25 percent of Puerto Ricans received monthly Social Security benefits compared to less than 19 percent of the overall U.S. population. Additionally, nearly 50 percent of the Puerto Rican population participated in either Medicaid or the Children's Health Insurance Program compared to 20 percent of the U.S. population overall.

The Cost of Imports

Since 1920, Puerto Rico has been subject to the Jones Act with respect to shipping cargo, which requires that all goods transported by water between U.S. ports be carried on U.S.-flag ships, constructed in the United States, owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents. The Jones Act effectively constrains the ability of Puerto Rico to import a variety of goods and services at more competitive prices



Shannon Stapleton/Reuters

(including, but not limited to, liquified natural gas [LNG], food, and other commodities). Although the exact magnitude of the effect is unknown due to data limitations, it is likely that the prices of imports in Puerto Rico, and of the goods and services produced from these imports, may be artificially inflated, which reduces the welfare of both producers and consumers.

In the energy market, for example, available data suggest that what appears to be short-term contracted delivery prices for LNG in Puerto Rico are greater than export plus estimated shipping and other costs from continental U.S., although a significant portion of imported LNG in 2017 was contracted at a price below contemporary short-term contracted prices. In addition, the Dominican Republic, which is not subject to the Jones Act, has imported LNG from the continental U.S. while most Puerto Rican imports are from Trinidad and Tobago, despite the fact that the source of Dominican imports (Sabine Pass, Louisiana) is approximately 1,000 nautical miles farther from the country than Trinidad and Tobago, implying higher shipping costs. While Puerto Rico currently imports mostly petroleum oil for its fuel, it is likely that reliance on similar (nonrenewable, imported, fossil fuel, etc.) inputs will result in continually increasing energy costs, which would have ripple effects across virtually every sector in Puerto Rico, contributing to comparatively high costs of living and of doing business there.

Economic Decline and the Debt Crisis

Following World War II, Puerto Rico's economic development was largely tied to a series of federal tax policies and incentives. The Industrial Incentives Act of 1948 officially launched Operation Bootstrap, which effectively exempted U.S. corporations from most Puerto Rican taxes, thus enabling U.S. corporations to take advantage of section 262 of the Revenue Act of 1921. A 1976 provision based on Internal Revenue Code Section 936 continued to allow U.S. corporations a tax exemption on income originating from U.S. territories, but not from foreign jurisdictions. However, in 1996, Congress repealed the 936 credit and began to phase it out. Many corporations responded by restructuring their Puerto Rico operations to "Controlled Foreign Corporations," which helped maintain federal tax advantages. Nevertheless, manufacturing employment began to decline over the phaseout period, although it is unclear the extent to which the phaseout caused this decline.



Alvin Baez/Reuters

Since that time, Puerto Rico's economy has been in near-continuous recession, with low labor-force participation (the labor force participation rate was approximately 40 percent prior to the hurricanes) and double-digit unemployment.

Economic contraction contributed to a severe fiscal crisis, in which lower revenues and high rates of expenditure were financed through heavy borrowing by the central government of Puerto Rico, municipal governments, and public-sector corporations. This resulted in high and unsustainable levels of debt. Despite stabilization efforts by the Government of Puerto Rico, Puerto Rico's credit rating dropped below investment grade in early 2014, followed by a series of defaults on debt payments.

The fiscal crisis ultimately resulted in the passage of PROMESA in 2016, which established the FOMB and provided the framework for restructuring Puerto Rico's debt. The FOMB's purpose is "to provide a method for [Puerto Rico] to achieve fiscal responsibility and access to the capital markets" by certifying financial plans, approving and monitoring budgets and activities related to the budgets and fiscal plans, providing advice on issues of financial stability and management, and certifying restructuring and approving actions related to debt issuance. Recovery activities will be undertaken in a way that is consistent with the FOMB's authorities.

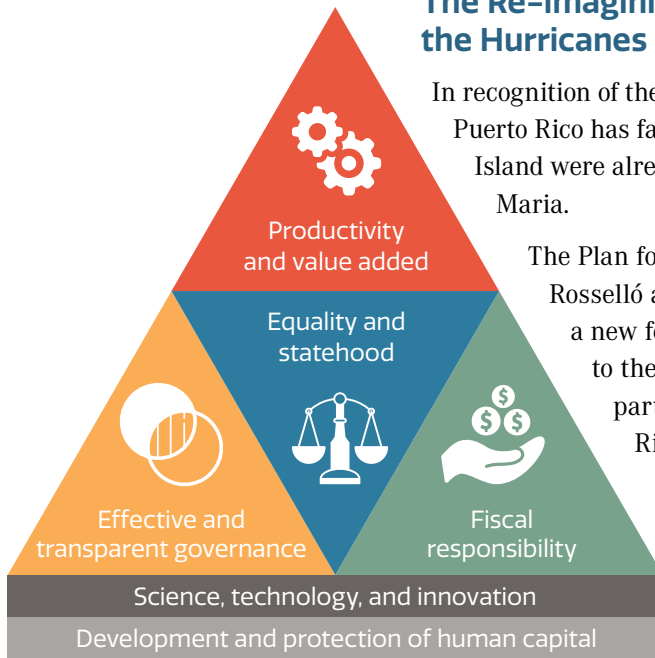
Limited Maintenance of Infrastructure

The financial hardships created by the economic decline and lack of transparency over ownership and responsibility, as well as the socioeconomic and governance challenges in Puerto Rico, contributed to deferred repairs and maintenance of infrastructure such as the telecommunications and energy systems, transportation networks, and public buildings. It is common in Puerto Rico for buildings to be owned by one set of entities (e.g., the Public Buildings Authority, or the Puerto Rico Industrial Development Company) and for day-to-day operations to be managed by another organization, such as a government agency or private sector tenant. This lack of accountability over asset management combined with limited finances has meant repairs are often deferred or not completed.

The financial hardships created by the economic decline ... contributed to deferred repairs and maintenance of infrastructure such as the telecommunications and energy systems, transportation networks, and public buildings.



The Re-imagining of Puerto Rico Prior to the Hurricanes



In recognition of the socioeconomic and governance challenges Puerto Rico has faced for many years, efforts to transform the Island were already in motion prior to Hurricanes Irma and Maria.

The Plan for Puerto Rico, established by Governor Rosselló as part of public policy, seeks to establish a new form of governance—efficient, sensitive to the most vulnerable, and based on citizen participation—focused on developing Puerto Rico’s human capital and economy using a number of near-, medium-, and long-term strategies. The Plan for Puerto Rico introduced a model for socioeconomic transformation (see figure at left). The model identifies four building blocks for Puerto Rico. Through an (1) efficient and transparent governance, (2) fiscal

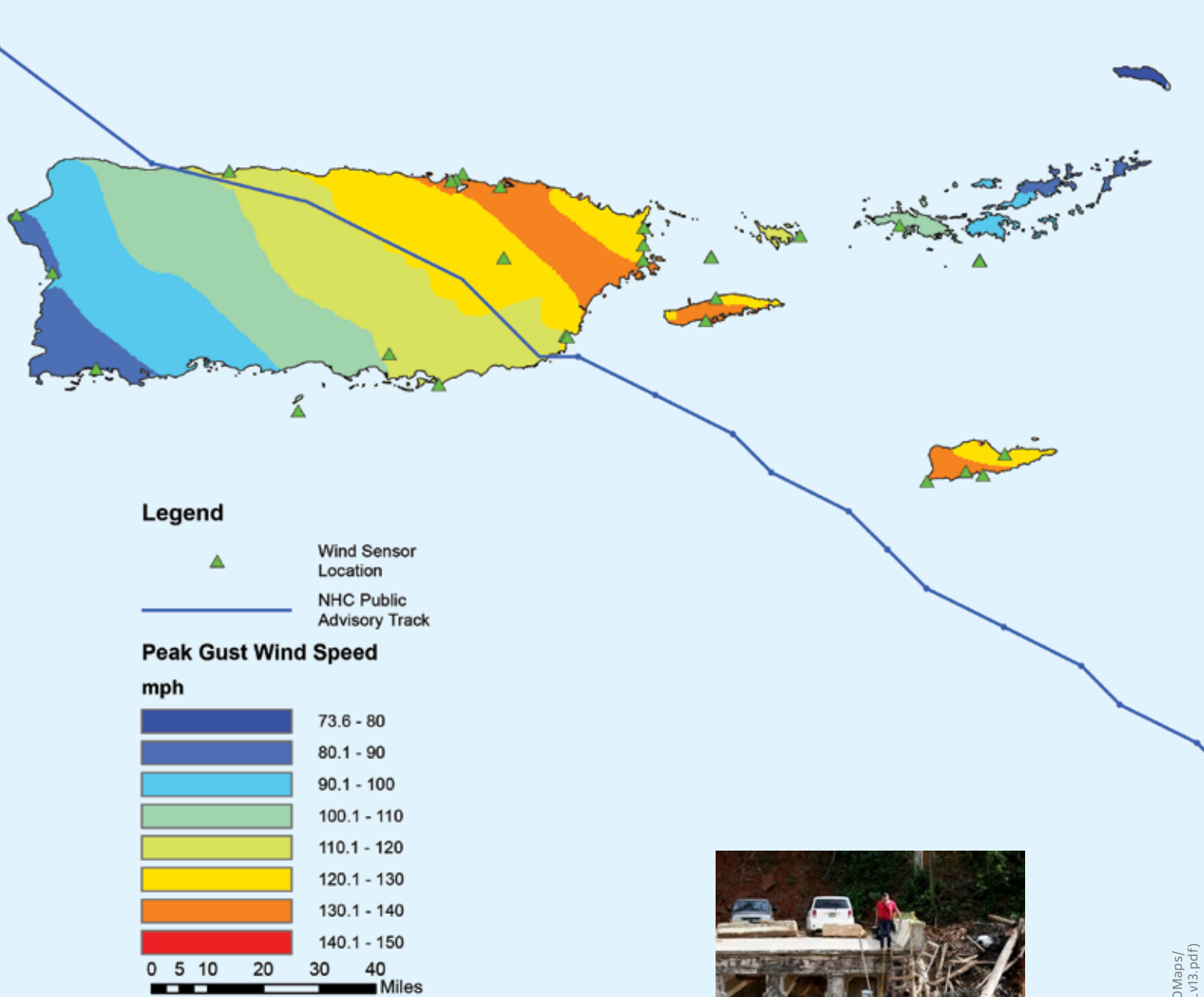
responsibility, (3) equality and statehood, and (4) enhanced productivity and value, Puerto Rico will be able to develop and protect its human capital, which is critical for socioeconomic transformation to occur. All of this work is done based on cutting-edge science, technology, and through the lens of innovation. The Plan for Puerto Rico produced over 40 specific initiatives and proposals, ranging from online training for adults to using technology to lower the costs of high-demand medications.

A year later, in March 2017, in compliance with PROMESA, a fiscal plan (*March 2017 Certified Fiscal Plan*) was submitted by the Government of Puerto Rico and certified by the FOMB. The plan laid out a number of reforms in line with the objectives of PROMESA: achieving fiscal responsibility and balance, regaining access to the capital markets, and restoring economic opportunity for Puerto Rico. Structural reforms in the *March 2017 Certified Fiscal Plan*, aimed at economic growth, address concerns with human capital and labor, ease of doing business, electric power, and other infrastructure sectors. The *March 2017 Certified Fiscal Plan* also introduced fiscal measures designed to enhance tax compliance, rebalance taxes and fees, adjust tax laws, improve agency efficiencies, comprehensively reform the pension system, reduce appropriations, reduce healthcare cost

inflation, and transform the Office of the Chief Financial Officer for Puerto Rico.

The Government of Puerto Rico had begun implementation of the proposed initiatives when the hurricanes hit in September 2017. At the FOMB's direction, the Government of Puerto Rico revised the *Fiscal Plan* to simultaneously address pre-hurricane economic challenges and post-hurricane critical infrastructure revitalization. The FOMB developed a new fiscal plan, the *New Fiscal Plan for Puerto Rico: Restoring Growth and Prosperity (Certified Fiscal Plan)*, and certified it while negotiations were taking place between the Government of Puerto Rico and the FOMB regarding a number of differences between the FOMB fiscal plan (*Certified Fiscal Plan*) and the Governor's fiscal plan, *New Fiscal Plan for Puerto Rico (New Fiscal Plan)*. The plan was re-certified on June 30, 2018, without any changes. The FOMB also certified its own \$8.76 billion budget that complies with its *Certified Fiscal Plan*.

Peak Wind Gusts From Hurricane Maria



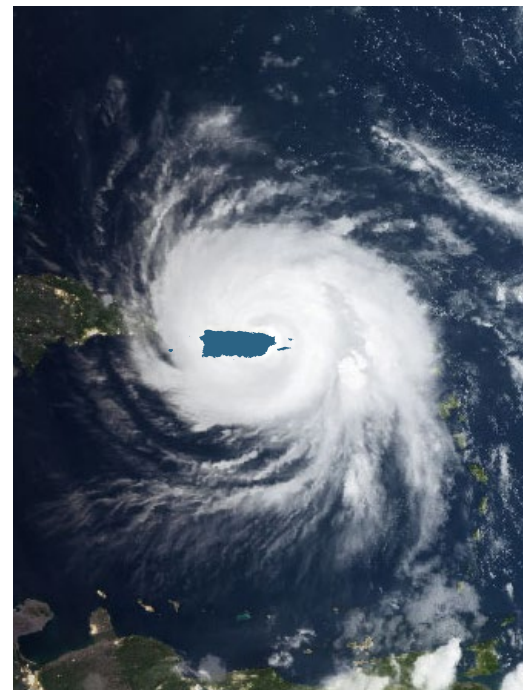
Alvin Baez/Reuters

PUERTO RICO'S CHALLENGE

In the early afternoon of September 6, the main island of Puerto Rico began experiencing Hurricane Irma's sustained tropical storm-force winds. Although Irma's southern eyewall passed just north of Puerto Rico, the Island experienced 10 to 15 inches of rainfall, concentrated in the mountains, between September 5 and 7. Rain, combined with tropical storm-force winds, caused minor damage to structures and trees and widespread power outages. Puerto Rico experienced a near total loss of electricity and water for several days. The island of Culebra suffered the most devastating impacts of Irma: Many homes were destroyed or suffered major damage, trees were uprooted, and nearly all power and water were lost. After the hurricane, the President issued a Major Disaster Declaration for the Commonwealth (FEMA-4336-DR), dated September 10, 2017. FEMA designated nine of Puerto Rico's 78 municipalities as eligible for Individual Assistance, which provides relief for immediate needs and housing restoration.

Less than a week after Irma, Hurricane Maria began forming in the tropical Atlantic Ocean. On September 20 at 6:15 AM AST, the Category 4 hurricane made landfall on the main island of Puerto Rico with peak wind speeds of up to 155 mph. The center of the hurricane moved west-northwest from southeastern Puerto Rico, over the center of the main island. Extreme winds battered all of the main island of Puerto Rico and the island of Vieques, as well as Saint Croix in the U.S. Virgin Islands (see the figure on page 22). Most of the main island of Puerto Rico and Culebra experienced extreme flooding. In the early afternoon, the hurricane moved offshore, though tropical storm-force winds continued into the late night hours. Hurricane Maria was the most intense hurricane at landfall in Puerto Rico since the 1928

Puerto Rico was enveloped by Hurricane Maria.



NASA



“Puerto Rico has a hurricane season! Emergency plans exist and have been tested many times in the past, including Irma just the week before. For the most part, they successfully passed those tests. The difference is that existing plans underestimated the level of devastation that Maria created.”

— A SENIOR-LEVEL FEMA OFFICIAL

San Felipe II hurricane, and the fifth most intense in history at landfall in the United States (including the continental United States, Puerto Rico, and Guam).

Many parts of Puerto Rico received 15 inches of rain or more from September 19 through September 21, 2017. The concentrated rain from the two hurricanes led to more than 41,000 landslides across a significant portion of Puerto Rico—and at least one landslide per square kilometer in most of the mountainous areas. Hurricane Maria’s extreme wind damaged most of the Island’s weather stations and stream gauges, but those that were working logged wind speeds of 137 mph on the islands of Culebra and Vieques to the east of the main island of Puerto Rico. Mountainous terrain likely contributed to the higher wind speeds and the widespread flooding of streams and rivers. In response, a second Major Disaster Declaration (DR-4339-PR) was issued on September 20, and FEMA extended eligibility for both Public Assistance and Individual Assistance to all 78 municipalities.

Preparation for and response to Hurricanes Irma and Maria

Among the municipalities that responded to the HSOAC survey, about 85 percent reported having disaster preparedness plans that guide their response to a disaster in place before the 2017 hurricane season, and 72 percent reported conducting emergency preparedness exercises at least once a year. Only 37 percent reported that the plans worked adequately after the hurricanes. Of those with disaster preparedness plans in place, 57 percent specifically addressed how to protect children, seniors, and individuals with disabilities. Lastly, 19 of the 78 municipalities had hazard mitigation plans—which aim to reduce the ultimate damage caused by a disaster—that were expired, according to a FEMA Community

Conditions Assessment from May 2018. Some municipalities also lacked a detailed inventory of municipal assets, hindering their ability to both protect those assets ahead of a disaster and facilitate their repair and recovery afterward. The Puerto Rico Aqueduct and Sewer Authority (PRASA) and the Puerto Rico Electric Power Authority (PREPA) did take some precautions, including preemptively lowering water in reservoirs and stockpiling materials—steps that proved insufficient given the extensive damage and prolonged response period following Maria.

However, even approved emergency preparedness plans did not envision a disaster as extreme as Hurricane Maria where critical systems failed causing a cascading chain of effects. The total collapse of the telecommunications grid and widespread infrastructure damage rendered existing contingency plans insufficient and hindered coordination with state government agencies. Power outages created failures in water treatment plants. Failures in the telecommunications system made it difficult to coordinate both response operations and repair damages to critical systems. Washed-out, debris-strewn roads cut off municipalities across Puerto Rico for days and even weeks in the mountains, and local leaders indicated that they did not have the equipment they needed to address these problems. Mayors resorted to extraordinary measures to provide food and water for citizens. Many set up community food kitchens and distribution centers, where citizens and nongovernmental organizations brought supplies to share with the broader community. These community leaders were fiercely proud of the resilience that their citizens and communities displayed in the face of such devastation.

Hurricane impacts by the numbers

The hurricanes' impact on the people of Puerto Rico cannot be overstated. The hurricanes left in their wake deep economic losses and damage to infrastructure. Hundreds of thousands of residents needed assistance to meet basic needs for an extended period of time. The businesses that survived struggled to open their doors, given that Hurricane Maria essentially destroyed Puerto Rico's electric grid and severely disrupted cellular service, landlines, and Internet access. The hurricanes shut down water and sewer services, hindered first responders' ability to dispatch 911 calls, and brought transportation to a halt. Schools and some healthcare facilities were forced to close, and hospitals had to rely on emergency generators.

The graphics on the following pages provide a high-level overview of damage after the hurricanes, and, where available, repairs to date and remaining needs based on the data collected from various entities. Damage estimates are based on available data (generally through March or April 2018) and include economic activity from the recovery effort. In many—if not most—cases, damage persisted beyond that date and likely continues at the time of this writing. As a result, no total damage figure is available.



Infrastructure

DAMAGE OVERVIEW

REPAIRS

NEEDS

ENERGY



100% of customers lost power, causing other systems to fail (e.g., water, wastewater treatment plants)

Over 25% of transmission line towers and poles were damaged

21% of the 1,110 gas stations were closed

73% of transmission lines re-energized (as of 3/18/18)

87% of gas stations reopened (as of 3/21/18)

Power outages remain intermittent

Significant work remains on transmission and distribution systems

WATER



100% of PRASA customers **lacked drinking water**

Out of service:

- 40 water treatment plants** of 114
- 800 water pumping stations**
- 22 wastewater treatment plants** of 51
- 222 sanitary pumping stations** of 714

Untreated wastewater spills in San Juan (13.7B gallons) and Manatí, Mayaguez and Ponce (0.78M-1.19M gallons)

Damage to storage tanks at 65 non-PRASA sites

As of 2/28/18:

100% of water and wastewater treatment plants in PRASA's principal service regions operational

Drinking water restored in 46 non-PRASA communities with solar-powered water pumps

Multi-agency efforts underway to **stabilize Guajataca Dam**

\$2.51B in initial estimates of hurricane damages and \$16.45B in legacy pipe replacement

\$215.8 M of stormwater system damages in 51 of Puerto Rico's municipalities



COMMUNICATIONS and IT



95% of cellular sites were out of service

91% of private telecom infrastructure was damaged

80% of above ground fiber and **85-90% of "last-mile fiber"** was destroyed

1 submarine cable supported off-island communications for about 40 days after the primary cable landing station for many major telecom carriers flooded

60% of communications infrastructure was fully reliant on generators (as of January 2018)

4.3% of cell sites out of service overall, but up to 25% of sites in some municipalities (as of 03/21/18)

Information is limited about the extent of repairs and continued reliance on generators

Off-island communications are restored for Puerto Rico but remain vulnerable in a future storm. Culebra and Vieques are relying on microwave systems until their submarine networks are operational.

\$1.5B in total damage to **private telecom infrastructure**



TRANSPORTATION



Just 400 miles of road were passable (out of 16,700 miles)

100% of Tren Urbano service was suspended

Bus service in San Juan was nonexistent for two weeks.

Air travel suspended for 2 days, then 10 flights per day for a week

Major ports and all ferry terminals and vessels were damaged

Tren Urbano is operational

Ferry service is operational

All airports are operational

Seaports are operational, and cruise ship traffic rebounded (since early 2018)

Estimates for repairs

- **Public roads and bridges:** (emergency and permanent): \$647M
- **Tren Urbano:** \$106M
- **Other municipal transit systems:** \$36M
- **Ports** in San Juan, Penuelas, Guánica and Fajardo: \$906M
- **Ferries:** \$38.3M
- **San Juan bus system:** \$8.3M
- **PR-22 and PR-5:** \$14.5M
- **Airport:** \$237M



PUBLIC BUILDINGS



586 public buildings of 778 owned by PRIDCO reported damage

Over 90% of 735 buildings owned by PBA applied for assistance with debris removal and emergency protective measures, and **65% were damaged**

A hindrance to repairs is the lack of a comprehensive inventory of public buildings and little clarity as to which entities are responsible for them.



8,500 applications from 43 applicants **seek about \$300M** in public assistance for repairs (as of 5/3/18)

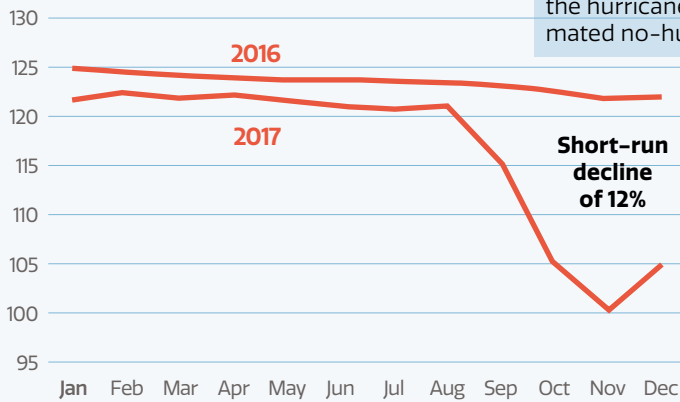


Economic

Hurricane damage

Coupled with the destruction of various capital stocks, the short-term impact to economic activity was severe. Although data are limited at the time of this writing, the following are estimated impacts from post-storm data (September-December 2017) for the economy, business, and employment.

Economic Activity Index



Short-run decline in the Economic Activity Index (correlated with GNP) of approximately 12 percent over the three months following the hurricanes relative to an estimated no-hurricane world.

After the hurricanes



Business and employment losses are based on projections (using pre-storm data) of what conditions would have been like without the storm. Agricultural losses were estimated and reported by the Puerto Rico Department of Agriculture.

BUSINESS

LOSSES FROM THE HURRICANE

Agricultural production: **\$227 million**

Agricultural infrastructure: **\$1.8 billion**

Tourism: **\$547 million** in direct revenue*

Trade: Large impacts on exports; imports reflect the response and recovery effort*



Many sectors (e.g. tourism and trade) lag pre-hurricane levels despite uptick in traveler counts and value of exports

EMPLOYMENT

Average private payroll employment in the 3 months after the hurricanes: **-4.35%**

Average manufacturing payroll employment in the 3 months after the hurricanes: **-1.27%**

The **overall workforce decreased** in both the number of people employed and the number of people in the labor force

The **hurricanes accelerated outmigration** as many islanders left for the U.S. mainland

Employment (and wages) lag pre-hurricane levels

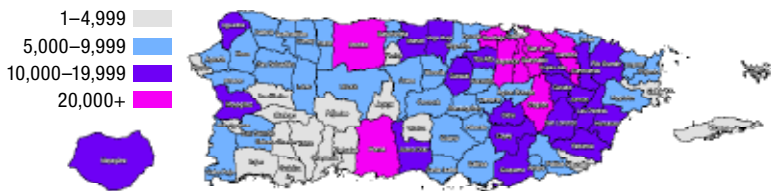


Hurricane damage

FATALITIES According to initial reports, 64 lives were lost. That estimate was later revised to **1,427**.

HOUSING **527,000 homeowners** who registered with FEMA indicated they had property damage
197,000 renters indicated damage to personal property (e.g., cars, TVs, clothing)

Number of Individual Assistance registrants with damage to structures or personal property



Most properties were **not insured**

After the hurricanes

Estimates from other studies range from about 800 to 8,500 deaths from delayed or interrupted health care.

Total damage to all dwellings: **\$33.9B**

Disbursements (as of 5/14/18):

FEMA: **\$517M** in structure repair for owner-occupied homes

FEMA: **\$402M** for personal property

SBA home loans: **\$1.2B**

Homeowners insurance: **\$358M**

A lack of accurate ownership records meant that many homeowners were not eligible for federal assistance



EDUCATION **38-44 schools** closed permanently by structural damage



An estimated **1,075 of 1,112 K-12 schools** had re-opened by December 2017

SOCIAL SERVICES Households that applied for assistance: **90% of 1.23M**

HEALTH **5 of 16 outpatient clinics** administered by the Puerto Rico Department of Health were damaged
20 of 92 federally qualified health centers were damaged

11% of federally qualified health centers have limited or no grid power

- 3 health centers have intermittent power and use generators for backup
- 5 lack power and rely solely on generators
- 1 is now using solar power



Resilience

Hurricane damage

FIRST RESPONDERS Stations with ability to relay 911 calls:
12 of 78 police stations,
0 of 93 fire stations,
14 of 56 EMS stations



Damage to state-level communications systems (e.g., two-way radios) used in emergencies left **many agencies and municipalities without critical communications**

Municipalities reported that **damage hurt key industries** (e.g., agriculture, tourism, retail), and that **cost for first responders was substantial**

After the hurricanes

Almost 90% of municipalities in a survey had **disaster preparedness plans**, but just 37% said the plans worked adequately after the storms

One-quarter of police stations were classified as "restricted use" or "unsafe" after the storms

All 99 fire stations submitted public assistance applications for building repairs

Significant numbers of **municipal personnel moved away**

Of course, an overview of key facts and figures cannot fully convey the depth of the damage to virtually every sector in Puerto Rico and the hurricanes' impact on people's lives, health, and safety.

The hurricanes had a human cost

In interviews and focus groups conducted after the hurricanes, residents described lacking water, electricity, and even food; being trapped in their communities because roads were impassable; having no access to medical care or pharmacies; and elderly people getting injured as they rode out the hurricanes alone. In the hurricanes' wake, people reported losing their jobs because they had no gasoline to get to work, struggling to pay for necessities as prices spiked, and worrying about the disruption to their children's education.

Most poignant were the stories residents told about the psychological toll—the deaths of loved ones, the separation from family members, and the financial stress. At one focus group in Las Marias, residents related how they saw community members die after being trapped in their cars for days. One mayor said three dialysis patients died in his town because they could not access treatment.

Many residents expressed their frustration with the emergency response and the lingering effects on essential services like power and water.

Mayors spoke of the difficulty of helping their residents while being cut off from outside help. They noted that satellite phones that were provided as a contingency measure did not work, and that many agencies and services were unresponsive or inaccessible. Communities in close proximity dealt with the isolation by sharing the resources they had available, and working together to identify

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“Maunabo has a lot of older, sick, and bedridden people. Here we had deaths because of the lack of electric power. I had people call me at 1 a.m. to tell me that a person died because the respiratory aid was turned off.”

—FOCUS GROUP PARTICIPANT FROM MAUNABO
(AUTHOR TRANSLATION)

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“The best agent of change is all of us. We have created a directory of resources because within the community we have carpenters, builders, plumbers, etc. We have people with equipment who can help clear the roads. There's a bank of resources and that's the most valuable currency we can have, the people. Really, we're the ones who will see Puerto Rico through. Whatever comes from the outside is just mere aid, but we're the ones who will make Puerto Rico rise above.”

—FOCUS GROUP PARTICIPANT FROM LOIZA
(AUTHOR TRANSLATION)

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“The next day, when we were able to come out, the entire community (helped). Whoever couldn't help clear debris and take it out of the road was the one making breakfast or a pot of soup. The community gave 100 percent.”

—FOCUS GROUP PARTICIPANT FROM NARAJITO
(AUTHOR TRANSLATION)



MANY MAY BE VULNERABLE TO HURRICANE IMPACTS

Any person can experience vulnerability, especially following a disaster, and it is not a static characteristic of any individual or group. Given the fluid nature of vulnerability, considering characteristics that can increase risk for people in communities can guide actions taken during each of the four phases of emergency management. People who face Communication challenges, have health Maintenance needs, rely on medical devices or supplies to remain Independent, lean on Services to manage behavioral health needs, or infants and children who rely on others for sustenance, and persons who may face Transportation obstacles all may be particularly vulnerable in a disaster (derived from the C-MIST framework for identifying the functional needs of people with disabilities or who have access and functional needs before, during, and after a disaster).

Many community members will face these issues at some point in life. Some of these challenges can be more acutely felt with age, which is of particular importance given the increasingly aged Puerto Rican population. Meanwhile, fragile transportation networks and power grids and inconsistent or easily interrupted access to services can be significant obstacles for people who live in geographically remote areas or are technologically dependent for medical services. Additionally, a communication network that is easily disrupted or does not reach all Puerto Ricans may fail to provide life-saving information in an emergency.

All phases of emergency response and recovery should consider vulnerabilities that communities and individuals face, and the impact that actions will have. For example, when rebuilding the road network, one must consider whether the efforts will promote or restrict equitable access to schools, health and social services, and economic opportunities. Similarly, with a significant portion of the population participating in safety net programs, ensuring that there are jobs and relevant training opportunities available near impacted people must be a part of any consideration of shrinking or placing restrictions on safety net programs.

people in need and clear roadways of debris.

Although the official death count from the Puerto Rico Department of Public Safety was initially 64, the toll appears to be much higher. On June 13, the Government of Puerto Rico revealed that there were 1,427 more deaths in the four months after the hurricanes than normal (based on the previous four years), and it will update the official count after a George Washington University study is completed. Similarly, independent researchers analyzing vital statistics data found that about 1,000 more people died in September and October 2017 than normal, largely in the hurricane's path or in mountainous rural areas. A much-publicized Harvard study estimated hurricane deaths likely ranged from about 800 to 8,500 due to indirect causes, such as delayed or interrupted health care.

Loss of power degraded other systems

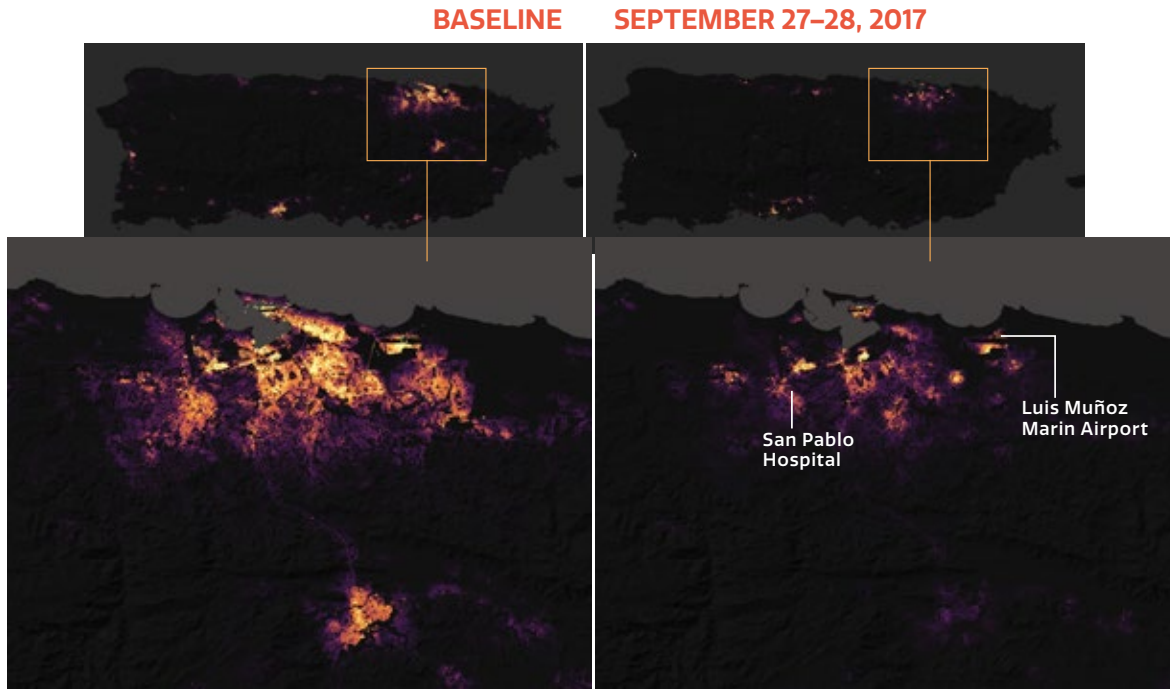
The loss of power may have been the most damaging consequence for infrastructure, causing entire systems to fail. The fossil fuel-based power plants that generate most of Puerto Rico's electricity did not suffer major damage from the hurricane. But damage to the electricity grid—including downed power lines, transmission

Top: A resident of the San Rafael nursing home in Arecibo, Puerto Rico.

REUTERS/Alvin Baez

Nighttime lights in San Juan before and after Hurricane Maria

Source: NASA



lines, and poles—was severe. Significant work remains to restore electrical transmission and distribution systems to acceptable condition; some water treatment plants, hospitals, and other critical infrastructure continue to use emergency generators. While there was major damage to some wind and solar generation facilities, these make up a very small percentage of Puerto Rico’s overall generation capacity.

The lack of power disrupted other systems. With much of Puerto Rico’s power grid offline, wastewater treatment plants were out of service. Some sewage plants were upstream from the drinking water supply, so their failure contaminated potable water. Water-damaged structures were exposed to other potential environmental hazards such as mold, an increase in rodents and pests, and chemicals and waste.

Since the hurricanes, there have been concerted efforts to get water treatment plants, hospitals, and other critical infrastructure off emergency

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“As the days went by it descended into chaos. You needed money ... because it was all cash. The ATMs weren’t working, the phones were cut off.”

— FOCUS GROUP PARTICIPANT FROM LOIZA
(AUTHOR TRANSLATION)

generators, often by incorporating cutting-edge approaches that do not rely on imported fossil fuels into repairs and rebuilding. One approach is the use of “microgrids” in which solar panels or wind turbines allow customers to operate off the grid or are connected to the broader electrical grid but go into “island mode” in an emergency. In addition, dual-backup generation systems are being installed at hospitals to avoid an extended loss of power. Puerto Rico is integrating these assets into the power system and ensuring that they comply with regulations and standards.

PRASA has worked to restore water and sewer services but continues to face challenges. As of February 28, 2018, all water and wastewater treatment plants in each of PRASA’s principal service regions were operational, but due to energy availability constraints, 88 percent of water treatment plants and 98 percent of wastewater treatment plants were operating below their normal operating capacity. By the same date, 10 non-PRASA facilities were classified as a state priority and eight were classified as a U.S. EPA priority. Together with nongovernmental organizations, EPA has been working to repair damaged non-PRASA water systems, providing generators and equipping systems to operate on solar power. To date, over 1,100 solar-powered water pumping systems have been installed.

Damage to flood protection put people in harm’s way

Puerto Rico’s dams, levees, natural infrastructure (e.g., coral reefs, wetlands, dunes), and other stormwater infrastructure were also damaged, which resulted in extensive flooding, erosion, and the scouring of waterways. Of 18 dams that were assessed, 11 had areas of erosion, and six were inaccessible due to debris, landslides, or road damage. At the Dos Bocas Dam, sedimentation and high flow damaged all three hydroelectric turbines.

Guajataca Dam—the water source for 350,000 people—suffered the most significant damage. During Hurricane Maria, Guajataca’s large volumes of water flowed over the emergency spillway, which compromised its structural integrity. Some 70,000 residents downstream were in immediate danger and were evacuated. Since the hurricanes, Guajataca Dam’s integrity has been somewhat stabilized, and temporary fixes to the spillways are underway.



Photo: Arthur Brooks/FEMA via Wikimedia

Mobile devices were nearly useless, and social service providers struggled

The hurricane’s devastating effects on people’s health and safety cannot be overstated. More than 80 percent of Puerto Ricans rely solely on mobile devices for telecommunications, but mobile communications broke down as the hurricanes took out antennas, fiber-optic cables, and the electric grid. Without service, people were unable to call for help, search for emergency information, and apply online for FEMA relief. Further, the lack of power meant that many communications devices could not be recharged. As a result, basic resources became scarce, communities were isolated, and people with special health needs were not able to access proper care.

Damage to buildings and to electrical, water, and communications infrastructure forced the closure of hospitals, clinics, public health laboratories, food assistance offices (Nutrition Assistance Program and the Special Supplemental Nutrition Program for Women, Infants and Children or WIC), elder-care facilities, and other social service agencies. However,

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“We were faced with the problem of not being able to acquire gasoline, a generator, or medical services. All of that was affected. We had no direct access to medical care, not even pharmacies.”

— FOCUS GROUP PARTICIPANT FROM RIO GRANDE
(AUTHOR TRANSLATION)

Six months after the hurricanes, approximately one in 10 of the permanent health center sites on the Island had limited or no grid power.

some of Puerto Rico’s federally qualified health centers stayed open when the hurricanes made landfall, and most opened immediately afterwards. In some municipalities, these clinics were the only places where emergency and acute health care services were provided around the clock.

Even at facilities that remained open, services were compromised by intermittent access to power and water, lack of access to electronic records, and the inability of some staff to come to work. Water damage to paper records affected services and operations at the central offices of the Department of Family and in many elder-care facilities. In some schools, instruction was interrupted by the need to use the buildings as shelters.

Six months after the hurricanes, approximately one in 10 of the permanent health center sites on the Island had limited or no grid power. Three health centers had intermittent grid power and rely on generators as a backup source of power; five were without use of grid power and rely solely on generators, and another health center was using solar power. Many Head Start centers and schools were undergoing repairs and remain closed. Infectious diseases such as influenza have been controlled to within comparable rates in the continental U.S., although concerns about water quality persist.

Coasts, forests, and parks experienced landslides and erosion

Coastal and terrestrial natural resources act as natural infrastructure to protect communities and infrastructure from flooding, pollution, and other hurricane-related effects. As of June 2018, approximately 25 assessments of damage to natural and cultural resources were completed, and a few were still ongoing. The full effects of Hurricane Maria on natural resources will not be known for years to come. Comprehensive, Island-wide information on the condition of natural resources before the hurricanes was not always available, making it difficult to quantify hurricane damage at this time. However, coastal impacts included wetland and mangrove damage from winds, pollution discharge, excessive sedimentation, changed hydrology, and stranded boats; severely eroded beaches and dunes; and damage to coral reefs, seagrasses, and other species. One rapid assessment found significant impact to wetland buffers at 20 sites, and 75 percent of them had increased stress, mostly due to changes in hydrology; debris; and tree defoliation, disease,



Fire crews clear fallen trees in the El Yunque National Forest after Hurricane Irma.

Jose M. Martinez, U.S. Fish and Wildlife Service via Wikimedia

and damage. About 11 percent—or approximately 13,600 acres—of reefs were also damaged. Human activity, including coral harvesting, pollution, overfishing, and illegal development practices, may inhibit the natural recovery of Puerto Rico’s coastal resources.

Damage to forests was also widespread, with an early estimate of 23 to 31 million trees killed or severely damaged. Tens of thousands of landslides increased sedimentation in reservoirs and behind dams, caused flooding hazards, trapped fish in streams, polluted marine environments, and blocked roads and trails. Although these reservoirs were filling with sediment before the hurricanes, landslides substantially exacerbated reservoir capacity challenges and other environmental issues. Preliminary estimates suggest that landslides added an estimated 30 million cubic yards of sediment potential in one watershed alone.

Virtually all this natural damage affected the mortality and habitat of animals. For example, 53 percent of the hawksbill sea turtle nests at Humacao Nature Preserve were lost as a result of the hurricanes, while other species lost their food sources (e.g., seeds), and concerns remain regarding pollinators. Facilities critical for the captive breeding program of the Puerto Rican parrot, a culturally significant, endemic species, were also damaged. These impacts put many threatened and endangered species at a higher risk of extinction, thereby reducing

**The full effects
of Hurricane
Maria on
natural
resources will
not be known
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come.**



Staff from the U.S. National Archives and Records Administration demonstrate how to clean books and historical artifacts to Puerto Rico General Archive and National Library staff members.

Andrea Booher/FEMA

biodiversity and resilience in the longer-term.

Before the hurricane, the majority of landfills were over capacity and/or out of compliance with environmental regulations, and 1,600–2,000 illegal dumps proliferated around Puerto Rico. Hurricane stormwater carried an unknown quantity of pollutants off these sites, potentially affecting the environment and human health. Then, the hurricanes generated a massive amount of debris and solid waste. Unless new cells come online, Puerto Rico will run out of landfill capacity in 2–3 years, not accounting for likely additional waste as hurricane-damaged buildings are demolished.

Finally, wind and water weakened physical structures at hundreds of historic and cultural sites, the larger of which include Fortín de San Gerónimo de Boquerón (an 18th-century fortress) and the National Library and General Archives, which has a statutory requirement to maintain records significant to Puerto Rican governance and history. Many of the collections of artifacts housed inside these sites were also damaged from hurricane effects and loss of power. Water damage has also increased the risk of mold. Artisans and performers who comprise the cultural community in Puerto Rico lost materials and income.

As of May 2018, coral reef and critical species stabilization is underway. Puerto Rico’s Solid Waste Authority estimated that the hurricanes created 6.2 million cubic yards of waste and debris. By May 15, 2018, the U.S. Army Corps of Engineers had collected 4 million of the 4.15 million cubic yards of debris it was tasked with collecting. Vegetative debris is turned into mulch, and other materials are sent to recycling centers or landfills, preferably for use as cover material. Mulch can also be blown into forests to decompose or used for enrichment of agricultural soils. Precious woods are harvested and made available for future needs, such as commercial sale and for repairs to historic properties through a pilot program. In many cases, cultural institutions have re-opened to the public, but sometimes with temporary fixes for structural damage or with diesel generators to provide power. Cultural institutions are also being provided emergency preparedness education, response kits, and protocols in preparation for future disasters.

Municipal governments were severely impacted

Municipalities in Puerto Rico faced substantial challenges prior to Hurricanes Irma and Maria due to chronic financial pressure, outmigration, stagnant economic growth or economic contraction, and overlapping and at times duplicative service delivery. Almost two-thirds of municipalities had deficits in 2016, with many carrying deficits over multiple years, and the amount of municipal debt increased by more than 50 percent since 2007. Hurricanes Irma and Maria exacerbated these underlying problems by placing additional stress on local economies and municipal finances while creating new issues. A survey of municipalities showed that the hurricanes led to declines in economic activity, particularly in key industries such as agriculture, tourism, and retail. This has led to substantial declines in revenue collection from key sources of municipal revenue such as sales taxes and business license fees. Because the municipalities were the first responders after the hurricanes, they incurred substantial unplanned expenses that they could not afford, and many have yet to be reimbursed—negatively affecting their ability to provide services and fund reconstruction projects.

Mayors and municipal staff also reported significant damage and continuing needs across key sectors that impact their constituents' lives and their capacity to govern effectively. Extensive power and telecommunications outages, lack of access to safe drinking water or adequate sewers, and at times, limited access to health services created immediate health and safety hazards—some of which persist at the time of this writing. For example, about half of the municipalities surveyed in May and June of 2018 reported that their stormwater systems are unable to handle excess water and prevent flooding when it rains. Almost a quarter of municipalities—24 percent—reported that half or less of their community had landline or cellular service, while 38 percent of municipalities reported that half or less of their constituents had access to internet services (as of May/June 2018). And many municipalities noted that they still have communities without electricity.

Municipalities also lost significant human resource capacity: almost all municipalities surveyed lost personnel to outmigration following the hurricanes, and nearly half reported significant reductions in policing due to loss of personnel and resources.

The decline in economic activity due to the hurricanes—particularly in key industries such as agriculture, tourism, and retail—led to substantial decreases in revenue collection from key sources of municipal revenue such as sales taxes and business license fees

Crosscutting disaster and economic recovery needs

Since the hurricanes, Puerto Rico has been working to restore services, reopen schools and other public buildings, and help residents return to something approaching normal, but much work remains to be done. While the sections above identified needs in individual sectors, the sections below identify unmet needs that cross multiple sectors. They are separated into short-term (1–2 years) and longer-term (3–10 years) needs, roughly corresponding to the time needed to address them.

RECOVERY NEEDS ARE
SEPARATED INTO

Short-term
(1–2 years)

and

Longer-term
(3–10 years)

Short-term needs

Some critical infrastructure remains non-functioning or in disrepair

Reestablishing power, communications, and water utilities across Puerto Rico remains a priority. While reliable power, communications, and water are important to the economy, they are crucial to giving Puerto Ricans a sense of normalcy, protecting their health and well-being, and confirming that all regions will take part in the recovery. It is critical to create an energy grid that is reliable enough to get water treatment plants, hospitals, and other critical infrastructure off emergency generators and make them less vulnerable to crashes, outages, or future hurricanes.

Homes remain damaged or destroyed

Rebuilding or repairing the approximately 166,000 residential structures that were either damaged or destroyed during the hurricanes remains a key priority in the short-term. These efforts are critical for all damaged residential structures—particularly for the homes built before more-protective building codes were adopted or for which building codes were not enforced. Historically, enforcing building permit requirements has been complicated by a lack of resources for qualified inspectors and an uneven history of requiring building permits before construction could proceed. A major challenge during the recovery will be to require and enforce building permits, which has implications for both personnel and processes to enforce building codes and collect penalties. The houses that were not damaged by the hurricanes also remain at-risk unless they, too, are brought up to code.

Emergency preparedness plans need updating

With the arrival of a new hurricane season, it is critical for Puerto Rico to address a number of gaps in the emergency preparedness infrastructure so that all residents and businesses are protected in a future disaster. Assessments found that municipal-level emergency response and mitigation plans were inadequate during the hurricanes, with only 37 percent of municipalities reporting that the response plans worked adequately after the hurricanes. The Puerto Rico Emergency Management Agency (PREMA) is working to update or develop plans for all 78 municipalities with FEMA, which is also educating residents on preparedness and developing the government workforce. Coordinating parties responsible for the emergency response and for stockpiling materials, resources, and personnel are near-term priorities.

Responsibility for various infrastructure, assets, and services is not clearly established

After the hurricanes, determining which agency was responsible for maintenance and repairs of various infrastructure and public buildings was difficult because many sectors had no comprehensive asset inventory or management system. The threat posed by a new hurricane season makes clarifying ownership and responsibility an immediate need. Creating a comprehensive inventory and management system is a next step for the housing, energy, transportation, and public buildings sectors in particular.

Similarly, Puerto Rico's mayors believe that the overlapping responsibilities between the municipalities and the Government of Puerto Rico for maintaining and clearing debris from roads led to coordination issues and delays in getting critically needed supplies to some areas after the hurricanes. There appears to be emerging consensus about the need to rethink how services are delivered—including creating regional structures—to improve efficiency, reduce costs, and improve the lives of citizens. This reorganization is needed to respond to future disasters and streamline service delivery, but it will have broad implications that likely require involving key stakeholders in Puerto Rico and incorporating municipal input.

It is estimated that destruction from Hurricanes Irma and Maria will lead to as much outmigration from the Island in two years as seen in the previous decade under a notable fiscal crisis.

Longer-term needs

Economic contraction that precipitated population loss and inhibits recovery must be addressed

According to a recent briefing to the Financial Oversight and Management Board for Puerto Rico, about one million Puerto Ricans left the Island between 2000 and 2015. From 2006 to 2016, Puerto Rico lost 525,769 net migrants—equivalent to 14 percent of its total population—since the fiscal crisis started. Outmigration began in a few southern municipalities and the capital, San Juan, prior to Hurricanes Irma and Maria. Since the hurricanes, however, outmigration has spanned all municipalities. Furthermore, it is estimated that destruction from Hurricanes Irma and Maria will lead to as much outmigration from the Island in two years as seen in the previous decade under a notable fiscal crisis.

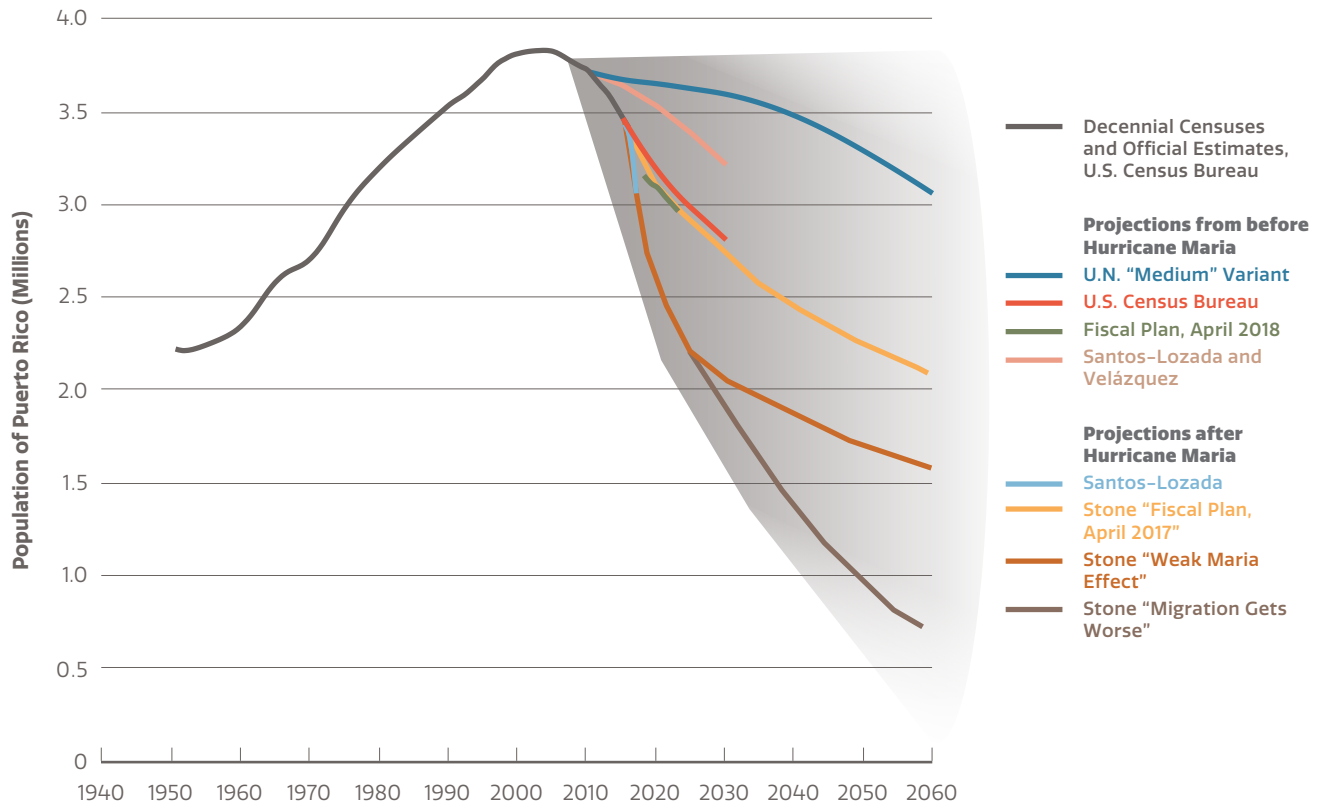
Based on this analysis, policies related to the following broad areas should be considered in order to encourage growth:

- Increase the attractiveness of doing business in Puerto Rico by lowering the costs of doing business, including both financial and non-financial costs, and stemming the flow of outmigration
- Increase the formal labor force participation rate by reducing or removing disincentives for formal work
- Broaden the tax base and increase the fiscal and economic resilience of Puerto Rico through a flattening of the tax structure and lower dependence on particular tax exemptions
- Increase fiscal discipline to ensure a sustainable and right-sized public sector.

Municipal priorities for economic development and recovery

The municipalities HSOAC met with generally noted that revitalizing Puerto Rico's urban centers should be a key focus of economic recovery efforts. Participants argued that this would allow the Government of Puerto Rico and municipal governments to reduce expenditures and take advantage of economies of scale by concentrating delivery of key services, provide employment opportunities to residents, keep tax revenues within the municipality, reduce social isolation for the poor, the elderly, and those with special needs, and improve resilience and facilitate more effective emergency response and recovery in the event of another natural disaster.

Puerto Rico’s population was already declining; the hurricanes made future losses harder to project



Sources: U.S. Census Bureau International Database, 2017; U.N. World Population Prospects, 2017; Santos-Lozada and Velasquez, 2015; Santos-Lozada 2018; New Fiscal Plan for Puerto Rico, April 2018; Stone, 2017.

HSOAC also asked municipalities to share their visions for recovery and economic development. Although responses varied substantially across twelve regional roundtables, a number of broadly shared objectives emerged.

- Invest in rebuilding and upgrading key infrastructure, including electric power, water and wastewater, communications, and transportation
- Incentivize large manufacturers to stay in Puerto Rico
- Reduce labor shortages by both incentivizing workers to stay in Puerto Rico and allowing businesses (particularly agribusinesses) to bring in foreign workers on temporary visas
- Involve municipal authorities in identifying priorities for their region
- Adjudicate the authority for planning and implementation of development projects to municipal authorities
- Expand investment in projects related to the visitor economy and tourism to all municipalities in Puerto Rico—not just the traditional hotspots.

Social service, health, education, and infrastructure systems must be scaled for the current and future population

Across sectors, social service systems, financial planning, administrative functions, and physical infrastructure have not been appropriately scaled and adjusted to sustainably meet the health, social, and economic needs of Puerto Rico's citizens. The simultaneous challenges posed by people moving away, the low birth rate, and the aging of those who remain require right-sizing education, workforce development, health, and social services to better match the population's size and needs. For example, older adults may require more emergency and support services or a wider variety of transportation options, and public utilities must be reconfigured to become financially solvent despite a shrinking customer base.

The effectiveness of these investments will be affected by where people choose to live. The difficulty restoring services to remote and vulnerable communities after the hurricanes convinced many mayors that Puerto Rico needs to invest in revitalizing urban centers and bolstered support for implementing regional approaches to providing services and reducing duplication of effort (voiced during a series of roundtables with mayors). "No tiene sentido"—it makes no sense—one mayor said about plans to spend \$5 million to rebuild roads and bridges connecting one community to the rest of the municipality because its location ensures disaster will strike again. Many mayors said it was much easier to provide and restore a wide range of services to citizens living in urban centers, which is especially important as Puerto Rico's population ages. All of this underscores the importance of monitoring the population's size and updating assumptions about trends in fertility and residents relocating outside of Puerto Rico.

Infrastructure in Puerto Rico is vulnerable to natural hazards and needs to be built to 21st-century standards

Many years of deferred maintenance has degraded Puerto Rico's infrastructure and raised repair costs. Degraded power and water facilities in particular result in lost revenue that puts public utilities and agencies further in debt. In addition, many of Puerto Rico's systems are not built according to the latest standards. Developing infrastructure that meets 21st-century standards will make Puerto Rico more attractive to businesses, potential immigrants, and returning residents, and will improve the tax base.

In addition, Puerto Rico has entered another hurricane season, and other natural hazards such as drought and sea-level rise continue to affect infrastructure and residents. Understanding these vulnerabilities and creating robust and flexible systems will take significant investment moving forward.

Building-permit and code-enforcement gaps reduce the effectiveness of utilities and perpetuate activity in the informal sector


Before the hurricanes, “informal” buildings that were unpermitted and not constructed to code were common. Similarly, unmetered water connections and inconsistent electricity metering were common, and laws and regulations governing these activities were not rigorously enforced. As the Island rebuilds, the Government of Puerto Rico plans to clarify which entities are in charge of regulation and enforcement, and to improve building codes, standards, and enforcement to both protect residents from substandard buildings and improve the collection of fees and taxes.

Timely and accurate data on Puerto Rico’s economic and fiscal status is required

Both the public and private sectors require timely, accurate, and comprehensive information to make effective strategic decisions regarding both recovery and day-to-day operations. Puerto Rico’s outdated methods of national income accounting and lack of participation in some data programs (U.S. Census Bureau, Bureau of Labor Statistics, Bureau of Justice, Health and Human Services, Energy Information Administration, National Center for Education Statistics, National Center for Health Statistics, and U.S. Department of Agriculture) limit the quantity of information available relative to U.S. states. While the Puerto Rico Institute of Statistics has been recognized as an exemplar of good statistical practice, it cannot be expected to fill this gap at historical funding levels.



REUTERS/Alvin Baez

A construction worker wearing a yellow hard hat, an orange safety vest over a long-sleeved shirt, and blue jeans is leaning over a concrete structure. He is wearing work gloves and looking down at his work. The background shows a large-scale construction site with many vertical rebar columns and other workers in the distance.

Employees work
on the last phase of
construction of the
new bridge in Barrio
Chorreras, Utuado.

Eduardo Martínez/FEMA

PUERTO RICO'S OPPORTUNITY

As of July 2018, nearly \$35 billion in funding has been allocated to Puerto Rico, but these initial obligations only begin to cover the investments needed to move Puerto Rico towards its broader vision of social and economic progress. Additional recovery funds present a unique opportunity to advance the vision for a transformed Puerto Rico. This unprecedented influx of resources will allow transportation and energy systems to be rebuilt and made more resilient, schools to be redesigned, the healthcare and emergency services systems to be modernized and additional investors from the private and philanthropic sectors to be attracted.

Federal funds will not be enough to achieve this vision or necessarily fully achieve all the economic, infrastructure, society, and capacity goals set forth in the plan; private and philanthropic funds will also be an essential source of funds. While the vision and goals of the plan are meant to be aspirational, making them a reality will require innovative thinking about how post-disaster assistance can be most productively invested in a way that encourages new investments and continues to build a strong and sustainable economy and a vibrant society through public-private partnerships.

Recovery investments can help propel Puerto Rico toward vision and goals

Puerto Rico's economic development and growth requires investments not only in a stronger and more resilient infrastructure, but also in promoting the health and well-being of the people and the environment of Puerto Rico. To truly propel Puerto Rico towards the vision and goals laid out in this

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“This is a transformative moment in the history of Puerto Rico.”

—GOVERNOR RICARDO ROSSELLÓ



HURRICANE DISASTER APPROPRIATIONS

After Hurricane Irma, the Continuing Appropriations Act, 2018 and Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (PL 115-56) was signed into law including \$1.5 billion in Community Development Block Grant Disaster Recovery funding (CDBG-DR) for Puerto Rico.

After Hurricane Maria, the President issued a major disaster declaration, and the Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2017 (PL 115-72) was signed into law including funds for the Disaster Assistance Direct Loan Program (FEMA), Disaster Nutrition Assistance Program (USDA), and General Fund (National Flood Insurance).

In February 2018, a third supplemental, Further Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2018 (PL 115-123), was signed into law and appropriated an additional \$28B in CDBG-DR funding, which was later announced to include \$18.4 billion for Puerto Rico (\$10.1 billion for Recovery + \$8.3 billion Mitigation).

plan, the Government of Puerto Rico needs to be strategic: It will need to select initiatives that leverage and maintain investments in infrastructure, people, and the environment while also setting the stage for diversified economic activity and building capacity in areas that attract and support new public-private partnerships and investors. Federal recovery investments in infrastructure, people, the environment, and strategic economic and societal capacities will need to be combined with efforts to attract and maintain new partners and investors and efforts to lower the cost of doing business by reducing transaction costs, streamlining permitting and enforcing property rights, and providing timely, accurate information. To maintain both federal and private/philanthropic partnerships, governance and policy need to promote transparency, reflect appropriate regulations and procurement processes, and be enforced adequately.

Investing to promote disaster recovery and enduring economic recovery

As Puerto Rico moves forward in its economic and disaster recovery, investing in infrastructure, people, and the environment will be critical to promoting economic and social development and improving people's everyday lives. By making the investments flexible, resilient, and sustainable, Puerto Rico can position itself to respond to future disasters—and set the stage for an economic landscape that is bound to look different in the future than it does today. To start, a key set of foundational actions—increasing the ease of doing business in Puerto Rico, strengthening government capacity in day-to-day service provision as well as during disasters, making available high-quality data to guide decisionmaking and support transparent governance, and promoting formal work and

workforce training—need to be in place to support and sustain any recovery investments.

To achieve Puerto Rico’s vision, capital investments are also needed in three critical areas. First, physical infrastructure must be rebuilt to provide the services that people, businesses, and communities need to thrive. Without power, water, transportation, telecommunications, houses, and public buildings, recovery is not possible. But physical capital must be built back better than before: It must be adaptable to Puerto Rico’s possible future pathways and resilient to future storms.

Second, human capital—a healthy, educated, and trained workforce—is critical to improving economic growth, giving residents greater opportunities, and reducing inequities. Investments must be made to develop a skilled workforce that is prepared to meet today’s challenges but flexible enough to adjust to tomorrow’s opportunities.

Finally, investments in natural capital are necessary to protect communities and businesses from disasters and to provide food, fiber, and fuel; habitat for native species; and recreational and tourism opportunities. This natural capital is part of what makes Puerto Rico a unique and desirable location.

These capital investments have the potential to benefit all Puerto Ricans and to draw new investors from the Island, the rest of the United States, and abroad by reducing the cost of doing business and providing Puerto Rico with a comparative advantage moving forward. These capital investments are foundational to Puerto Rico recovering from the disaster and reversing its economic decline.

Investing in physical, human, and natural capital does not just mean rebuilding these assets—even to high standards—but also maintaining and protecting them in the future. Small investments and forward-thinking



Source: @ricardorossello via Twitter

GETTING DOWN TO BUSINESS

A week before Hurricane Irma made landfall, the Governor and Boston Scientific officials announced that the major medical device manufacturer would be investing an additional \$10.5 million in its facilities in Dorado. Soon after, Boston Scientific was chartering its own planes to bring food, clothing, and emergency supplies to its employees and to fly its products off the island in the storm’s wake.

These additional costs—on top of recent changes to the tax code that diminish incentives that drew Boston Pacific to Puerto Rico in the first place—significantly increased Boston Scientific’s cost of doing business there.

How can Puerto Rico encourage companies like Boston Scientific to stay and attract new businesses? Investing in resilient and modern infrastructure, a skilled workforce, and Puerto Rico’s natural capital will go a long way toward ensuring that companies have the resources and workforce they need to thrive. Lowering the cost of doing business by, for example, streamlining that makes business permitting and regulation compliance processes more affordable will also improve the business environment.

Capital investments provide the essential foundation upon which Puerto Rico will grow and thrive over the coming years—while the strategic initiatives are sets of actions aimed at seeding and catalyzing specific areas for Puerto Rico’s growth.

approaches now can have huge dividends moving forward and are key to the long-term success of these recovery efforts.

The nine capital investment priorities described in this plan are intended to build a smarter, stronger Puerto Rico and provide the foundation for economic growth. These investments restore and enhance physical, human, and natural capital.

Strategic initiatives build on capital investments and focus on the future

Capital investments provide the essential foundation upon which Puerto Rico will grow and thrive over the coming years—while the strategic initiatives are sets of actions aimed at seeding and catalyzing specific areas for Puerto Rico’s growth (see figure on Page 49). For this plan, strategic initiatives reflect an opportunity to capitalize on an asset or strength in Puerto Rico (e.g., oceans) or to close a gap that could hinder Puerto Rico’s economic development or resilience. The eight strategic initiatives described in this plan are intended to encourage a growing focus on these opportunities. The initiatives comprise cross-cutting actions that create an ecosystem of investable projects, supportive policy, accessible and sustainable resources, and a clearly defined direction.

Recovery investments are interdependent

Disasters do not happen in silos and neither can disaster recovery. Prior disaster recovery efforts and Puerto Rico’s experiences with Hurricanes Irma and Maria have underscored the importance of understanding cross-sector interdependencies and coordinating across sectors during economic and disaster recovery efforts. Understanding cross-sector interdependencies (not limited to just those among physical infrastructures) will help to ensure that recovery and rebuilding plans account for ways in which failures in one sector can affect other sectors, and investments in one sector can help to improve the health and performance of another.

Completing a thorough analysis of cross-sector interdependencies across the entirety of Puerto Rico is no small feat. But the hurricanes highlighted a few key interdependencies that should be carefully considered in ongoing recovery planning efforts. The figure on the following page provides examples of these interdependencies and how failures in one system led to failures



CAPITAL INVESTMENTS

Foundational

Physical Capital

ENERGY

Transform the energy system to ensure it is customer-centric and more affordable, reliable, resilient, and renewable.

TRANSPORTATION

Rebuild and strengthen maritime, surface, and air transportation systems to move people and goods flexibly and reliably.

WATER

Rethink water systems to be more efficient, reliable, and protected from future disasters.

TELECOMM/IT

Modernize the telecommunications system to ensure fast and reliable residential, commercial, and emergency communications.

PUBLIC BUILDINGS

Build back stronger and more resilient buildings that meet today's standards, mitigate against future disasters, and encourage innovative designs.

HOUSING

Repair and rebuild safe, secure, and affordable residential housing.

Human Capital

HEALTH AND WELLBEING

Rebuild and enhance the health and social service infrastructure and regional health networks to ensure reliable and equitable access and health-promoting communities, including an efficient and effective response in the event of public health crises, disease outbreaks, and other future disasters.

EDUCATION

Transform the education system to produce competitive graduates with the knowledge and skills needed to adapt to changes in the economy, the environment and technology.

Natural Capital

NATURAL ENVIRONMENT

Restore, plan for, and develop marine and terrestrial ecosystems so that they coexist sustainably with the economic development of Puerto Rico and protect against storm damage.



STRATEGIC INITIATIVES

Future Focused

OCEAN ECONOMY (BLUEtide)

Integrate and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth, improve quality of life for residents, and enhance the visitor's experience.

VISITOR ECONOMY

Develop a strong, sustainable visitor economy to help position Puerto Rico as a global destination for tourism, investment, production, and wealth.

DIGITAL TRANSFORMATION

Build the digital capabilities and workforce needed to fundamentally transform key industry and government processes to become more user-focused, relevant, and efficient at addressing local needs and delivering basic services.

ENTREPRENEURSHIP

Expand opportunities for entrepreneurship and development of small to medium local businesses that can compete globally to promote economic development.

ADVANCED MANUFACTURING

Address policy and structural barriers to increase opportunities for investment, expand public-private partnerships, and promote innovation, learning, and coordination throughout the economy.

AGRICULTURAL TRANSFORMATION

Modernize agriculture to promote greater productivity and output, and improve exports.

21ST CENTURY WORKFORCE

Develop and protect an educated world-class workforce, increase labor force flexibility, and create high quality employment opportunities aligned with economic growth strategies.

EMERGENCY SERVICES MODERNIZATION

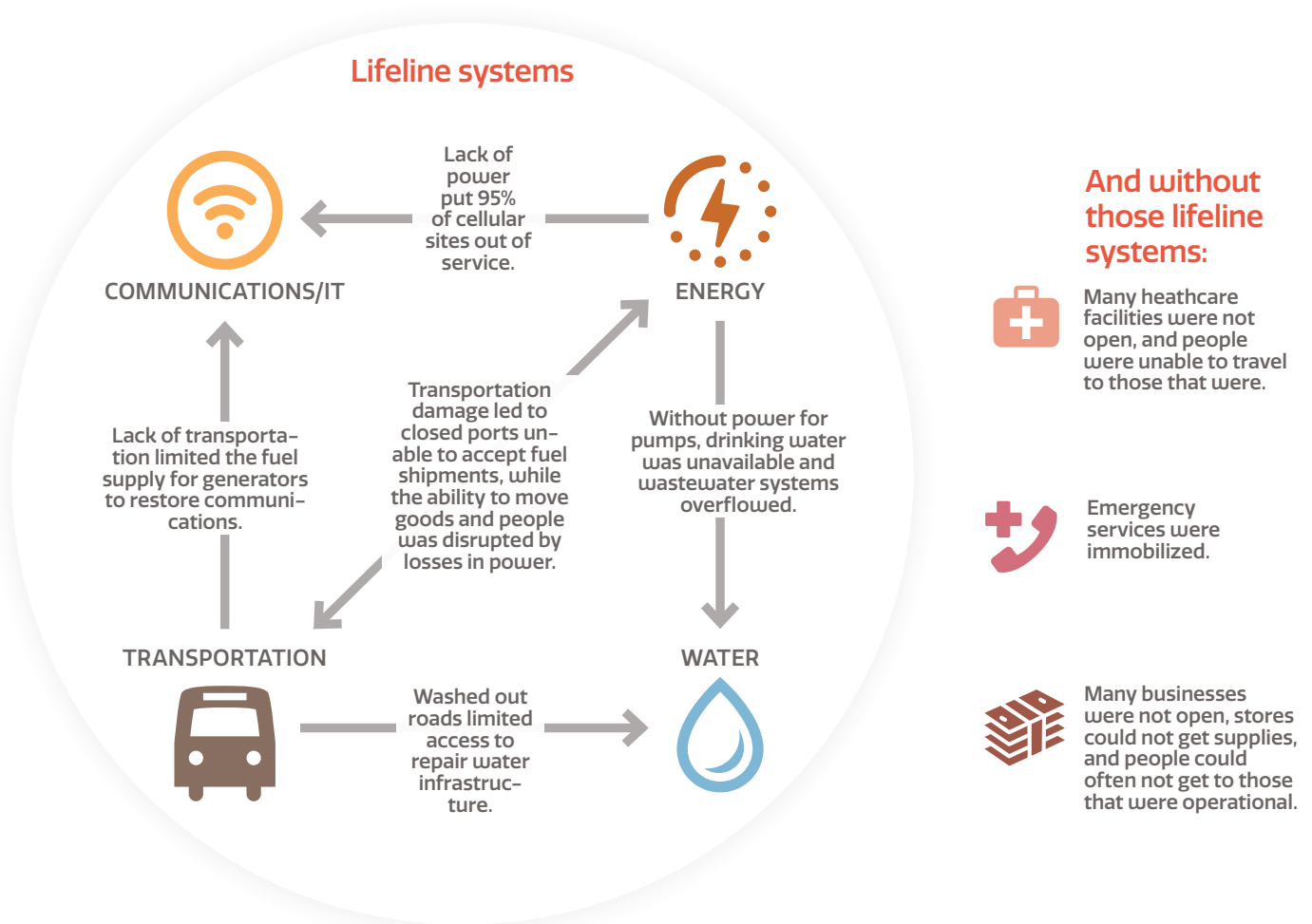
Enhance public safety and first responders' ability to deliver reliable, modern, and integrated emergency services.

in another during and after the hurricanes. In particular, four systems—energy, transportation, water and wastewater, and communications—are considered lifeline systems because practically every critical social service relies on having access to each of them. Additionally, these lifeline systems depend on each other to operate. Ensuring the reliability and resilience of these critical systems is foundational to all recovery efforts.

Having a good understanding of cross-sector interdependencies alone is not enough. Coordination and collaboration among sectors is essential to ensuring that a systems view drives recovery efforts, and that actions taken across sectors are scoped, sequenced, and carried out in an efficient manner. For example, a key action for the energy sector is to bury high-risk power lines underground, and one for the transportation sector is to repair surface damage to the transportation network. Since underground powerlines are often collocated with roads, burying the powerlines in advance of restoring the roads will ensure that the road does not need to be repaired twice. A lack of coordination or sufficient situational awareness on the part of one or both sectors could lead to process inefficiencies, ultimately delaying recovery efforts. Over three quarters of the actions listed in the “Detailed Actions” section of this plan depend directly on one or more other actions being taken. While this plan does not prescribe a way to sequence actions or specify details of how coordination and collaboration ought to occur among sectors, the courses of action comprising this plan were developed bearing in mind cross-sector interdependencies. The plan highlights actions for Puerto Rico to:

- **Start with a strong foundation:** This section of the plan describes the actions that affect or feed into all systems and other recovery actions
- **Build community resilience, modernize infrastructure, and restore the environment:** This section begins with a description of the critical capital investments needed to rebuild and strengthen lifeline systems – those systems all other systems depend on. This section concludes with a description of the remaining critical capital investments needed for economic growth
- **Focus on the future:** This section describes a suite of future-focused strategic initiatives that capitalize on a unique asset or strength in Puerto Rico (e.g., oceans, tourism) or to close a gap that could hinder Puerto Rico’s economic development or resilience to future disasters.

Interdependencies among critical infrastructure systems





Pueblo
SANO

OPEN

This owner of a restaurant is back in business after Hurricane Maria.
GDA via AP Images

START WITH A STRONG FOUNDATION

The skills, tenacity, trust, and interconnectedness of Puerto Ricans will form the cornerstone of recovery. Empowering individuals and local organizations to participate in the recovery process is thus critical to long-term, sustainable, social and economic growth. Social and organizational networks and partnerships need to be supported and strengthened to ensure that communities are well prepared in advance of the next disaster. Supporting recovery efforts that are informed by cross-sector thinking and diverse stakeholder perspectives will help to ensure that rebuilding is context-sensitive and robust to a range of concerns. Effective governance is needed to ensure scarce public resources are invested wisely and reach those who need them most. Recovery efforts need to promote consistent and equitable access to high quality economic, social, and health services. In addition, strengthening local government capacity in day-to-day service provision as well as during disasters will strengthen the Government of Puerto Rico's capacity to respond and recover Island-wide. A trained and capable, resilience-oriented workforce needs to be developed to support recovery in both the public and private sectors. At the same time, improving the integration and availability of information and data will allow for timely and informed decisionmaking about immediate and longer-term resource allocation.

Consistent with these elements of community resilience, the Government of Puerto Rico has identified several specific actions that are critical to the success of its vision and should be prioritized for investment. These actions are precursors—actions that should come first because they provide critical support to ensure the success for all of the priorities discussed later in the plan. These precursors are discussed in detail below.

PRECURSORS TO PUERTO RICO'S RECOVERY

Build government capacity to handle day-to-day business and recovery efforts

Puerto Rico will need to build government capacity to coordinate sector-based plans for infrastructure systems and capital improvement projects (CPCB 11). Coordinated planning of recovery investments (especially those related to infrastructure systems) enables hazard risk to be examined and addressed across sectors and at a neighborhood, municipal, and/or multijurisdictional scale. Such planning will also be critical to reduce fragmentation in the delivery of federal resources (over time and across programs), increase return on investment, and reduce future losses. Enabling this with teams of experienced planners who ensure investment collaboration and coordinate input from all sectors will facilitate infrastructure planning and transparency, and will help integrate sectors needs during development and implementation.

Recovery plan implementation would be further improved if government services are planned more efficiently and delivered more cost-effectively. As municipal budgets decline from falling tax receipts, outmigration, and declining state subsidies, municipalities will need to find efficiencies in their operating budgets to continue delivering basic services. A small number of municipalities have created consortiums to explore sharing services, with limited success. A transparent, finite decisionmaking process will be required to engage the Government of Puerto Rico, the 78 municipal governments, citizens, and other stakeholders and culminate in adopting and funding a regional service delivery and planning model (MUN 7). This action is administrative, and while it will require some time to change an activity, it is not costed for the purposes of a recovery budget.

LOCATING COURSES OF ACTION ASSOCIATED WITH SPECIFIC PORTFOLIOS

Some specific courses of action are highlighted in the following chapters. In such cases, the course of action identifier is included in parentheses. All courses of action identified for the precursors to recovery, capital investments, and strategic initiatives are located, by respective portfolio, at the end of this document (see Detailed Actions).



PREPARING FOR AN UNCERTAIN FUTURE

As Puerto Rico moves forward, some aspects of the recovery will be influenced by conditions that are beyond the control of local decisionmakers. These factors may shape not only the need for certain actions (e.g., preparing for an aging population) but also whether actions taken today will be successful in the long term (e.g., is new water distribution infrastructure sufficient to meet future demand?).

Governance: Future changes to the institutions, laws, and policies that now govern Puerto Rico would shape its ability to recover and would influence the outcomes of the best-laid plans. For example, if the U.S. Congress were to alter the Jones Act governing U.S. maritime commerce, it could have significant positive implications for the local economy.

Climate and extreme weather: Puerto Rico is vulnerable to climate-related stressors (e.g., rising temperatures, changing precipitation patterns, sea-level rise) and extreme weather and its effects (e.g., hurricanes, storm surge, landslides, and erosion). But predictions about future trends are uncertain. Will storms continue to grow in intensity as they have for 20 years? Will sea levels rise an inch every 15 years, as the EPA predicts? Investing in efforts to mitigate these risks hinges heavily on assumptions about what the risks will be.

Economic conditions: Puerto Rico's ability to recover depends on both global economic conditions (e.g., economic growth and international trade patterns) and local conditions (e.g., growth patterns in different economic sectors and policies that improve the ease of doing business)—all of which are uncertain in the long term. For example, the tourism industry is sensitive to employment and interest rates, which affect people's ability to visit or invest in Puerto Rico.

Population and demographics: Puerto Rico has seen significant numbers of people move away since the hurricanes, and the *New Fiscal Plan* projects the decline will continue at an annual rate of 0.5 percent to 1.2 percent between 2019 and 2023. However, the long-term population and its makeup are deeply uncertain, and many recovery initiatives hinge on right-sizing infrastructure and systems to better match the population. For instance, the number and location of schools will depend on how many and where students live in Puerto Rico. To ensure delivery of health and mental services to those in need, health clinics or telehealth options will be needed to improve access to individuals across the Island. Similarly, investments in water distribution infrastructure must be tailored to the demand.

Technology: Technological advancements in any field can create the space for new approaches to address a need or can change the effectiveness of existing resources or chosen paths forward. For instance, the use of web-enabled ride-sharing services may change demand for traditional transit options, or new battery storage technologies may create opportunities for using solar or wind to make and store energy in close proximity to where it will be used and make investments in more conventional methods less desirable.

Collecting and making available high-quality data and information can reduce uncertainty for investors and the public at large and lead to more informed decisionmaking by government and local leaders.

Make high-quality data available to support better decisionmaking

Collecting and making available high-quality data and information can reduce uncertainty for investors and the public at large and lead to more informed decisionmaking by government and local leaders (ECN 6). Such efforts will require

- maintaining transparent property records and tax rolls and enforcing property rights to ease transaction burdens in property markets
- presenting timely, audited financial reports
- improving the process of collecting and storing basic economic information, such as gross domestic product/gross national product and tourism satellite accounts (an economic measure of tourism)
- providing information about public-sector policies and programs to interested parties
- compiling and maintaining inventories of public buildings, and
- gaining a better understanding of how to facilitate system-wide infrastructure-related decisionmaking.

Broadly, the transparency and accessibility of government services will need to be increased, for example, by instituting e-government portals, 311 systems, and other technology-based systems (MUN 9). In addition, online platforms that track and publicly report key performance indicators for state and local services in a standardized format can help citizens monitor and evaluate change in Puerto Rico (MUN 18). Such systems will help government deliver services more efficiently, saving taxpayer dollars and improving service outcomes for citizens.

The number and size of grants received for rebuilding is likely to be much higher than Puerto Rico's grant management workforce has experienced historically. In addition to investing in technology, strengthening and expanding financial management personnel to ensure funds are managed efficiently and spent in accordance with regulations and accounting practices will be needed to reduce uncertainty and improve decisionmaking (CPCB 12).

Enhance local capacity to secure and manage recovery funds

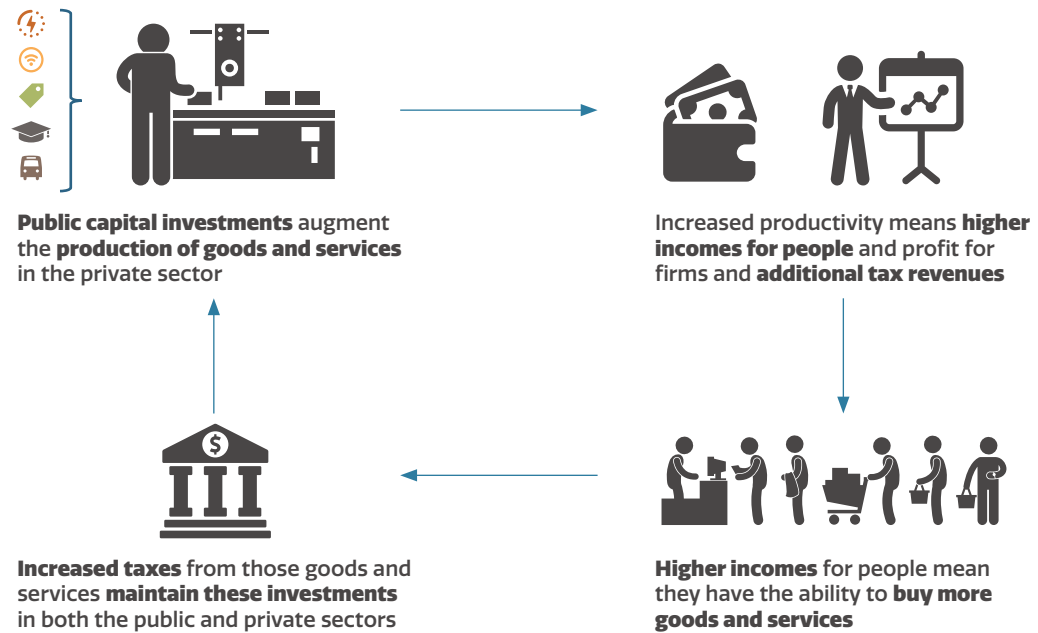
Training is needed to build local capacity to adequately apply for, secure, and manage recovery funds (MUN 16). Where local personnel lack expertise or experience, specialized labor may need to be imported. Sharing lessons learned from procurement experiences in prior recoveries (e.g., Hurricane Katrina, Hurricane Sandy) would also help to build local capacity to manage funds. Convening chief acquisition officers, contract officers, and other procurement experts from the contiguous United States (particularly Louisiana, New Jersey, and New York, which have experienced natural disasters and recovery efforts), along with officers and experts in Puerto Rico, would provide a forum for individuals with post-disaster experience to train Puerto Rican procurement officers, share best practices, advise on possible shortcomings, and provide recommendations (CPCB 13).

Maximize the impact of available federal funding

At the state level, the Government of Puerto Rico will need to set aside at least \$10 billion in unrestricted CDBG-DR funding to serve as a match for other federal grants to repair roads, public buildings, and other infrastructure (ECN 36). The success of projects funded with federal funds will be enhanced by fiscal responsibility initiatives, as documented in the fiscal plans, that strengthen the Government of Puerto Rico's revenue base (e.g., ECN 4), which can help Puerto Rico regain meaningful access to credit markets and decrease investor uncertainty. Transparency efforts are discussed further in the "Commitment to Transparency" section of the plan.

At the municipal level, many governments are in financial distress, leaving them unable to address expenses from emergencies. In addition, many individuals and private-sector entities lack disaster insurance. Starting smart at the municipal level means setting aside money (e.g., from tax revenues) for an emergency fund before the next disaster (MUN 1). This would allow each municipality to access financial resources for extraordinary expenses not immediately covered by day-to-day operating budgets and/or by insurance in the event of emergencies and natural disasters. Local management of emergency funds can increase the speed and effectiveness

Municipalities will need technical assistance to develop plans that are aligned with the overall economic development goals for Puerto Rico



of emergency response and recovery. Preparedness can be enhanced further by setting up a common coordinated process (led by the Puerto Rico Planning Board) that can be followed by all municipalities needing a resilient recovery and reconstruction plan (\$35-40 million upfront) (CPCB 9). Funds will also be needed to support local disaster recovery managers (\$11.2 million for 40 full-time managers) who can support municipal governments planning and implementing multiple recovery projects.

Support planning at the local level

Beyond establishing local control of emergency planning and funds, communities are more likely to work in an organized and efficient manner when they have determined a vision for economic development prior to a disaster. Having such a vision provides a post-disaster target to aim for and helps ensure that the vision is not overlooked due to immediate needs and the stress of an emergency. Municipal and regional economic plans will need to assess available local workforces, provide additional education and training where needed, and identify infrastructure needed to support industry locally (MUN 12).

FEMA Hazard Mitigation Grants may be available to support the need for more resilient infrastructure, and U.S. Small Business Administration programs may be available to support other local business needs. Workforce development programs may be funded by several federal agencies, including the U.S. Department of Labor, U.S. Department of Education, or U.S. Environmental Protection Agency; in addition, nongovernmental organizations and philanthropic donors may support a number of educational or workforce programs.

Increase the ease of doing business

As noted in a recent World Bank Group report (*World Bank Group, Doing Business 2018: Reforming to Create Jobs. Economy Profile: Puerto Rico [U.S.]*), financial and non-financial costs of doing business (i.e., transaction costs) are relatively high in Puerto Rico. In order for any capital investments to be put to best use, these costs should be lowered using policy levers related to permitting, taxation, occupational licensing, and other regulations that impede commerce, both internally and externally (ECN 1). Policy actions aimed at decreasing the costs of doing business are consistent with both the Governors proposed *New Fiscal Plan* and the *Certified Fiscal Plan* (certified by the FOMB). While the efficacy of any of these policies is likely dependent on the external economic environment, the effectiveness of any capital investment or strategic initiative will only be enhanced through actions that lower the cost of doing business in Puerto Rico. These efforts would likely build on steps Puerto Rico has already taken in this direction.

Lessons learned about how policies and trends have impacted economic recovery in other countries may also inform Puerto Rico's recovery (see box on page 61).

The U.S. federal government can also help to decrease costs, for example, by undertaking the following actions which would likely contribute to lowering the costs of doing business: a) full exemption of Puerto Rico from the provisions of the Jones Act (ECN 44) or a special exemption for certain Special Economic Zones, (e.g., Port of Ponce); and b) inclusion of Puerto Rico in the Stevens Amendment (ECN 45), which would allow foreign cargo and passenger aircraft to proceed to the continental U.S. following a stop in Puerto Rico. Title 49 Section 41703(e) of the U.S. Code allows foreign cargo aircraft that stop in Alaskan airports to proceed to other cargo airports within the U.S. This



Presidencia República Dominicana/Flickr

Policy actions aimed at decreasing the costs of doing business are consistent with both the Governor's proposed *New Fiscal Plan* and the *Certified Fiscal Plan*.

is not allowed for any other airports within the U.S. Since the passage of this “Stevens Amendment,” Alaska is now a major international air cargo hub serving flights in the Asia-North America routes. Adding “Puerto Rico” to the law will boost air cargo activity and create additional economic opportunities for the air industry in Puerto Rico. The inclusion of Puerto Rico in this exception should be paired with authorizations from the federal Department of Transportation to allow for cargo transfers; Alaska, the Mariana Islands, and Guam currently enjoy these benefits. This initiative should also work to reestablish the “transit-without-visa” program in Puerto Rico, with all the necessary security requirements and safeguards. This should make it easier for people to visit the Island. These policies would likely result in lower prices and increased economic growth, but would require action by Congress.

Reduce barriers to formal work and incentivize workforce training

Economic growth results from increasing the quality and quantity of factors that contribute to the production of goods and services (these factors include land, labor, capital, and entrepreneurship). Thus, any laws, policies, or regulations that artificially distort the labor market and raise labor costs could hamper growth. Training programs can help new or returning workers develop in-demand skills, lowering barriers to workforce (re)entry and reducing dependence on the public sector for income. Standing up a workforce development system in high-demand occupations across multiple sectors, especially for vulnerable populations, would increase the supply of available talent, increase income for the trained individuals, fill jobs, and improve efficiencies in the delivery of education and training (ECN 2).



Andrea Bajandas/FEMA

LESSONS LEARNED ABOUT ECONOMIC RECOVERY COULD INFORM PUERTO RICO'S RECOVERY

Republic of Georgia



After the chaos of the first post-Communist decade, Georgia embarked on a program of deregulation, privatization, and streamlining bureaucracy to fuel growth and reduce corruption, becoming one of the best performing economies during that period. Armed conflict with Russia in 2008 and the Great Recession temporarily slowed Georgia's economic growth and increased the public debt. Though Georgia has continued liberalization and technological reforms, as a small economy without valuable natural resources, it remains subject to the economic trends of its large neighbors and the global economy.

Republic of Ireland



Ireland experienced a dramatic shift in economic fortune from the 1980s to the 1990s because of increasing globalization and policies including investment in secondary education and low taxes for businesses, which attracted multinational corporations to locate in Ireland. The subsequent economic boom from 1995 to 2007 became known as the "Celtic Tiger." A pattern of poor land-use and financial regulation, leading to a housing and land speculation bubble and collapse in 2008, contributed to a deep decline in the Irish economy during the global financial crisis and the subsequent Great Recession. During the crisis, Ireland's government made commitments to cover their banks' debts through austerity measures consisting of reducing government spending and raising individual income taxes. A memorandum of understanding with the International Monetary Fund (IMF), European Union (EU), and European Central Bank (ECB) allowed Ireland to borrow 85 billion euros at low rates in return for taking steps to stabilize the economy and banking system while continuing to take responsibility for its debts. Finally, Ireland's economy began to recover, driven again by the information technology (IT) and finance sectors and multinational corporations.

Capital investments

Physical capital | Human capital | Natural capital



⊕ Transform the energy system



⊖ Rebuild and strengthen maritime, surface, and air transportation

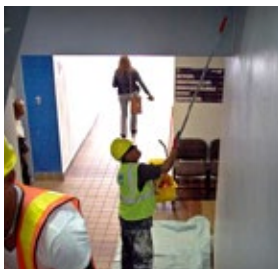


⊖ Rethink water systems



⊖ Modernize the telecommunications system

⊕ Repair, rebuild, and right-size public buildings inventory



⊖ Repair and rebuild resilient residential housing and commercial properties

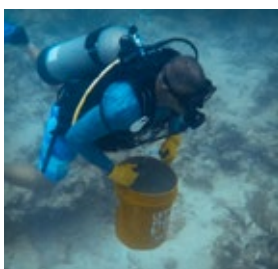





⊖ Transform the education system



⊖ Rebuild and enhance health and social services infrastructure and regional health networks

⊕ Restore, plan for, and develop the natural environment



- Physical capital 
- Human capital 
- Natural capital 

BUILD RESILIENT COMMUNITIES, MODERNIZE INFRASTRUCTURE, AND RESTORE THE NATURAL ENVIRONMENT

⊕ Nine objectives define these capital investments—in infrastructure, human, and natural capital—needed to help achieve the goals that are outlined in the plan. To build the strong infrastructure and systems that Puerto Rico needs to support an enduring economy and a thriving society, it will require approximately \$118 billion in capital investments over the 2018-2028 time period, of which some has already been provided by federal disaster relief, private insurance, private sector, and philanthropic sources.

This section begins by describing the capital investments needed to restore and strengthen the four lifeline systems: energy, telecommunication/IT,

water, and transportation. Then, needed capital investments in

housing and public buildings, health and education, and the

natural environment are described. Each objective is future

focused and includes a series of high-level steps to achieve

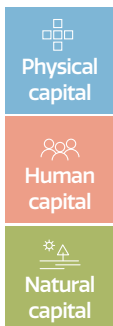
that priority. Given the breadth and scope of recovery, over

270 specific recovery actions were identified for the objectives

overall. A brief description of these more detailed actions, their

estimated costs, and possible funding sources and implementers

can be found at the end of this plan.



CAPITAL
INVESTMENTS

Solar panels being installed in Caguas.

FEMA/Yuisa Ríos



TRANSFORM THE ENERGY SYSTEM

THE FUTURE IN FOCUS

Customer-centric, affordable, reliable, and scalable electricity that incorporates more renewables, microgrids, and distributed energy resources and can drive new businesses and employment opportunities and support residents' well-being

Issues to Address

The complete failure of Puerto Rico's electricity grid was, and still is, emblematic of the magnitude and longevity of the disaster. One hundred percent of Puerto Rico was without power as a result of the hurricanes and, even nine months after Hurricane Maria, power has not been fully restored to all Puerto Ricans. Without power, many other systems failed and were unable to return to full service for weeks and even months—telecommunications/IT, water, and transportation, to name a few. However, Puerto Rico's electricity grid was vulnerable before the hurricane, and the disaster was, in fact, many years in the making. The Island's power system infrastructure—key portions of it traversing remote and mountainous terrain—was poorly maintained, aging, and prone to blackouts. Powered predominantly with imported fossil fuels (with renewables providing only 2 percent of the generation), electricity has been both expensive

and polluting. Many energy workers with the skills and institutional knowledge to help rebuild, improve, and maintain the system have, in recent years, retired or moved off the Island.

In addition, PREPA faces enormous challenges: more than \$11 billion in outstanding debt (as of FY17); declining revenue due in part to shrinking population and disappearing manufacturing industry; and strong indications of long-term neglect and mismanagement. A judicial debt restructuring process in 2017 spread responsibilities for the energy sector among at least nine federal and GPR agencies, producing a complex regulatory environment that has made strategic planning and investment difficult. As of June 21, 2018, the Government of Puerto Rico authorized the privatization of PREPA, including the sale of all generation assets and the long-term concession of the transmission and distribution system, thereby leveraging public-private partnerships to support managing and maintaining these assets, following the development of a 30-year plan.

Taking Action

Enacting a new vision for the energy sector is an opportunity to literally power the future of Puerto Rico. This effort will need to focus on customers first, financial viability “on both sides of the meter,” reliability and resilience, sustainability, and powering the economic engine of the Island. With coordinated planning and analysis, substantive input from all the stakeholders, and thoughtful stewardship of resources, Puerto Rico will be able to ensure that the lights stay on and that the Island can truly be open for business.

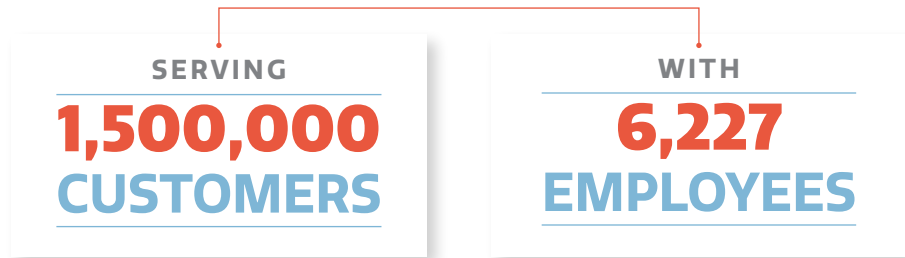
The bold and needed action of PREPA restructuring and privatization will be the platform for a once-in-a-generation opportunity. The Government of Puerto Rico is leveraging the knowledge of world-class technical experts and all key stakeholders to help inform a truly innovative and sustainable path forward. Below is a comprehensive overview of the many activities that can and must occur for this transformation. However, the exact pathway to be chosen among these activities can only be determined once the technical and economic tradeoffs between these courses of action are fully understood and the financial constraints are more clearly defined. Ongoing activities and analysis that will clarify the pathway and enable sound decisionmaking are well-underway and include, without limitation:

- Development of the 2018 PREPA Integrated Resource Plan (IRP) and other planning within PREPA
- Extensive modeling and analysis by U.S. Department of Energy National Laboratories, coordinated by U.S. DOE Headquarters and



**SEE THE FULL
PORTFOLIO**
of **energy system
strategies** and
**details about cost
and funding in
the last section of
this plan**

PREPA's workforce serves the majority of energy customers



shared with PREPA

- Supporting modeling and analysis undertaken to support the development of this plan, including development of sophisticated power grid models by experts at MIT/MIT-Lincoln Labs
- Modeling and analysis of future visions for the electricity grid by faculty at the University of Puerto Rico and their collaborators

The courses of action presented herein were collaboratively developed and have been extensively vetted with a broad range of stakeholders and published plans that include expertise from utilities, regulators, federal and state agencies, community and municipalities, nonprofits, and industry. Collectively, these actions describe what will be needed to transform Puerto Rico's energy sector. Exactly how, when, and at what level to execute these actions, including how to select among the many activities within them, will be decided in the months ahead through the collaboration constructs between federal and state agencies and external stakeholders that have been established on the Island post-Maria. The descriptions below are intended to provide an illustration of the complexity and range of choices that remain to be made.

Foundational requirements for the health of the energy sector

To improve the quality, reliability, and speed of recovery of electricity in Puerto Rico, the grid will need to be rebuilt and maintained to adhere to industry best practices—tailored to the unique conditions in Puerto Rico—and regulators will need to ensure timely and continual compliance and enforcement with established standards (ENR 1). Operations and maintenance will need to be performed routinely and based on periodic risk assessments, and the industry best practices established in the first course of action described can help inform and

implement a predictive maintenance effort (ENR 4).

Due to ongoing planning and potential privatization of PREPA, and to potential changes in the electricity sector's regulatory jurisdiction and asset ownership, the roles and responsibilities of Government of Puerto Rico agencies in the energy sector will need to be clarified. Associated with this effort is the degree of transparency, accountability, and interrelated lines of authority between regulators, energy system operators, legislators, and executive officers (ENR 26).

Achieving the vision for Puerto Rico's energy sector calls for a workforce with the ability to install, operate, and maintain an energy system for the future and keep the power on during emergencies. The workforce will need to be right-sized, new workers trained, and existing personnel retrained. A skilled workforce can drive energy system transformation, speed recovery from power loss events, and drive economic growth from a steady, reliable energy supply (ENR 18).

Improve, harden, and maintain electricity infrastructure

Grid assets will need to be hardened, especially when it comes to supporting critical infrastructure—water, communications, manufacturing, health services, and schools— and emergency response so that hospitals can care for the injured, first responders can dispatch 911 calls, and water pumps continue to work (ENR 5). Critical infrastructure also requires backup power solutions and detailed plans prior to any future bulk power system failures (ENR 17). Solutions for reliable power can also be established and deployed for individual consumers, such as those with electricity-dependent medical devices, in case of electricity failure (ENR 16).

Private standby and baseload generation that provide backup power can be enabled in both a regulatory and technical sense. New policies are needed to clarify that consumers have a responsibility to plan for a power outage of a reasonable duration, and these emergency backup systems will need to be inspected and maintained to ensure compliance. Technically, site-specific strategies include expanded availability and capability of existing and new generation to provide black start capabilities, relocation of existing electricity assets, and the adoption of cost-effective grid-scale batteries (ENR 15).

Infrastructure that supports the electricity grid such as control centers, communication systems, and collection systems will also need to be hardened to withstand future disasters. For example, PREPA's communication backbone suffered considerable damage from high winds, flooding, and other threats, thus preventing normal system operations/billing, and requiring expensive temporary solutions (ENR

3). Improvements in this supporting infrastructure will allow for the modern grid to implement technologies that provide real-time information and grid control to keep the power system operating and/or speed its recovery (ENR 11). Also dependent on improved communications infrastructure and to ensure rapid response to and recovery from an emergency, data, information technology (IT), and operational technology (OT) systems can be deployed to inform decisionmaking. This includes creating a robust data inventory of assets, acquiring communications systems to support inventory management, improving coordination stakeholders responsible for critical infrastructure, and bringing PREPA's IT and OT systems up to date to enhance their ability to rapidly identify threats, outages, and anomalies, and quickly provide data insight into repair progress (ENR 19).

Specific asset improvements will need to be made to reduce vulnerability to both flooding and high windspeeds. In some cases, these improvements can be complementary; in others, tradeoffs will need to be made based on the modeling and analyses currently being conducted about system design and asset improvements. As an example of the type of improvements that can be made, electrical assets that are vulnerable to flooding can be strengthened, elevated, moved, and made more resistant to damage—or decommissioned if the risks are too costly to mitigate (ENR 6). Similarly, assets that may not withstand high winds can be hardened or decommissioned. Some of these efforts (such as installing poles more resistant to damage) have already been implemented in the restoration process (ENR 7). Ancillary services that support the electric system and make it more resilient in outages will need to be improved (ENR 10).

Design, build, and maintain an electricity system with “islandable” portions of the grid

Major portions of Puerto Rico's electric grid may need to be completely rebuilt for the future. A smarter grid will integrate “islandable” portions of the grid that can balance generation and load to continue delivering localized electricity if the electric grid fails (ENR 2). Modeling efforts are currently being performed to determine the optimal design of a system architecture that incorporates technically feasible, resilient, and financially viable solutions. The inclusion of microgrids in the system has been decided and a microgrid rule has been established by the regulatory body of Puerto Rico. How these are optimally integrated in the future system requires collaboration and further conversation with many decisionmaking bodies in Puerto Rico.

Diversify energy sources to reduce reliance on imported fuel

Beyond the resilience efforts, Puerto Rico has the opportunity to be a global leader in new island energy—the production of energy through renewable yet physically strong assets that empower diverse industries across the

economy. Energy generation on islands is often challenging and costly, due to factors such as high-cost imported fuels and the inability to leverage the resilience and efficiency benefits of being connected to a larger grid. The goals for Puerto Rico's energy sector are to diversify its energy sources to be less dependent on pricey imports and establish energy policies, production, and public-private partnerships that can energize economic growth.

Determining the best path forward will require assessing the potential for all types of renewable energy (wind, solar, biomass, hydro, tidal, etc.), as each has its pros and cons; evaluating the possibility of revitalizing hydropower facilities across Puerto Rico, especially facilities with black start or islanding capabilities; and potentially promoting the development of prioritized siting of renewable energy (ENR 23). Ongoing analysis is needed to help inform the tradeoffs between these and other choices for the grid.

The power system will need to be designed and built to meet current and future projections for demand, including right-sizing and relocating assets as required (ENR 14). This right-sizing also includes locating new generation closer to demand and/or critical loads. Before new generation is built, decisions will need to be made about how best to integrate distributed generation assets across the whole system (ENR 22). A significant portion of the generation system must be rebuilt; however, some generation assets proved resilient and others were built while power was being restored. Maintenance for these assets may need to take priority over that of newly built facilities to mitigate the risk from future storms and to manage costs (ENR 8).

As long as fossil fuels remain a substantial fraction of generation capacity, the energy sector's ability to operate will depend on having a supply of these fuels and the ability to distribute it to power plants. Given the difficulty of both importing fuel and being able to transport it after the hurricanes, redesigning the fuel supply chain from port to end use is critical. To prepare for future disasters, storage facilities will need to be expanded and fuel stockpiled; the number of delivery trucks and trained personnel to drive them increased and strategically positioned to provide a ready response; and existing shipping ports expanded to accommodate periods of high demand. This approach hedges against spikes in fuel prices and allows emergency fuel to be distributed to geographically dispersed areas (ENR 9).

Enhance the emergency preparedness and response of the energy system

Electricity system improvements should be made in service of economic growth and managed and maintained through a framework of good governance. This effort is expected to create an initial plan that is reevaluated and updated on a regular schedule, and could include implementing

preparedness best practices such as updating mutual aid agreements, pre-positioning equipment, materials, and personnel, and streamlining the incident command system (ENR 21). Pre-positioning efforts are expected to include assessing the optimal level of material and workers needed for each portion of the grid (ENR 13).

The federal and state emergency response should be coordinated with the private sector to improve the response to outages, access to information, and the use of available resources (ENR 12).

To reduce the time and cost of energy restoration after an emergency, new investments could be made in maintenance and operations, standardization of components, relocation of transmission and distribution assets to improve access, stockpiling of rapidly deployable grid restoration assets, installation of additional assets to reduce failures, and redesign of some existing generation and substation units (ENR 20).

Enable economic growth in a stable governance structure

Economic growth is the context by which the system improvements are taken, and governance provides a framework by which the system is managed and maintained. To support economic growth, energy needs to become more affordable and prices more predictable. Toward this end, goals for the quantity and type of energy sources to be generated will need to be established, the costs and benefits of alternative generation resources evaluated, incentives for private investment assessed, and a workforce developed that can maintain the costly investments that will be made in generation (ENR 24).

The energy sector cannot deliver on the vision of providing a modern energy system that is affordable, reliable, renewable, scalable, and redundant without the appropriate regulatory policies in place that respond to the needs of customers. A suite of energy sector regulations will be required to align the needs, resources, monitoring, incentives, and feedback to deliver on this vision, contribute to economic growth, and facilitate the efficient achievement of energy-related strategic objectives in this plan (ENR 27).

To empower local decisionmakers, actions can be taken to increase the capacity for municipalities to make decisions concerning energy systems. Helping municipalities manage the decisionmaking and implementation process can help advance efforts to meet Puerto Rico's broader renewable energy goals (ENR 25).

A new radome under construction, after the previous radome was damaged by Hurricane Maria.

FEMA/Eduardo Martinez



Physical
capital

MODERNIZE THE TELECOMMUNICATIONS SYSTEM

THE FUTURE IN FOCUS

Fast, reliable and resilient residential, commercial, and emergency communications that drive Puerto Rico's economy, prosperity, and well-being

Issues to address

Puerto Rico's communications infrastructure has been in a fragile state for some time, creating challenges for both day-to-day operations and when disasters happen. For example, Puerto Rico largely lacks modern emergency communications systems, which has and will continue to put citizens at risk. During Hurricane Maria, police, fire, and emergency medical services lacked the ability to respond to 911 calls at a time when such responses were urgently needed. In addition, some wireless infrastructure (cellular towers) may have been overloaded with equipment and the remote mountainous

location of some cellular tower sites made regular maintenance a challenge. Additionally, the predominant part of Puerto Rico's telecommunications infrastructure, including cellular backhaul, has relied primarily on aerial fiber-optic cables. These conditions have made Puerto Rico's telecommunications infrastructure susceptible to damage from extreme weather and natural disasters, as happened during Hurricanes Irma and Maria. Potential damage to cellular telecommunications service is of particular concern in Puerto Rico, where over 80 percent of the population uses cellular phone or other wireless connection services to communicate.

While numerous actions have been taken and are underway to address near-term recovery needs and prepare for the current hurricane season, Puerto Rico will need to consider how best to transition its systems and processes to actions for mid- and long-term solutions. Government agencies and the private sector will have important roles in these actions' implementation and funding. To ensure effective modernization of the telecommunications and information systems, Puerto Rico would benefit from implementing actions using proven best practices, including those related to cyber and information security.

Taking action

Strengthen emergency communications systems to facilitate quick and effective disaster response

The ability to communicate is essential for effective and responsive emergency services and government functions in the aftermath of a disaster. Puerto Rico will need to develop a number of capabilities to secure this type of robust emergency communications system. One such need is a system of communications assets that can be safely stored when not needed and quickly deployed throughout the Island during an emergency to restore voice and data communications for disaster response, emergency services, and government functions (CIT 38). Different technologies including mesh radio and satellite networks are available to fulfill this function. This system must include portable power generation to ensure independent operations and remote deployment. Second, since the power grid was devastated during Hurricane Maria, building power redundancy and standardized power back-ups wherever practical will be required for public safety and government communications infrastructure (CIT 5). Third, Puerto Rico's two 911 centers need redundancy—that is, additional 911 centers outside San Juan—and need to have dispatch

capability (CIT 3). The prior lack of dispatch capability has meant that a 911 operator must use telephone lines to call a first responder (police, EMS or fire) operator who then dispatches via a separate system (typically radios) the needed first responders to the location of the initial caller. After the disaster hit, most of the telephone lines were not operational, meaning 911 operators often could not call first responder dispatch centers and many requests for emergency response received by the 911 centers were not able to reach the needed first responders. Fourth, locations must be established where the public can access the Internet and government information portals; municipal “hot spots” can be used for that purpose (CIT 19). Finally, easy access to information and situational awareness (e.g., via status.pr) will be important to ensure a speedy recovery process. For example, real-time information can help determine where to allocate resources during disaster response. Beyond supporting effective disaster communications, better communications infrastructure is critical to improving first responder operations more broadly. Currently, many emergency medical service (EMS) crews and their hospitals require two dispatchers to radio communicate with one another because EMS has its own Land Mobile Radio (LMR) system, while hospitals typically use the police LMR system and the two systems are not interoperable. Options being considered to solve this problem include integrating these LMR systems in the near-term using federal and cellular first responder networks when they become available or using one LMR system for voice traffic and another for data traffic (CIT 1).

Create and sustain a robust and resilient communications infrastructure, including widely available broadband Internet

Given the near catastrophic failure of communications assets during the hurricanes, creating and sustaining a robust and resilient communications infrastructure is also a top priority of the recovery effort. A key challenge will be to transition from aerial fiber-optic cables to fiber-optic cables in buried conduit, which will greatly increase the reliability and resilience of the communications network. To achieve this, the Government of Puerto Rico will need to consider how to incentivize private telecommunications providers—which own over 90 percent of the Island’s telecommunications infrastructure—to rebuild damaged networks using buried fiber-optic cable, and to use buried fiber-optic cable for new projects. One option that has been well received by telecommunications providers is a “conduits project” in which the Government of Puerto Rico owns both the trenches and conduits required for fiber-optic cables, and private providers install and own the cables that would be run through those conduits (CIT 21).



SEE THE FULL PORTFOLIO of communication/IT strategies and details about cost and funding in the last section of this plan

One benefit of this approach is that it incentivizes telecommunications providers to bury fiber-optic cable, since the cost in time and money for them to do so would be significantly reduced. Another benefit is that it incentivizes the deployment of broadband infrastructure throughout Puerto Rico by greatly reducing the investments required by the private companies.

Another opportunity is to engage with the Federal Communications Commission (FCC), which has programs that encourage private companies to provide telecommunications and internet services to schools, hospitals and libraries, especially in rural or disadvantaged areas. In particular, the FCC's E-Rate program offers funding, on a sliding scale of financial support, to support providing telecommunication services to health clinics and schools and libraries. Access to this funding, supplemented by funding from other federal programs, such as the USDA's Rural Broadband Program and the Broadband Infrastructure Grants and Community Development Block Grants offered by HUD, would help expand broadband service to all 78 municipalities (CIT 22).

A high-profile panel of nationally recognized subject matter experts, industry leaders, and senior government officials charged with developing a comprehensive broadband deployment plan (CIT 25) will be needed to ensure the swift and effective rollout of the efforts described above. This panel could oversee the establishment of government-sponsored municipal wi-fi hotspots, as well as the use of federal programs to support the provision of telecommunications and internet services to schools, libraries, and health clinics. This group is expected to play a key role in obtaining political and industry support for the deployment plan, as well as full support from critical agencies such as the FCC and HUD.

Telecommunications system resilience will also need to focus on undersea cables. Currently, undersea cables, which form the primary method of communications to and from Puerto Rico, converge in the northeastern area of the main island, presenting a singular point of failure for high capacity communication. Efforts to address this will need to include the introduction of new undersea cable(s) and disaster-hardened landing sites that are located away from San Juan (e.g., in the SW as opposed to the NE of the Island) (CIT 10). Upgrades to existing terrestrial infrastructure for undersea cable communications will be required to address known physical threats (e.g. flooding and loss of power), which have negative, multi-sector impacts on disaster-related response and recovery efforts. An effective strategy should consider updating the undersea network infrastructure to incorporate a communications ring system linking presently unconnected

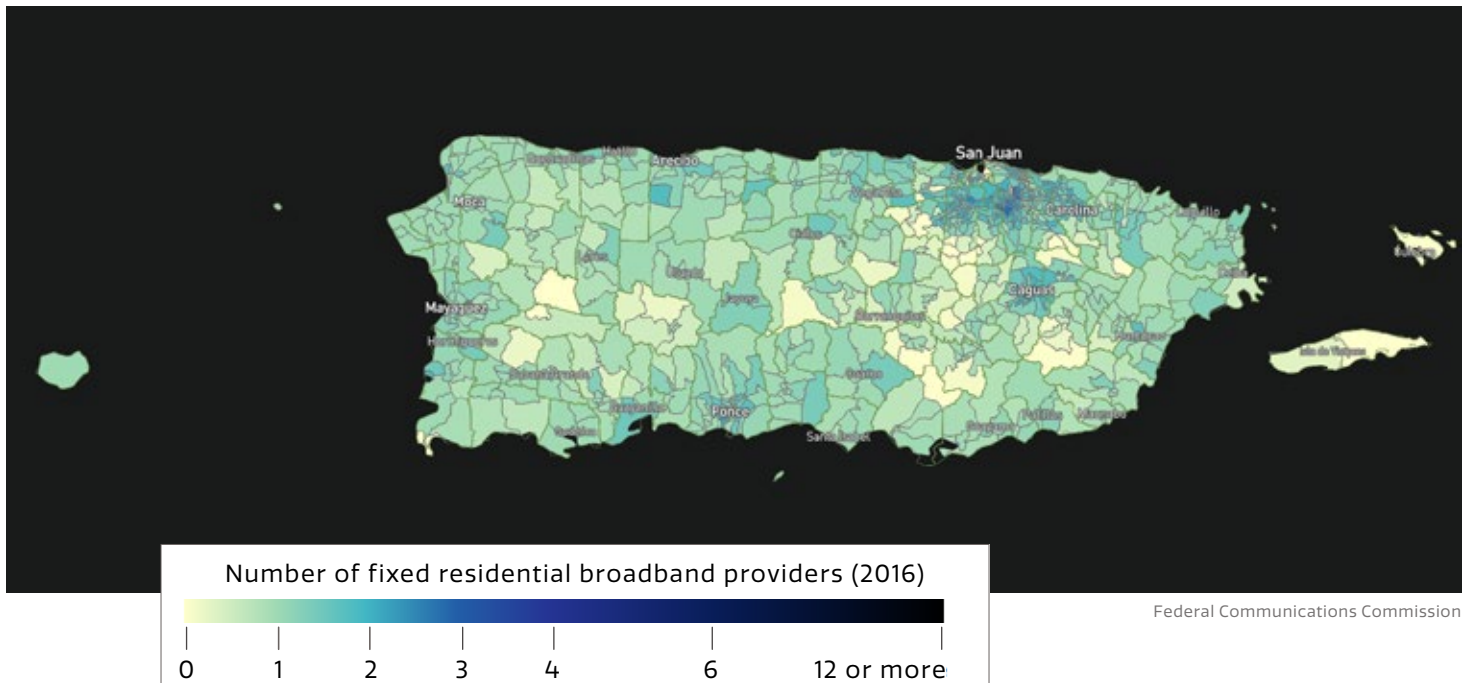
regions around the Island (CIT 15). The ring system will add to and improve the availability of communication route options both within Puerto Rico and into or out of Puerto Rico to points globally in the event of natural disasters. Similarly, the increased communications capacity available with new cables may improve the performance of the network during such events. When viewed both on their own and with a cross-sector lens, these improvements will be critical for Puerto Rico's vision of economic growth and resilience.

Establish governance structures to support and monitor changing infrastructure

Effective communications governance can play an important role in ensuring modernization is done efficiently and effectively and leads to transformative outcomes. An important step to ensuring sound communications governance will be to establish a Puerto Rico Communications Steering Committee that brings together all the relevant stakeholders to implement the vision of a modern telecommunications system (CIT 24). This committee will need leadership support, discrete goals and objectives, and appropriate authorities and resources to succeed where past efforts have not. A feasible government-wide digital transformation strategy—with clear priorities, needs, costs—is also critical to improve communications governance (CIT 16). Without such a strategy, valuable time and resources may be invested in activities that do not transform and modernize communications. In addition, a new Tier III or Tier IV, cloud-enabled data center for state-level information systems will expand the Government of Puerto Rico's ability to perform essential functions and deliver essential services efficiently—using government-owned, highly available, scalable, and evolvable infrastructure (CIT 17). Expand the scope of the Puerto Rico Innovation and Technology Service (PRITS) to include a focus on citizen-centered services and prioritize a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion (CIT 34). Best practices will also be needed for ensuring digital inclusion and accessibility, such as the ability to access government services from mobile devices.

Efforts to improve governance will also need to include creating a database of critical infrastructure (government and private sector) using an open, modular and standards-based approach for information exchange and storage (CIT 18, CIT 37). Plans include a focus on continued maintenance and expansion of status.pr, a website platform launched in the wake of Hurricane Maria, that uses personal outreach and crowdsourcing to update the media, public, and first responders about conditions across Puerto Rico (CIT 36). PRITS, in coordination

Many parts of Puerto Rico have no broadband provider



with COR3, is expected to oversee this effort, building on its ongoing efforts to digitize government data, form data sharing partnerships, and utilize “smart” devices such as Internet of Things sensors. Status.pr will provide data updates for ongoing government functions as well as critical information during disasters.

Streamlining the permitting and rights of way processes for the installation of fiber-optic cable and the construction of cell towers will be needed to increase efficiency of recovery efforts and get government “out of the way of the private sector” (CIT 13). Methods that encourage the coordination of trenching by state agencies and the private telecommunications sector, for example, the “conduits project” mentioned above, are a key component of these efforts.

Secure digital identity could be a key component to digital transformation—facilitating financial transactions, contracts, and government services. It can also increase accuracy and reduce costs associated with validation and access to government services, especially in disaster recovery, when paper records can be inaccessible. An assessment of secure digital identity including its reliance on resilient power and communications will be needed to help identify opportunities and challenges from existing models to determine how Puerto Rico might best leverage digital identity (CIT 27).

Take advantage of improved access to broadband services and information technology for the betterment of Puerto Rico

The Internet is one of the most important aspects of communications infrastructure in society today. Puerto Rico has the opportunity to transform its future by taking advantage of improved access to broadband services and by utilizing information technology to improve the health, well-being, and education of the people, as well as spur economic growth. Widely available and affordable broadband can reduce the “digital divide” between the more affluent and more disadvantaged segments of Puerto Rico’s population. Furthermore, by leveraging information technology services enabled by wider access to broadband, the Government of Puerto Rico can help facilitate a digital transformation that reforms how government serves its citizens and prepares Puerto Rico to successfully compete in an evolving, connected digital world.

Following the example of successful models in Detroit and New York, a “Digital Stewards” program is planned to train residents to install and service wi-fi hotspots in public housing (CIT 26). Participants of the program learn valuable skills, build employment experience, and act as community liaisons for Internet connectivity and maintenance of hotspots in their communities. And the resulting government-sponsored wi-fi access provides a way to decrease the “digital divide” many disadvantaged communities face. Another planned effort to increase skills and improve outreach will be a public-private initiative focused on providing digital skills training, entrepreneurship programs, and access to new technologies for people throughout Puerto Rico (CIT 28). The initiative will operate through a network of innovation hubs and entrepreneur centers, training partnerships with schools, and outreach via mobile labs to rural and underserved areas.

Given its location within the hurricane band of the Caribbean, Puerto Rico is also well placed to incubate a resilience technology industry to test resilient systems and construction processes that can withstand natural disasters. In this regard, a new Resiliency Innovation Network across Puerto Rico is expected to build on existing Puerto Rico Science, Technology, and Research Trust (PRSTRT) and university facilities to teach, test, and refine existing resilience products and services, and develop new ones to enhance capability and stimulate new commercial ventures (CIT 30). For example, PRSTRT resources such as entrepreneurial programs and existing corporate ties could be leveraged to encourage established companies to collaborate and

DIGITAL STEWARDS PROGRAM CASE STUDY: RED HOOK, NEW YORK

The Digital Stewards program, which began in Detroit, was implemented in Red Hook, New York, by the Red Hook Initiative following Hurricane Sandy in 2012. As the lead for the Digital Stewards program, RHI became a community hub of disaster response, providing a gathering place for residents to charge phones, fill out FEMA forms, and check in with family members. RHI helped to organize volunteers, post updates on social media, and increased the reach of its mesh wi-fi to serve more than 1,000 people per day. This wi-fi program’s contribution after Sandy was recognized at a White House-hosted FEMA roundtable on emergency response best practices.

In 2017, 92 percent of RHI Digital Stewards agreed or strongly agreed that the program helped them “learn skills that allow them to succeed in the workplace and to make a difference in their neighborhood.” Seventy-seven percent remained employed or were actively pursuing further education within six months of completing the program.

invest in resilience innovations; existing government ties to PRIDCO could be leveraged for tax incentives and business credits; and the Technology Transfer Office could be utilized to provide intellectual property protection and negotiate licensing agreements.

A planned e-Construction Learning Lab pilot project will focus on digitizing hurricane damage assessment, permitting, and reporting processes in one Puerto Rican municipality (CIT 31). Findings from this project will feed into a feasibility and cost-benefit analysis for an e-Permitting and e-Construction ecosystem across Puerto Rico. The use of electronic tools and information systems is expected to deliver greater process efficiency, cost-savings, flexibility, and independence from paper-based methods, while increasing transparency.

By addressing issues of connectivity, human capital and digital skills, public use of the Internet for a wide range of tasks, integration of digital technologies into business practices, and digital public services, such actions have the potential to transform Puerto Rico into a digital society that stands as a role model in the western hemisphere and world.

Water pipes and bridge foundations are constructed to replace a hurricane-damaged bridge in Mayaguez.

FEMA/Michael Medina-Latorre



RETHINK WATER SYSTEMS

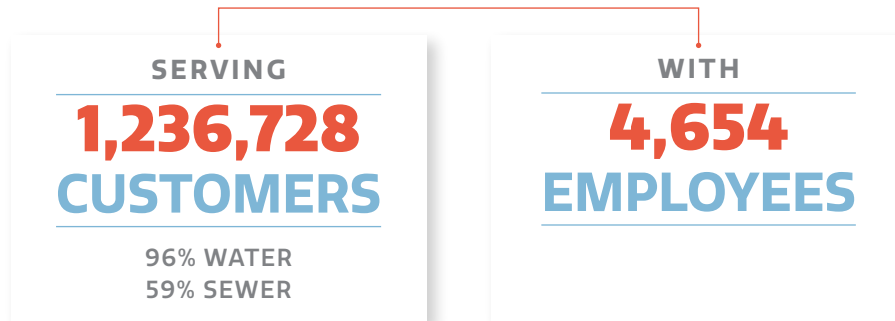
THE FUTURE IN FOCUS

Safe and reliable water systems that are protected from future disasters to ensure the well-being of Puerto Ricans and the operations of government and businesses

Issues to address

Flooding, loss of electricity, landslides and debris that resulted from the hurricanes damaged and disrupted service for nearly every element of Puerto Rico's water system—from drinking water, to wastewater and stormwater systems, to dams, levees and channels. The hurricanes also exacerbated long-standing challenges. Water infrastructure has degraded due to financial constraints that have limited maintenance and investment by operators, particularly PRASA, which supplies 96 percent of drinking water and 59 percent of wastewater service in Puerto Rico, and by municipalities, which manage the majority of Puerto Rico's stormwater systems. In addition, water sources have degraded due to wastewater, stormwater, and industrial and agricultural contamination. Many of these issues are even more severe in rural or disadvantaged areas, which rely on small,

PRASA's workforce serves the majority of water and wastewater customers



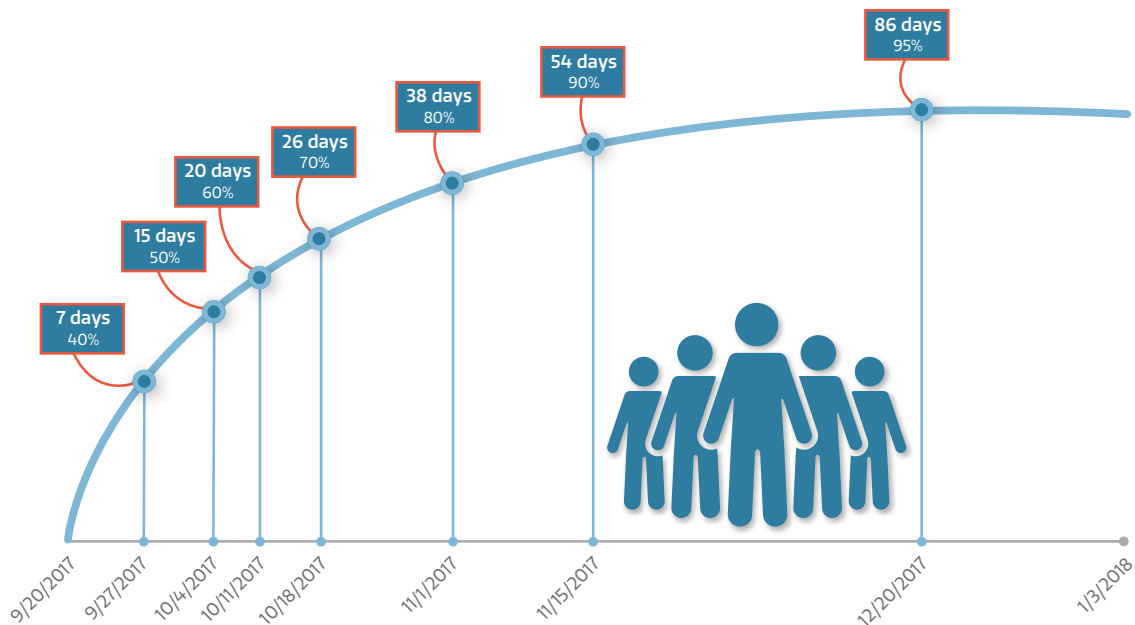
community water systems, private wastewater systems, individual wells, and septic tanks. Further, water sources in rural areas are often improperly protected from contamination, which compromises drinking water quality and safety.

Contributing to these challenges is the limited availability of certified operators and maintenance crews, monitoring and enforcement officials, and general emergency preparedness. And, as with many of Puerto Rico's utilities, financial sustainability has been a daunting problem for PRASA, non-PRASA systems, and stormwater system operators. For PRASA, lost revenue due to leakage, malfunctioning or incomplete metering, illegal connections to the water system, and delinquency rates have exacerbated financial challenges. Finally, flood control infrastructure has experienced high rates of sedimentation, which limits flood protection capacity, and many flood control assets have been undermaintained and were designed to outdated standards. More broadly, water infrastructure and water management in Puerto Rico were not designed with resilience in mind, yet more frequent and intense precipitation events, droughts, and other stressors continue to test water systems across Puerto Rico.

Taking action

Looking ahead, the Government of Puerto Rico has an opportunity to redesign its water systems to be more reliable, safer, and more resilient in the face of future disasters, climate and population-related stressors, and extreme weather. In the short term, PRASA, municipalities, DNER, and the managers of other water systems will need the liquidity and financial management capabilities, as well as the workforce, to handle the potentially large influx of capital as

Restoring PRASA services required months of repairs



they finance repairs and improvements. In the long term, addressing legacy contamination, bolstering enforcement, and ensuring systems are properly designed, monitored, protected, and maintained will help Puerto Rico’s water systems become more efficient and fiscally sustainable. The Government of Puerto Rico intends to develop a professional workforce to help ensure that maintenance and operations are better managed, and that service is safe, reliable, and equitable. Rebuilding and redesigning infrastructure to be more resilient, and improving planning, processes, and mitigation measures can also help to address climate-related consequences.

Diversify energy sources, enhance emergency protocols, and harden water infrastructure to keep services flowing during disasters

To keep essential water facilities and assets up and running in emergencies, PRASA and non-PRASA systems aim to devise ways to diversify energy sources and use more off-grid renewable energy and storage as permanent power sources. For PRASA, this could include installing distributed solar power generation and battery storage, increasing the use of hydropower by optimizing PREPA hydro facilities, maintaining a reserve inventory of solar panels, using biosolids as an energy source, using modular reactors, and developing

resilient microgrids (WTR 3). PRASA also intends to reduce its use of electricity through demand management strategies (WTR 3), and non-PRASA systems propose to increase off-grid renewable energy, upgrade electrical systems, and right-size and stockpile backup generators (WTR 32).

PRASA plans to implement new emergency management protocols to improve its capacity to deliver resilient services to hospitals, schools, and other critical customers during emergencies (WTR 30). In the long term, the agency intends to relocate assets that are in flood zones or redesign them to meet the latest standards to help keep them operating when extreme storms occur (WTR 20). This may include priority assets such as the Dorado Wastewater Treatment Plant.

Improve fiscal planning and asset management to enhance PRASA's sustainability and service

For PRASA to become financially sustainable, it intends to develop plans for divesting assets, reducing operating costs and customer delinquencies, enhancing revenue collection through public-private partnership, and exploring alternative pricing mechanisms (WTR 8). In addition, to cut down on the long-term life cycle costs of PRASA's assets, an asset needs assessment and asset management program is proposed for PRASA's drinking water and wastewater systems, with a particular emphasis on vulnerable assets and large diameter pipes (WTR 7).

Make PRASA's drinking water service more efficient and reliable

PRASA plans to repair or replace drinking water infrastructure to address both hurricane damage and pre-hurricane deficiencies in ways that enhance their resilience (WTR 1). It intends to make operations and distribution more efficient by increasing the use of customer metering, operational sensors, data, and tools for real-time monitoring and situational awareness; upgrading operational control systems; and enhancing the use of optimization methods to improve quantity and quality of service (WTR 2). To more easily transfer potable water among service zones, PRASA aims to improve the interconnections between them (WTR 4). Finally, the agency proposes to upgrade water treatment plants in vulnerable service zones by improving water treatment and storage capacity to handle high turbidity—cloudiness that is a key measurement of water quality—caused by heavy rains (WTR 5).

Build PRASA's wastewater systems for the future, and educate residents to help keep them clean

PRASA intends to repair, replace, or improve wastewater treatment plants and sanitary sewer collection systems to maintain regulatory standards in a manner that anticipates future capacity needs and follows industry best practices (WTR 11). To keep wastewater systems flowing, the agency aims to educate Puerto Ricans about the proper disposal of fats, oil, and grease, and other damaging, unauthorized releases into sanitary sewers (WTR 10). PRASA proposes to cut the disposal cost of sludge and other treatment byproducts by reusing them, including selling them for use in the agricultural, industrial, or energy sectors (WTR 13).

Improve safety and reliability of non-PRASA drinking water and wastewater systems

To improve the reliability and safety of non-PRASA drinking water systems, operators plan to repair or replace existing assets that are damaged or degraded, improve treatment and monitoring, and expand contingency plans to include future demand, climate-related effects, and emergencies (WTR 15). In remote areas with even smaller unregulated drinking water systems, operators aim to develop equitable and resilient solutions by better coordinating NGO and municipal efforts to support the provision of safe drinking water in these areas (WTR 14). To prevent exposure to raw sewage and contamination of drinking water sources, these operators propose working with a range of partners to develop an institution that builds technical capacity and collaboration among practitioners and to implement septic tank design standards and best maintenance practices (WTR 17). To build self-sufficiency and capacity, non-PRASA systems propose to improve communication among themselves and conduct outreach to communities, including expanding a “circuit rider” program that provides technical assistance, education, and training (WTR 16). Given that PRASA already provides the vast majority of Puerto Rico’s drinking water, it is expected to explore opportunities for expanding service into unconnected areas (WTR 34).

Develop water supply sources that are sustainable and safeguarded from contamination

To ensure that Puerto Rico has a water supply far into the future, PRASA intends to work with the EQB and EPA to strengthen the redundancy and diversification of drinking water sources, including the use of groundwater, greywater and water reuse (WTR 29). Publicizing measures to protect potable water, enforce land use



SEE THE FULL PORTFOLIO
of **water sector strategies** and details about cost and funding in the last section of this plan

restrictions, and remediate contaminated areas can help to protect drinking water sources from residential, agricultural, and industrial waste (WTR 28). Plans also call for groundwater systems to be rehabilitated and protected from saltwater intrusion, contamination, and over-extraction (WTR 27).

Improve stormwater systems to reduce urban flooding and contaminated runoff

Improving stormwater infrastructure design standards; retrofitting assets to catch, reserve, and filter stormwater runoff; enhancing stormwater permitting processes and land use regulations to implement green infrastructure; right-sizing system capacity, including conveyances and pumping stations; and implementing public outreach and education programs can reduce urban nuisance flooding, curb erosion and sedimentation, and mitigate the discharge of contaminated stormwater runoff into surface water bodies (WTR 19).

To better manage stormwater systems, operators propose investments in stormwater system cleaning, monitoring, maintenance, and assessment, including comprehensive and routine asset mapping, assessing system capacity and condition, removing debris and blockages, and repairing damaged infrastructure and assets (WTR 18). Other plans include centralizing stormwater system support and management at the state level; support for this action includes building a workforce of stormwater practitioners, streamlining permitting processes, and enhancing technical capacity, community outreach, and best management practices (WTR 21).

Make flood control infrastructure and management more resilient to current and future events

To upgrade flood control protection, the owners of these assets plan to evaluate, repair, and improve the performance and resilience of dams, levees, channels, and water control structures. In addition, they intend to analyze the tradeoffs of existing and proposed levees and channels with natural infrastructure alternatives; implement comprehensive monitoring and maintenance programs; and consider the influence of increased flooding from extreme weather (WTR 23). To reduce dredging and ensure the performance of flood control systems, PRASA, PREPA, and private entities intend to implement and enforce sediment control plans and sediment reduction measures (e.g., sluicing, sediment traps, etc.) (WTR 24).

In terms of governance, PRASA plans to lead an effort to consolidate and streamline the ownership and management of dams and other flood control infrastructure, where appropriate (WTR 25). PRASA,

PREPA, and DNER also intend to upgrade reservoir management rules to improve the balance among current water management objectives, including drinking water supply, flood control and hydroelectric generation, and implement dam safety programs (WTR 22).

Use outreach to improve conservation and emergency preparedness, and engage the public in developing creative approaches and innovative projects

PRASA intends to enhance communication, education, and outreach to customers on conservation and emergency preparedness strategies as well as water and wastewater system planning, performance, and investments to foster strong relationships and garner trust (WTR 31). The agency also aims to engage the public in a “Rebuild by Design” competition with disaster relief block grant funding from HUD to spur innovative resilience projects that are collaboratively developed by community members, civic leaders, and nationally recognized design and engineering firms (WTR 33). Just as this effort stimulated creative resilience strategies in the aftermath of Hurricane Sandy, a similar effort would develop innovative solutions to enhance resilience and address vulnerabilities exposed by Hurricanes Irma and Maria.

Workers onboard a
freighter in San Juan.

FEMA



REBUILD AND STRENGTHEN MARITIME, SURFACE, AND AIR TRANSPORTATION

THE FUTURE IN FOCUS

A flexible and reliable transportation system that moves people and goods to ensure economic continuity and facilitate disaster response

Issues to address

Though Puerto Rico has numerous small ports and airports, the Port of San Juan and San Juan Luis Muñoz Marín International Airport receive the vast majority of shipments and air traffic. Both suffered significant damage from the hurricanes, and in the immediate aftermath, faced obstacles such as power outages and bottlenecks due to the competing needs of daily operations and the emergency response. As was the case with the energy sector, pre-hurricane conditions for transportation were poor. PRPA struggles to maintain and improve its airports and seaports due to deteriorating finances, in addition, multiple port facility owners and operators contribute to a lack of coordination among ports. Similarly, finances are challenging for PRHTA, which funds and oversees major road and bridge projects. Major roads were in fair condition before the hurricanes, but about half of Puerto Rico's bridges were structurally deficient or functionally obsolete—an issue that hurricane damage compounded. While Puerto Ricans are heavily

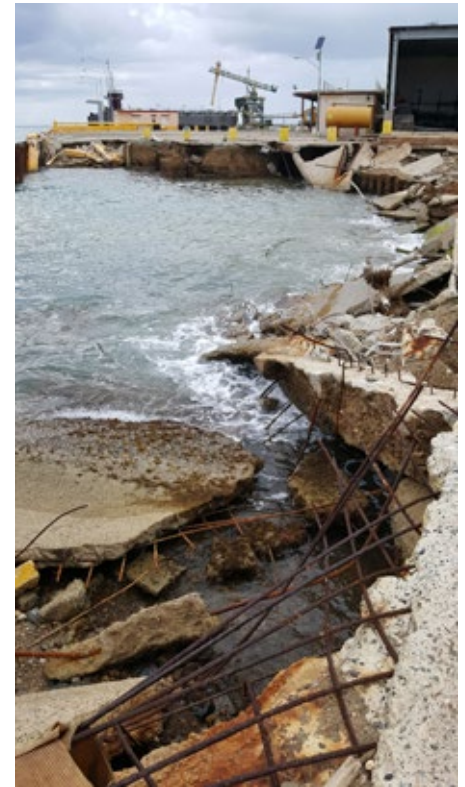
dependent on their vehicles, public transportation is generally considered inadequate, and ridership has been declining over the past decade.

Taking action

The transportation sector plays an important role in any economy—whether for shipping and receiving goods or getting residents to work, school, appointments, and events. To better serve all these purposes, the Government of Puerto Rico intends to seize this chance to develop a more robust multi-modal (surface, maritime, and air) transportation sector that is well-maintained, safe, efficient, and resilient to future disasters.

Upgrade ports and consolidate ownership to improve emergency response and attract new maritime business

Port authorities and private operators intend to repair damage to ports and ferry terminals so they are at their full pre-hurricane capacity (TXN 17) and make upgrades that enhance their resilience to storms and sea-level rise (TXN 25). To ensure that backup capacity exists if the Port of San Juan is damaged, PRPA and other port operators plan to further develop an existing seaport to provide redundant capacity through the use of public-private partnerships (TXN 10). Reevaluating the Maritime Transportation System Recovery Plan could also help the ports take advantage of lessons learned during the hurricane response, such as pre-positioning reserve capacities and assets to better respond to an emergency, establishing an integrated operations center, developing a communications protocol for first responders during a disaster, and implementing pre-hurricane protection measures in an integrated fashion to protect critical resources (TXN 13).



Damage at the port in Mayaguez

HSOAC

San Juan Tourism Ports



PIER 1

In-transit cruise ships and limited passenger capacity turnaround port. Also used by the military.



PIER 2

Operated by Maritime Transportation Authority for local ferry service.

PIER 3

In-transit cruise ships. Royal Caribbean has preferential use.



PIER 4

In-transit cruise ships and turnaround port. Carnival and its subsidiaries have preferential use.



PANAMERICANOS I (EAST) & II (WEST) PIERS

In-transit cruise ships and turnaround port. Royal Caribbean and preferred use for subsidiaries.

NAVY FRONTIER

No turnaround port. In-transit only for mega yachts.

Photos by Sgt. Josue Rivera, Kenneth Wilsey, pyzata | Adobe Stock.

To better manage the maritime transportation system as a whole and make ports more attractive to maritime businesses and investors, maritime industry expert input indicates the need for consolidating ownership and oversight of the nine main ports (TXN 15). In addition to being a multi-purpose port, the Port of Ponce is proposed as a future regional transshipment hub for cargo traveling between South and North America, with shipping agencies incentivized to use it through reduced taxes or a government subsidy (TXN 14).

Prioritize repairs to roads and bridges, and extend three key highways

PRHTA intends to repair damaged roads and bridges and restore them to pre-hurricane functionality to ensure the mobility of people, goods, and service providers. This initiative replaces missing road signs and inoperable traffic signals, and repairs or replaces collapsed or weakened bridges (TXN 16). PRHTA aims to harden, re-engineer, or relocate infrastructure in high-risk areas to make them more resilient in future disasters, with a focus on the most cost-effective projects (TXN 2).

Under a new “fix it first” approach, PRHTA proposes to prioritize road maintenance and repair projects over new or expanded infrastructure. This approach improves roadway conditions and makes safety or operational improvements, and prioritizes projects based on their cost-effectiveness (TXN 5). Projects to extend PR-5 and PR-22, and complete PR-10 are included in this portfolio of surface transportation projects to improve mobility, safety, access, resilience, and emergency response and to complete Puerto Rico’s strategic highway network (TXN 21, TXN 22, and TXN 23).

To better manage transportation infrastructure, public agencies intend to develop infrastructure asset management programs to inventory their assets and track their condition to improve maintenance, repair, and rehabilitation (TXN 11). Related to this effort, PRHTA aims to review its standards on road design—to include more innovative standards on roadway marking, lighting, drainage, and signage and signals (including using solar to power them)—and better enforce them (TXN 1).

In addition, PHRTA aims to develop an Intelligent Transportation System so that transportation operations across Puerto Rico can provide real-time traveler information, divert traffic away from crashes, clear crashes more quickly, and reduce the possibility of other crashes after an initial incident (TXN 9).



**SEE THE FULL
PORTFOLIO**
of transportation
strategies and
details about cost
and funding in
the last section of
this plan

Develop new mobility options to supplement improvements to bus service

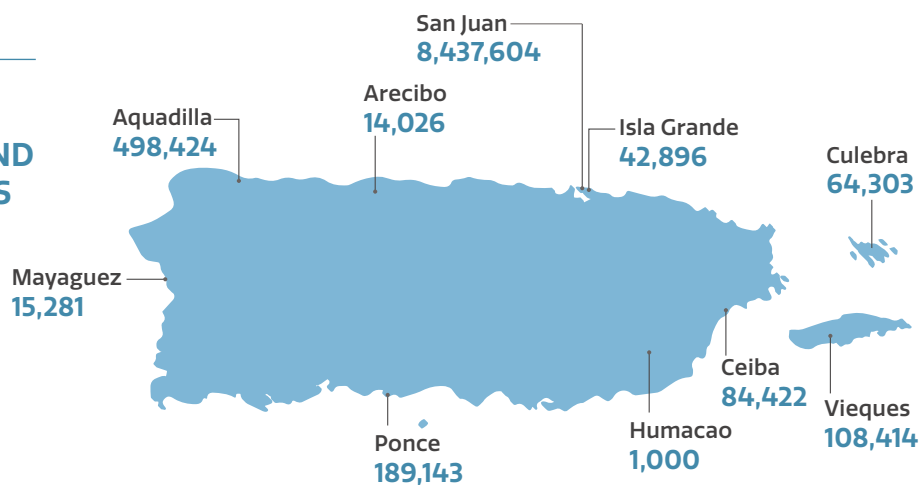
The Puerto Rico Metropolitan Bus Authority intends to make bus service more reliable through transit signal priority (which gives buses additional time to cross a signalized intersection) and dedicated bus lanes, as well as bus stops that provide real-time arrival information and use smart card fare media (TXN 8). To address the dearth of other mobility services, particularly outside of San Juan, plans call for developing additional options, such as ride-hailing/ride-sharing, expanded “publico” (jitney) service, inter-city bus service, bike/scooter-sharing, and peer-to-peer car-sharing (TXN 7). In addition, PRHTA proposes developing two new high-capacity transit services—likely bus rapid transit—to give travelers another way to reach the San Juan airport (TXN 19), which is served by just three bus routes, and to give the 130,000 residents of Caguas a public transit option to reach nearby San Juan (TXN 20).

Upgrade San Juan and Aguadilla airports to boost resilience and Porta del Sol tourism

To ensure that the San Juan airport can operate at full capacity for both normal operations and in an emergency, PRPA and airport operator Aerostar plan to repair remaining damage to the facilities (TXN 18), update the airport emergency plan to take advantage of lessons learned from the hurricanes, and further develop a coordinated disaster recovery plan for the various airports across Puerto Rico (TXN 24).

In addition, PRPA proposes to expand and upgrade Rafael Hernández Airport (BQN) in Aguadilla, including a new runway, taxiway, apron areas, terminals, and control tower, to increase Puerto Rico’s overall capacity for air traffic and to boost tourism in Porta del Sol, a region with beautiful beaches that are currently difficult to reach (TXN 12).

AIRPORTS 2017 TOTAL PASSENGER ARRIVALS AND DEPARTURES





Prayitno/Flickr

A home,
destroyed by
Hurricane Maria,
is rebuilt in
Maricao.

FEMA/Michael Medina-
Latorre



REPAIR AND REBUILD RESILIENT RESIDENTIAL HOUSING

THE FUTURE IN FOCUS

Safe, secure, and affordable residential housing to create a better built environment

Issues to address

Puerto Rico's housing sector was hit hard by the hurricanes: Approximately 90 percent of the Island's nearly 1.24 million households applied for immediate relief and housing assistance from FEMA, with 78 percent of these indicating damage to their structure or personal property. But the housing market was experiencing significant challenges long before the hurricanes. As residents have moved away, home values have plunged, dropping 18 percent in Puerto Rico since 2010, while values in the United States have risen 35 percent. Puerto Rico's large amount of "informal" housing presents an additional challenge—an estimated 55 percent of residential and commercial structures were built without permits and often on land not owned by the resident or builder. Without permits, proper construction techniques may not have been followed and the structures may be located in risky areas. Many of these homes are vulnerable to natural hazard risks, such as flooding, high winds,

earthquakes, and landslides.

A compounding challenge is that about 70 percent of homes lack flood and homeowner's insurance that can help with rebuilding after an event, leaving the vast majority of Puerto Rican families dependent upon disaster aid. In addition, recent estimates suggest that only about 70 percent of property titles are recorded in the land registry, and many of those are likely out of date. The lack of clear title and title records makes collecting property taxes difficult for Puerto Rico's already underfunded governments. Unclear legal ownership also complicates applications for federal aid. Other problems include the lack of a common address system that makes it difficult for emergency responders to locate homes and businesses, the lack of adequate affordable housing, high housing construction costs, and increasing mortgage delinquencies.

Taking action

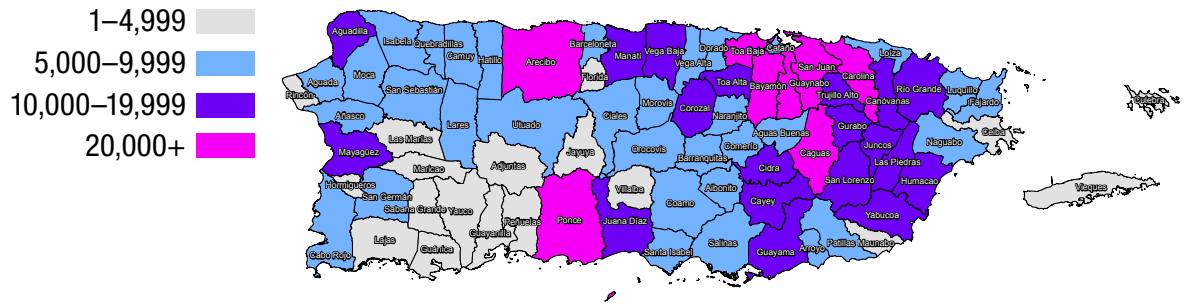
The scale of the hurricane damage presents the recovery effort with an opportunity to right some of the challenges described above. It is an opportunity to transform the housing sector to be safe, secure, resilient, and forward-looking, particularly for the most vulnerable. Puerto Rico has a clear vision for its housing sector: provide residents with safe, secure, and affordable places to live; retrofit homes to make them less vulnerable to damage; relocate households that live in the most dangerous areas; increase insurance coverage in order to help rebuild structures in the event of disaster; and clarify ownership records to bring the informal housing into the formal sector, which would facilitate government service delivery and collection of property taxes.

Make buildings safe, secure, and affordable for residents

Substantially damaged owner-occupied homes would be repaired or rebuilt to code onsite if the structure could be made reasonably safe from natural hazard risk at reasonable cost. Households with income below a specified income cutoff would be eligible for this type of assistance. Rebuilding and relocation would emphasize safe, resilient, affordable communities with access to good schools, jobs, transit, and health care (HOU 1). In addition, homes in high-risk areas without substantial damage will be inspected to determine the specific risks the structure faces, and then strategies will be developed and funding made available to determine which homeowners will be offered relocation and which structures can be secured through mitigation (HOU 3, HOU 4).

Damage to real and personal property, based on FEMA registrants for individual assistance

Number of Individual Assistance registrants with damage to structures or personal property



Similarly, affordable housing units and housing and shelters for the homeless will be repaired, moved from high-risk areas, or made less vulnerable to disaster (HOU 14). This effort will also include updates to accommodate special needs communities and upgrades such as energy conservation, ADA compliance, and universal design. Given the long wait lists for public housing and Section 8 units, communities also intend to adopt programs to provide more public or subsidized rental and homeless housing for lower-income households and those with special needs (HOU 15).

Abandoned and blighted properties will be rehabilitated, redeveloped, or demolished (HOU 20). First, an inventory will distinguish vacant properties from currently unoccupied vacation properties, then strategies will be developed to quickly gain legal ownership of the property and implement buyout programs. Community members will help develop strategies to rehabilitate properties for residential uses, including future homes, affordable rental housing, and rent-to-own programs, and community uses, including community centers, clinics, or business incubators.

The number of homeowners whose mortgage payments are delinquent or severely delinquent increased after the hurricanes; it has recently decreased but remains relatively high. The Federal Housing Authority (FHA) issued a foreclosure moratorium after the hurricanes, but that is set to expire August 16, 2018, and lenders are unsure how many homeowners will resume payments. Homeowners will be provided with financial counseling and education campaigns about loss mitigation programs available from lenders. Some homeowners who are capable of sustaining mortgage payments will be provided financial assistance to bring their mortgage payments up to date (HOU 19).

To help homeowners recover and to lower the reliance on federal and state aid after future disasters, the number of properties with wind and flood insurance will be increased by (1) increasing education and outreach campaigns about the coverages and costs, (2) studying whether other types of low-cost products should be developed, and (3) identifying financial assistance options and funding an assistance program to help purchase or reduce the cost of insurance (HOU 17).

Restructuring the housing sector

The creation of a central source of data related to the housing stock, including title, permits, land use, property tax and location will be crucial in the recovery effort (HOU 5). This information can support planning, relocation, and mitigation efforts needed to make these communities safer and resilient against future natural disasters. It can also contribute to the development of emergency plans and recovery efforts.

Improving compliance with the building permit process and adopting and enforcing consistent land-use plans are key to a more resilient housing sector. Updated land use plans will better align new construction and rehabilitation of existing homes away from disaster risk and near jobs, schools, health care, and transportation. The capacity to enforce both land use plans and building permit requirements will increase at the state and municipality level, and efforts will also be made to reduce costs and delays in the building permit process (HOU 6).

The proportion of properties that are properly titled and registered will be increased with the aid of a consistent process for determining title, including the acceptable types of documentation. To get owners on board, dissemination efforts will describe the title registration process, the importance and benefits of obtaining a clear property title, and potential penalties for failure to establish title title and register properties (HOU 12). This may directly lead to receiving disaster assistance more quickly, more effective distribution of social services to targeted populations, reduced property disputes, and a more accurate and precise collection of property taxes.

To improve emergency response, mail delivery, and provision of other services, a common and more logical address system will be developed, new street signs and address numbers installed, and government databases updated with new property addresses (HOU 11).



SEE THE FULL PORTFOLIO

of housing strategies and details about cost and funding in the last section of this plan

A student reads a book after receiving a donated bag of school supplies.

FEMA/Eduardo Martinez



TRANSFORM THE EDUCATION SYSTEM

THE FUTURE IN FOCUS

Competitive graduates with knowledge and skills needed to adapt to changes in the economy, environment, and technology

Issues to address

Education is a cornerstone of Puerto Rico's economy, society, and political systems. Its purpose is to build and sustain the knowledge and skills needed to ensure that individuals, communities and key institutions can adapt to changes in the world economy, the environment, and technology. Education also plays a role in helping individuals and communities respond to social/cultural changes while maintaining Puerto Rico's unique identity. Yet, Puerto Rico's education system was impacted by the 2017 hurricanes and has for years been weakened by economic crisis, outmigration of skilled professionals, sharp declines in the student population, and by governance structures that limit the ability to use community, nonprofit, and business resources most effectively.

The Government of Puerto Rico now has the opportunity to fundamentally transform its education system in a way that improves student outcomes, supports the development of children, youth and adults, and supports its vision of economic and social development moving forward.



SEE THE FULL PORTFOLIO

of education system strategies and details about cost and funding in the last section of this plan

Taking action

Upgrade school infrastructure to support resilience and sustainability

A critical step to promoting resilient infrastructure is addressing the many schools located in flood hazard zones. To reduce flood risk, schools will need to be relocated to vacant or new buildings outside flood risk areas, elevated, or otherwise upgraded to reduce flood risk (PBD 8). In addition, plans call for completing repairs on damaged schools, with a focus on meeting current building safety codes for wind, flood, and seismic risks (PBD 9). Ensuring schools meet current codes means they will be more resilient against future storms or other disasters (PBD 11). State- and municipal-level agencies will need to work together to implement policies and programs that establish clear standards for energy and water efficiency in schools. These efforts will be coupled with incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services (PBD 10). Finally, buildings will need to be repaired and upgraded in ways that create learning and thriving environments that promote student-directed learning and provide collaborative workspaces where students and teachers share creative, innovative and developmentally appropriate PK-14 teaching and learning experiences.

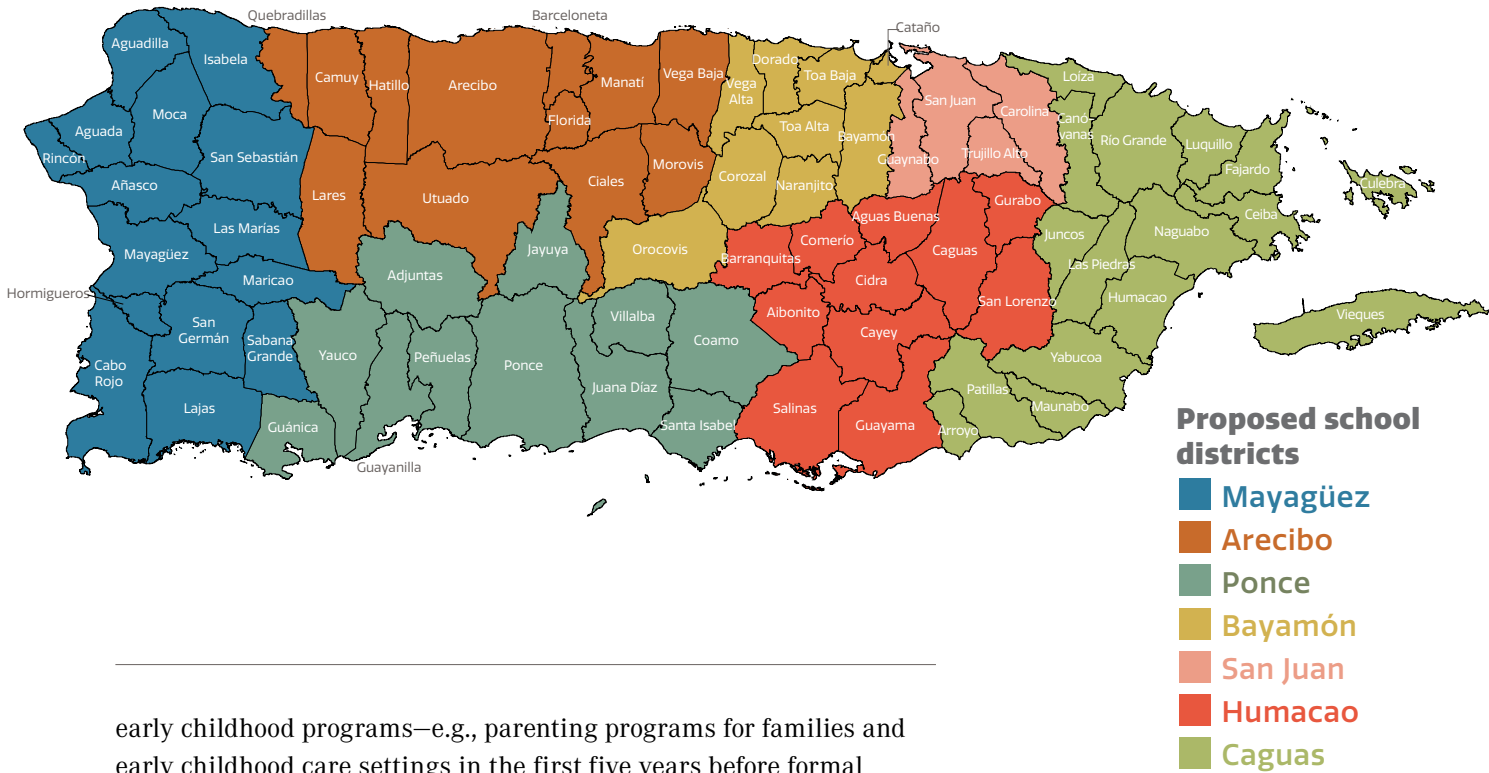
Increase K–12 access to vocational, technical, and career education and strengthen school-to-work transitions

As the Government of Puerto Rico pushes toward new social and economic opportunities, students need to be well prepared to take advantage of this landscape. In partnership with local schools and private industry, the Puerto Rico Department of Education (PRDE) intends to launch a one-year pilot program to expand and update K-12 vocational programs in Puerto Rico to align with changing workforce needs, foster entrepreneurship, and grow economic sectors (EDU 6). Those growth sectors include manufacturing (particularly biopharmaceuticals), entrepreneurship, finance, renewable energy, construction, hospitality, and healthcare. The pilot, which will serve 280 to 560 students, can be scaled up over a ten-year period to reach as many 22,000 students.

Promote pre-school and out-of-school learning opportunities

Extensive research shows the benefits of high-quality pre-school and

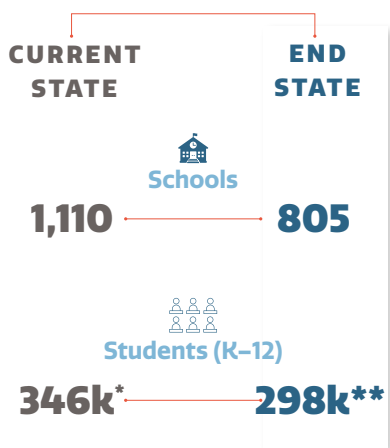
Local educational agencies proposed in the Education Reform Bill**



early childhood programs—e.g., parenting programs for families and early childhood care settings in the first five years before formal schooling. Such programs support whole of child well-being, and provide an important foundation that improves children’s academic, social, and health development as well as outcomes for parents. They also can support better economic outcomes for students later

in life. Puerto Rico’s Administration for the Care and Integral Development of Children intends to lead a landscape analysis of existing needs and resources, and propose strategies for strengthening available resources in this area (EDU 13).

Expanding access to after-school, summer, and online learning opportunities can also provide benefits to Puerto Rico’s students. The approaches can increase access to high-



*Enrolled student count as of August 2017
 **Projected number of students for 2018-2019 school year

quality educational content for students regardless of their geographic location, and help address any learning loss resulting from hurricane-related school closures. The PRDE plans to partner with professional development providers to create a repository of online learning resources aligned with the scope and sequence of the curriculum, so students' education is not disrupted during temporary school closures (EDU 7). Such an online repository—offering free, open, English- and Spanish-language educational resources appropriate for various subject areas, grade levels, and technology platforms (e.g., desktop, laptop/tablets, mobile/smartphones)—can help schools and teachers provide “emergency instruction” in the event of school closures lasting more than two weeks. The development of municipal hotspots in public buildings, parks, town squares, and public housing (CIT 19, CIT 26), as well as plans to expand broadband infrastructure throughout Puerto Rico (CIT 4, CIT 21, CIT 22, CIT 25), will be critical to ensure the success of online learning efforts.

In addition to online learning programs, the PRDE plans to expand existing and implement new summer and after-school learning programs to address post-hurricane learning loss caused by prolonged school closures (EDU 1). Beyond academic challenges, the hurricanes negatively impacted students' mental and physical health, and ongoing changes in the school system might cause students further confusion and distress. Out-of-school learning programs are another way to provide physical and mental health services to address these needs.

Strengthen systems to support new education reform package

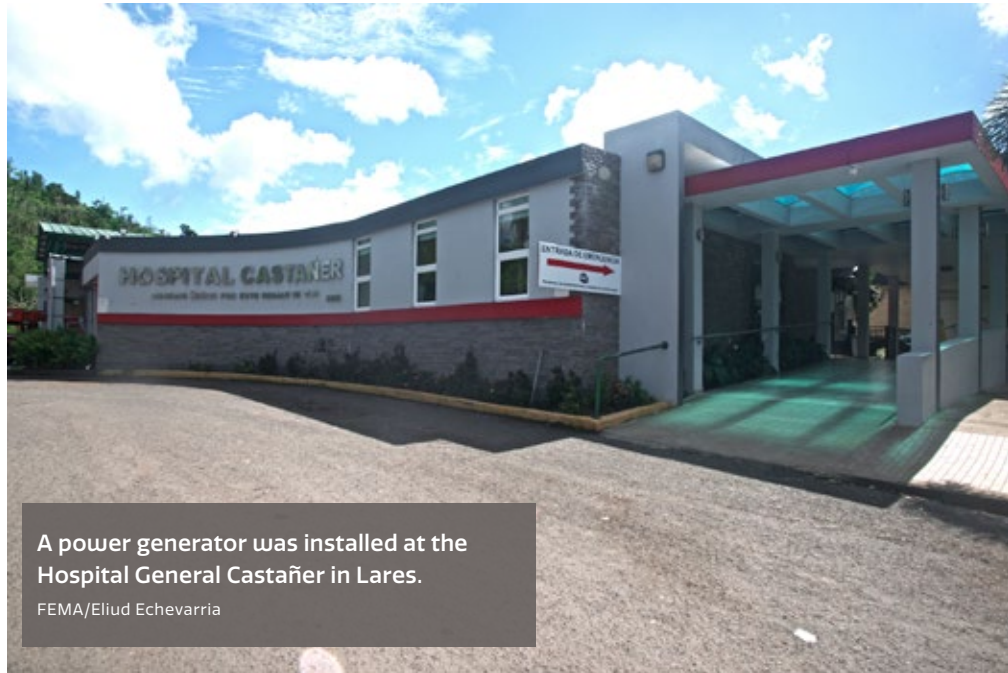
Finally, significant transformation of Puerto Rico's educational system has already been initiated by the state's Education Reform Bill, which features (among other things) decentralization into seven local educational agencies (see map on previous page), increased parental choice, and increased focus on school-to-work transitions. Plans call for building on these efforts in a number of ways.

Decisions such as school closures are complicated and must balance schools' links to communities and student well-being with post-hurricane enrollment decreases driven by students leaving Puerto Rico. Completing development of a longitudinal data system will be key to supporting timely evidence-driven decisionmaking about school closures and resource allocation, as well as targeted professional development and other operational decisions and education policymaking (EDU 2). Planned system enhancements include increasing user-friendliness and linking K-12 data to post-secondary outcomes and workforce data to better manage school-to-

work transitions. The PRDE will also need to provide training on how to integrate data into operations and decisionmaking.

In addition, schools and education systems both impact, and are impacted by, the communities in which they are located. Inputs from analysts and stakeholders will be key to help the PRDE and others make future-facing decisions that better align investments in schools (e.g., infrastructure updates, reassigning teachers, location of school-to-work programs) with local economic, infrastructure, and community characteristics (EDU 14). To address equity issues, the PRDE, local schools, and their partners will need to review how funds are allocated to schools and identify any funding gaps or regional/municipal inequities. This information can inform if and how student-based budgeting can be used to ensure an equitable match between student needs and resources allocated (EDU 5).

New professional development and talent management systems will be needed to ensure that PRDE's administrator and teacher workforce is prepared for the performance requirements of 21st century approaches to learning (EDU 9), that the system has strong leadership in regional superintendent's offices (EDU 8), and that school directors are well positioned to function with the greater autonomy given them under the Governor's new education reform plan. Finally, a new program will educate parents/guardians (especially in disadvantaged communities) about the options provided to them through new school choice programs (EDU 10).



A power generator was installed at the Hospital General Castañer in Lares.

FEMA/Eliud Echevarria



REBUILD AND ENHANCE HEALTH AND SOCIAL SERVICE INFRASTRUCTURE AND REGIONAL HEALTHCARE NETWORKS

THE FUTURE IN FOCUS

Reliable and equitable access to health and social services and health-promoting communities, including an efficient and effective response to public health crises and other future disasters

Issues to address

Communities in Puerto Rico faced widespread and persistent challenges with health and social services before the hurricanes, due in part to a fragmented spectrum of health and social services systems, varied access to these services by region, shortages in some health specialties, and differential access to health-promoting environments. Low Medicaid and Medicare reimbursement rates

combined with cost of living challenges have put a downward pressure on payments for providers, and there is limited access to preventive programs, including psychosocial supports, particularly for low-income Puerto Ricans. Exposure to environmental hazards in Puerto Rico—which has 23 contaminated sites that the EPA lists as candidates for Superfund cleanup—has been correlated with a high prevalence of childhood asthma, preterm births, and water- and vector-borne disease outbreaks. Unenforced building codes and informal housing, and storm-related hazards such as mold, also present environmental hazards to residents.

The hurricanes exacerbated these challenges by making health and social services harder to access and delaying or interrupting care, which contributed to many deaths after the hurricanes. Damage to buildings and electrical, water, and communications infrastructure closed medical and social service facilities and impacted health and social service agencies' ability to operate. In some municipalities, federally qualified health centers were the only open and operational places where emergency and acute health care services were being provided around the clock. Even at facilities that remained open, services were compromised by intermittent access to power and water, lack of access to electronic records, and the absence of staff who were unable to come to work. Residents' mental health suffered, and cleanup and other activities exposed them to various hazards after the hurricanes.

Ensuring that residents can live healthy, productive lives in Puerto Rico is essential to a robust economic recovery. To strengthen and expand access to healthcare and promote healthful living, the Government of Puerto Rico will need tools such as provider retention programs, expanding licensure for advanced practice clinicians, and utilizing nontraditional health providers to promote healthy lifestyles. This effort will also require building resilience in the health and social service systems through emergency preparedness measures such as administrative and financial waivers to support access and interoperability during and after disaster and stronger regional health networks. Greater flexibility in nutrition assistance and social services will provide support for the most vulnerable Puerto Ricans. Parallel infrastructure and economic developments will be essential to the ultimate success of these efforts.

Taking action

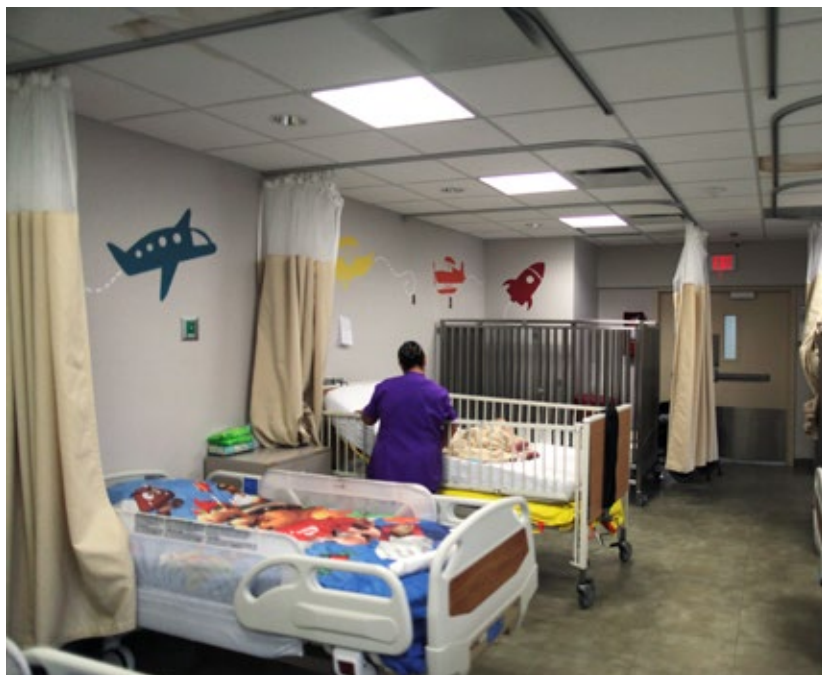
Build health and social service system capacity

One critical challenge exposed by the hurricanes is the health system's

fragility, across medical, social, behavioral, and environmental health services. The Government of Puerto Rico plans to build resilience to ensure flexibility and agility in response and long-term recovery. Health and social services require reliable electricity systems to function, so efforts to create a hardened electricity grid supported by alternative energy generators will help keep these services available in a future disaster. Plans call for robust, resilient communications initiatives that will connect community clinics across Puerto Rico using a broad range of technologies—including mobile and telehealth—to ensure real-time access to clinical data from any access point and improve clinical care delivery and adaption to disaster impacts (CIT 29). The Government of Puerto Rico intends to develop flex-funding for critical social service centers such as domestic violence and homeless shelters and child- and elder-care facilities so these centers can tap into additional financial resources, such as uninsured fuel expenses during a long-term response and recovery period (HSS 19). Other initiatives call for implementing temporary waivers for a range of emergency health and social service needs to ensure uninterrupted access to care post-disaster and prevent potential delays in time-sensitive care and nutrition support (HSS 33). Finally, the Government of Puerto Rico proposes to build resilience through initiatives such as upgrades and enhancements to the 911 service (CIT 3), a shift toward a regionally-integrated approach for emergency preparedness (HSS 22), and improved systems for emergency medical stockpiles and supplies (HSS 26, HSS 34).

A nurse attends to a young patient at the San Juan Children's Hospital, after the island was hit by Hurricane Maria.

REUTERS/Alvin Baez



But health and social services also need to meet the day-to-day needs of its citizens at all stages of life. To meet these needs, the Government of Puerto Rico intends to strengthen the backbone of the system by improving the standard of care and increasing access to services. Reducing the gap means reconsidering the current Medicaid/Medicare reimbursement rates to address the financial viability of the healthcare system at large and to actively analyze the links between health expenditures and outcomes in ways that are transparent and useable by payors and providers (HSS 7). To support a full array of primary care services, primary care options will need to be expanded by enhancing the existing network of community health centers in Puerto Rico and augmenting relevant primary care supports, including mobile care clinic options as well as training and supplies (HSS 12). To improve mental health services, the Government of Puerto Rico intends to expand care for psychological trauma and chronic stress, increase promotion of and referral to existing services (HSS 10), and encourage greater uptake of evidence-based practices to promote health in other settings such as community centers and schools (HSS 15). These will be paired with a comprehensive suicide prevention campaign promoting wellness and self-care to ensure that those at risk are identified and referred to appropriate services (HSS 41). It also aims to increase access to care through telehealth options (HSS 9) in conjunction with broader efforts to improve data integration and digitization of health and related information (HSS 14).

However, this expansion of services is only possible if there are doctors and other health providers to support it. Given the shortages in some health specialties and concerns about personnel moving away, the Government of Puerto Rico intends to incentivize, retain, and train the healthcare and public health workforce through initiatives such as loan repayment programs and allowing nurse practitioners and physician assistants from other states to provide care in Puerto Rico (HSS 11, HSS 13). Part of the system improvements will be increasing public health surveillance capacity (HSS 40, HSS 42) and vital records data use (HSS 43), which will be important during disaster-response as well as under normal circumstances.

Strengthen supportive services

The most vulnerable residents have greater needs during and after a disaster, such as those who are home-bound, seniors (especially those who live alone), people who depend on nutritional support, and those with chronic health conditions. To address these challenges, the Government of Puerto Rico proposes to enhance services and other supports that ensure continuity during and after disaster and that



SEE THE FULL PORTFOLIO

of health and social services strategies and details about cost and funding in the last section of this plan

limit disruptions to food, medication, technology, and other crucial supplies. Puerto Rico provided nutrition assistance through the Food Stamp program from 1974–1982. Congress switched Puerto Rico from FSP to a block grant through the Omnibus Budget Reconciliation Act of 1981, which became the Nutrition Assistance Program. Transitioning Puerto Rico back to the Supplemental Nutrition Assistance Program (SNAP) will allow greater surge capacity post-disaster and provide greater benefit to participants (HSS 16). In the event the transition to SNAP does not occur, long-term waivers to the existing Nutrition Assistance Program (NAP) regulations (HSS 17), which would be implemented by the USDA Food and Nutrition Service, would enable greater flexibility in how program participants access food during a disaster. To raise awareness of child and elderly abuse and how to report it, public education campaigns and training staff at Integrated Service Centers and Disaster Shelters are needed to detect and address abuse (HSS 18). The Government of Puerto Rico intends to support the elderly population through both routine day-to-day efforts and targeted, community-led support post-disaster (HSS 20). These initiatives include enhancing food stockpiles through a policy change requiring a minimum 14-day, healthy, shelf-stable food supply at all licensed child- and elder-care facilities and providing guidance to them on stockpile contents. In addition, plans call for increased funding to the Puerto Rico Department of the Family to hire additional child welfare investigators to reduce the backlog of child maltreatment investigations (HSS 37).

The Government of Puerto Rico plans larger efforts to build capacity that will make all residents more resilient to future disasters. These include developing, updating, and implementing preparedness and response plans across the Island—including for vulnerable communities that face particularly high risk during disasters—so that communities can better sustain themselves immediately after a disaster. Plans call for developing a public information and communication capability to continuously engage communities in the recovery process, and increase residents’ visibility into recovery planning and implementation (CPCB 6), and hiring planners in each municipality and at the state level to support a more robust emergency shelter system for the longer term (CPCB 7). Finally, the Government of Puerto Rico aims to strengthen the involvement of local nonprofit and nongovernmental organizations in disaster recovery by establishing a unit within the Office for the Socioeconomic and Community Development (ODSEC), or any other agency designated by the Government of Puerto Rico, to maximize their contributions as partners with government agencies in the recovery process while helping to build their capacity (CPCB 15).

Create healthy communities

Healthy communities support healthy people. Transportation, municipal infrastructure, education, economic development, natural and cultural resources, and telecommunications, are all required to improve and protect the health and well-being of communities.

Toward that end, the Government of Puerto Rico proposes a range of initiatives, from deploying wi-fi and broadband internet connectivity (increasing access to health information); to providing incentives to move from remote communities to urban centers (increasing access to key services); to offering better access to transportation and community resources, such as museums, parks, and community centers, as well as natural resources (promoting access to services, healthy activities, exercise, and well-being).

In addition, plans call for summer and after-school learning programs (described in greater detail in the education section) that incorporate physical and mental health services to promote whole child health and well-being (EDU 1). The Government of Puerto Rico intends to conduct a landscape analysis of early childhood opportunities to determine the current supply of interventions and care settings, demographics of children age 0-5 year (and their families), and the cost of and possible funding streams for providing high-quality care to all children in Puerto Rico and improve their long-term health and learning trajectories (EDU 13).

Finally, plans to collect and map housing sector data will directly benefit people's health through increased accuracy in routing of emergency vehicles (HOU 5), and initiatives to implement healthy housing guidelines for mold mitigation, remediation, and public health will help prevent respiratory-related disease (HSS 2). The Government of Puerto Rico also intends to reduce water- and vector-borne disease transmission through improved public health surveillance (HSS 4) and innovative mosquito control practices (HSS 6). Closing illegal dumps will further remove environmental and public health threats to the people of Puerto Rico (NCR 10).

Contractors paint walls as part of the repairs to the Bayamón Police Command Center.

FEMA/Yuisa Ríos



REPAIR, REBUILD, AND RIGHT-SIZE THE PUBLIC BUILDINGS INVENTORY

THE FUTURE IN FOCUS

Stronger and more resilient public buildings that meet today's standards, mitigate against future disasters, represent innovative designs, and meet communities' needs

Issues to Address

In Puerto Rico, ownership of public buildings is a complex issue. Government agencies may have ownership responsibilities for a wide variety of types of buildings, and the type of building does not determine ownership. For example, there are several different government agencies that own schools. One of these agencies, the Public Buildings Authority (PBA), also owns a collection of police stations, judicial centers, and office buildings. Publicly owned

buildings may house activities operated by other public agencies or private-sector tenants. For example, the Puerto Rico Industrial Development Company (PRIDCO) is a public agency that owns and operates hundreds of buildings that it leases to the private sector with the mission of fostering economic development. This complexity makes it difficult to track the complete inventory of public buildings and the government lacks a central data set showing the number, type, location, legal status, and condition of the real estate and assets that it owns.

Beyond the ownership conundrum, recession, declining population, and shifting demographics have led to a substantial number of underoccupied buildings, and even those that are occupied often suffer from insufficient maintenance. Given these complications, it has been difficult to assess the extent of damage specifically caused by the hurricanes. Some assessments of this damage, compiled from U.S. Army Corps of Engineers data or FEMA Public Assistance (PA) data, estimate that one quarter of police stations were classified as “restricted use” or “unsafe” after the hurricanes, and all 99 fire stations and 85 percent of schools reported damage.

Taking Action

The vision for Puerto Rico’s public building sector is to not only repair and maintain buildings but also to right-size and redesign buildings to support new ways of providing public services and increase their resilience to disaster. This effort includes repurposing, reallocating, and refurbishing buildings to meet population needs and economic conditions. To make this sector more efficient, ownership will be realigned, and new systems will make managing them more efficient.

Prior to the hurricanes, various initiatives were already seeking to consolidate and right-size the public building sector, including proposals to consolidate schools and establish Integrated Government Service Centers, a “one-stop shop” for Puerto Ricans seeking public services. Puerto Rico plans to build on this effort by further aligning and consolidating functions into fewer buildings (in conjunction with the agency consolidation mandated by the FOMB). These buildings will need to be refurbished, moving critical government operations out of areas at high risk for flooding, repairing hurricane damage and implementing structural retrofits to increase hazard resilience, and developing policies and standards to improve asset management, increase energy efficiency, and ensure backup power is available.



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strategies and
details about cost
and funding in
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this plan



Create a comprehensive inventory of buildings to improve how they are managed

Plans call for creating a comprehensive, centralized database of government-owned buildings to help the owners make better decisions about their structures, as well as providing accurate information to potential investors (PBD 1). Having a clear picture of the entire inventory of schools, courts, prisons and other public buildings and their condition will facilitate decisionmaking about general operations, maintenance, future infrastructure needs, emergency response, and vulnerabilities to future disasters that must be mitigated. This database could be used to inform complementary asset inventories that municipalities are creating for the same purposes (MUN 6).

Repair and retrofit public buildings to be resilient

To ensure that all public buildings meet both today’s standards and future needs, the Government of Puerto Rico intend to repair hurricane damage (PBD 9), retrofit buildings to meet building safety codes and upgrade systems when feasible (to reduce vulnerability to natural hazards and improve energy performance) (PBD 11).

To increase public buildings’ resilience to power outages, plans call for developing guidelines for secondary power systems by building

on the nationally recognized standards for emergency and standby power systems that already exist (PBD 13). This effort would prioritize buildings that house essential functions.

Critical government functions will need to be moved to vacant or new buildings in areas with less risk of flooding if retrofitting is not appropriate (PBD 8). Similarly, 300 community centers and 172 community technology centers will be refurbished and provided with generators for backup power (PBD 15) so they can act as gathering places in an emergency.

Rebuild with state-of-the-art standards in mind

New policies and incentives will be developed to promote state-of-the-art building design, practices, and technologies. This effort will establish clear standards for energy and water efficiency in public buildings and incentives for energy and water efficiency, renewable energy systems, innovative redesign or reconfiguration of spaces to better support critical public services, as well as increased resilience to natural hazards (PBD 10).

Right-size the number of public buildings

The public buildings sector will need to be right-sized to make efficient use of space and consolidate maintenance costs. This effort involves examining the demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Public services in private facilities would be moved to public buildings so that buildings are used more efficiently (PBD 5), and services would be clustered in integrated service centers to make them easier for residents to access (PBD 3).

Repurpose structures and realign ownership

Plans call for repurposing and refurbishing buildings, reallocating the space, and selling or demolishing unneeded buildings (PBD 2). Where possible, structures would be repurposed by municipalities, for example, as economic development vehicles through public-private partnerships or municipal corporations to house and attract new businesses (MUN 5). Similarly, PRIDCO's abandoned buildings could be repurposed for use as business incubators (ECN 13). Finally, ownership of some buildings will need to be transferred to align with how they are used so that buildings of the same type, such as schools or government centers, are all owned by the same agency (PBD 4).

Evaluate externalization of PRIDCO

An independent analysis will be needed to examine whether externalizing the services provided by PRIDCO would improve or reduce its ability to support economic development through the private-sector real estate market (PBD 6), given that government competition in an otherwise healthy market can crowd out private business. This analysis should be undertaken by a third-party entity with expertise in economic development, real estate markets, and the Puerto Rican context.

INFORMATION THAT THE PUBLIC BUILDINGS INVENTORY DATABASE COULD INCLUDE

- Building purpose
- Current user
- Owning agency
- Occupancy status, including capacity utilization
- Value
- Existing liens and restrictions on use
- Location (street address and geocode)
- Zoning
- Vulnerability assessment results
- International Building Code building risk category
- Year built
- Dimensions (area, height, number of stories)
- Construction characteristics (based on NFPA construction type)
- Subsurface conditions (e.g., garage or basement facilities)
- Utility information
- Condition and remaining life of building mechanical, electrical, lighting, roofing, elevator, and backup power systems
- Energy efficiency and natural hazard mitigation features
- Major repair and retrofit records
- Historical landmark status

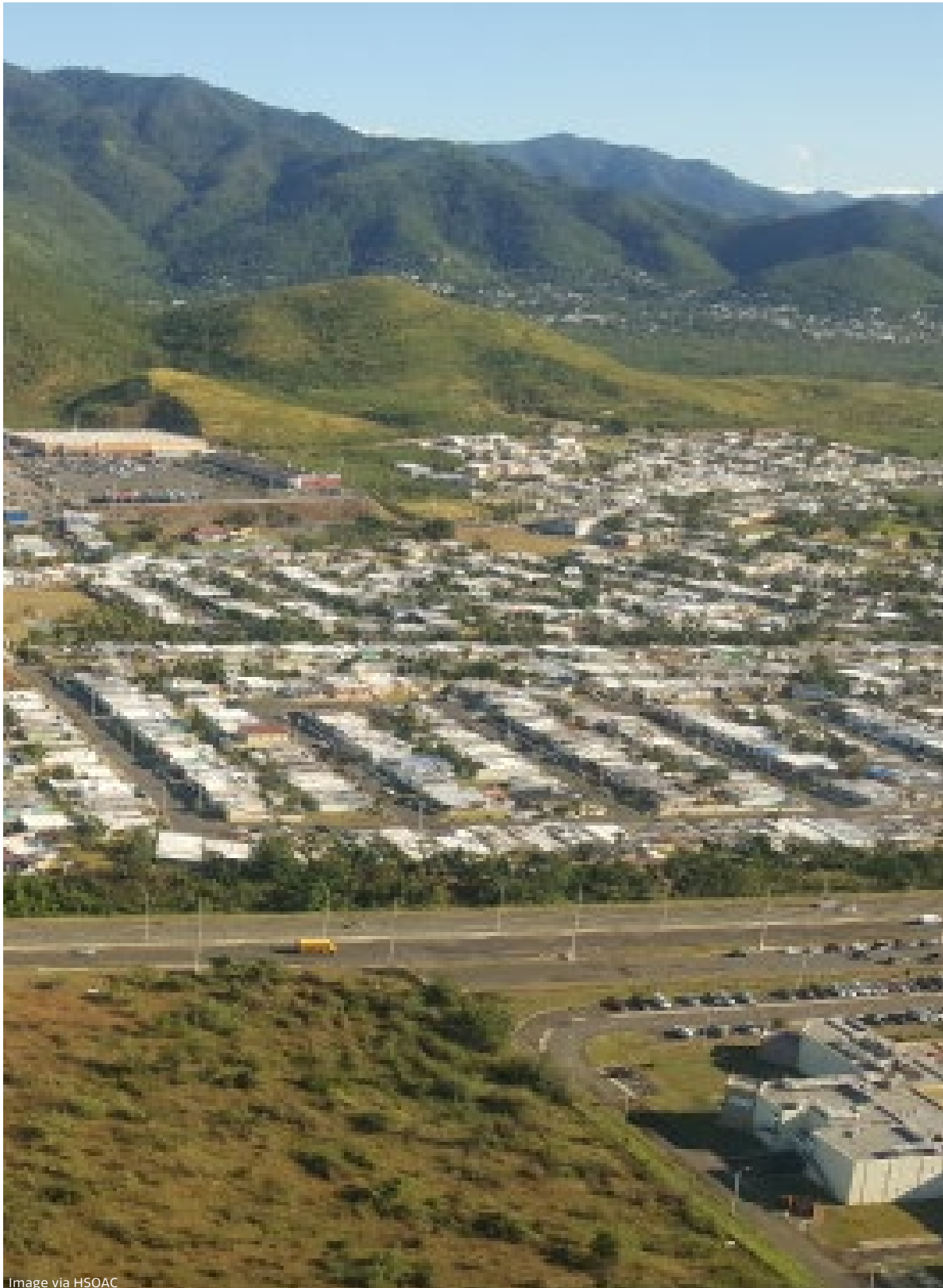


Image via HSOAC

A diver works to restore damaged coral reefs, off the coast of Culebra.

FEMA/Andrea Bajandas



RESTORE, PLAN FOR, AND DEVELOP THE NATURAL ENVIRONMENT

THE FUTURE IN FOCUS

Marine and terrestrial ecosystems that coexist sustainably with tourism and economic development of Puerto Rico and protect against storm damage

Issues to address

Puerto Rico's range of coasts, forests, waterways, and diverse endemic species are important assets both for economic development and for the well-being of its citizens and visitors. However, prior to the 2017 hurricane season, Puerto Rico's natural resources suffered from a lack of investment, a lack of clarity over asset ownership, and a dearth of emergency preparedness capacity. Significant destruction from the hurricanes compounded these problems. Damage to coastal resources such as corals and seagrasses, and forests was severe, and landslides and resulting debris blocked roads and threatened infrastructure and public safety. The waste and debris from the disaster cleanup effort is going to landfills, many of which were already out of capacity or compliance before the hurricanes, or to illegal open dumps. EPA has ordered non-compliant landfills to be closed, but local governments say they lack the funds to do so.

To restore and protect Puerto Rico’s natural assets, the Government of Puerto Rico plans to develop and implement strategies to create healthy, resilient, Island-wide ecosystems that support its people, infrastructure, and economy.

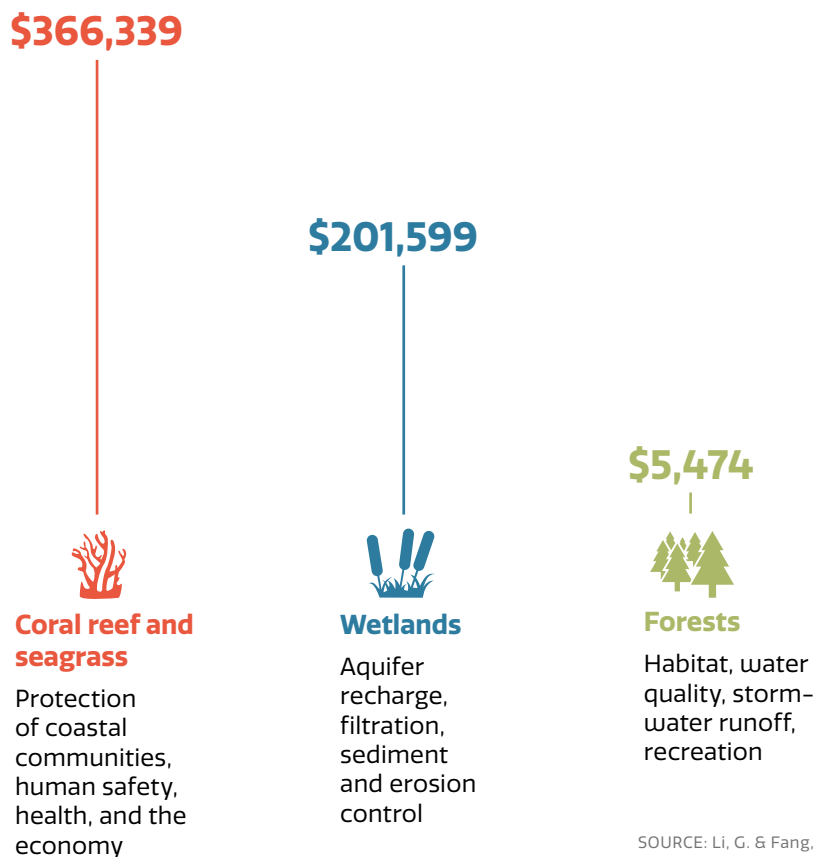
Taking action

Implement green infrastructure solutions

Natural, or “green,” infrastructure is often the first line of defense in protecting manmade infrastructure during natural disasters. On the coast, beaches and dunes, wetlands, seagrasses and coral reefs all serve as a bulwark against inundation from storm surge. To protect these critical assets, the Puerto Rico Department of Natural and Environmental Resources (DNER) will need to work with federal agencies to take several actions. One action is the recovery of severely

The services that natural capital provides are valuable

(The estimated dollar value of the products and natural services that natural capital provides to communities, measured in dollars/hectare/year.)



SOURCE: Li, G. & Fang, C., 2014.

damaged coral reef and seagrass sites to maintain and increase the coastal protection services they provide to key communities (NCR 15). Another is expected to focus on restoration of coastal wetland capacity and hydrology at 10 priority sites across Puerto Rico (NCR 16). These wetlands lessen the impact of storms while protecting coastal communities' infrastructure, agriculture, and habitats. Finally, by 2035, beaches and dunes should be stabilized and protected from human degradation so they (1) are resilient to storms and sea-level rise; (2) protect human life, property, and critical infrastructure on coastal areas; (3) support biodiversity, tourism, and recreation; and (4) help improve the livelihoods of coastal communities (NCR 17). Workforce development programs, focused on building capacity and jobs in habitat restoration and other recovery needs, will be needed to support these efforts (NCR 33). In the long term, this workforce will be able to apply these skills towards other sectors such as construction, education, and tourism.

Another key area of critical green infrastructure is the prevention of erosion and sedimentation to increase resilience to disasters and reduce negative impacts to the environment and public health. One component of this approach is stabilizing soils in areas that experienced landslides or are prone to them to diminish future risk to communities and critical infrastructure, and to reduce the loss of storage capacity from sedimentation in key reservoirs and other negative effects on both fresh- and marine-water quality (NCR 13). Another component is forest recovery in rural protected areas, private forests, critical watersheds, and urban areas (NCR 5). Through both public and private collaborations, DNER intends to develop and implement landscape habitat conservation strategies to restore the function and structure of urban and rural forests, which will lessen erosion and sedimentation challenges and provide other ecosystem services such as enhancing air quality and managing stormwater runoff. Forest restoration is also expected to contribute to species recovery plans that combine habitat restoration, captive breeding, and predation threat reduction activities for each species of interest (NCR 6). Finally, DNER will likely need to cooperate with federal agencies to develop watershed restoration and management strategies in four priority watersheds: Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor (NCR 14). These strategies would not only help communities manage stormwater runoff and soil erosion, but also reduce future pollution risks from sewage discharge. Similar control efforts are also planned for the highly sensitive coastal areas of Mosquito Bay Natural Reserve in Vieques and Tres Palmas Marine Reserve in Rincón.

Comprehensively manage waste to protect human health and safety

Addressing the critical capacity challenges of managing solid waste will require working with local partners to complete repairs to hurricane-damaged landfills within approximately six months of funding availability and close unlined open dumps, which threaten public health and the environment (NCR 9). In addition, DNER and partners intend to create approximately 18 new landfill cells and 10–12 new transfer stations, increasing staff as necessary to manage permitting and inspection needs (NCR 8).

It will be similarly important to tackle the unpermitted and unregistered illegal open dumps located throughout Puerto Rico. Action will be required to clean up and eliminate approximately 1,600–2,000 of these dumps, including those created in the wake of the hurricanes, within two years (NCR 10). This effort includes preventing new illegal open dumps from forming in the future.

Given the longstanding problems with solid waste management in Puerto Rico, DNER plans to work with contractors and federal partners to establish a long-term, sustainable, Integrated Solid Waste Management program (NCR 11). This program would develop comprehensive solid waste management strategies, waste reduction initiatives, and composting and recycling practices. In addition to mitigating risks to the environment and public health, a strong integrated approach to waste management will help ensure sufficient landfill capacity in the future.

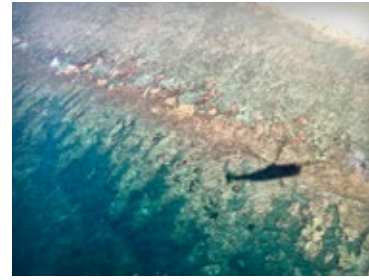


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Strategic Initiatives

Eight objectives guide the strategic initiatives selected by the Governor to promote the transformational vision for social and economic progress.



⊕ **Visitor Economy** | Develop a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth



④ **Ocean Economy** | Integrate and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth and improve quality of life for residents and enhance the visitor's experience



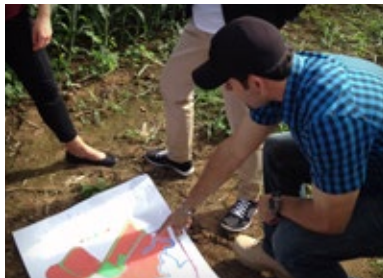
⊕ **Digital Transformation** | Build digital capabilities and workforce needed to fundamentally transform key industry and government process, making them more user-focused, relevant, and efficient at addressing local needs and delivering basic services



⊕ **Emergency Services Modernization and Integration** | Enhance public safety and first responders' ability to deliver reliable, integrated emergency services



④ **Entrepreneurship** | Expand opportunities for entrepreneurship and development of small to medium local business that can compete globally to promote economic development



⊕ **Agricultural Modernization and Processing** | Modernize agriculture to promote greater productivity and output and improve exports



⊕ **21st Century Workforce** | Develop and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies



④ **Advanced Manufacturing** | Address policy and structural barriers to increase opportunities for investment and the growth of private/public partnerships

FOCUS ON THE FUTURE

While capital investments will help Puerto Rico to grow and thrive over the coming years, strategic initiatives are sets of actions aimed at driving Puerto Rico's future in specific ways consistent with Governor Ricardo Rosselló's vision. These initiatives reflect an opportunity to capitalize on a unique asset or strength in Puerto Rico (e.g., oceans) or to close a gap that could hinder Puerto Rico's economic development or resilience to future events.

⊕ The eight strategic initiatives described in this plan are intended to signal Puerto Rico's growing focus on these opportunities. The initiatives comprise crosscutting actions that create an ecosystem of projects, supportive policy, accessible and sustainable resources, and clear targets.

The strategic initiatives build on the robust infrastructure recovery made possible by the capital investments, with specific projects and programs designed to move beyond the recovery precursors and investments in capital assets and toward social and economic growth in the long run. Since these initiatives draw on the infrastructure, human, and natural capital improvements made through capital investments, the additional costs required, above and beyond those already covered by capital investments of these limited actions, is approximately \$6.4 billion.

Five strategic initiatives reflect clearly defined and strategic initiatives that are crosscutting—building resilience, improving society, and growing the economy:

- Visitor economy
- Ocean economy
- Digital transformation
- Emergency services modernization and integration
- Agricultural modernization and processing

Three strategic initiatives are much broader and generally reflect aspirational directions for Puerto Rico’s future that in many cases are reflected within the more crosscutting strategic initiatives:

- 21st century workforce
- Entrepreneurship
- Advanced manufacturing.

Crosscutting Strategic Initiatives

OCEAN ECONOMY

THE FUTURE IN FOCUS

Integrate and promote all of Puerto Rico's ocean-dependent industries and ecosystems as a cohesive effort to promote economic growth and improve quality of life for residents and enhance the visitor's experience

Puerto Rico has exceptional marine assets that can help promote economic growth and improve quality of life. Leveraging these resources appropriately will require that efforts focus on ensuring the health and sustainability of Puerto Rico's oceans and coastal areas. Thus, a Blue Economy approach will help to preserve the long-term benefits of the sustainable use of marine assets and preserve natural marine ecosystems in Puerto Rico, while also supporting economic growth. A Blue Economy comprises a range of economic sectors and related policies and may include traditional industries like fisheries and tourism, as well as emerging industries like marine biotechnology and offshore renewable energy. Ocean ecosystems also contribute significantly to human livelihoods and well-being through services such as coastal protection, biodiversity, and storage of carbon dioxide.



SEE THE FULL PORTFOLIO

of **strategies for the Ocean Economy** and details about cost and funding in the last section of this plan

Creating a Blue Economy requires new investments to maximize financial, social, and environmental returns. Investing in, and using, the best available science, data, and technology will help to inform management and policy decisions about ocean assets. Investment is needed also in diverse marine infrastructure such as fish aggregating devices, artificial reefs, fish habitats, and near-shore fishery infrastructure like piers, marinas, and boat docks. Living shorelines are critical to reducing ongoing erosion, stabilizing shorelines, and enhancing overall coastal resilience.



THE BLUE TIDE INITIATIVE

An interdisciplinary, collaborative approach anchored in a Blue Economy framework is "BLUEtide," which proposes a whole-of-Puerto Rico approach to disaster mitigation and resilience, workforce development, advanced manufacturing, and tourism by developing coastal resources. This approach would incentivize jobs in advanced manufacturing, fishing, the knowledge economy, and tourism industries, increasing the value of ocean-dependent assets and human capital development, international competitiveness, natural disaster mitigation and resilience, and food security.

Investing in science, data, and technology collaboratives such as the Marine Business, Innovation, and Research Center of the Caribbean will be needed to aggregate ocean-dependent industries and stakeholders to create and deploy innovative solutions throughout Puerto Rico and the Caribbean. It also could support the establishment of the Puerto Rico Ocean Technology Complex (PROtech), and Project 12-38: designing, developing, manufacturing, and deploying of advanced fish aggregating devices to enhance the sport fishing industry. In addition, this Marine Business Center would serve as an international marine field laboratory network hub to foster partnerships across the Caribbean and around the world to enhance disaster resilience research and the knowledge base needed to guide policies for better preparing at-risk communities in advance of future hurricanes.

To guide emerging industries, investments need to support business incubators and improve retail options to support fisheries (e.g., fishing villages, fish market). Investments to discover and harness the therapeutic potential of compounds bio-synthesized by marine organisms and their symbiotic microorganisms could help support advancements in manufacturing. Investments in open-ocean aquaculture could help advance methods and associated increases in sustainable production of edible seafood.

VISITOR ECONOMY

THE FUTURE IN FOCUS

Develop a strong visitor economy to help position Puerto Rico as a global destination of investment, production, and wealth

Puerto Rico's unique natural and cultural resources provide an opportunity to enhance existing tourism hubs and diversify by building capacity in additional hubs. Creating a suite of tourism hubs across Puerto Rico can generate economic growth; improve the quality of life in disadvantaged communities; preserve natural, cultural, historical treasures; and provide unique, authentic experiences for visitors. Local communities should be empowered to build the industry, work in the industry, and receive the economic benefits of the industry, for example, through tourism workforce training and local entrepreneurship incubators. Preserving the natural/cultural/historical inheritance of Puerto Rico will also help natural resources and cultural communities flourish, contributing to Puerto Rico's competitive advantage as a unique tourism experience. Moreover, tying Puerto Rico's appeal to its unique assets ensures that the growth of the tourism industry will nurture these assets, rather than damaging them.

Cultivating the visitor economy in Puerto Rico involves countering the narrative of the Island as a disaster site and rebuilding its reputation as a destination. In addition to a destination marketing campaign, this involves both revitalizing the existing hubs of traditional mass tourism, and could also creating new hubs of alternative tourism – lower-volume tourism that emphasizes unique, authentic experiences and extended trips. As the primary point of entry, San Juan is particularly key to existing mass tourism in Puerto Rico, so steps to rehabilitate neighborhoods, plazas, beaches, and piers in the area are needed. Also needed are steps to enhance tourism operations at Puerto Rico's world-famous beaches (Culebra, Rincón, etc.).



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of **strategies for the Visitor Economy** and details about cost and funding in the last section of this plan

The alternative tourism industry is nascent in Puerto Rico, but many areas have significant potential to serve as hubs, such as the Rio-Grande-Fajardo-Humacao, Aguadilla-Aguada-Moca, and the Adjuntas-Peñuelas areas. Each region offers some combination of natural assets; archeological sites; historic structures, plazas, and plantations; distinct culture and festivals; and agro-tourism opportunities. Developing each hub will require investment—infrastructure improvement, workforce training, support for local entrepreneurship, natural/cultural/historical preservation, and a commitment to social justice. However, these hubs will improve Puerto Rico’s uniqueness—and therefore its competitive advantage—in the Caribbean tourism market, while ensuring that the benefits are more broadly distributed within the population. Alternative tourism hubs can also potentially be a boon to the existing mass tourism industry. Cruise ship passengers, a major source of mass tourism revenue, currently stay only a short time, and do not tend to stray far from the docking piers in San Juan. A network of tourism hubs, linked through coordinated tour packages and cruise schedules, could potentially entice passengers out of San Juan, and towards extended stays on the Island.

Additional opportunities exist to transition beyond a tourism economy towards a visitor economy. Using the infrastructure of the tourism economy, Puerto Rico can potentially host workforce training, exchange students, medical tourism, apprenticeship programs, and conventions—especially during tourist off-seasons.



EMERGENCY SERVICES MODERNIZATION AND INTEGRATION

THE FUTURE IN FOCUS

Enhance public safety and first responders' ability to deliver reliable, integrated emergency services

Lessons learned from Hurricanes Irma and Maria suggest that Puerto Rico's capacity to respond to major emergencies needs to improve at the state and municipal levels. A number of these needed improvements are captured by capital investments discussed in the previous section, such as upgrading communications channels used by emergency response personnel, establishing data systems and centers to support decisionmaking, particularly during the response phase directly after an event, building capacity for treating acute and chronic conditions during and after an emergency, and ensuring road conditions allow first responders to reach people with acute needs immediately. In addition, resources are needed to improve emergency preparedness and support response and recovery planning by the Government of Puerto Rico and municipalities.

The effectiveness of emergency services also relies on building community capacity and resilience so that emergency services can prioritize the highest-risk situations during a major emergency. For example, investments are needed to ensure that more residents can access clean water and power and maintain safe housing, even during a major emergency. Community resilience can also be built with investments that foster social cohesion and address long-term stressors which can destabilize communities (e.g., chronic violence). By improving local economies, addressing environmental sustainability, and engaging in health promotion, Puerto Rico can build communities that can better draw on their own resources during a disaster.



MUNICIPAL PERSPECTIVE

Nearly half of municipalities suggested that specialized emergency training and citizen awareness campaigns were needed to prepare for future disasters. Over a third stated that a new and enhanced emergency response and disaster mitigation plan for the municipality—one that surveyed capacities and evaluated flood and landslide hazards—was critical. About a third of municipalities emphasized the need to build and maintain more supply centers and shelters that could be stocked regularly.

Source: HSOAC survey of municipal staff



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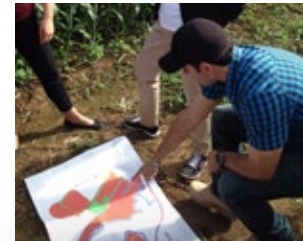
AGRICULTURAL MODERNIZATION AND PROCESSING

THE FUTURE IN FOCUS

Modernize agriculture to promote greater productivity and output and improve exports

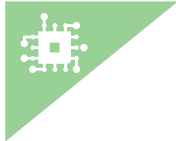
The Puerto Rican agricultural sector suffers from (1) a lack of critical mass to achieve greater productive capacity for both domestic consumption and export; (2) outdated farming practices; (3) a general failure to attract a younger workforce to sustain operations long term; and (4) insufficient access to needed capital that stifles entrepreneurship and growth.

Direct recovery support to existing farmers for hurricane-related infrastructure damage and crop loss is needed first and foremost. This support is intended to bring the agricultural industry back to its pre-recovery baseline. To overcome the constraints that plague the industry's growth and to foster greater self-sufficiency and resilience, training opportunities are needed. Training should address both the labor shortages in the industry among younger workers and outdated farming practices, using technology-driven and innovative approaches. Young, newly trained workers need support to launch operations in a land- and credit-constrained environment. One source of support is the Revolving Loan Fund, a new financing program within the Economic Development Bank that expressly supports innovative agricultural enterprises and can encourage entrepreneurship in the industry. This program would overcome the common failure of private industry to provide adequate credit access to farmers that operate in a risky environment. By providing a workforce trained in modern practices and agricultural technologies an initial infusion of credit access from public funds, the hope is that the industry can collectively demonstrate creditworthiness to attract private financing. Finally, investment in underdeveloped PRIDCO Parks could support conversion of unused public buildings into controlled environment agricultural greenhouses available for lease by private agricultural entrepreneurs. These modern "ag parks" can help attract young farmers to the industry and could work in conjunction with the training initiative. In addition, the parks can be built to reduce climate risk by hosting controlled environment agricultural practices (which may further ease private industry credit constraints), and by enabling vertical hydroponics and other technology-driven operations, they can ease the land constraints faced by Puerto Rican farmers and increase productive capacity.



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of **strategies**
for **Agricultural
Modernization
and Processing**
and details about
cost and funding
in the last section
of this plan



SEE THE FULL PORTFOLIO
of strategies for Digital Transformation and details about cost and funding in the last section of this plan

IMPROVE WASTE MANAGEMENT WITH TECHNOLOGY

Mobile applications such as Recycle Coach allow officials to broadcast information regarding changes in waste removal schedules, transfer station status, and changes in recycling policies. These applications are specifically developed for state and local governments and have been successfully launched in both the U.S. and the U.K. Using data from sensors to optimize collection strategies, and thus save money on collection costs, as well as implementing sensors throughout the process to automatically detect and monitor public health risks related to waste could also improve waste management.

DIGITAL TRANSFORMATION

THE FUTURE IN FOCUS:

Build digital capabilities and workforce needed to fundamentally transform key industry and government processes, making them more user-focused, relevant, and efficient at addressing local needs and delivering basic services

Cutting-edge technologies along with a digitally skilled workforce have the potential to improve public welfare by transforming industries and public services ranging from transportation to health care. Research suggests that technology-empowered governance—sometimes referred to as “Smart Cities”—can enhance public services, improve asset monitoring, increase sustainability, and contribute to infrastructure robustness. This approach leverages Internet and communication technologies, mobile sensors, and networked devices to monitor the status of assets, people, and infrastructure. The interconnected data can then be analyzed and synthesized to aid decisionmakers. Such a crosscutting initiative will require a series of incremental and interdependent improvements. Two main elements are necessary: (1) a mature technological infrastructure and hardware to collect and integrate relevant data, while protecting privacy (much of which is described in the capital investments); and (2) human capital to transform the data into actionable recommendations for key decisionmakers.

Other elements of digital transformation include data and technological enhancements that can improve state and municipal administration and finance systems and help make them more transparent. Data improvement efforts can also enhance decisionmaking for health and social services (e.g., through electronic medical records) and disaster preparedness, surveillance of water-borne disease, public information and communication, and provide the tools needed for greater opportunities in online or tele-education and tele-health.

In addition, efforts to grow Puerto Rico’s digitally proficient human capital could be an important foundation to expand the use of new technologies and innovative processes in Puerto Rico and reinforce Governor Ricardo Rosselló’s vision that Puerto Rico is “open for business.” Expanding Internet access—for example, by using a “digital stewards” program to train residents to deploy increased wi-fi access in public housing—can help foster essential skills needed for a digital world (as described in the capital investments). Other avenues, such

as entrepreneurship programs, innovation hubs, and mobile labs, may provide opportunities to nurture the digital literacy needed to proliferate the “human cloud”—a skilled digital workforce in Puerto Rico that can work with companies around the world.

Broad Areas for Future Focus

In addition to these more focused strategic initiatives, Puerto Rico will need to consider how to grow and sustain a 21st century workforce and competitive small and medium businesses that can compete globally while being located locally, and how to address declining manufacturing capacity in Puerto Rico. Brief descriptions of each of these themes follows.

21ST CENTURY WORKFORCE THE FUTURE IN FOCUS

Develop and protect human capital to establish a world-class workforce, increase labor force flexibility, and create high-quality employment opportunities aligned with economic growth strategies

The labor force of Puerto Rico needs to keep pace with an evolving employment landscape characterized by rapid technological innovations, increased automation, globalization, self-employment opportunities in a “gig” economy, and increased worker mobility across employers. This landscape requires a labor force that is agile and flexible, with skills that are transferable across employers and industries and which are continually updated across a worker’s career and life. In-demand, transferable skills have evolved over time and now include digital, scientific, financial, civic, and other literacies; “soft” skills such as creativity, critical thinking, and problem solving; and “life” or “workplace” skills and competencies such as communication, leadership, collaboration, the ability to take initiative and learn from feedback, self-direction, accountability, and social and cultural competence.

To date, the structure of most education and training programs has not evolved apace, and most operate under the notion that workers will linearly progress through their careers within a single industry, requiring a narrower set of more-or-less static skills to start.

Developing a modern workforce imbued with 21st century skills requires a world-class K-12 and higher education system that is



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of strategies for
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equitable, efficient, and better-integrated with the demands of the labor market and needs of businesses. As technology and innovation prompt change and the workplace evolves, K-12 and higher education institutions, along with employers, must keep pace and be able to contemporaneously adapt curricula and training programs. Specific activities should support increasing the number, diversity, and quality of educational, vocational, and training opportunities, with a focus on sector-based models. Activities include the development of (1) flexible and worker-centered career pathways; (2) flexible pedagogical approaches, such as online, brick-and-mortar, and hybrid classrooms; (3) curriculum and standards that incorporate hands-on, project-based, student-centered learning; (4) public-private/business partnerships; (5) job portals to match job opportunities with workers; (6) career and technical education centers to complement vocational education; (7) stackable credential models; and (8) on-the-job learning opportunities. Additionally, these approaches will take advantage of the global trend toward jobs that are geographically independent (e.g., the “human cloud”) to help people that want to relocate to Puerto Rico and bring the advantages of a global economy to Puerto Rico to support a better quality of life for Puerto Rico’s residents.

A 21st century workforce system, which builds on the capital investments in education, will be needed to address the short-term employment needs of the currently unemployed and underemployed in Puerto Rico, especially vulnerable populations (e.g., youth, women, veterans) and “middle skill” workers with some postsecondary training, to fill positions in high-demand industries (e.g., healthcare, construction, energy, and information technology). Further, the government can build on these short-term strategies to develop and refine a more sustainable, longer-term workforce system.

Individuals with transferable, 21st century skills will have the ability to navigate an evolving labor market and will see positive gains in their employment status and wages, as well as their resilience to industry-specific shocks. Communities’ economic development will be improved by the resulting expansion of the formal economy, higher employment and labor force participation rates, and a growing tax base. Improved economic opportunities are also likely to have a positive impact on migration, reducing the number of potential workers who choose to leave Puerto Rico and helping to spur both return migration and new immigration.

ENTREPRENEURSHIP

THE FUTURE IN FOCUS:

Expand opportunities for entrepreneurship and development of small to medium local business that can compete globally to promote economic development

Increasing entrepreneurial opportunities in Puerto Rico will require a comprehensive approach focused on rewarding initiatives while creating a supportive ecosystem that encourages community collaboration, provides access to startup capital funding, creates advantage through education, and accelerates growth to gain access to export markets. Migration to Puerto Rico needs to be encouraged among populations likely to create job growth. Some elements inhibiting business startups include unduly complex or selective permitting processes and a low survival rate for startup companies in Puerto Rico. Business incubators can be used to support new business and industrial development, and educational and vocational programs are needed to support the workforce. This effort is also supported by directly investing in small to medium-sized local businesses and reducing barriers and red tape (e.g., by streamlining the permitting process for communications technologies). Also valuable is a system that provides statistics, information, and data needed to establish plans, strategies, and actions based on market studies, financing options, and economic projections. Micro-financing is one way of raising capital for startup businesses.

Partnering with universities and others within the education system is also a critical path forward, consolidating entrepreneurial expertise that could be applied in a more enterprise-wide approach. This would help facilitate the development of “centers of excellence” linked to the education system, supporting public policy, and industries benefiting from regionally-aligned accelerators and incubators in Puerto Rico. Private and public investment in various startup opportunities could be through managed risk, as businesses initially focus on internal markets while eyeing openings to export their goods and services. In being able to see the investment and business climate in Puerto Rico more clearly, more businesses will feel confident starting operations in Puerto Rico.



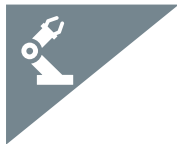
SEE THE FULL PORTFOLIO

of **Entrepreneurship strategies** and details about **cost and funding** in the last section of this plan

ADVANCED MANUFACTURING

THE FUTURE IN FOCUS:

Address policy and structural barriers to increase opportunities for investment and the growth of private/public partnerships



SEE THE FULL PORTFOLIO

of strategies for Advanced Manufacturing and details about cost and funding in the last section of this plan

This initiative is intended to address the declining manufacturing capability within Puerto Rico by supporting entrepreneurial startups to make the shift to larger-scale production and to develop and employ more-advanced approaches and techniques (e.g., vertical integration, intellectual property creation). For example, vertical integration can help manufacturers gain a competitive advantage by controlling other parts of the value chain that feed into or out of the manufacturing component. Companies can do this by buying other entities, such as buying key suppliers to ensure access to raw materials, or by entering into contractual arrangements for goods and services at a fixed rate. By giving manufacturers greater control over supply chains and distribution networks, vertical integration often results in cost savings and decreases network complexity. Investments that support the creation of intellectual property (data, tracking, creating) in a sustainable way can support a continuum of local businesses stemming from research and development opportunities in Puerto Rico, attract foreign capital businesses, and create export products to drive Island-wide economic development.

In addition, joining the National Network for Manufacturing Innovation (also known as “Manufacturing USA”) would provide access to their 14 institutes, each of which is focused on bringing together capabilities in a specialized technology area to address challenges in advanced manufacturing. The institutes are public-private partnerships with manufacturers of all sizes, university partners, regional and state organizations, nonprofits, and federal agencies. Workforce development, institutional partnership development, and advancement in manufacturing techniques and products can transform human capital and intellectual property into an exportable product for Puerto Rico. Current innovation efforts run by different university campuses on the Island should be strengthened so that their services are more connected to government entrepreneurship or business development or assistance programs.



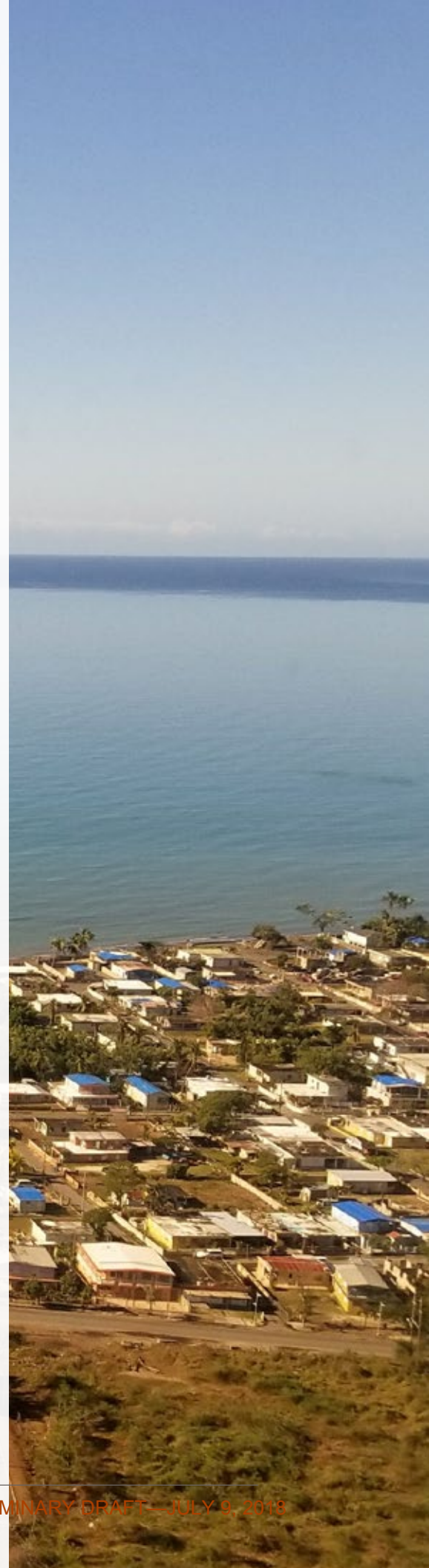
Image via HSOAC

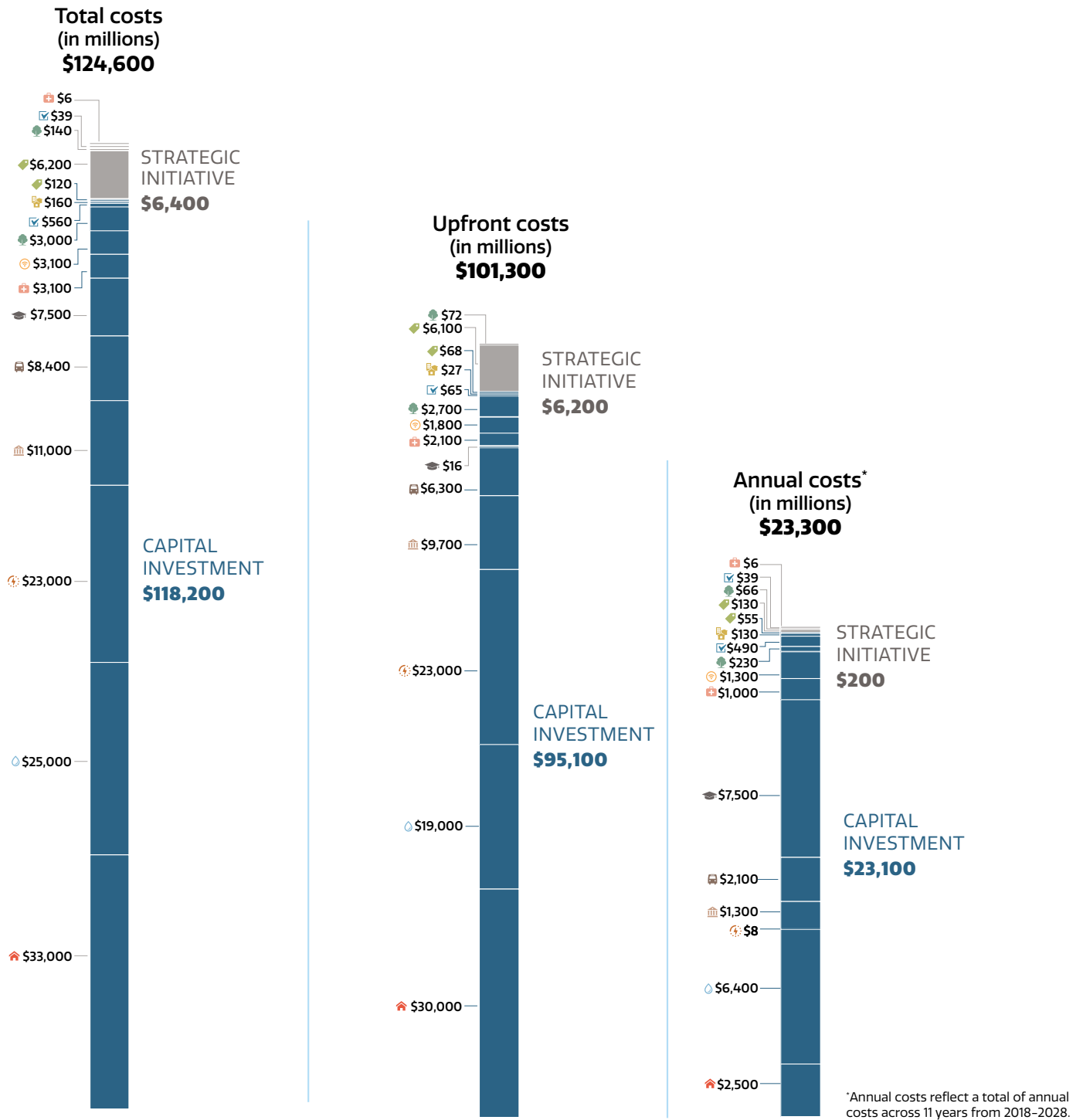
PRELIMINARY DRAFT - JULY 9, 2018

ESTIMATED COSTS AND FUNDING FOR PUERTO RICO'S RECOVERY

As noted in the introduction, and explained in more detail in *Detailed Look at How the Plan Was Developed*, a combination of portfolios that addresses the full set of strategic objectives by the Government of Puerto Rico provided the basis for total cost estimates for the plan.

Most of these actions (roughly 90 percent) are focused on the capital investments needed for Puerto Rico to recover. The plan objectives described in this document would require approximately \$125 billion to fully fund. Some of these costs have already been covered through FEMA allocations of existing funds, and some will be covered by private insurance. Expected future funding availability is detailed below. Costs for recovery include repairing damaged assets to pre-storm conditions, improving them to meet current regulations, such as building codes and EPA regulations and, where cost-effective, improving them so that they are more disaster-resilient (which may require moving them). Improving the disaster-resilience of facilities is proposed when it is judged to be cost-effective in terms of lowering future disaster recovery costs. Some courses of action involve repairing damaged assets and improving them in other dimensions, such as more appropriate fuels for power plants or upgraded electricity distribution or communications networks; or establishing new kinds of activities that improve Puerto Rico's post-recovery future. Improving facilities and capabilities is proposed when it is judged to be cost-effective in terms of raising Puerto Rico's economic prosperity; this will also generally





The three bars are not in proportion to each other for legibility. Sector costs have been rounded so may not add up to the totals shown.

Sectors represented in the plans

- Economy
- Community Planning and Capacity Building
- Municipalities
- Housing
- Energy
- Natural and Cultural Resources
- Transportation
- Public Buildings
- Communications/IT
- Water
- Health and Social Services
- Education
- Cross-sector

Estimated potential costs for the energy sector were derived from a cross-walk of courses of action against those in *Build Back Better Puerto Rico* and the *Puerto Rico Energy Working Group (PREWG) Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico* plans. In both of these reports, the total cost to “build back better” was just under \$18 billion. Our courses of action included some additional activities (e.g., studies and analysis to support decisions as provided by cost team) and total to \$22 billion.

increase its tax base, and thus its financial ability to respond to disasters. The chart on the next page provides the breakdown of costs (including initial upfront and annual operations and maintenance) by sector where cost estimates were available. Actions in the precursor portfolio are all capital investments, thus the cost for this portfolio is reflected along with the cost of the actions for other capital investments.

This section of the plan also identifies in broad terms the classes of potential funders, and estimates the order of magnitude of the funds they may be able to provide.

Estimate costs of recovery

Where possible, for each proposed course of action, the relevant sector team made rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. Where available, costs are presented in 2018 dollars. Costs are included for the period FY 2018 through FY 2028. They include both initial costs (e.g., construction investment) and future costs (e.g., operations and maintenance) over the 11-year period. Incremental operations and maintenance costs are included if they are an increase from pre-hurricane levels (e.g., because of structural improvements or technological upgrades) and thus would represent a new expense that would have to be covered. Similarly, full operations and maintenance costs are included for facilities that were not being maintained prior to the hurricane. And it is worthy to note that the estimates represent only those costs for which a specific payment is made by some source to carry out a specific action; they do not include all of the costs to society that may be associated with recovery actions (e.g., the costs that better enforcement of regulations incurs on the individuals and business owners who must comply).

The approach to estimating the rough-order-of-magnitude cost of each individual course of action was based on its specific nature and the available sources of information robust enough to inform the estimate. As such, ranges and point estimates are given for courses of actions depending on the methods and information used. Some cost estimates are much more precise than others, and the estimated costs may vary based on the scale of implementation. Cost information presented in this plan should be regarded as preliminary since more specific cost estimates will require both more specificity in the manner in which recovery options will be implemented and the completion of ongoing damage assessments.

Some courses of action do not have costs that require specific recovery funding (policy changes, for example), though these

actions may require administrative time or other resource. Other courses of action included in the plan that do not have costs assigned are likely costly, but not enough information is available to provide even rough-order-of-magnitude estimates so these items remain un-costed.

Matching resources to needs

Although resources will be needed to undertake recovery efforts, at this stage of recovery planning, it is not possible to precisely identify what specific funding sources will be used to meet the costs of each course of action. This is true for several reasons. First, the total amount of each funding source that will be available is not now known. In addition, funding programs have specific eligibility requirements. Determining the extent to which courses of action conform to those requirements requires more detailed analysis and reviews with potential funders. Therefore, achieving funding for recovery actions will be a continuous process of discussions with funders, applications, and adjustments as funds are found for specific courses of action. As specific projects find funding, there will be a continuous process of matching remaining *unfunded* needs to appropriate funding sources. The Government of Puerto Rico will be responsible for guiding this process of matching donors to funding sources. This process will sometimes be in coordination with local private, social service agencies but always contracted for and guided by the Government of Puerto Rico.

This section of the plan identifies in broad terms the classes of potential funders, and estimates the order of magnitude of the funds they may be able to provide. More detail on potential funding sources for each course of action, from which the finer process of discussion and application can begin, is included in the *Detailed Actions* section. At this stage, all identified funders are *potential* only; others may arise as the process of matching funds to unmet needs progresses.

Opportunities for recovery funding

Carrying out this economic and disaster recovery plan will require substantial resources. These funds will need to be invested wisely—in a coordinated way over many years—to ensure the resources align efficiently and effectively with Puerto Rico’s vision. By identifying actions that will help Puerto Rico recover, this strategic plan provides a path to help decisionmakers start identifying and asking questions about potential funding



U.S. Air National Guard photo by
Maj. Randy Stillingner

It is clear that multiple federal agencies, as well as the private sector, including philanthropies, will play a part in funding recovery.

sources. It is clear that multiple federal agencies, as well as the private sector, including philanthropies, will play a part in funding recovery. Although the funding available and the amount Puerto Rico will receive are uncertain, resources needed for recovery do exist and Puerto Rico will make a vigorous and concerted effort to obtain them.

Eight categories of resources, six of which involve U.S. government (USG) aid, are potentially available. These are discussed below.

Funds from the Disaster Relief Fund (DRF), as provided for in the Stafford Act.

- Individual Assistance (IA) grants for immediate relief and assistance to individuals and households. The recovery plan only considers Housing Assistance as a recovery funding source, not Other Needs Assistance.
- Public Assistance (PA) grants for repairing, restoring, and replacing facilities damaged by the disaster. The recovery plan only considers Permanent Work (Categories C–G) as a recovery funding source, not Categories A–B. Section 406 hazard mitigation funds are part of PA.
- Hazard Mitigation Grant Program (HMGP) grants to reduce the hazard risk of damage, hardship, loss, or suffering from future disasters.

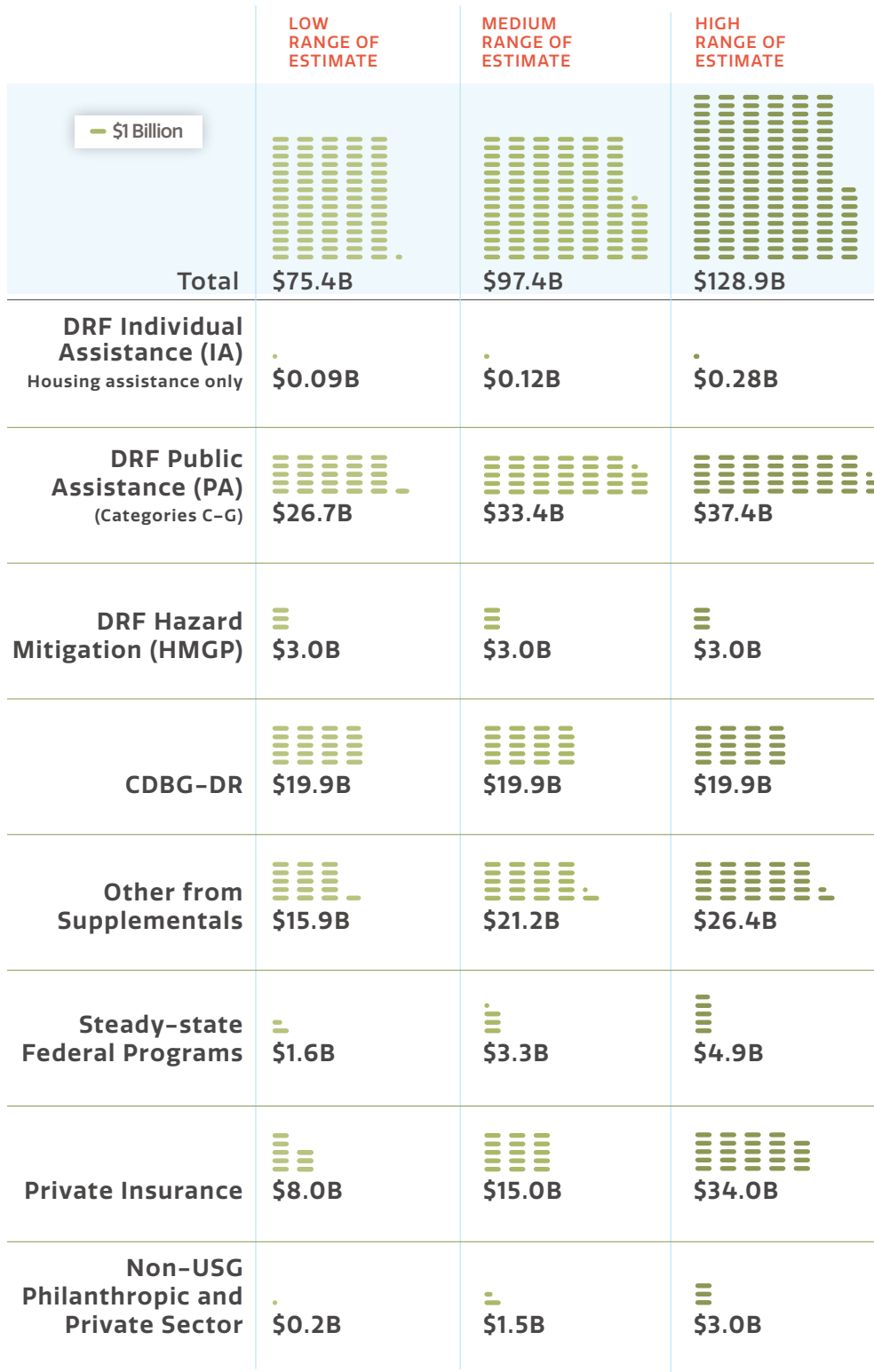
Funds specifically appropriated for disaster relief and recovery in Congressional Supplemental Appropriations

- Community Development Block Grant–Disaster Relief (CDBG-DR) funding. Administered by HUD, this is the largest of the individual appropriations, and nearly \$20 billion has already been directed to Puerto Rico’s recovery effort. CDBG-DR funding does not require recipients to provide a non-federal matching contribution. In fact, once the funds have been awarded to a state or territory, they can be used as “non-federal” matching contributions for other federal grants.
- Other appropriations administered by a wide variety of USG departments and agencies.

Steady-state federal programs, funded via normal annual program budgets

- These programs fund authorized federal programs that existed before the disaster and are ongoing. Most of this funding will continue to go toward previously identified needs and priorities; however, some programs allow funds to be re-programmed for recovery needs.

Range of Estimated Resources Available to Puerto Rico for Disaster Recovery



Non-USG sources

- Private insurance proceeds will be available to support some recovery.
- Private philanthropic and volunteer groups are already contributing to the Puerto Rico recovery, and additional funding may also be available from sources such as philanthropic private and corporate foundations, as well as public/private partnerships. Venture capital is another potential source, which would only be available if the investors expected a market rate of return on the investments.

While total resources available to Puerto Rico for recovery funding are uncertain, the graphic below identifies a range of funding possibilities from low to high, which have been reviewed with FEMA and other outside experts.

DRF sources

FEMA administers the DRF, which serves the entire nation. Congress, which is responsible for ensuring the DRF has adequate funding to meet current and anticipated needs, appropriated \$50 billion to the DRF in the three disaster-related supplemental bills of late FY 2017 and early FY 2018 (PL 115-56, PL 115-72, and PL 115-123). The amount of funding to be received by applicants in Puerto Rico will depend on the eligibility of specific recovery costs for DRF program support. The amount is therefore uncertain and this uncertainty is reflected in the high, medium and low estimates. These estimates are FEMA's latest assessment of how much IA, PA, and HMGP will eventually be allocated to Puerto Rico recovery. Below, the PA estimate will be broken down by sector.

Funding from disaster-related supplemental bills

CDBG-DR funds were appropriated in the supplemental bills PL 115-56 and PL 115-123, and HUD has allocated \$19.9 billion to Puerto Rico's recovery. Separate from CDBG-DR and the DRF, the three disaster-related supplemental bills of late FY 2017 and early FY 2018 also included \$35 billion of appropriations to federal agencies for specific disaster-relief activities (listed in the Congressional Research Service's 2018 report). Not all of the funds will be available to support the actions in this recovery plan for two reasons. First, some of the funds—about \$4.5 billion, based on the Congressional language—are dedicated to federal expenses (e.g., agencies repairing their own hurricane-damaged facilities). Second, Puerto Rico will compete for the remaining \$30.5 billion with other states impacted by Hurricanes Irma and Maria, Hurricane Harvey, recent wildfires, and other disasters. The medium projection is that \$21.2 billion of those funds will be available to Puerto Rico, based on the CDBG-DR allocation. The low and high cases reflect uncertainty about the ultimate allocation of the funds across those states.

ACTION PLAN FOR SPENDING CDBG-DR FUNDING

This recovery plan aligns with many of the activities that the Government of Puerto Rico laid out in its action plan, submitted on June 14, 2018, for how it will spend the \$1.5 billion in CDBG-DR funding that it was initially allocated. However, there are some differences in actions and funding levels between the action plan and this recovery plan, primarily because the action plan addresses only a fraction of the anticipated funding—\$1.5 billion allocated in February 2018 out of \$18.4 billion announced a month later. Once HUD publishes the requirements for the additional funding, the Government of Puerto Rico will develop additional action plans for how those funds will be spent.

Steady-state (i.e., ongoing) federal programs

This plan projects \$9.35 billion per year in steady-state federal grants to Puerto Rico, much of which will be pass-through funds directly to individuals. Much of the remaining funds will continue to go to daily program needs. The medium case projects that 32 percent of the funds will allow re-programming for recovery needs, and that 10 percent of those funds will actually be re-programmed. The low and high cases project that 5 percent and 15 percent will be re-programmed, respectively, again reflecting uncertainty. The sum includes 11 years of such funds, consistent with the 11-year horizon over which costs have been estimated.

Private insurance

There is currently considerable uncertainty about the level of private insurance claim resources that will be available for recovery efforts. Based on the estimates of personnel at the Office of the Commissioner of Insurance of Puerto Rico, the recovery plan projects \$15 billion as the medium case. The high case of \$34 billion is the middle of AIR Worldwide's estimate of \$25 to \$43 billion. The low case of \$8 billion is based on the FOMB's May 30, 2018, *Restoring Growth and Prosperity*.

Other non-USG sources













The greatest uncertainty surrounds the level of private funds that may be available. The medium case of \$1.5 billion offers a rough order-of-magnitude estimate; the low case of \$0.2 billion and the high case of \$3 billion represent this high level of uncertainty.

A vigorous effort to secure the highest levels of funding

Given the wide range of funding levels, optimizing the allocation of funds will require vigorous, cooperative engagement with all potential funders to propose, justify, and negotiate individual projects or sets of projects needed for recovery. In addition, many potential funding sources require a non-federal matching share, and the Government of Puerto Rico will work diligently and creatively to maximize the availability of funds for non-federal matching contributions. As noted above, CDBG-DR is a potential source of matching funds. Non-USG funds may also be available for that, though the eligibility depends on any specific project's characteristics. The success of Puerto Rico's recovery depends in part on its success in securing the necessary resources, and that success depends on effectively communicating both the depth of the problem and the exciting opportunity for a better life for all Puerto Ricans that recovery will bring.

The table to the right indicates potential federal funding sources by sector. Whether a specific course of action in any sector is eligible for

Potential Funding Sources by Sector

	FEMA			HUD			DHHS	DOC	DOI	DOL	DOT	ED	DOE	EPA	NSF	SBA	USDA	NON-USG
	IA	PA	HMGP	FEMA (Other) ¹	CDBG-DR	HUD (Other) ²												
 COMMUNICATIONS/IT																		
 COMMUNITY/CAPACITY																		
 ECONOMY																		
 EDUCATION																		
 ENERGY																		
 HEALTH/SOCIAL SERVICES																		
 HOUSING																		
 MUNICIPALITIES																		
 NATURAL/CULTURAL RESOURCES																		
 PUBLIC BUILDINGS																		
 TRANSPORTATION																		
 WATER																		

1. FEMA (other) includes the National Flood Insurance Program, Emergency Management Performance Grant, Dislocated Workers Program, port security grants, and the Pre-Disaster Mitigation Program, among others.

2. HUD (other) includes the CDBG Entitlement Program, Capital Fund Program, Rental Assistance Demonstration Program, Choice Neighborhoods Program, Section 18 (Demolition/Disposal), Energy Performance Contracting, and Housing Choice Voucher Program, among others.

MAKING INVESTMENTS WORK FOR THE LONG-TERM

In 2013, the Hurricane Sandy Rebuilding Task Force developed a set of Infrastructure Resilience Guidelines to ensure that key principles of resilience were incorporated into the formulation, evaluation, and prioritization of infrastructure investments. The guidelines aim to (1) ensure that federal agencies adopt a consistent approach to building resilience and (2) improve decisionmaking by setting criteria for investment to better protect communities and ensure wise investment of scarce public resources. The guidelines were incorporated into Federal Register notices or requests for proposals with selection criteria reflecting resilience principles. Agencies, organizations, and jurisdictions already familiar with resilience principles reported being more efficient in putting the Sandy supplemental funds to work and prioritizing longer-term results over solving immediate needs. Key lessons learned are that resilience criteria need to be streamlined across federal funding sources and that grantees may need support to address the more substantive issues contained in the guidelines.

funding from any specific program depends both on the kinds of activities required to carry out the course of action, and on the program's specific eligibility rules. Courses of action may incur costs in such categories as construction, personnel, equipment and materials, operations and maintenance, financial incentives, and transfer payments. Programs naturally vary in the kinds of costs they may cover, as well as in the goals they support.

As noted earlier, at the state level, the Government of Puerto Rico will need to set aside at least \$10 billion in unrestricted CDBG-DR funding to unlock matching federal funding to repair roads, public buildings, and other infrastructure (ECN 36).

At the municipal level, many governments are in financial distress, leaving them unable to address expenses from emergencies. In addition, many individuals and private-sector entities lack disaster insurance. Above it is noted how some of the courses of action will enable municipalities to make themselves more resilient to future disaster, such as by setting aside money (e.g., from tax revenues or, if permissible from CDBG-DR funding) for an emergency fund before the next disaster (MUN 1), as well as other measures.



Pursue alternative funding sources

While governmental funding sources will be key to comprehensively rebuilding a resilient Puerto Rico, alternative funding sources can bring additional revenue, expertise, innovation, and volunteers to the recovery efforts.

Charitable foundations

Charitable foundations—whether billion-dollar family foundations or small-grant, single-issue foundations—tend to focus on “world-changing” ideas, such as protecting and preserving oceans and watersheds, eradicating poverty, or increasing health equity—all of which are issues for Puerto Rico. Puerto Rico’s social and economic development efforts can be understood and articulated as complementing these ambitious frameworks. Environmental preservation is addressed by clean energy infrastructure in Puerto Rico. A project that fosters women entrepreneurs could be a step in reducing poverty. Building new rural clinics can address health disparities in underserved areas.

Projects like these both further the mission of charitable organizations or individuals and support courses of action already planned for Puerto Rico. For example, the Ford Foundation’s \$5 million contribution to the Reimagine Puerto Rico project aims to help Puerto Rico rebuild while also supporting the Foundation’s focus on reducing global inequality. Charitable organizations can both fund the work of others—which is most common for foundations and for high-net-worth

EXAMPLES OF CHARITABLE FOUNDATIONS CONTRIBUTING TO THE RECOVERY EFFORT

Nonprofit

The Red Cross has raised \$31.6 million for relief efforts in Puerto Rico associated with Hurricane Maria.

Catholic Charities has contributed an additional \$1.2 million for Puerto Rico and the U.S. Virgin Islands.

Charitable foundations

The Knight Foundation has donated \$2.5 million.

The Center for Disaster Philanthropy, a hub of targeted disaster-related donations, raised \$2.6 million for 2017 hurricane relief efforts throughout the Caribbean.

EXAMPLES OF CORPORATIONS CONTRIBUTING TO THE RECOVERY EFFORT

AbbVie, a pharmaceutical company with a substantial presence in Puerto Rico, has pledged \$100 million to the recovery effort to be split between the nonprofits Direct Relief and Habitat for Humanity.

Pharmaceutical companies Amgen and Merck, which have local operations, have contributed \$5 million and \$4.5 million, respectively.

Walmart contributed more than \$7 million in aid.

FedEx donated \$3 million in cash and transportation support.

Duracell contributed \$2 million worth of batteries to Puerto Rico.

UPS lent the use of two of its freight aircraft to fly in Meals Ready to Eat.

Google donated its experimental solar powered balloons to provide cell and internet service. This philanthropic act also provided important testing of a still-developmental technology.

philanthropists, who often work through foundations—or can themselves help perform the work on the ground, as is common with charitable and religious nonprofits.

Corporate foundations

Corporate foundations or corporate social responsibility (CSR) initiatives can donate funds (usually less than \$2–3 million per project), employee hours and expertise, and goods and services. Corporate foundations are most likely to invest in rebuilding efforts that help achieve corporate goals, improve corporate reputation, or both. For instance, a corporate foundation for a telecommunications company might fund projects bringing broadband internet to developing countries. The company might also fund seemingly unrelated projects, such as building schools and giving scholarships, in an effort to burnish its corporate image.

Institutional investors

Institutional investors include sovereign wealth funds, mutual funds, and pension funds as well as a wide range of private financiers, from quasi-philanthropic development banks to corporations engaging in public/private partnerships. Institutional investors can have much larger sums at their disposal, sometimes as much as billions of dollars for a single, complex project. However, the potential to bring in such investors is often limited. Given their tremendous fiduciary responsibilities, institutional investors are often cautious and conservative, as they often protect capital for purposes such as funding federal worker retirement.

Specific de-risking strategies, including “blended finance” models, may be required to encourage investment in Puerto Rico’s rebuilding. For example, an institutional investor might undertake a large housing overhaul project, if the project offers the opportunity for substantial profit with little risk. One way to decrease risk is to merge, or blend, developmental, philanthropic, and public funds with investor funds to lower collective risks, scale up projects, and build momentum for more widespread investment. For example, the government of Tamil Nadu in India used blended finance, incorporating public resources, private capital, and concessional loans, to create a “Water and Sanitation Pooled Fund” that addressed key infrastructure needs.

Another means of marshaling nongovernmental resources and reducing governmental costs is to engage public/private partnerships (P3s) to develop infrastructure for a more resilient

Puerto Rico. P3s generally use some degree of private funds and financing to address public infrastructure needs in exchange for a percentage of future revenue. P3s have been used throughout the U.S. for building or expanding toll roads, with private companies and banks funding construction or operations in exchange for retaining toll revenues. Similarly, several cities have supplemented their public housing system with P3 mixed-use development, with developers setting aside a certain number of units in a building as low-income housing in exchange for government concessions, such as access to specific land or tax incentives. P3s are also often used for the redevelopment of downtown city spaces and waterfront areas, in an effort to bring in businesses, new residents, and tourists.

Puerto Rico has already implemented several major P3 projects in transportation since the creation of the P3 Authority. Luis Muñoz Marín International Airport in San Juan, the largest passenger airport on the Island, has been operated since 2013 by the joint venture Aerostar. It is the only major privatized airport in the United States. Two toll roads, PR-22 and PR-5, have been operated by Metropistas since 2011. Other P3 agreements, such as the Teodoro Moscoso bridge and the Tren Urbano, pre-date the P3 Authority.

P3s are appealing when public funding is tight or politically fraught. P3s can be a viable way of injecting immediate resources into much-needed infrastructure projects. They can add financial flexibility and bring corporate innovation and technology to solve infrastructure problems. In addition, P3s give private partners a profit incentive to avoid delays. P3s can spread risk among several stakeholders, lightening the burden on government to undertake complex projects. However, P3s are not without risks. Even with private financing, the money to recoup the project costs must still come from somewhere, either through taxes or user fees.

For the most part, P3s function best when the process is transparent and accountable, the future revenue is sufficient and known, the project benefits the population equitably, and the P3 addresses a fundamental need. In addition, for P3s to function effectively and efficiently, they should be integrated into a coordinated and centralized plan and be managed by a consistent governing body of leaders and invested stakeholders.

PUBLIC/PRIVATE PARTNERSHIPS AUTHORITY (P3 AUTHORITY)

The Puerto Rico Public Private Partnerships Act was passed in 2009 to "identify innovative measures and nontraditional vehicles that promote and render economic development feasible, provide the People with the required public services, and allow the Government to stabilize its finances."

In addition to establishing a policy of creating public/private partnerships (P3s), the Act created the Public Private Partnerships Authority (P3 Authority), which has broad powers to identify, evaluate, and select P3 projects. These projects may cover diverse aspects of Puerto Rico's economy and government services, including solid waste facilities (e.g., waste-to-energy and recycling facilities); water and energy infrastructure (e.g., renewable energy projects); transportation infrastructure; health care, educational, law enforcement, and penitentiary facilities; low-income housing; communications infrastructure; and recreational, cultural, and tourism facilities.



Personnel from Liberty Cable work to restore fiber-optic lines on the third day after the impact of Maria, a Category 4 hurricane that crossed the island, in Carolina, Puerto Rico, Saturday, Sept. 23, 2017. Since the passing of the hurricane the connectivity of digital communication has been a nightmare for both the authorities and the population in general.

Carlos Giusti via AP Images

PRELIMINARY DRAFT—JULY 9, 2018

A COMMITMENT TO TRANSPARENCY

Prioritizing fiscal transparency and strong governance

Transparency is a key guiding principle of Puerto Rico’s entire recovery process. To ensure the economic development and recovery courses of action described in this recovery plan will be implemented in a way that promotes fiscal transparency in recovery investments, processes are needed to both track progress of these actions and help prevent waste or abuse of disaster funding. In addition to the body of legislation that already addresses these issues (see box), the Government of Puerto Rico has been embedding such processes in the recovery effort, particularly through the procurement and contract policies and procedures of the Central Recovery and Reconstruction Office (later renamed the Central Office of Recovery, Reconstruction, and Resilience).

Central Recovery and Reconstruction Office of Puerto Rico

Issued by the Governor on October 23, 2017, Executive Order 2017-065 authorized the creation of the Central Recovery and Reconstruction Office (later renamed the Central Office of Recovery, Reconstruction, and Resilience or COR3) as a division of the P3 Authority, to centralize control and oversight of the recovery and reconstruction of Puerto Rico. The COR3 was created following global best practices, such as those used in New Jersey, Louisiana, New York and New Zealand, to ensure accountability and coordination of the disaster recovery efforts expected by residents of Puerto Rico and U.S. taxpayers. It will ensure that the Government of Puerto Rico can implement reconstruction efforts with efficiency, effectiveness, and transparency, while capitalizing on opportunities to build back in a way that makes Puerto Rico better, stronger, and more resilient.

“

“Our commitment is to have the most transparent rebuilding process in the history of disasters in the United States and to make Puerto Rico stronger than before.”

—GOVERNOR RICARDO ROSSELLÓ

(INTERVIEW WITH NATIONAL PUBLIC RADIO, NOVEMBER 2017)

SAMPLE OF PUERTO RICO LEGISLATION RELATED TO TRANSPARENCY

Puerto Rico Public Private Partnerships Act

The Public Private Partnerships Act of 2009 requires that “upon completion of the negotiation for the Partnership Contract, the Partnership Committee shall prepare a report, which shall include the reasons for entering into a Partnership, the reasons for selecting the chosen Proponent, a description of the procedure followed, including comparisons between the Proponent and the Partnership Contract recommended and other proposals presented, as well as all other information pertinent to the procedure followed and the evaluation conducted.” This report is filed with the Secretary of the Senate and the Clerk of the House of Representatives and published on the Internet.

Anticorruption Code for a New Puerto Rico

On January 4, 2018, the Governor signed into law House Bill 1350, known as the “Anticorruption Code for a New Puerto Rico.” The Code, which consolidates separately enacted anticorruption legislation into a single legislative code, establishes the rights, duties and ethical responsibilities for current and former government officials. The Code also establishes anticorruption requirements for private entities and for individuals who provide goods and/or services to the Government of Puerto Rico, and specifies protections for whistleblowers.

Puerto Rico Government Ethics Act of 2011

In 2011, the Government of Puerto Rico approved a comprehensive reform to its Office of Government Ethics. In addition to reasserting the Office's duties to identify, analyze, and provide education on values such as trustworthiness, fairness, and responsibility, the Act aims to optimize audit and investigation processes, and streamline these services to efficiently and effectively prevent and address corruption.

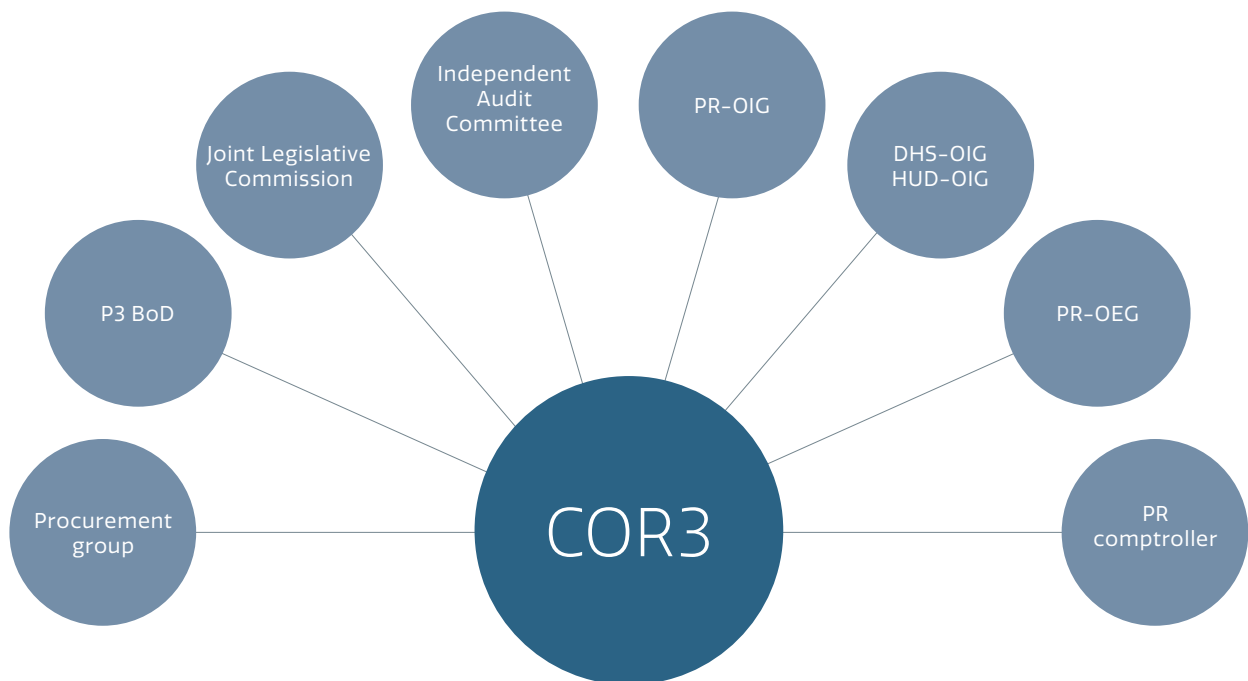
TexPhoto via GettyImages

As stated in the fiscal plans, key among the COR3’s responsibilities are to:

- **Monitor** contracting for compliance and effectiveness purposes.
- **Implement and enforce** checks and balances for procurement and approval of contracts and payments.
- **Deploy** a proven grant-management software and provide external visibility via frequent status updates to its public website.
- **Coordinate and channel** all efforts and activities of the Government related to recovery efforts.
- **Process, finance, and execute** works and infrastructure projects related to recovery efforts.

The Governor’s Executive Order 2017-069, issued on November 10, 2017, further clarified that the COR3 “shall exercise its functions under the highest standards of integrity and professional quality.”

As part of the Government of Puerto Rico’s commitment to ensuring a transparent and effective recovery process, the COR3 is subject to rigorous and unprecedented control measures, including the requirement that FEMA approve the disbursement of funds for recovery projects. Below is a graphic showing stakeholders with oversight of the COR3.





Gerald Herbert via AP images

WEB PORTALS USED AFTER RECENT DISASTERS TO PROMOTE TRANSPARENCY ABOUT RELIEF FUNDS

Following Hurricane Sandy, New Jersey created the Sandy Transparency Portal to promote transparency in the distribution of reconstruction funds in the state. The Portal provided public access to all state contracts for the allocation and expenditure of federal disaster relief funds, including contract vendor information

(Source: <http://nj.gov/comptroller/sandytransparency/index.shtml>).

New York City also established a public website that listed Sandy-related contracts and expenditures. One potential barrier to any public facing website is how to handle proprietary data. A limitation of these recovery portals was a lack of detailed information about funding available to specific counties (and other sub-state levels) that would have been useful to local government.

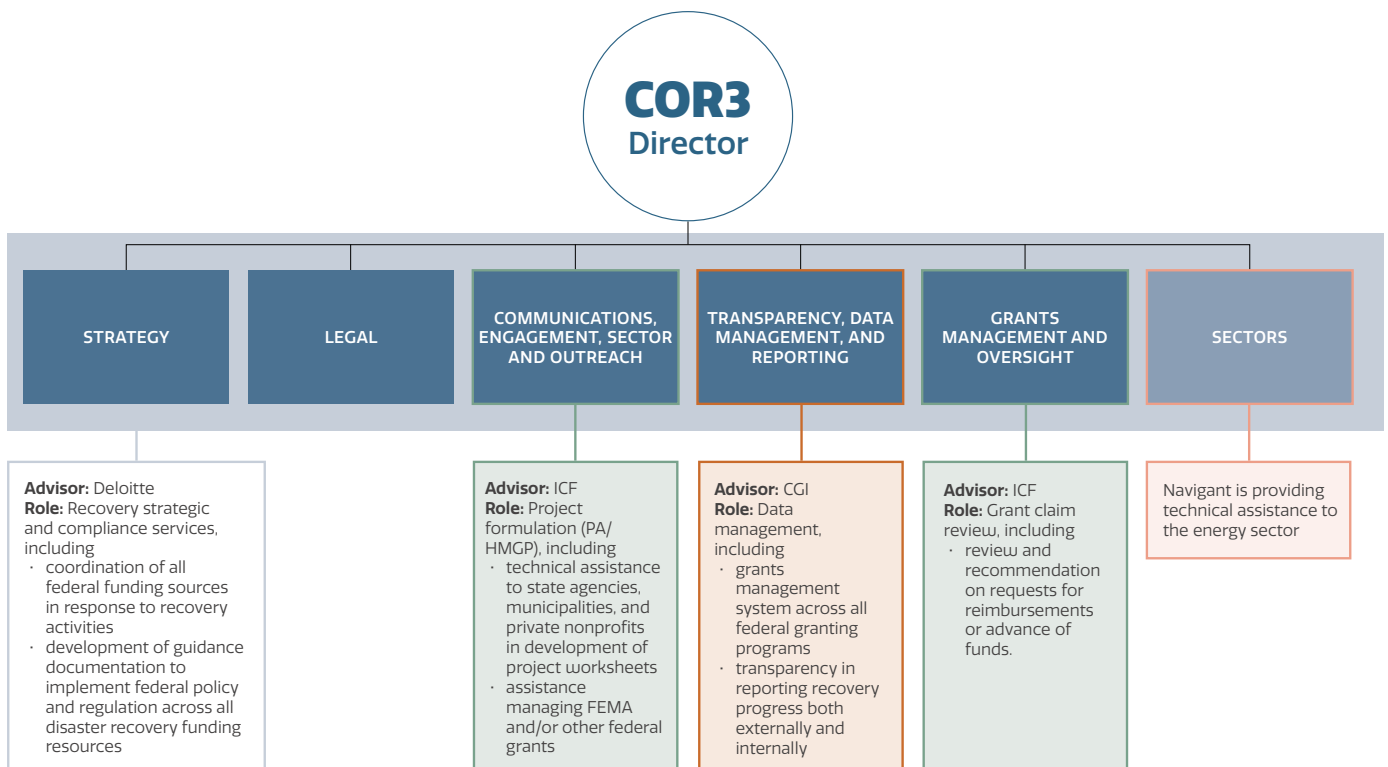
Not only was the Government required to establish the grant oversight activity, but also to support it with third-party assistance. Consequently, the COR3 conducted a procurement process (2 CFR 200 compliant) and hired Deloitte, ICF, CGI, Navigant to provide their expertise and guide the reconstruction and recovery efforts. Third-party assistance will also be used to manage recovery funds and optimize the long-term reconstruction process. The Government of Puerto Rico will engage consultants with expertise in managing FEMA, HUD, and other grant programs and a national accounting firm to develop financial controls, policies and procedures.

Recovery web portal

Another opportunity to share recovery information with the public is through the use of web-based portals. In the wake of Hurricane Maria, the Puerto Rican government recognized a need for publicly available up-to-date information about basic services in Puerto Rico. The Governor's office launched www.status.pr to update the media, public, and first responders about conditions across

the islands. This site has been used in the months following the hurricanes to keep the public informed about response efforts, and the Government of Puerto Rico is in the process of building a similar transparency portal to share information about the recovery.

The Government of Puerto Rico has contracted with CGI for data management services around disaster recovery. One element of that work is to develop and maintain a website that presents data about federal funds that have been requested, obligated, and disbursed for projects at the municipal level. The data may also be presented in other ways, such as by category of FEMA PA funding, or by the Government of Puerto Rico agency managing the funds.





Jonathan's Photos via Adobe Stock

NEW ORLEANS INDEX AT FIVE

Southeast Louisiana has experienced multiple large-scale disasters since 2005, including Hurricane Katrina and the Deepwater Horizon oil spill. Recovery has been tracked by the New Orleans Index at Five, a set of indicators published on the fifth anniversary of Katrina by the Brookings Metropolitan Policy Program and Greater New Orleans Community Data Center. The Index relies on multiple indicators and topical essays to assess the extent to which New Orleans city and the surrounding metro area is rebounding from the disasters. Indicators focused on measures of population, economy, housing and infrastructure. Five years after Hurricane Katrina, the information collected suggested that much progress had been made in some areas, but that meaningful progress toward prosperity had not been made for the most vulnerable. New Orleans' recovery and transformation continues to be tracked using an expanded set of indicators and methods. The Index provides important information for decisionmakers about whether the region's resilience capacity has changed over time and how social and environmental trends may challenge resilience in the future.

Brookings Metropolitan Policy Program & Greater New Orleans Community Data Center, 2010, The New Orleans Index at Five. https://www.brookings.edu/wp-content/uploads/2016/07/08_neworleans_execsum.pdf

Tracking recovery progress in a transparent manner

Recovery indicators provide important information for decisionmakers and the public

Decisionmakers at every level want to know about Puerto Rico's economic and disaster recovery so they can allocate resources appropriately and prepare for future disasters. Indicators, which can be organized around key themes such as economic growth and quality of life, are important to track progress toward recovery, identify areas of strength and weakness and modify plans accordingly, support economic growth, and build community resilience to future shocks.

Research suggests community resilience is a process of using social and economic resources to adapt to and withstand stressors brought on by disasters. Building resilience throughout the recovery process involves a sequence of interdependent activities. The sequenced time structure for future infrastructure recovery projects means that some projects need to happen before others (e.g., a road needs to be repaired before mass transit can expand its operations), so some interim outcomes will be observed before others. Additionally, some outcomes (e.g., employment) lag, due to the time it takes for the effects of some actions (e.g., workforce development) to ripple through different sectors. Puerto Rico's recovery and resilience thus needs to be tracked with a range of indicators, including population wellbeing; access to high-quality health, social, and economic services; education, job, and housing opportunities; and a healthy environment. Indicators need to capture the ability of individuals, organizations, and whole communities to adapt to a changing environment through economic development, social support and organizational linkages, communication, and community members engaged in collective decisionmaking and action.

What might recovery progress look like?

The extent to which a set of recovery indicators appropriately captures long-term outcomes after a disaster depends on the type of damage sustained, the pre-existing conditions, the characteristics of the communities impacted, and broader global social and environmental trends. Ultimately, if Puerto Rico has a healthy economy and society, one would expect to see the population grow, and economic indicators improve (e.g., presence of small businesses, employment rates). People will want to live in Puerto Rico if there is an opportunity for a good quality of life. This means that physical and emotional needs are being met, indicated through good physical health, access to health care services, job opportunities, and education. The growing economy and increased quality of life will be supported by a healthy environment and reliable infrastructure, such as electric power, water services and broadband access, and communities will be better prepared for future disasters through emergency plans and adequate insurance coverage.

These types of indicators can move slowly since they are driven by many things, not just specific recovery initiatives (see box on the New Orleans Index at Five).

Dashboard of recovery indicators needs to be easy to understand and collect










For recovery indicators to be useful and usable to diverse decisionmakers, several features have been prioritized. First, the selected indicators are positive, that is, higher numbers reflect good outcomes. Second, complicated or abstract concepts that are difficult to understand are avoided. Third, minimizing new data collection methods will reduce the burden within Puerto Rico and increase credibility and access to data outside Puerto Rico. Fourth, to be useful, indicators need to cut across the many factors contributing to recovery. Finally, it is critical that recovery indicators not only assess progress in outcomes by sectors, but can track improvements in systems capacity. Given that this plan is intended to be transformative and improve the systems for a future, innovative Puerto Rican economy, it is also essential to track changes in structures such as communication, workforce, and data systems.

Puerto Rico's recovery and resilience thus needs to be tracked with a range of indicators, including population wellbeing; access to high-quality health, social, and economic services; education, job, and housing opportunities; and a healthy environment.

On the next page are a number of indicators that the Government of Puerto Rico expects to track to support its recovery process in a transparent and effective manner. These indicators could inform a web-based portal for sharing information about the recovery effort. Given the commitment to addressing the needs of those populations most vulnerable, the indicators should include consideration of how progress varies by subgroups of interest (e.g., older adults, children, those living in rural locations).

Puerto Rico recovery indicators

How the people of Puerto Rico will measure success

	INDICATOR NAME	POSSIBLE SOURCE	DEFINITION
	Population change	Puerto Rico Community Survey	Change in working age (18–64 years) adults as percent of overall population
	Employment growth	Puerto Rico Community Survey	Percent of population 18–64 years of age in civilian labor force
	Small business growth	Bureau of Labor Statistics	Net number of start-up businesses
	Visitor economy	Puerto Rico Tourism Company	Average number of nights of lodging rented
	General health	Updated PR–Behavioral Risk Factor Surveillance System	Percent of adults reporting good, very good, or excellent health
	Access to health services	Updated PR–Behavioral Risk Factor Surveillance System	Percent of adults reporting access to healthcare coverage
	Educational attainment	Puerto Rico Community Survey	Percent of adults over 25 years of age with at least some college or a bachelor’s degree
	Broadband communications	FCC Broadband Progress report	Percent of population with access to broadband service
	Properties insured	Puerto Rico Mortgage Bankers Association	Percent uptake of insurance
	Emergency preparedness	Puerto Rico Emergency Management Agency	Percent of municipalities with an emergency response plan that has been updated in the past year
	Water and wastewater treatment	Puerto Rico Aqueduct and Sewer Authority	Number of water and wastewater treatment plants in operation
	Ocean health	NOAA	Chlorophyll A Concentration



PLAN IN ACTION

This plan describes key priorities and actions intended to propel Puerto Rico toward social and economic transformation. How these priorities and actions are planned, implemented, maintained, and monitored over time will determine whether Puerto Rico is ultimately able to realize its ambitious vision. It is also key that the plan considers the complexity of implementation—that is, the interplay of sectors within a system that supports the physical, human, and natural capital that is integral to ongoing resilience development. This section of the plan summarizes the importance of creating an environment for innovation in Puerto Rico, balancing speed and deliberation over the recovery continuum, preparing for transition for individuals receiving federal aid, and communicating effectively about recovery progress from diverse perspectives.

Build an environment to support innovation

If the vision and goals identified in this recovery plan are to be realized, it is crucial that the principle of innovation guides investments and implementation of recovery activities. Equally important is that the plan helps to create an environment that supports the continued cultivation of innovative ideas, technologies, and policies across the population and diverse communities in Puerto Rico. Innovation is not merely applying technology to a problem; it is a more expansive—and ultimately more powerful—approach that leverages emerging technologies, methods, and expert advice to turn ideas into solutions that improve Puerto Rico’s capabilities. Innovative solutions are problem-oriented, usable, forward-looking, and adaptive. These solutions emphasize doing things more equitably, efficiently, cheaply, or in a way that is more environmentally sustainable. At

It is important to remember that novelty is a means to an end, rather than an end in itself. For known problems with well-understood and readily available solutions, there is no need to generate new solutions in the name of “innovation.”

a minimum, an innovative solution cannot simply repeat what has been done in the past, especially if that path has proven unsuccessful.

Innovative solutions embrace novel or unprecedented approaches when necessary and as the problem dictates. It is important to remember that novelty is a means to an end, rather than an end in itself. For known problems with well-understood and readily available solutions, there is no need to generate new solutions in the name of “innovation.”

Creating an environment conducive to innovation will be critical as implementation of recovery activities moves forward. It is particularly important that individual projects—and the recovery plan more generally—be open to feedback. It is essential to have sufficiently detailed data to identify when a course of action does not have the intended result. Assignments of responsibility throughout the government will need to be made and enforced to identify and implement any necessary course corrections.

Similarly, it is important to be able to identify courses of action that are working, as successes offer lessons that can and should be diffused to other relevant parts of the recovery process. Recovery investments must not only support innovative implementation but also embed a strong system of innovation within Puerto Rico for the future. The processes and institutions that drive this approach are interdependent, as existing research shows.

This plan focuses on innovation not through one-time injections of research and development spending or the establishment of an isolated business incubator, but rather through widespread investment in the institutions, infrastructure, and people that allow innovation to flourish. For example, courses of action that streamline business or property registration may give companies more time to develop new ways to satisfy existing customers or reach new markets. Actions that focus on establishing strong and resilient infrastructure facilitate the coordination, cooperation, and exchange of ideas that result in innovation. Even actions aimed at improving health care delivery can spur innovation by accelerating the process by which Puerto Ricans recover from illness.

Support decisions that balance speed and deliberation and acknowledge the true length of recovery

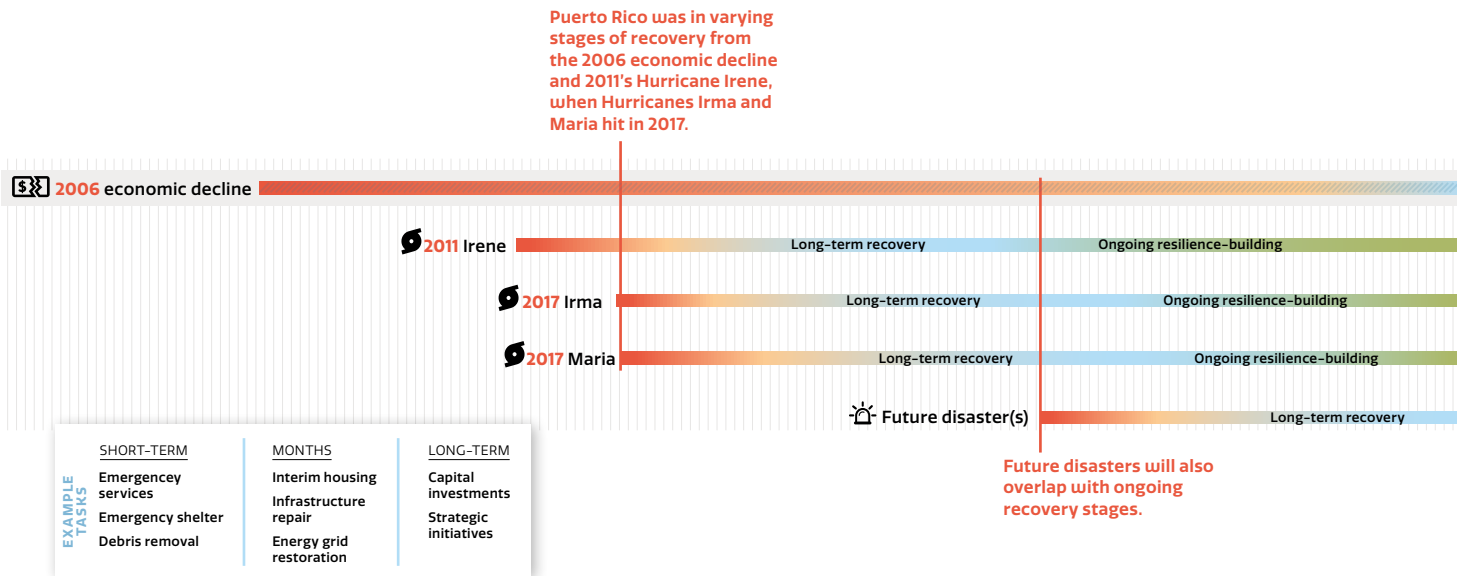
The nature, pace, and inclusiveness of recovery across communities may be strongly influenced by decisions made early in the recovery process and by local institutional capacity. On one hand, a speedy approach is important to keep businesses operating, provide temporary and permanent shelter for disaster victims, and rebuild infrastructure that is important to the community and the economy. If official agencies do not act quickly, communities will begin to rebuild in their own ways. At the same time, deliberation is an important part of post-disaster reconstruction planning to ensure that land use and infrastructure are coordinated and safe, that approaches to rebuilding improve residents' quality of life, that the needs and concerns of all citizens are heard, and that cost-effective solutions are identified. For successful long-term recovery, deliberate planning requires the right information, including scientific data, so that alternative paths forward can be evaluated and robust solutions developed.

The NDRF portrays recovery as a continuum of overlapping phases: disaster preparedness (continuous), disaster response (usually days or months), an intermediate phase of both response and recovery activities (months), and a long-term recovery phase (may start soon after a disaster but can last months or years, depending on the size and scope of the event). These conceptual phases, however, may not reflect the true length of recovery because the process is typically nonlinear, complex, and multidimensional. Recovery planning requires substantial analysis and public debate of difficult tradeoffs as decisions are made about infrastructure repair, economic development, environmental cleanup, restoration of natural systems, urban redevelopment, hazard mitigation, equity and justice, and other challenging issues. In addition, multiple disasters may occur one after the other, so periods of response, recovery, and preparation for future risks may overlap or take longer. For example, Puerto Rico was still recovering from Hurricane Irene in 2011 when Irma and Maria hit in 2017 (see figure below). Carefully sequencing recovery efforts is important to avoid bottlenecks and minimize frustration.

For successful long-term recovery, deliberate planning requires the right information, including scientific data, so that alternative paths forward can be evaluated and robust solutions developed.

The recovery continuum

Simultaneously recovering from one disaster while preparing for another



FEMA's Interim Operating Facility (IOF) at the Puerto Rico Convention Center, following Hurricane Maria.

FEMA/Paul McKellips

Prepare for transition of federal support

As the recovery period extends over months and years, much of the initial support that flooded the Island after the hurricanes will begin to wane. Appropriate planning is needed to promote coordinated transitions for individuals and families receiving government aid. These transitions include a transition from individual assistance to disaster case management. Disaster case management provides short- and long-term relief to individuals and families by connecting them with comprehensive services that facilitate recovery. Lessons learned from prior disaster case management approaches suggest that to be effective these transitional supports need to be planned with complete and accurate information about numbers of people and their needs. Without this information, government and service providers will not be able to strategize appropriately for staffing, resource

allocation, and development of a robust resource network.

The Government of Puerto Rico will need to coordinate closely with FEMA to ensure that individuals receiving disaster case management services who have remaining needs when the program ends are connected with the appropriate steady-state supports. This means knowing the who these individuals are and coordinating the handoff before the end of case management. The stop and start of recovery initiatives at both the federal and Island levels can lead to serious discontinuities in recovery.

Communicate about recovery progress and projects and integrate community perspectives in decisionmaking

Effective engagement with affected communities is important throughout the lifecycle of a disaster, including during the implementation of the long-term recovery actions detailed in this plan. All communication should be clear, consistent, effective, accessible, and acknowledge the needs of vulnerable populations. Additionally, a strong emphasis should be placed on inclusive, two-way communication to ensure community feedback is shared with the Government of Puerto Rico. Two-way communication that facilitates engagement in the recovery process helps to highlight the unique and diverse needs of many populations, serves to empower individuals and communities, and, ultimately, provides the context to understand and implement pathways to action.

Engagement opportunities with the general population of Puerto Rico, Puerto Ricans who have left the Island, and the most vulnerable populations increases the likelihood that the recovery projects will address each population's

Possible Topics for Recovery Communication

Edelman conducted an analysis of 275 news articles from 40 top-tier English and Spanish-language outlets in the United States and Puerto Rico reflecting coverage (from February to April 2018) associated with the hurricanes. The purpose of this analysis was to identify the most frequently covered (both number of times and across multiple outlets) issues in media and recommend some topics that could be prioritized for communication during the recovery process:

Coverage of the ongoing response persists and provides an opportunity to highlight current or upcoming recovery work.

- **Preexisting housing conditions and infrastructure challenges** are frequently covered in the media, providing an opportunity to share information about how to manage aid requests in the absence of property ownership evidence.
- **Broader issues of insurance** are highlighted in media as many Puerto Rican residents may receive only a portion of their damage claim requests from companies. Information about how to handle such setbacks could address a noticeable information gap.
- News outlets are still reporting **challenges with temporary housing and education**. Addressing the needs of outmigrants who lack housing and students experiencing challenges with under-enrollment in schools should be considered a priority.
- Residents remain interested in learning about current **progress to ensure stable electricity** to the Island, which provides an opportunity for media updates on the status of the energy system improvement efforts.
- Stories about **aid and other investments by the private sector** can help to renew interest in the recovery activities on the Island, and nationally.
- Media remains focused on the rising **death toll and long-term impacts**. Communication and resources that can connect residents with unmet needs to health and mental health care services should be provided.
- Sharing details about how local leaders are **preparing for the upcoming hurricane season**, collecting and distributing resources about hurricane preparedness, and using multiple channels including accessible AM radio stations are essential to addressing a continued interest into the upcoming hurricane season and how to prepare.

distinctive needs equitably. Leveraging community leaders with one-on-one meetings or in broader community workshops, establishing partnerships with universities to host discussions or facilitate trainings, creating a centralized information repository and hotline, and leveraging both traditional (i.e. non-digital) and new media (i.e. social channels) could promote engagement with all populations at a large scale. Engaging populations to understand their specific needs and priorities can improve support for the recovery process and ensure that communities remain included post-disaster. This is especially important because in order to implement many recovery efforts, deeper engagement with stakeholders (e.g., experts, resource managers, local leaders, communities) must occur first. Some recovery efforts require identifying partner NGOs to implement specific courses of action, securing contracts with agencies to utilize their resources. (e.g., to develop a workforce or volunteer base). Further, residents across diverse communities need to be more readily engaged in future discussions about resilience investments and disaster planning to better integrate information about community assets and needs.



PRELIMINARY DRAFT—JULY 9, 2018

CONCLUSION

Over the past year, Puerto Rico has been creating and putting to work plans to transform itself. *Transformation and Innovation in the Wake of Devastation* builds on this work in fundamental ways, proposing a path to a more equitable and prosperous society for all Puerto Ricans. The voices of citizens and mayors, agency heads, representatives from FEMA and other federal agencies, subject matter experts, and other stakeholders have been brought together in this plan. Informed by research and thoughtful analysis, Puerto Rico has developed a comprehensive plan that goes far beyond simply building back what was destroyed by the hurricanes, and instead looks to a future that is resilient to shocks, be they economic or natural.

Achieving this vision will have costs and require patience, but in the end, the benefits will be shared by the people of Puerto Rico, the taxpayers of United States, and communities around the world facing similar challenges. Adelante, Puerto Rico. El camino será difícil, pero un futuro deslumbrante nos espera.



DETAILED ACTIONS

Below are the full sets of actions—for each plan objective focused on precursors to recovery, capital investments, and strategic initiatives—that have been identified as necessary to support Governor Ricardo Rosselló’s vision for recovery, resilience, and economic growth.

As noted in the “Developing the Plan” section, while cost-benefit and feasibility analyses for each course of action were not possible, when developing courses of action the teams considered their responsiveness to needs, level of innovation, and alignment with the evidence base (e.g., based on best or promising practices). Further, the approach to estimating the rough-order-of-magnitude cost of each individual course of action was based on the specific nature of the action and the available sources of information robust enough to inform the estimate. Total estimated costs include both upfront and annual costs, where applicable. These figures should be regarded as preliminary pending greater detail about specific implementation activities and the completion of ongoing damage assessments.

Also as discussed in “Developing the Plan,” analyses of funding sources for the courses of action identified included U.S. government aid and nongovernmental funding sources. In addition, eligibility requirements for many supplemental funding elements are still unspecified. Therefore, funding sources identified below are notional at this time. Suggestions about possible implementers are also preliminary because details about how the courses of action will be put into effect will not be known until there is additional clarity about available funding and associated criteria.

Because the recovery plan is crosscutting and integrated, some courses of action support multiple objectives. These actions appear under each relevant objective. However, their cost is not counted more than once when estimating the total cost of the proposed recovery plan. Some courses of action identified below may portray overlapping or complementary activities; as additional details about these activities become available, refinements will ensure alignment of efforts that avoid duplication. The courses of action are not numbered sequentially because some actions were eliminated during the development process.

The following sections contain detailed portfolios of actions for each plan objective.

Section 1: Precursors

Section 2: Capital Investments

Section 3: Strategic Initiatives



COURSES OF ACTION

Precursors

START WITH
A STRONG
FOUNDATION

**The order of these precursor actions
is based on the order in which they
were presented in the main text.**

CPCB 11
Cross-Sector Coordination in Infrastructure and Implementation

Hire 5 experienced planners to serve as Cross-Sector Infrastructure and Implementation Leaders (CIIL) whose dedicated role within COR3 will be to ensure collaboration and coordination between sectors when major infrastructure projects are proposed or are being developed.

Potential benefits: Ensures cross-sector integration during infrastructure planning and development projects. Increases transparency of infrastructure planning. Integrates sector needs during development and implementation.

Potential costs: \$6.8 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): Government of Puerto Rico

MUN 7
Create and Implement a Model of Regional Service Delivery and Planning

Design, adopt, and fund a regional public service delivery and planning model based on a collaborative decision making process that includes all levels of government, citizens, and other stakeholders. This action could include the GPR delegating services to municipalities and regional entities, and municipalities potentially consolidating the delivery of services as well.

Potential benefits: Helps municipalities plan more effectively and deliver particular services more efficiently. Saves money by using economies of scale. Reduces duplication of efforts. Fills service gaps and improves transparency. Clarifies roles during emergency response.

Potential costs: \$7.8 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, municipalities

Potential implementer(s): Government of Puerto Rico, municipal governments

ECN 6**Improve Data Collection, Analysis, and Presentation**

Implement policies to improve the collection, analysis, and presentation of publicly available data, including (1) updating tax rolls and land registries; (2) preparing timely, audited financial reports; (3) improving collection and storage of economic information such as national and tourism satellite accounts; (4) providing information about public sector programs and policies; and (5) cataloging current intellectual property and patents held by citizens of Puerto Rico.

Potential benefits: Decreases levels of uncertainty for investors and the public, informs resource allocation decisions, and promotes innovation.

Potential costs: \$55 million in total estimated costs

Potential funder(s): DOC EDA, USDA

Potential implementer(s): PRPB, PRTC, Institute of Statistics, other GPR agencies, federal agencies

MUN 9**Enhance Transparency and Improve Service Delivery Through Municipal Service Request Fulfillment and Tracking Systems**

Implement technology-based mechanisms (such as electronic portals and 311 systems) to increase accessibility and transparency of municipal government services.

Potential benefits: Increases efficiency, transparency, and accessibility of municipal service delivery. Saves taxpayer money. Improves service outcomes.

Potential costs: \$110 million in total estimated costs

Potential funder(s): DOL, U.S. Department of Education, private sector, nongovernment sources

Potential implementer(s): Municipal governments

MUN 18**Develop and Publicly Report Key Municipal Performance Indicators**

Develop key performance indicators (KPIs)—in collaboration with the Government of Puerto Rico, municipal officials, and citizen groups—for services provided by municipal and state-level government. Track and publicly report KPIs regularly.

Potential benefits: Improves government transparency, citizen confidence, and performance management. Allows rapid identification of issues and reallocation of resources to meet citizens' needs more effectively.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 12
Capacity Building for Financial Management

Conduct a study that will re-evaluate the current state of the Government of Puerto Rico's grant management processes and workforce in light of the increased volume and pace of work associated with hurricane rebuilding efforts. Anticipate the hiring of 10 additional FTE financial management personnel as result of study.

Potential benefits: Ensures that funds earmarked for rebuilding efforts are spent efficiently and in accordance with regulations and accounting practices. Allows the financial management workforce to cope with the additional workload resulting from rebuilding efforts.

Potential costs: \$15 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): Puerto Rico Federal Funds Management Office

MUN 16
Build the Capacity of Municipalities to Apply for, Secure, and Manage Grants

Assess municipal governments' current capacity and skillset to apply for and manage federal and other grants. Provide technical assistance and training to increase grant management capacity and skills. This action will be a critical need as federal and other funding flows to Puerto Rico for recovery-related projects.

Potential benefits: Improves ability of municipal governments throughout Puerto Rico to access and successfully implement grant funded programs, particularly federal grants for recovery efforts.

Potential costs: \$3.4 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico

Potential implementer(s): Puerto Rico Office of Management and Budget, University of Puerto Rico, municipal governments

CPCB 13**Training Workshop on Best Practices in Post-Disaster Procurement**

Organize a conference that convenes chief acquisition officers, contract officers and other procurement experts from the mainland U.S. who were involved in rebuilding after Hurricanes Katrina, Harvey and Sandy, along with officers and experts in Puerto Rico. Produce conference proceedings and a guide to post-disaster procurement for innovation and resilience.

Potential benefits: Provides a forum for people with post-disaster experience to train Puerto Rico procurement officers and share best practices. Provides a networking opportunity among professionals in disaster management.

Potential costs: \$400,000 in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): Puerto Rico Federal Funds Management Office, chief acquisition officers, contract officers, procurement experts

ECN 36**Establish Matching Fund Set Aside**

Set aside at least \$10 billion from unrestricted CDBG-DR funding to provide the 10 percent to 20 percent needed for the Government of Puerto Rico to obtain matching federal grants, which would unlock billions of dollars in additional federal funding.

Potential benefits: Allows the Government of Puerto Rico to access the \$50 billion to \$100 billion that the federal government can provide through FEMA, USDA, EPA, DOC EDA, and other federal agencies to help rebuild and repair public buildings, roads, and other infrastructure.

Potential costs: N/A (\$10 billion in total estimated costs as a cost-share requirement; no costs applicable to the total cost of the plan)

Potential funder(s): CDBG-DR

Potential implementer(s): Puerto Rico Executive Branch

ECN 4**Enact “Pure” Fiscal Policies**

Implement policies to reduce public spending, adjust the level of public spending relative to revenue, or increase the revenue base of the Government of Puerto Rico by enforcing tax compliance.

Potential benefits: Improves access to credit markets and reduces economic uncertainties in the public and private sectors. Increases confidence of private investors in the Commonwealth of Puerto Rico.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Puerto Rico Executive Branch

MUN 1**Establish an Emergency Fund for the Government of Puerto Rico and Municipalities**

Establish an emergency fund for the Government of Puerto Rico that can also be used by municipalities during disaster response and recovery. This fund would provide financial assistance for extraordinary expenses incurred during future disasters, and could be modeled on examples from the continental United States.

Potential benefits: Improves efficiency and effectiveness of emergency response and recovery by allowing municipalities to manage and disburse emergency funds directly. Allows municipalities to continue to fund response and recovery activities while they are awaiting reimbursements from FEMA or payouts from insurance companies.

Potential costs: N/A

Potential funder(s): N/A

Potential implementer(s): Governor, Legislative Assembly, PRPBA

CPCB 9**Coordinated Local Recovery Planning Process**

Establish a process by which all the municipalities that were severely affected by the hurricanes develop their respective recovery and reconstruction plans in a common, coordinated way. This action provides support—in the form of a dedicated Local Disaster Recovery Manager—to municipal governments that need to coordinate the implementation of a large number of recovery projects.

Potential benefits: Provides an opportunity to address long-standing problems, specifically the fragmented delivery of federal resources, both over time and among numerous programs, which leads to ad hoc decisionmaking and a piecemeal recovery.

Potential costs: \$51 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, nongovernment sources

Potential implementer(s): PRPB, municipal governments

MUN 12**Create Regional Economic Development Plans**

Provide technical assistance to municipalities to help create municipal and regional-level economic plans that align with the overall economic development goals of the GPR. Plans will include workforce assessments, identifying industries with the highest potential in each region, identifying needed infrastructure, and providing training.

Potential benefits: Ensures each municipality will be part of an economic development plan to improve workforce training and employment, increase the level of economic activity, and contribute additional revenues to municipal governments and local economies.

Potential costs: \$6 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, municipalities

Potential implementer(s): Government of Puerto Rico, municipal governments

Potential implementer(s): Puerto Rico Office of Management and Budget, University of Puerto Rico, municipal governments

ECN 1**Lower Cost/Increase Ease of Doing Business**

Decrease the overall cost and increase ease of doing business across Puerto Rico, including labor costs, input costs, tax costs, and transaction costs in dealing with the government by modifying federal and state-level government policies.

Potential benefits: Stimulates investment and economic growth across nearly all sectors by reducing policy-induced barriers to business activity, resulting in decreased outmigration due to economic conditions over the short- and long-term.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Government of Puerto Rico

ECN 44**Permanent Exemption of Puerto Rico from the Jones Act**

Support efforts to work with the federal government to provide a permanent exemption to enforcing the Jones Act for Puerto Rico, similar to the exemption in place for the U.S. Virgin Islands.

Potential benefits: Decreases cost of shipping, which is expected to (1) lower the price of every imported item used by business, consumer, government, and agricultural concerns in Puerto Rico; and (2) lower the cost of exporting items from Puerto Rico. Results in less expensive energy and lifts impediments to Puerto Rico evolving as an international transshipment hub.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): GPR Congressional delegation

ECN 45**Enable Puerto Rico to Become an International Air Cargo and Passenger Hub**

Encourage the federal government to amend Title 49 Section 41703(e) of the U.S. Code (the “Stevens Amendment”) to include Puerto Rico and to allow for cargo transfers. The Stevens Amendment allows foreign cargo aircraft that stop in Alaska to proceed to other cargo airports within the United States. Reestablish the “transit-without-visa” program.

Potential benefits: Boosts air cargo activity and creates additional economic opportunities for the air industry in Puerto Rico by transforming airports into major international air cargo hubs. Reimplementing the transit-without-visa program in Puerto Rico will help promote tourism by easing air travel.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): GPR Congressional delegation

ECN 2**Implement Workforce Development Programs**

Implement policies and activities such as the creation of regional training centers to support education and training of the workforce, especially the unemployed, underemployed, and those in training for employment, with a focus on persons disproportionately affected by disaster who are in high-need occupations.

Potential benefits: Improves labor force participation rates, engages those not currently or not gainfully employed, and increases the labor force’s years of education, which should benefit both individuals and the economy.

Potential costs: \$68 million in total estimated costs

Potential funder(s): CDBG-DR, DOL, U.S. Department of Education, FEMA Dislocated Workers Program, nongovernment sources

Potential implementer(s): P3, Puerto Rico Department of Labor and Human Resources

COURSES OF ACTION

Capital Investments

BUILD RESILIENT
COMMUNITIES,
MODERNIZE
INFRASTRUCTURE,
AND RESTORE
THE NATURAL
ENVIRONMENT

The order of these actions first highlights actions from the sector most relevant to that objective, listed numerically. Numerical assignment is random and does not indicate a specific prioritization. They are then followed by actions from other sectors that are also important to achieving the capital investment objective, which are listed in alphabetical order by code and number.

Transform the energy system

*The “potential costs” were derived from a cross-walk of activities against those in *Build Back Better Puerto Rico* and the Puerto Rico Energy Working Group (PREWG) Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico plans. In both of these reports, the total cost to “build back better” was just under \$18 billion. Our COAs included some additional activities (e.g., studies and analysis to support decisions as provided by cost team) and total to \$22 billion. The “potential funders” and the “potential implementers” listed below are notional and cannot be definitively identified until long-term planning and privatization of PREPA has been finalized.¹

ENR 1

Establish and Enforce Best Practices for Electricity Grid

Align grid standards with industry best practices—tailored to the unique conditions in Puerto Rico—and ensure timely compliance and enforcement.

Potential benefits: Increases knowledge of system components. Increases ready access to replacement parts. Lowers maintenance costs. Allows for faster repairs, a broader range of material and supplies that can be used, and synergies with other endeavors, e.g., the installation of new technologies and the establishment of a resilient grid.

Potential costs*: \$1 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PREC, U.S. Department of Energy

ENR 2

Design, Build, and Maintain “Islandable” Portions of the Electricity Grid

Design and create an “islandable” grid that can balance generation and load to continue delivering localized electricity if other portions of the system fail. Strategically install, test, and maintain microgrids with an adequate inventory of replacement assets.

Potential benefits: Allows for more resilient electricity and potentially improved environmental performance (and improved public health). May save money depending on relative electricity rates. Promotes economic growth through less price volatility and potentially improved access to electricity.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy, private industry, public-private entities, municipalities

¹As of June 21, 2018, GPR authorized the privatization of PREPA generation assets following the development of a 30-year plan.

**ENR 3****Design and Build a Supporting Infrastructure for the Electricity System, Including Communications**

Strengthen the electricity system through improvements to supporting infrastructure such as control centers, communication systems, and collection systems.

Potential benefits: Improves communications and systems that allow faster response to disruptive events. Leads to an electricity supply that is less impacted by threats and hazards. Promotes economic growth with a more reliable and resilient energy supply.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, PREC, new private owner/operators

ENR 4**Perform Routine Operations and Maintenance Informed by Periodic Risk Assessment**

Increase operational capability and resilience with ongoing risk assessments and predictive maintenance. This action includes periodic risk assessments that will inform maintenance efforts of the electrical system. A survey of industry best practices will help inform and implement a predictive maintenance effort.

Potential benefits: Improves understanding of potential risks. Improves the use of funds for capital investments and maintenance. Supports an electricity supply that is more reliable. Promotes economic growth with a more reliable energy supply.

Potential costs*: \$500 million in annual total costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators

ENR 5**Design and Build Hardened Grid Assets to Support Critical Infrastructure**

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure. This action includes (1) policy guidance to clarify a plan for outages of a reasonable duration at critical facilities and enforce these standards where they already exist, (2) energy solutions for homes with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pumps systems.

Potential benefits: Promotes economic growth by creating a reliable electricity supply that is less impacted by threats/hazards.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, U.S. Department of Energy

ENR 6**Improve Grid Assets' Resilience to Flooding**

Prioritize hardening the grid to flooding. This action includes (1) altering floodplains; (2) altering asset types to reduce vulnerability; (3) reducing exposure by moving, raising, or waterproofing assets; (4) strengthening assets against hydrostatic and hydrodynamic pressures; (5) decommissioning assets where flood risks are too costly to mitigate; and (6) expediting repairs to reduce mold and rot damage.

Potential benefits: Creates a more reliable and resilient electricity supply. Reduces maintenance costs. Allows for the integration of hydropower, and synergies with other endeavors such as microgrid installation.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy



ENR 7 **Improve Grid Assets' Resilience to High Windspeeds**

Prioritize hardening the grid to high wind speeds. This action includes (1) underground high-risk lines for critical loads, (2) design and install poles and towers to withstand 150 mph winds per U.S. standards, (3) vegetation management, (4) reduce transmission and distribution distances by moving generation closer to load centers, (5) decommission assets where wind risks are too costly to mitigate, and (6) establish dual-use programs to better manage third-party use of assets.

Potential benefits: Creates a more reliable and resilient electricity supply. Reduces maintenance costs. Allows for synergies with other endeavors, such as microgrid installation.

Potential costs*: \$3 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy

ENR 8 **Maintain Disaster-Resilient Generation Assets**

Prioritize the maintenance of generation assets that were resilient to hurricane damage or that were built during the power restoration efforts and are resilient to future disasters. This action includes (1) assessing the current state of generation assets, (2) establishing a generation asset maintenance budget, and (3) conducting routine maintenance efforts.

Potential benefits: Prepares the generation system for disaster impacts. Uses recovery funds for rebuilding other aspects of the energy system. Promotes economic growth from a reliable, cost-effective energy supply.

Potential costs*: \$2 billion in total estimated costs

Potential funder(s)*: HMGP, U.S. Department of Energy, EPA, NOAA, PREPA, public sector investment companies

Potential implementer(s)*: PREPA, U.S. Department of Energy

ENR 9**Design and Build Fuel Supply Chain to Provide Reliable Energy Source**

Improve the fuel supply chain from port to end use. This action includes (1) increasing investment in the fuel stockpile, (2) expanding the number of storage facilities, (3) increasing the number of—and strategically locating—trucks and trained workforce to deliver fuel, and (4) expanding the size of existing shipping ports.

Potential benefits: Diminishes vulnerability to fuel price spikes and enables the distribution of emergency fuel to geographically dispersed areas.

Potential costs*: \$700 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy

ENR 10**Design and Build Adequate Ancillary Services for the Grid**

Improve the availability of ancillary services by (1) upgrading generation black start capacity; (2) repairing or replacing damaged or high-risk supervisory control and data acquisition systems; (3) installing spill prevention, control, and containment; (4) selectively installing redundant battery systems and backup generators for charging; (5) replacing damaged transformers; (6) installing high side switches or circuit breakers; and (7) expanding the use of renewable and distributed energy resources.

Potential benefits: Creates a more stable, resilient electricity supply. Allows for synergies with other endeavors. Promotes economic growth.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, PREC



ENR 11
Design and Deploy Technologies to Improve Real-Time Information and Grid Control

Improve centralized energy management and geographic information systems. Install a distributed energy resource management system and technologies to allow communities to operate off-grid after a disaster.

Potential benefits: Relieves pressure from response efforts. Improves access to life-sustaining resources. Makes the electricity supply adaptable to changing economic conditions. Improves the speed of response and recovery efforts.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, USACE, FEMA

ENR 12
Coordinate Federal and State Emergency Response with Private Sector

Provide needed improvement in federal, state, and private-sector emergency response coordination. This action includes incident response improvements, access to information, and efficient resource realignments. Evaluate response efforts and design new incident response plans that efficiently align resources, lines of authority, and areas of need for the power sector.

Potential benefits: Increases speed of response. Uses resources efficiently. Increases support from local populations. Increases access to resources. Allows for more recovery in less time with fewer resources.

Potential costs*: N/A

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA

Potential implementer(s)*: PREPA, new private owner/operators, PREC, PREMA, FEMA, USACE

ENR 13

Pre-Position Materials and Prepare Workforce for Rapid Response

Strategically locate materials and prepare the workforce to facilitate a rapid restoration of electricity service. This activity includes (1) assessing the optimal level of material and workforce resources necessary for recovery for each portion of the grid, (2) installing the materials and training the workforce (both personnel in Puerto Rico and mutual aid partners), and (3) maintaining existing investments through consistent analysis of depreciation.

Potential benefits: Creates an electrical supply that is more resilient and more easily recovered following natural disasters. Allows for greater access and reliability. Promotes economic growth.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators

ENR 14

Design and Build Grid Assets to Meet Current and Future Demand

Design and build generation, transmission, and distribution assets to meet current and future demand projections, including right-sizing and relocation as required.

Potential benefits: Increases efficiency with the use of updated technology. Improves efficiency and effectiveness of response efforts. Improves access during all types of operations. Meets other GPR goals, such as diversifying energy generation.

Potential costs*: \$3 billion in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PREMA, PRIDCO, private companies



ENR 15

Enable Private Assets for Standby and Baseload Generation

Create policy guidance to clarify consumers' responsibility to plan for outages. Expand availability and capability of existing and new generation to provide black start capabilities and emergency backup. Establish enforceable inspection and maintenance measures for compliance with requirements. Relocate existing generation, transmission, and distribution assets.

Potential benefits: Creates an electricity supply that is better able to provide energy during, and more easily recover from, emergency situations. Limits vulnerability to the cascading effects of grid failures.

Potential costs*: \$700,000 in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, FEMA, PRIDCO, private companies, municipalities

ENR 16

Promote and Provide Sustained Electricity Delivery to Critical Facilities

Provide sustained electricity delivery to critical facilities—water, communications, manufacturing, health services, schools, airports, and seaports—to ensure the sustained delivery of public services in the absence of the bulk power system. This action includes (1) policy guidance on the reasonable duration of outages for critical facilities, (2) targeted energy solutions for households with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pump systems.

Potential benefits: Improves the efficiency and effectiveness of response efforts. Improves access to life-sustaining resources after a disaster.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE

ENR 17

Promote and Provide Energy and Water to Emergency Infrastructure

Ensure appropriate energy and water infrastructure at critical facilities, e.g., schools and stadiums. This action includes (1) selectively investing in microgrids and islanding equipment for emergency services; (2) installing technologies to make communities more independently resilient, such as feeder automation controls, onsite backup generation, combined heat and power systems, rooftop solar, and battery storage; and (3) building energy management systems at strategically located sites.

Potential benefits: Creates a reliable energy source after a catastrophe. Enhances emergency response.

Potential costs*: \$500 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE

ENR 18

Train the Future Energy Workforce

Train a workforce capable of installing, operating, and maintaining Puerto Rico's future energy system. This action includes (1) developing and implementing plans to provide workforce training and capacity building, (2) workforce rightsizing, (3) adequately supporting the integrated resource plan process, and (4) establishing centers of excellence to attract skilled research and engineering talent.

Potential benefits: Develops a skilled workforce that can drive energy system transformation and economic growth. Speeds recovery from power loss events.

Potential costs*: \$4 million in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, DOL, EPA, NSF, U.S. Department of Education, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, Puerto Rico Department of Labor and Human Resources, professional societies

**ENR 19****Design and Deploy Data Systems to Inform Response and Recovery Decisions**

Establish data, IT, and OT systems to inform decisions during response and recovery. Create a robust data inventory of assets. Acquire communications systems to support inventory management. Improve coordination among stakeholders responsible for critical infrastructure. Update PREPA's IT and OT systems.

Potential benefits: Creates an electricity supply that can be restored faster after a major power loss.

Potential costs*: \$30 million in total estimated costs

Potential funder(s)*: FEMA, Government of Puerto Rico, private sector

Potential implementer(s)*: PREPA, new private owner/operators, USACE, FEMA, U.S. Department of Energy

ENR 20**Design and Build Capital Assets to Reduce Restoration Time and Cost**

This action includes (1) investments to enhance maintenance and operations, (2) standardization of components, (3) relocation of transmission and distribution assets to improve access, (4) stockpiling of rapidly deployable grid restoration assets, (5) installation of additional assets to reduce failures, and (6) the redesign of some existing generation and substation units.

Potential benefits: Creates an electricity system that can be restored more quickly after a major power loss and that is more resistant to damage in the first place.

Potential costs*: \$5 billion in total estimated costs

Potential funder(s)*: HMGP, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector

Potential implementer(s)*: PREPA, new private owner/operators, PREMA, FEMA, USACE

ENR 21**Establish Energy Response and Preparedness Plan**

Create and maintain an emergency response and preparedness plan. Conduct personnel training and drilling. Re-evaluate and update plans on a regular schedule. Establish and update mutual aid agreements. Streamline an incident command system.

Potential benefits: Creates a response plan that will increase the ability for the electricity supply to be restored faster in the event of future major power loss events. Promotes economic growth with increased confidence in energy supply.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: FEMA, Government of Puerto Rico, private sector

Potential implementer(s)*: PREPA, new private owner/operators, PREMA, FEMA, USACE

ENR 22 Enable and Promote Distributed Generation

Distribute generation assets in a new way to align generation facilities with the highest demands, decreasing the transmission distances and strengthening the system. Integrate distributed energy resources and maintain service continuity to critical customers and loads.

Potential benefits: Prevents cascading failures. Provides emergency power to critical needs. Provides reliable power options to consumers. Advances clean energy and energy cost goals.

Potential costs*: \$70 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, HUD, PREPA, private sector

Potential implementer(s)*: PREPA, Government of Puerto Rico

ENR 23 Design Best Strategies for Renewable Energy Resources

Determine the appropriate strategies for all types of existing and potential renewable energy resources (wind, solar, biomass, hydro, tidal, etc.). Assess the possibility of revitalizing hydropower facilities across Puerto Rico, especially facilities with black start or “islanding” capabilities. Promote the development of prioritized siting of renewable energy.

Potential benefits: Changes the cost structure for the electricity utility. Improves resilience and faster recovery of the energy grid. Increases access and reliability. Reduces environmental and health costs. Promotes economic growth.

Potential costs*: \$800,000 in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PRASA, Government of Puerto Rico, municipalities



ENR 24 **Design Best Strategies for Affordable and Stable Energy Prices**

Prioritize strategies for energy generation resources that reduce prices and volatility faced by consumers. Establish goals for the quantity and type of energy sources to be generated. Evaluate the costs and benefits of alternative generation resources. Evaluate options and establish policies that incentivize private investment. Develop a workforce that can maintain generation investments.

Potential benefits: Establishes a system that provides affordable, reliable, and high-quality electric power to small businesses, commercial and industrial users, and the broader economy of Puerto Rico.

Potential costs*: \$3 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: Government of Puerto Rico, PREPA, new private owner/operators, PREC

ENR 25 **Build Capacity for Municipality Decisionmaking of Energy Systems**

Enable municipalities to plan, finance, and develop renewable energy systems and other strategic distributed energy resources for municipal buildings. Help municipalities manage the decisionmaking and implementation process by providing needed expertise and advice on how to align activities aimed at meeting renewable energy goals.

Potential benefits: Helps meet GPR renewable energy standards and provides cost efficient solutions. Contributes to resilient and/or redundant systems.

Potential costs*: \$2 million in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, Government of Puerto Rico, municipalities

ENR 26**Establish Energy Sector Governance Responsibilities for State-Level Agencies**

Encourage the GPR to clarify goals and identify efficient relationships and governance sharing across the energy sector. Evaluate and increase the degree of transparency, accountability, and interrelated lines of authority between regulators, energy system operators, legislators, and executive officers.

Potential benefits: Allows for the maximum benefit to flow to the energy sector and, ultimately, to the people of Puerto Rico.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: Government of Puerto Rico, PREC

ENR 27**Establish Regulations to Transform the Energy Sector**

Establish regulatory policies, with implementation and responsiveness to the needs of energy customers, that will allow the energy sector to deliver a modern energy system that is affordable, renewable, scalable, and redundant. Create a regulatory process that aligns the needs, resources, monitoring, incentives, and feedback needed to deliver on the energy sector potential and promises.

Potential benefits: Helps meet the vision of modernizing the energy system to ensure that it is affordable, renewable, scalable, and redundant.

Potential costs*: \$2 million in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: Government of Puerto Rico, PREC, U.S. Department of Energy



Modernize the telecommunications system

CIT 1

Land Mobile Radio System

Devise and execute a plan that will assess (1) upgrading and consolidating the current public LMR systems and supporting microwave networks, and/or (2) joining the federal LMR system when available. The plan will also monitor FirstNet's progress as a potential backhaul, complementary service, and/or potential replacement. The plan's options may differ in the short/long terms and for voice/nonvoice applications.

Potential benefits: Achieves a resilient, state-of-the-art, cost-effective public LMR system. Allows system interoperability; reduces maintenance and logistics costs; and facilitates repairs, restoration, and equipment upgrades.

Potential costs: \$140 million in total estimated costs

Potential funder(s): PA, CDBG-DR

Potential implementer(s): DPS, PRTRB, CIO

CIT 3

Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, and consolidate dispatch at the PSAP.

Potential benefits: Improves the effectiveness of 911 service through new features (such as text, photo, video and GPS location sharing), improves 911 response times, and improves system resilience.

Potential costs: \$3 million-\$7 million in total estimated costs

Potential funder(s): DOC

Potential implementer(s): Puerto Rico 9-1-1 Service Governing Board

CIT 4

Rural Area Network Task Force

Establish a task force to develop communications networks and information systems in rural or disconnected areas, particularly for the elderly, limited-mobility individuals, and caregivers, for use in emergencies.

Potential benefits: Initiates establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

Potential costs: \$400,000-\$800,000 in total estimated costs

Potential funder(s): Government of Puerto Rico, private sector

Potential implementer(s): PRTRB, PREMA

CIT 5

Implement Public Safety/ Government Communications Backup Power

Increase the resilience and redundancy of Puerto Rico's public safety and government communications networks by implementing standardized backup power sources.

Potential benefits: Improves resilience and redundancy. Helps ensure continuity of emergency services and essential government operations.

Potential costs: \$30 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): Government of Puerto Rico

CIT 6**Modernize the Emergency Operations Center**

Upgrade the EOC to meet U.S. standards.

Potential benefits: Improves emergency managers' ability to coordinate with disaster response and recovery.

Potential costs: \$11 million–\$17 million in total estimated costs

Potential funder(s): FEMA EMPG, Government of Puerto Rico

Potential implementer(s): PREMA, PRTRB

CIT 7**Establish an Alternate Emergency Operations Center**

Establish an alternate EOC, an alternate PSAP, and a center for COOP and COG housed in the same building, located outside the San Juan area.

Potential benefits: Provides backup location for emergency management operations and critical government functions in times of crisis.

Potential costs: \$17 million in total estimated costs

Potential funder(s): FEMA EMPG, Government of Puerto Rico

Potential implementer(s): PREMA, PRTRB

CIT 9**Auxiliary Communications—Volunteer Radio Groups and Organizations**

Build a skilled, trained volunteer workforce of radio operators to provide auxiliary community communications to support response efforts.

Potential benefits: Extends emergency operations at minimal cost.

Potential costs: \$1 million in total estimated costs

Potential funder(s): Government of Puerto Rico, nongovernment sources

Potential implementer(s): PREMA, volunteer groups

CIT 10**Transoceanic Submarine Cable**

Introduce state of the art undersea cable(s) situated away from San Juan (e.g., one for the mid-term, two additional drops in the long term with room to grow in bandwidth). Mitigate threats to existing landing stations and related infrastructure after a disaster.

Potential benefits: Increases redundancy and on-island internet capacity/performance and potentially reduces communications network recovery time and consumer costs. Maintains service if a line is damaged, and provides economic benefits.

Potential costs: \$67 million–\$235 million in total estimated costs

Potential funder(s): Government of Puerto Rico, private sector, sale of capacity via Indefeasible Right of Use or by lease

Potential implementer(s): PRTRB, GPR agencies, private industry



CIT 12

Perform Site Structural Analysis for All Government Telecom Towers (Both Public and Privately Owned)

Perform a detailed structural analysis every five years of the towers that are considered critical infrastructure and provide government with emergency and other services. Determine whether all towers used for emergency communications meet the Puerto Rico tower code on structural loading.

Potential benefits: Aids in maintaining a resilient communications infrastructure and emergency communications, as well as continuity of government services.

Potential costs: \$4 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR

Potential implementer(s): DPS, PRTRB

CIT 13

Streamline the Permitting and Rights of Way Processes for Towers and the Deployment of Fiber-Optic Cable

Establish a central rights of way and permitting approval authority to achieve uniform and streamlined approval processes.

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): FCC

Potential implementer(s): PRTRB, GPR agencies, municipalities

CIT 15

Undersea Fiber Ring System

Expand the submarine communications network using a ring topology to connect regions around the Island.

Potential benefits: Ensures a highly resilient, island-level network with reduced recovery time after failures; provides economic benefits; and improves route availability to, from, and within the island.

Potential costs: \$67 million–\$235 million in total estimated costs

Potential funder(s): DOC EDA, Government of Puerto Rico, private sector, sale of capacity via Indefeasible Right of Use or by lease

Potential implementer(s): PRTRB, private industry

CIT 16

Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

Potential benefits: Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): CINO, CIO

CIT 17**Puerto Rico Data Center**

Establish a robust and disaster-proof, scalable, cloud-enabled data center for governmental information systems that expands its capacity to perform essential governmental functions and deliver essential services.

Potential benefits: Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally, while preserving the integrity of all essential information systems.

Potential costs: \$68 million–\$190 million in total estimated costs

Potential funder(s): Government of Puerto Rico, lease of excess capacity, nongovernment sources

Potential implementer(s): CIO, GPR agencies

CIT 18**Database of Critical Infrastructure**

Create an open, modular, and standards-based information system for up-to-date, geo-referenced, cross-sector data on government and privately owned critical infrastructure with near-real-time mapping capabilities.

Potential benefits: Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

Potential costs: \$8 million–\$15 million in total estimated costs

Potential funder(s): Private sector, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies

CIT 19**Municipal Hotspots**

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

Potential benefits: Reduces the “digital divide” and provides a priority post-disaster connection point for reaching a large number of residents in one place.

Potential costs: \$18 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): CINO, PRTRB, GPR agencies, municipalities

CIT 20**Continuity of Business at PRIDCO Sites**

Maintain key business activities at PRIDCO sites to provide continuity of services when primary communications methods are degraded after a disaster by using, for example, fiber-optic, satellite, microwave, and cloud-based or hosted services and information systems.

Potential benefits: Improves the resilience of business enterprises that are major contributors to the US economy, facilitates cross-sector economic development within Puerto Rico, and supports communications to impacted areas during a disaster.

Potential costs: \$24 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, Government of Puerto Rico

Potential implementer(s): PRIDCO

**CIT 21**

Government-Owned Fiber-Optic Conduits to Reduce Aerial Fiber Optic Cable and Incentivize Expansion of Broadband Infrastructure

Design for the deployment of conduit for buried fiber optic cable and other utilities. Trench and lay empty conduit according to the design. Allow telecom providers to install their own fiber optic cable in GPR-owned conduit.

Potential benefits: Increases the resilience of telecom services while reducing costs to telecom providers to bury cable, facilitating the burial of aerial fiber optic cable, and provision of broadband deployment throughout the Island. Provides trenching and conduit adequate to accommodate other utilities. Minimizes the need for multiple roadway disturbances.

Potential costs: \$1.3 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, P3

Potential implementer(s): PRTRB, FCC, private telecommunication companies

CIT 22

Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through FCC's E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies and GPR agencies to leverage these programs.

Potential benefits: Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): FCC, USDA, HUD, DOC EDA, NTIA

Potential implementer(s): PRTRB, FCC, PRDE

CIT 24

Establish Puerto Rico Communications Steering Committee

Establish a new Government of Puerto Rico of Puerto Rico Communications Steering Committee with a rotating chairperson to organize planning efforts and coordinate among key public safety and commercial communications stakeholders in the event of a disaster.

Potential benefits: Helps ensure proper planning, governance, and collaboration to effectively and efficiently recover, maintain communications infrastructure, and mitigate interoperability challenges and duplication of effort after a disaster.

Potential costs: \$6 million in total estimated costs

Potential funder(s): Government of Puerto Rico

Potential implementer(s): Office of the Governor, PREMA, PRTRB, DPS, CIO, CINO, municipalities

**CIT 25****Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico**

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, in particular those of the Federal Communications Commission (FCC).

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): CDBG-DR, FCC

Potential implementer(s): PRTRB, FCC, private telecommunication companies

CIT 26**Wi-fi Hotspots in Public Housing and “Digital Stewards” Program**

Establish a “Digital Stewards” program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

Potential benefits: Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

Potential costs: \$20 million in total estimated costs

Potential funder(s): CDBG-DR, PRDH

Potential implementer(s): CINO, HUD, PRDH

CIT 27**Study Feasibility of Digital Identity**

Study existing models and public acceptance of a secure digital identity including its reliance on resilient power and communications to facilitate government and private-sector transactions.

Potential benefits: Helps enable secure digital transactions, reduce costs associated with validation and access to government services when privately held records are unavailable, and reduce potential for fraud and identity theft.

Potential costs: \$2 million in total estimated costs

Potential funder(s): Government of Puerto Rico, P3

Potential implementer(s): CINO, GPR agencies

CIT 28**Innovation Economy/Human Capital Initiative**

Create a public-private initiative to provide digital skills training, entrepreneurship programs, and access to new technologies through a network of innovation hubs and entrepreneur centers, training partnerships with schools, and outreach via mobile labs to rural and underserved areas.

Potential benefits: Promotes a digitally literate employment pool for tech-reliant industries.

Potential costs: \$30 million–\$70 million in total estimated costs

Potential funder(s): DOC EDA, NSF, U.S. Department of Education, nongovernment sources

Potential implementer(s): CINO, GPR agencies, universities, municipal governments



CIT 29

Health Care Connectivity to Strengthen Resilience and Disaster Preparedness

Provide robust, resilient, multimodal connectivity to the 86 community clinics across Puerto Rico using satellite, low-power radio, and line-of-site technologies to complement fiber and cell systems and allow clinics to share bandwidth to support other recovery activities.

Potential benefits: Improves health care, emergency response, and medical innovation; provides real-time access to electronic health records, clinical data, and services, and bolsters situational awareness after a disaster.

Potential costs: \$140 million–\$280 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, ASPR, FCC, DHHS, VA, DoD, Government of Puerto Rico

Potential implementer(s): CINO, PREMA, PRTRB, PRDOH

CIT 30

Resiliency Innovation Network Leading to Development of a Resiliency Industry

Create a Resiliency Innovation Network to build on existing Puerto Rico Science, Technology, and Research Trust (PRSTRT) and university facilities to develop, teach, test, and refine resiliency products and services.

Potential benefits: Stimulates new commercial ventures and jobs, empowers communities and individuals, and increases resilience to disasters.

Potential costs: \$29 million in total estimated costs

Potential funder(s): DOC EDA, SBA, NSF, PRSTRT, PRIDCO, private sector

Potential implementer(s): CINO, universities, PRSTRT, Resilient Puerto Rico Advisory Commission, DEDC, PRIDCO

CIT 31

Resilience/e-Construction Learning Lab

Establish a Resilience/e-Construction Learning Lab in partnership with universities as a one-year pilot project in one municipality to digitize resilient construction assessment, permitting, and reporting processes.

Potential benefits: Streamlines construction, saves document printing and storage costs, decreases communication delays and transmittal times, and increases transparency and tax collection.

Potential costs: \$20 million–\$70 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, DOT

Potential implementer(s): CINO, PRDH

CIT 34

Digital Citizen Services

Expand the scope of PRITs to include a focus on citizen-centered services and prioritizing a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion.

Potential benefits: Increases public trust, transparency, and accountability; increases adoption of digital services; and streamlines government processes.

Potential costs: \$33 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, Government of Puerto Rico

Potential implementer(s): CINO, GPR agencies

CIT 35

Government Digital Process Reform

Establish people-centered digital design and data science teams within the Government of Puerto Rico to tackle cross-cutting policy and operational challenges and coordinate government agencies.

Potential benefits: Establishes a “whole-of-government,” people-centered digital design and data-driven approach to continuously improve services, spend resources effectively, improve service delivery, better serve the public, and make better policy.

Potential costs: \$70 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, Government of Puerto Rico

Potential implementer(s): CINO, GPR agencies

CIT 36

Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

Potential benefits: Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by developers.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): CINO, PREMA, GPR agencies

CIT 37

Consolidated Government Information Systems

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

Potential benefits: Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

Potential costs: \$482 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies

CIT 38

Procure a Mobile Emergency Communications Capability

Develop the capability to quickly reestablish communications for emergency and government operations in the aftermath of a disaster that causes widespread, catastrophic damage to the telecommunications infrastructure. This system is envisioned as a quick and temporary fix for the loss of primary communications capability.

Potential benefits: Provides a mobile emergency coordination capability throughout Puerto Rico for reliable and interoperable means of communication for emergency services and government operations and promotes more effective and responsive disaster recovery.

Potential costs: \$140 million in total estimated costs

Potential funder(s): FEMA EMPG, Government of Puerto Rico

Potential implementer(s): PREMA, GPR agencies



Rethink water systems

WTR 1

Resilient Repair or Replacement of the PRASA Drinking Water System

Repair or replace PRASA drinking water system assets and facilities in a manner that enhances future resilience to extreme events.

Potential benefits: Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through a more resilient infrastructure system.

Potential costs: \$6.340 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, DOC EDA, Government of Puerto Rico, PRASA, private insurance

Potential implementer(s): PRASA, EQB, EPA, PRDOH

WTR 2

Improve the Operational Efficiency and Performance of PRASA Water and Wastewater Systems

Improve operational efficiency of PRASA's systems by leveraging technology, enhancing monitoring and strengthening use of industry best practices to improve quantity and quality of service.

Potential benefits: Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through increased efficiency and performance as well as reduced operating costs.

Potential costs: \$1.335 billion in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, PRASA, P3

Potential implementer(s): PRASA, EQB, EPA, PRDOH



WTR 3

Enhance the Efficiency and Resilience of PRASA Electricity Services

Enhance the efficiency and resilience of electricity services for PRASA assets and facilities by developing an energy diversification strategy that ensures adequate backup power for essential facilities and reduces electricity demand.

Potential benefits: Ensures quality and quantity of service to PRASA clients during electricity disruptions, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through cost-saving reductions in energy demand and greater use of self-supplied energy sources.

Potential costs: \$2.183 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, PRASA, P3

Potential implementer(s): PRASA, EQB, EPA

WTR 4

Enhance Ability to Transfer Potable Water Among PRASA Service Zones

Enhance ability to transfer potable water among PRASA service zones by improving interconnections and operations.

Potential benefits: Ensures quality and quantity of service to PRASA clients, tourism and industry by enhancing flexibility and reducing the likelihood of service disruptions to households and businesses. Strengthens PRASA financial sustainability through cost-effective interconnections between PRASA service areas.

Potential costs: \$150.5 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, PRASA

Potential implementer(s): PRASA, EQB, EPA

WTR 5

Improve Treatment and Storage Capacity to Handle High Turbidity Events

Improve treatment and storage capacity to handle high turbidity events by upgrading water treatment plants in vulnerable service zones and better protecting water sources.

Potential benefits: Increases the safety of PRASA drinking water services by reducing the public health risks associated with high turbidity water entering the potable water distribution system.

Potential costs: \$347 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA, Government of Puerto Rico, PRASA

Potential implementer(s): PRASA, EQB, EPA

WTR 7

Strengthen PRASA's Asset Management Program

Conduct an asset needs assessment and implement an enhanced asset management program for PRASA drinking water and wastewater assets to decrease lifecycle costs and improve performance.

Potential benefits: Supports cost-effective and reliable drinking water and wastewater service delivery, which is critical for economic activity and public health. Strengthens PRASA financial sustainability through decreases in lifecycle costs for infrastructure assets and improved investment planning.

Potential costs: \$11.5 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA, DOL, EPA, nongovernment sources

Potential implementer(s): PRASA, EQB, EPA



WTR 8 **Achieve Financial Stability for PRASA**

Improve financial sustainability of PRASA by developing and implementing plans that include asset divestment, reducing operating costs and customer delinquencies, enhancing revenue collection, as well as exploring alternative pricing mechanisms and public-private partnerships.

Potential benefits: Ensures sustainability of Puerto Rico's dominant water and waste water service provider, which supports economic activity, safeguards public health, and facilitates provision of public services.

Potential costs: \$1.8 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA, nongovernment sources

Potential implementer(s): PRASA

WTR 10 **Curtailed Unauthorized Releases into Sanitary Sewers**

Curtailed the disposal of fats, oil and grease (FOG) and other unauthorized releases into wastewater collection systems by introducing educational programs, implementing mitigation measures, and creating incentive programs.

Potential benefits: Improves the performance of sanitary sewer systems, reduces overflow events and raw sewage exposure, and improves human health and the quality of receiving waters.

Potential costs: \$24 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA, EPA

Potential implementer(s): PRASA, EPA

WTR 11 **Repair, Replace, and Improve PRASA Wastewater Treatment Plants and Sanitary Sewer Collection Systems**

Repair and update WWTPs as well as sanitary sewer collection systems to maintain regulatory standards, anticipate future capacity needs and follow industry best practices.

Potential benefits: Eliminates discharge of untreated sewage into the environment. Reduces risk of impacts to human health and closures of beaches and waterways due to contamination.

Potential costs: \$4.284 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, PRASA, private insurance

Potential implementer(s): PRASA, EQB, EPA

WTR 13 **Develop Reuse Practices for Treatment Byproducts**

Find economically viable uses for drinking water and wastewater treatment byproducts by developing reuse practices and processes that enable the use of biosolids in the energy, industrial, and agricultural sectors.

Potential benefits: Mitigates the costs associated with byproduct disposal and develops an additional revenue stream for PRASA.

Potential costs: \$90 million in total estimated costs

Potential funder(s): CDBG-DR, EPA, USDA, P3, Government of Puerto Rico, PRASA

Potential implementer(s): PRASA, EQB, EPA



WTR 14

Improve Equity in Drinking Water Provision for Nonregulated Systems

Develop equitable and resilient solutions to household drinking water provision in geographically remote areas by expanding mechanisms to coordinate NGO and municipal efforts for the provision of safe drinking water in nonregulated systems.

Potential benefits: Increases equity in water service provision, reduces public health impacts and exposure to waterborne disease, and institutionalizes support for nonregulated systems.

Potential costs: \$12.5 million in total estimated costs

Potential funder(s): EPA, USDA, nongovernment sources

Potential implementer(s): Individual nonregulated facilities, NGOs, PRDOH, Puerto Rico Public Service Commission, universities, DNER

WTR 15

Improve Reliability and Safety of Non-PRASA Systems

Repair or replace equipment, improve water treatment, enhance monitoring, and expand contingency planning to improve reliability and safety of water provision for non-PRASA drinking water systems.

Potential benefits: Increases capacity to provide reliable, safe drinking water and improves compliance with the Safe Drinking Water Act.

Potential costs: \$19 million in total estimated costs

Potential funder(s): EPA, USDA, Government of Puerto Rico

Potential implementer(s): Non-PRASA water treatment facilities, Puerto Rico Public Service Commission, USDA, EPA, PRDOH (Potable Water Division, Environmental Health Regional Offices), NGOs

WTR 16

Build Capacity of Non-PRASA Systems

Build the technical, managerial, administrative, and financial capacity of non-PRASA communities and nonregulated drinking water systems and their users by enhancing and institutionalizing communications and outreach to non-PRASA and nonregulated system operators and communities.

Potential benefits: Builds capacity by giving community members the skills and experience to run their own systems, resulting in better service and improved public health.

Potential costs: \$13.9 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA, Government of Puerto Rico

Potential implementer(s): Individual non-PRASA water treatment facilities, Puerto Rico Public Service Commission, NGOs, EPA, PRDOH

WTR 17

Reduce Incidence of Raw Sewage Exposure

Reduce incidence of raw sewage leakage from septic tanks, as well as human and environmental exposure to sewage, by (1) establishing an institution to build technical capacity, and (2) enhancing regulatory and enforcement actions for septic tank design standards and best maintenance practices, (3) implementing financial assistance programs.

Potential benefits: Reduces exposure to harmful bacteria in raw sewage and ensuing health risks. Improves community and environmental stewardship.

Potential costs: \$1.814 billion in total estimated costs

Potential funder(s): CDBG-DR, EPA, USDA, homeowners

Potential implementer(s): EPA, OGPe, OIGPe, PRDOH, EQB, NGOs



WTR 18 **Invest in Stormwater System Management**

Invest in stormwater system cleaning, monitoring, maintenance and assessment through (1) comprehensive and routine asset mapping, (2) hydrologic and hydraulic analyses, (3) illicit discharge detection and elimination (IDDE) program expansion, (4) education and technical assistance, (5) assessment of system capacity and condition, (6) removal of debris and blockages, and (7) inventory management of parts and equipment.

Potential benefits: Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

Potential costs: \$418.7 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA

Potential implementer(s): Municipalities, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

WTR 19 **Reduce Urban Nuisance Flooding**

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

Potential benefits: Improves water and environmental quality and human health and reduces damages to public and private property from urban flood events.

Potential costs: \$1.005 billion in total estimated costs

Potential funder(s): EPA, USDA, Government of Puerto Rico, DNER

Potential implementer(s): Municipalities, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

WTR 20 **Relocate or Redesign Assets in Flood Zones**

Relocate or redesign assets in flood zones according to building standards and updated hydrologic guidelines to reduce the likelihood of service disruption or infrastructure failure during 100- and 500-year flood events.

Potential benefits: Decreases flood risk and increases water sector resilience to future disasters by preventing flooding, damage, and service interruption.

Potential costs: \$1.18 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOC EDA

Potential implementer(s): PRASA, PREPA, DNER, municipalities, DTOP, non-PRASA operators, FEMA



WTR 21

Centralize Stormwater System Support and Management

Enhance the performance of stormwater systems by centralizing stormwater management, building a workforce of stormwater practitioners, streamlining permitting processes, and enhancing technical capacity, community outreach, and best management practices for stormwater.

Potential benefits: Enhances the performance of stormwater systems, reduces risks to human health and the environment, expands the trained workforce for stormwater management, reduces risk of flooding and runoff in urban areas, and improves stormwater systems' financial sustainability.

Potential costs: \$67.7 million in total estimated costs

Potential funder(s): Government of Puerto Rico, DNER, municipalities, users

Potential implementer(s): Municipalities, Governor-appointed special commission

WTR 22

Upgrade Reservoir and Dam Safety Management

Upgrade reservoir management rules to improve and optimize operations across multiple water management objectives including drinking water supply, flood control, dam safety, and hydroelectric generation.

Potential benefits: Improves dam and reservoir management to reduce the impact of future disasters and extreme weather and increases the resiliency of the reservoir water supply.

Potential costs: \$83.6 million in total estimated costs

Potential funder(s): EPA, USACE, Government of Puerto Rico, PRASA, PREPA, nongovernment sources

Potential implementer(s): DNER, PRASA, EPA, USGS, PREPA, USACE

WTR 23

Evaluate, Repair, and Improve Flood Control Infrastructure

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

Potential benefits: Reduces flood risk for communities and infrastructure assets.

Potential costs: \$434.4 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA, USACE

Potential implementer(s): DNER, PRPB, PREMA, municipalities, USACE, EPA

WTR 24

Reduce Sedimentation of Water Bodies

Ensure the downstream water quality of reservoirs and channels while maintaining flood control capacity through sediment control plans and reduction measures, land use planning and practices, and dredging operations.

Potential benefits: Improves flood control capability and reduces future dredging needs and costs.

Potential costs: \$2.007 billion in total estimated costs

Potential funder(s): HMGP, CDBP, EPA, USACE, DOC EDA, Government of Puerto Rico, PRASA, PREPA, DNER, nongovernment sources

Potential implementer(s): USACE, EPA, USGS, FEMA, DNER, PRASA, PREPA, PRPB, EQB, municipalities



WTR 25

Rationalize Ownership and Management of Flood Control Infrastructure

Rationalize ownership and management of hydroelectric dams and other flood control infrastructure, including transferring ownership of infrastructure assets, and enhancing cooperation to increase operational efficiency and achieve flood control objectives.

Potential benefits: Enhances the operational efficiency, performance, and management of transferred assets.

Potential costs: \$336.6 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA

Potential implementer(s): PRASA, PREPA, DNER, municipalities

WTR 27

Protect and Rehabilitate Groundwater Systems

Protect and rehabilitate groundwater systems from saltwater intrusion, contamination, and overexploitation. Implement artificial recharge programs, monitoring networks, and groundwater modeling.

Potential benefits: Secures the quantity and quality of groundwater supply sources for agricultural, environmental, and domestic uses and mitigates the negative impacts of groundwater exploitation.

Potential costs: \$188.0 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, DOC EDA, EPA, U.S. Bureau of Reclamation, NRCS

Potential implementer(s): DNER, EQB, USGS, EPA

WTR 28

Secure Potable Water Sources Against Contamination

Secure potable water sources against contamination from domestic, agricultural, and industrial wastewater runoff and hazardous waste sites by raising awareness of source water protection measures, enforcing land use restrictions, and remediating contaminated areas.

Potential benefits: Improves water source protection and safeguards water supply, human health, and ecosystems.

Potential costs: \$49.3 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, DOC EDA, EPA, U.S. Bureau of Reclamation

Potential implementer(s): EPA, DNER, EQB, PRASA

WTR 29

Strengthen Redundancy and Diversify Water Supply Sources

Ensure the sustainability of water supply sources through integrated water management plans that include conservation and demand management strategies that balance environmental needs with the demands of communities, industry and agriculture. Enhance resilience to drought and climate change through alternative water supply use and water efficiency standards.

Potential benefits: Safeguards water supply and ensures adequate availability for the provision of drinking water during periods of drought.

Potential costs: \$1.477 billion in total estimated costs

Potential funder(s): CDBG-DR, P3, Government of Puerto Rico, PRASA

Potential implementer(s): DNER

**WTR 30**
Enhance PRASA's Emergency Management Operations

Enhance PRASA's capacity to deliver reliable services to critical facilities by designing and executing emergency management protocols that prioritize disaster response actions.

Potential benefits: Promotes water sector resilience, mitigates adverse consequences of extreme events, and can reduce the time required for emergency response and recovery, with downstream benefits for economic activity, public health, and safety.

Potential costs: \$8.8 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, PRASA

Potential implementer(s): PRASA, EQB, EPA

WTR 31
Build Trust and Engage PRASA Clients

Enhance communication, education, and outreach to PRASA customers on conservation and emergency preparedness and increase public understanding of water and wastewater system planning, performance, and investments to foster strong relationships between PRASA and its clients.

Potential benefits: Helps PRASA communicate its management priorities to clients and customers and provides a mechanism for clients and customers to play a more active role in helping PRASA meet its objectives.

Potential costs: \$66.3 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA, nongovernment sources

Potential implementer(s): PRASA

WTR 32
Enhance Electricity Reliability for Non-PRASA and Nonregulated Systems

Enhance electricity reliability for non-PRASA systems under both normal and emergency operations by assessing opportunities for resilient energy systems, diversifying energy sources with solar hybrid power generation, upgrading electrical systems, increasing water supply equipment capacity, locating backup generation and storage systems to reduce single points of failure, and training communities to install, operate, and maintain off-grid energy systems.

Potential benefits: Increases the reliability and resilience of rural drinking water systems.

Potential costs: \$63.8 million in total estimated costs

Potential funder(s): USDA

Potential implementer(s): EQB, EPA, PRASA, non-PRASA system operators

WTR 33
Conduct a Water Rebuild by Design Competition

Create a new "Rebuild by Design" competition to spur innovative water sector resilience projects that are developed collaboratively by community members, civic leaders, and nationally recognized design and engineering firms.

Potential benefits: Connects local communities with some of the nation's leading design firms to collaboratively address vulnerabilities that were exposed by Hurricanes Maria and Irma.

Potential costs: \$300 million in total estimated costs

Potential funder(s): CDBG-DR, U.S. Department of Energy

Potential implementer(s): Government of Puerto Rico, HUD



WTR 34

Expand PRASA Services to Unconnected Areas

Connect and convert non-PRASA systems to PRASA drinking water systems and connect communities with septic tanks and privately-owned wastewater systems to PRASA sewerage, where technically and financially practical.

Potential benefits: Eliminates risk of discharge of untreated wastewater into the environment, centralizes operation and maintenance of water and wastewater infrastructure, and improves quality of service and health outcomes

Potential costs: \$1.04 billion in total estimated costs

Potential funder(s): CDBG-DR, EPA, USDA

Potential implementer(s): PRASA, non-PRASA systems, EPA

CIT 6

Modernize the Emergency Operations Center

Upgrade the EOC to meet U.S. standards.

Potential benefits: Improves emergency managers' ability to coordinate with disaster response and recovery.

Potential costs: \$11 million–\$17 million in total estimated costs

Potential funder(s): FEMA EMPG, Government of Puerto Rico

Potential implementer(s): PREMA, PRTRB

CIT 7

Establish an Alternate Emergency Operations Center

Establish an alternate EOC, an alternate PSAP, and a center for COOP and COG housed in the same building, located outside the San Juan area.

Potential benefits: Provides backup location for emergency management operations and critical government functions in times of crisis.

Potential costs: \$17 million in total estimated costs

Potential funder(s): FEMA EMPG, Government of Puerto Rico

Potential implementer(s): PREMA, PRTRB

CIT 18

Database of Critical Infrastructure

Create an open, modular, and standards-based information system for up-to-date, geo-referenced, cross-sector data on government and privately owned critical infrastructure with near-real-time mapping capabilities.

Potential benefits: Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

Potential costs: \$8 million–\$15 million in total estimated costs

Potential funder(s): Private sector, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies

**CIT 37****Consolidated Government Information Systems**

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

Potential benefits: Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

Potential costs: \$482 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies

CPCB 1**Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 2**Capacity Building for Community-Level Preparedness and Response**

Develop and implement preparedness and response plans for 50–100 priority vulnerable communities that face particularly high risk during disasters. This action includes (1) recruiting, training, and equipping Community Emergency Response Teams (CERT) so that these communities can better sustain themselves during the response period, when emergency responders and access to the communities will be limited; and (2) establishing and maintaining a cache of emergency supplies—e.g., water filters and generators—for these communities.

Potential benefits: Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

Potential costs: \$37 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, municipal governments



CPCB 3

Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the Puerto Rico Planning Board (PRPB) so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions, and (2) hiring a risk officer for each of the 27 state-level agencies.

Potential benefits: Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

Potential costs: \$84 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): PRPB, infrastructure sectors

CPCB 4

Resilience Building in Collaboration with High-Risk Communities

Hire planners (on average 1.5 FTE per municipality) to develop and implement disaster response and recovery plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

Potential benefits: Builds community and individual resilience for both disaster response and long-term recovery

Potential costs: \$82 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS

Potential implementer(s): Government of Puerto Rico, municipal governments, local NGOs



CPCB 6

Public Information and Communication Capability for Coordinated Recovery

Build a Public Information and Communication (PIC) capability to maintain continued engagement with Puerto Rican communities in the recovery process. Establish and maintain methods of two-way communication with Puerto Rican residents about recovery planning and implementation. This action also includes establishing effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

Potential benefits: Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

Potential costs: \$8.8 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico

CPCB 8

Strengthening Emergency Management Capacity at Municipalities

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. Work with existing MEMOs to identify personnel and training needs. With PREMA/FEMA, create a training curriculum that more directly addresses municipal needs. Work with the Office of Human Resources to update job descriptions, specific classifications, tasks and responsibilities of all municipal staff during an emergency and response event. Train MEMOs to collect better information about people requiring evacuation (e.g., disabled, elderly).

Potential benefits: Strengthens municipalities' emergency management and response capacity.

Potential costs: \$165 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, Municipal Emergency Management Offices



CPCB 10
Incentivize the Design of Creative Solutions to Addressing Disaster Hazards

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards, and including but not limited to hurricanes and flooding—while also offering added social or economic benefits to the community.

Potential benefits: Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

Potential costs: \$6 million in total estimated costs

Potential funder(s): HMPG, CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, general public of Puerto Rico

CPCB 14
Building Grant Writing Capacity

Establish a set of 100 scholarships each year, for 5 years, for municipal government office workers and local NGO staff to receive ongoing training over a one-year period in grant writing from university-based certification programs (many of which are established in the mainland U.S.).

Potential benefits: Enables municipal government office workers to prepare competitive and compelling grant proposals to acquire funds for state-financed projects, including those in disaster recovery. Provides professional development for the governmental workforce and empowers members of the municipalities to seek solutions for their own communities.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDBG-DR, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipalities



CPCB 15
Strengthen Local Nonprofit and NGO Involvement in Disaster Recovery

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

Potential benefits: Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term sustainable funding.

Potential costs: \$9 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): ODSEC, NGOs, local nonprofits

ENR 5
Design and Build Hardened Grid Assets to Support Critical Infrastructure

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure. This action includes (1) policy guidance to clarify a plan for outages of a reasonable duration at critical facilities and enforce these standards where they already exist, (2) energy solutions for homes with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pumps systems.

Potential benefits: Promotes economic growth by creating a reliable electricity supply that is less impacted by threats/hazards.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, U.S. Department of Energy



ENR 16 **Promote and Provide Sustained Electricity Delivery to Critical Facilities**

Provide sustained electricity delivery to critical facilities—water, communications, manufacturing, health services, schools, airports, and seaports—to ensure the sustained delivery of public services in the absence of the bulk power system. This action includes (1) policy guidance on the reasonable duration of outages for critical facilities, (2) targeted energy solutions for households with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pump systems.

Potential benefits: Improves the efficiency and effectiveness of response efforts. Improves access to life-sustaining resources after a disaster.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE

ENR 17 **Promote and Provide Energy and Water to Emergency Infrastructure**

Ensure appropriate energy and water infrastructure at critical facilities, e.g., schools and stadiums. This action includes (1) selectively investing in microgrids and islanding equipment for emergency services; (2) installing technologies to make communities more independently resilient, such as feeder automation controls, onsite backup generation, combined heat and power systems, rooftop solar, and battery storage; and (3) building energy management systems at strategically located sites.

Potential benefits: Creates a reliable energy source after a catastrophe. Enhances emergency response.

Potential costs*: \$500 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE



ENR 19

Design and Deploy Data Systems to Inform Response and Recovery Decisions

Establish data, IT, and OT systems to inform decisions during response and recovery. Create a robust data inventory of assets. Acquire communications systems to support inventory management. Improve coordination among stakeholders responsible for critical infrastructure. Update PREPA's IT and OT systems.

Potential benefits: Creates an electricity supply that can be restored faster after a major power loss.

Potential costs*: \$30 million in total estimated costs

Potential funder(s)*: FEMA, Government of Puerto Rico, private sector

Potential implementer(s)*: PREPA, new private owner/operators, USACE, FEMA, U.S. Department of Energy

HOU 5

Collect, Integrate, and Map Housing Sector Data

Create an integrated database of housing and home ownership information, including title, permits, land use, property tax and location.

Potential benefits: Supports planning, relocation and mitigation efforts needed to make these communities safer and resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

Potential costs: \$30 million–\$50 million in total estimated costs

Potential funder(s): CDBG–DR

Potential implementer(s): PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

HOU 6

Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan (PUT) to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

Potential benefits: Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

Potential costs: \$102 million–\$317 million in total estimated costs

Potential funder(s): CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

Potential implementer(s): PRPB, OGPe, municipal governments

HSS 4

Improve Surveillance of Waterborne Disease

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

Potential benefits: Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

Potential costs: \$2.8 million–\$2.9 million in total estimated costs

Potential funder(s): EPA Water Finance Clearinghouse

Potential implementer(s): PRDOH, PRASA, CDC



HSS 6

Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

Potential benefits: Improves mosquito control in areas that have been difficult to reach.

Potential costs: \$2.1 million–\$3.8 million in total estimated costs

Potential funder(s): CDC

Potential implementer(s): PRVCU, PRDOH, municipalities

MUN 6

Create and Maintain Central Repository of Municipal Assets and Associated Conditions

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

Potential benefits: Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

Potential costs: \$13 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipal mayors

MUN 10

Provide Technical Assistance to Improve Municipal Finances by Generating Additional Revenues, Reducing Costs, and Balancing Budgets

Design and implement technical assistance programs to help municipalities find innovative ways to improve their finances by generating more revenue, cutting unnecessary costs, increasing productivity, and improving their ability to forecast revenue and spending.

Potential benefits: Helps municipalities balance their budgets. Improves their capacity to function and deliver services. Leads to improved fiscal situation throughout Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): CDBG-DR, SBA

Potential implementer(s): Independent research partner, municipal governments



MUN 17
Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

Potential benefits: Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

Potential costs: \$3.5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Government of Puerto Rico, municipal governments

NCR 5
Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations, with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

Potential benefits: Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

Potential costs: \$74 million–\$120 million in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, P3, Government of Puerto Rico, DNER, municipalities, nongovernment sources

Potential implementer(s): DNER, USFS, municipalities



NCR 8

Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 9

Landfill Repair and Closure

Repair landfills and open dumps that sustained damage from the hurricanes and close unlined open dumps throughout Puerto Rico.

Potential benefits: Reduces or eliminates the impact of landfills on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Benefits public health and the environment.

Potential costs: \$160 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities, Solid Waste Authority

NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 11

Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA



NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies

NCR 14

Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies

NCR 16

Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE



Rebuild and strengthen maritime, surface, and air transportation

TXN 1

Refine and Enforce Road Design Standards

Collect and refine guidance on road design, develop a set of engineering standards that promote innovative features, and ensure that roads meet these standards.

Potential benefits: Improves road safety through better roadway markings, signage, and lighting. Reduces maintenance costs, increases roadway life, and prevents damage from future disasters through improved roadway drainage systems and bridge design. Encourages people to walk and bicycle instead of driving by promoting sidewalks and bicycle lanes, which provides public health benefits and reduces traffic congestion.

Potential costs: \$6 million–\$100 million in total estimated costs

Potential funder(s): DOT

Potential implementer(s): PRHTA

TXN 2

Harden Vulnerable Transportation Infrastructure

Analyze transportation infrastructure vulnerability to natural hazards, beginning with floodplain mapping and landslide risk analysis, and then undertake cost-effective engineering projects to mitigate risk, including road relocation, traffic rerouting, and bridge, pavement, and culvert reconstruction.

Potential benefits: Increases the chances that the transportation system will continue functioning after future natural disasters.

Potential costs: \$1.3 million–\$380 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOT, U.S. Department of Energy

Potential implementer(s): PRHTA

TXN 5

Road Maintenance and Repair Program

Adopt a “fix it first” policy: Give priority to cost-effective road maintenance and repair projects over new construction or expanding existing roadways. Select projects on the advice of traffic engineers to improve the condition, safety, and operation of roadways.

Potential benefits: Reduces vehicle operating costs, travel times, crash rates, the severity of crashes, pollutant emissions, and future road maintenance costs while increasing resilience.

Potential costs: \$1.4 billion–\$6.4 billion in total estimated costs

Potential funder(s): DOT, DTOP

Potential implementer(s): PRHTA

TXN 7

Incentivize a Variety of Mobility Options

Provide additional travel options for people who do not drive or prefer to use other modes of transportation. Examples include ride-hailing/ride-sharing, expanded “publico” (jitney) service, inter-city bus service, bike/scooter-sharing, and peer-to-peer car-sharing.

Potential benefits: Increases mobility and quality of life for people who do not drive, reduces traffic congestion, reduces costs for people who give up driving, and promotes public health and decreases air pollution through the use of nonmotorized transportation.

Potential costs: \$5 million–\$190 million in total estimated costs

Potential funder(s): DOT, users, private sector

Potential implementer(s): PRHTA, private companies, Puerto Rico Metropolitan Bus Authority

**TXN 8**
Improve Bus Service

Improve existing bus service by giving priority to buses at intersections, providing real-time arrival information, upgrading bus stops, updating the payment system to use smart cards, adding dedicated bus lanes to some roads, and expanding the bus fleet.

Potential benefits: Increases the reliability and comfort of bus travel and expands transportation options for people who do not drive.

Potential costs: \$8 million–\$730 million in total estimated costs

Potential funder(s): DOT, users, P3

Potential implementer(s): Puerto Rico Metropolitan Bus Authority

TXN 9
Develop an Intelligent Transportation System

Support transportation agencies in providing real-time travel information to highway users, optimizing traffic signals on key roadways, and develop a plan to ensure that crashes and roadway obstructions are cleared from travel lanes as quickly as possible.

Potential benefits: Diverts traffic away from incidents, decreases incident response time, reduces probability of crashes after an initial incident, and provides data to inform transportation planning decisions.

Potential costs: \$78 million in total estimated costs

Potential funder(s): CDBG–DR, DOT

Potential implementer(s): PRHTA

TXN 10
Develop Redundant Seaport Capacity

Expand an existing seaport to mitigate the effects of major disruptions to the port in San Juan that could prevent goods from being delivered in a timely manner.

Potential benefits: Helps ensure that residents receive food and fuel in case of an emergency that disrupts operations at the main port in San Juan.

Potential costs: \$100 million–\$180 million in total estimated costs

Potential funder(s): PA, HMGP, FEMA Port Security grants, PRPA, private sector

Potential implementer(s): PRPA, port authorities and operators

TXN 11
Support Infrastructure Asset Management

Help public agencies inventory their transportation infrastructure, including roads, bridges, culverts, and signage. Improve systems for tracking the condition of that infrastructure and for scheduling maintenance, repair, and rehabilitation.

Potential benefits: Reduces infrastructure maintenance costs, vehicle operating costs, travel times, pollutant emissions, and the rate and severity of vehicle crashes.

Potential costs: \$6 million in total estimated costs

Potential funder(s): DOT

Potential implementer(s): PRHTA



TXN 12

Redevelop Rafael Hernández Airport

Expand and upgrade Rafael Hernández Airport in Aguadilla, northwest Puerto Rico. Specifically, add a new runway, taxiway, apron areas, terminals, and a control tower.

Potential benefits: Increases airport capacity, improves service to airport passengers, and boosts local economic activity by attracting more visitors.

Potential costs: \$400 million–\$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG–DR, FAA, PRPA, municipality, P3

Potential implementer(s): PRPA

TXN 13

Reassess the Maritime Transportation System Recovery Plan

Reevaluate the Maritime Transportation System recovery plan to ensure preparation for future disasters, including coordination among various partners and measures to protect critical resources. Establish an integrated operations center and a communications protocol for first responders during a disaster.

Potential benefits: Uses lessons learned from Hurricanes Irma and Maria to ensure that disaster response plans are in place at ports and that ports can recover quickly.

Potential costs: \$300,000–\$500,000 in total estimated costs

Potential funder(s): USCG, FEMA Pre–Disaster Mitigation Grant Program, Government of Puerto Rico, PRPA

Potential implementer(s): PRPA, USCG, maritime stakeholders

TXN 14

Long-Term Planning to Develop Port of Ponce as a Regional Transshipment Hub

Begin long-term strategic planning for the Port of Ponce in southern Puerto Rico to serve as a transshipment hub. Provide economic incentives (through reduced taxes or government subsidies) for shipping agencies to use Ponce as an intermediate destination for goods heading to South and North America.

Potential benefits: Encourages economic growth of Puerto Rico's maritime transportation sector and makes Puerto Rico's ports more attractive to investors and shipping companies.

Potential costs: \$100 million–\$500 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): Port of Ponce Authority, PRPA

TXN 15

Consolidate Port Ownership

Consolidate ownership and oversight of Puerto Rico's nine main ports to better manage maritime transportation.

Potential benefits: Increases the efficiency and profitability of Puerto Rico's ports, improves coordination among port owners, increases port response and recovery operations, and makes Puerto Rico's ports more attractive to investors and shipping companies.

Potential costs: N/A

Potential funder(s): PRPA (tax incentives), private sector

Potential implementer(s): PRPA, Port of Ponce Authority, Port of Mayaguez Authority



TXN 16

Repair Damage to Surface Transportation Network

Repair roads that remain damaged and replace bridges that failed or were severely damaged during the hurricanes. Repair transit systems to meet codes.

Potential benefits: Restores Puerto Rico's surface transportation network to its pre-hurricane state and ensures efficient transportation of people, goods, and services.

Potential costs: \$820 million in total estimated costs

Potential funder(s): DOT, FEMA, Government of Puerto Rico

Potential implementer(s): PRHTA

TXN 17

Repair Damage to Ports and Ferry Terminals

Repair damage to ports and ferry terminals/vessels that limits their use or poses long-term safety or operational concerns.

Potential benefits: Ensures that ports can operate at full capacity and provides some redundancy in the event of a disaster that disrupts a major port.

Potential costs: \$990 million in total estimated costs

Potential funder(s): PA, CDBG-DR, private sector

Potential implementer(s): PRPA, Port of Ponce Authority, Port of Mayaguez Authority, private port operators, Puerto Rico Maritime Transportation Authority

TXN 18

Repair Airport Damage

Make repairs to airport facilities that were damaged during Hurricanes Irma and Maria, including roofs, fences, and electrical systems.

Potential benefits: Ensures that airports can operate at full capacity and receive relief and recovery supplies, improves airport safety, and boosts local economic activity.

Potential costs: \$270 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, FAA, private insurance

Potential implementer(s): PRPA, Aerostar (San Juan Airport operator)

TXN 19

Provide High-Capacity Transit Service to San Juan Airport

Establish high-capacity bus rapid transit service to San Juan Airport.

Potential benefits: Provides an alternative means of transportation to Puerto Rico's busiest airport and reduces pollutant emissions and traffic congestion.

Potential costs: \$570 million in total estimated costs

Potential funder(s): DOT FTA, P3, DTOP

Potential implementer(s): PRHTA



TXN 20 **Provide High-Capacity Transit Service between San Juan and Caguas**

Establish high-capacity bus rapid transit service between San Juan and Caguas, probably along the route of PR-52.

Potential benefits: Provides an alternative means of transportation between San Juan and Caguas and reduces pollutant emissions and traffic congestion.

Potential costs: \$370 million in total estimated costs

Potential funder(s): DOT FTA, P3, DTOP

Potential implementer(s): PRHTA

TXN 21 **Extend PR-5**

Extend privately operated PR-5 in Bayamon between PR-199 and PR-167.

Potential benefits: Provides upgraded connections between the San Juan metro area and mountain municipalities.

Potential costs: \$210 million in total estimated costs

Potential funder(s): DOT, P3, DTOP

Potential implementer(s): PRHTA

TXN 22 **Extend PR-22**

Extend privately operated PR-22 for roughly 25 miles to the area currently served by PR-2.

Potential benefits: Improves connections between San Juan and western Puerto Rico and serves Rafael Hernández Airport in Aguadilla.

Potential costs: \$1 billion in total estimated costs

Potential funder(s): DOT, P3, Government of Puerto Rico, DTOP

Potential implementer(s): PRHTA

TXN 23 **Complete PR-10**

Fill gaps in Puerto Rico's highway network by completing work on PR-10, one of the few north-south routes.

Potential benefits: Improves mobility between Puerto Rico's interior and the north and south coasts, spurs local economic activity, and improves infrastructure resilience and road safety.

Potential costs: \$370 million in total estimated costs

Potential funder(s): DOT, P3, DTOP

Potential implementer(s): PRHTA



TXN 24

Update the Airport Emergency Plan

Update the Airport Emergency Plan to identify reserve capacity, ensure that items needed for response efforts are pre-positioned before an emergency, develop a communications protocol for first responders, and integrate disaster protection measures to ensure the safety of the airport populace and the community in which the airport is located.

Potential benefits: Uses lessons learned from Hurricanes Irma and Maria to ensure that disaster response plans are in place at airports across Puerto Rico, supports quicker recovery in the event of a future disaster, and promotes the health, safety, and security of communities near airports.

Potential costs: \$5 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, FAA, Government of Puerto Rico, PRPA

Potential implementer(s): PRPA, Aerostar (San Juan Airport operator)

TXN 25

Increase Port Facility Resilience

Improve and rehabilitate piers and associated buildings at ports to increase their resilience to disasters and sea level rise.

Potential benefits: Helps ensure continuity of operations at ports and increases the structural integrity of port infrastructure.

Potential costs: \$360 million–\$540 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOC EDA

Potential implementer(s): PRPA, Port of Ponce Authority, Port of Mayaguez Authority

CIT 13

Streamline the Permitting and Rights of Way Processes for Towers and the Deployment of Fiber-Optic Cable

Establish a central rights of way and permitting approval authority to achieve uniform and streamlined approval processes.

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): FCC

Potential implementer(s): PRTRB, GPR agencies, municipalities

CIT 17

Puerto Rico Data Center

Establish a robust and disaster-proof, scalable, cloud-enabled data center for governmental information systems that expands its capacity to perform essential governmental functions and deliver essential services.

Potential benefits: Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally, while preserving the integrity of all essential information systems.

Potential costs: \$68 million–\$190 million in total estimated costs

Potential funder(s): Government of Puerto Rico, lease of excess capacity, nongovernment sources

Potential implementer(s): CIO, GPR agencies

**CIT 22****Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide**

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through FCC's E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies and GPR agencies to leverage these programs.

Potential benefits: Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): FCC, USDA, HUD, DOC EDA, NTIA

Potential implementer(s): PRTRB, FCC, PRDE

ENR 5**Design and Build Hardened Grid Assets to Support Critical Infrastructure**

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure. This action includes (1) policy guidance to clarify a plan for outages of a reasonable duration at critical facilities and enforce these standards where they already exist, (2) energy solutions for homes with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pumps systems.

Potential benefits: Promotes economic growth by creating a reliable electricity supply that is less impacted by threats/hazards.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, U.S. Department of Energy



ENR 9

Design and Build Fuel Supply Chain to Provide Reliable Energy Source

Improve the fuel supply chain from port to end use. This action includes (1) increasing investment in the fuel stockpile, (2) expanding the number of storage facilities, (3) increasing the number of—and strategically locating—trucks and trained workforce to deliver fuel, and (4) expanding the size of existing shipping ports.

Potential benefits: Diminishes vulnerability to fuel price spikes and enables the distribution of emergency fuel to geographically dispersed areas.

Potential costs*: \$700 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy

ENR 16

Promote and Provide Sustained Electricity Delivery to Critical Facilities

Provide sustained electricity delivery to critical facilities—water, communications, manufacturing, health services, schools, airports, and seaports—to ensure the sustained delivery of public services in the absence of the bulk power system. This action includes (1) policy guidance on the reasonable duration of outages for critical facilities, (2) targeted energy solutions for households with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pump systems.

Potential benefits: Improves the efficiency and effectiveness of response efforts. Improves access to life-sustaining resources after a disaster.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE



HOU 5 Collect, Integrate, and Map Housing Sector Data

Create an integrated database of housing and home ownership information, including title, permits, land use, property tax and location.

Potential benefits: Supports planning, relocation and mitigation efforts needed to make these communities safer and resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

Potential costs: \$30 million–\$50 million in total estimated costs

Potential funder(s): CDBG–DR

Potential implementer(s): PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

HOU 6 Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan (PUT) to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

Potential benefits: Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

Potential costs: \$102 million–\$317 million in total estimated costs

Potential funder(s): CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

Potential implementer(s): PRPB, OGPe, municipal governments

HOU 11 Develop and Adopt a Common Address System

Revise address system to decrease complexity. Install new street signs and address numbers. Update government databases with new property addresses.

Potential benefits: Improves ability of emergency responders to locate properties. Improves ability of planners and social service providers to map and analyze urban problems and develop solutions. Improves efficiency of mail delivery and simplifies operations of other entities that rely on property addresses to provide or bill for services.

Potential costs: \$75 million–\$200 million in total estimated costs

Potential funder(s): CDBG–DR, Government of Puerto Rico

Potential implementer(s): PRDH, PRPB, PRDOJ, CRIM, OGPe, municipal governments

NCR 13 Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG–DR, NRCS, EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies

**NCR 16**
Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE

NCR 17
Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

Potential benefits: Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

Potential costs: \$80 million–\$82 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USACE, NOAA

Potential implementer(s): DNER, municipalities, USACE

WTR 18
Invest in Stormwater System Management

Invest in stormwater system cleaning, monitoring, maintenance and assessment through (1) comprehensive and routine asset mapping, (2) hydrologic and hydraulic analyses, (3) illicit discharge detection and elimination (IDDE) program expansion, (4) education and technical assistance, (5) assessment of system capacity and condition, (6) removal of debris and blockages, and (7) inventory management of parts and equipment.

Potential benefits: Improves water and environmental quality and human health. Reduces damages to public and private property from urban flood events.

Potential costs: \$418.7 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA

Potential implementer(s): Municipalities, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

**WTR 19****Reduce Urban Nuisance Flooding**

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

Potential benefits: Improves water and environmental quality and human health and reduces damages to public and private property from urban flood events.

Potential costs: \$1.005 billion in total estimated costs

Potential funder(s): EPA, USDA, Government of Puerto Rico, DNER

Potential implementer(s): Municipalities, DNER, PRASA, EPA, USGS, PRPB, OGPe, NOAA, EQB, DTOP, private industry and NGOs

WTR 20**Relocate or Redesign Assets in Flood Zones**

Relocate or redesign assets in flood zones according to building standards and updated hydrologic guidelines to reduce the likelihood of service disruption or infrastructure failure during 100- and 500-year flood events.

Potential benefits: Decreases flood risk and increases water sector resilience to future disasters by preventing flooding, damage, and service interruption.

Potential costs: \$1.18 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOC EDA

Potential implementer(s): PRASA, PREPA, DNER, municipalities, DTOP, non-PRASA operators, FEMA





Repair and rebuild resilient residential housing

HOU 1

Assess, Repair, or Relocate Substantially-Damaged Owner-Occupied Homes

Identify priority homes for repair or rebuilding—those with substantial damage, located in the most vulnerable areas or areas distant from core infrastructure, and identified as low-income households. Repair or rebuild homes onsite if locations are safe from future natural hazard risk. Offer residents of homes on unsafe sites assistance with relocation and temporary housing.

Potential benefits: Repairs or rebuilds homes to withstand future disasters and eliminates housing in high-risk areas. Takes community needs and approved land use plan into consideration.

Potential costs: \$8 billion–\$12 billion in total estimated costs

Potential funder(s): IA, HMGP, CDBG-DR, SBA, nongovernment sources

Potential implementer(s): PRDH, municipalities

HOU 3

Assess Vulnerability of Non-Substantially Damaged Homes

Engage in long-term resilience planning by assessing housing stock in high-risk areas through property inspections, developing strategies to determine which structures can be secured through mitigation or relocation, and counseling homeowners on flood risk and mitigation.

Potential benefits: Improves understanding of risks to housing structures that may not have manifested themselves during Hurricanes Irma or Maria. Increases resiliency of communities and the entire Island if high-risk houses are identified and repaired or strengthened.

Potential costs: \$30 million–\$80 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, nongovernment sources

Potential implementer(s): PRPB, PRDH, municipalities



HOU 4

Make Owner-Occupied Homes Less Vulnerable to Natural Hazards

Provide funding to perform mitigation work on homes not directly damaged by Hurricanes Maria or Irma but at increased risk of future damage from weather, climate, or other natural disasters.

Potential benefits: Increases the resilience of housing, which should lessen the impact of future disasters for residents and communities and reduce the need for dependence on federal programs to support repair and recovery or rebuilding. Seeks to leverage existing federal home improvement programs like the DOE Weatherization Program to potentially reduce costs and maximize funds available for mitigation efforts.

Potential costs: \$12 billion–\$18 billion in total estimated costs

Potential funder(s): HMGP, PDM, CDBG-DR, nongovernment sources

Potential implementer(s): PRDH, municipalities

HOU 5

Collect, Integrate, and Map Housing Sector Data

Create an integrated database of housing and home ownership information, including title, permits, land use, property tax and location.

Potential benefits: Supports planning, relocation and mitigation efforts needed to make these communities safer and resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

Potential costs: \$30 million–\$50 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

HOU 6

Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan (PUT) to align zoning and regulations for permitted land use and construction. Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

Potential benefits: Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

Potential costs: \$102 million–\$317 million in total estimated costs

Potential funder(s): CDBG-DR, HMGP, Government of Puerto Rico, nongovernment sources

Potential implementer(s): PRPB, OGPe, municipal governments



HOU 11

Develop and Adopt a Common Address System

Revise address system to decrease complexity. Install new street signs and address numbers. Update government databases with new property addresses.

Potential benefits: Improves ability of emergency responders to locate properties. Improves ability of planners and social service providers to map and analyze urban problems and develop solutions. Improves efficiency of mail delivery and simplifies operations of other entities that rely on property addresses to provide or bill for services.

Potential costs: \$75 million–\$200 million in total estimated costs

Potential funder(s): CDBG–DR, Government of Puerto Rico

Potential implementer(s): PRDH, PRPB, PRDOJ, CRIM, OGPe, municipal governments

HOU 12

Register Properties and Resolve Titling Issues

Promote registration of all property titles in the property registry. Create and publicize title registration process, importance and benefits of obtaining clear title, and potential penalties for failure to establish title and register properties.

Potential benefits: Reduces future uncertainty regarding property ownership and property disputes. Creates consistent process for establishing title. Improves accuracy of property tax collection.

Potential costs: \$800 million in total estimated costs

Potential funder(s): IA, CDBG–DR, Government of Puerto Rico

Potential implementer(s): Municipalities, PRDOJ, OGPe, PRPB, CRIM, PRDH

HOU 14

Assess Needs, Repair, and Mitigate Damaged Affordable Rental Housing

Repair damaged public housing and mitigate subsidized housing that is vulnerable to natural hazards or assist residents in relocating. Provide assistance to operators of homeless housing to complete needed repairs. Update existing publicly-assisted housing to better accommodate special needs residents (including the elderly and disabled).

Potential benefits: Provides safe, secure housing for low-income and homeless persons. Repairs damaged properties. Provides energy conservation upgrades. Mitigates damage from future disaster events.

Potential costs: \$1 billion in total estimated costs

Potential funder(s): PA, CDBG–DR, HUD

Potential implementer(s): Puerto Rico Public Housing Authority, HUD, Puerto Rico Housing Finance Authority, USDA Rural Development Program

**HOU 15****Assess Need for—and Adopt Programs to Provide—Additional Affordable Rental Housing and Housing for Vulnerable Populations**

Assess the current and future need for public or subsidized rental housing and homeless housing for lower income households and special needs populations. Identify programs to increase the supply of affordable housing.

Potential benefits: Provides safe, secure housing for low-income and special needs populations.

Potential costs: \$1.4 billion–\$4.4 billion in total estimated costs

Potential funder(s): HUD, Low-Income Housing Tax Credit, Puerto Rico Public Housing Authority, nongovernment sources

Potential implementer(s): Puerto Rico Housing Finance Authority, Puerto Rico Public Housing Authority, HUD, USDA Rural Development Program

HOU 17**Increase Adoption of Homeowners and Flood Insurance**

Increase the proportion of Puerto Rican homes that carry wind and flood insurance. Conduct education and outreach campaigns about coverage and costs. Assess whether other types of products should be developed and offered at lower cost. Provide financial assistance to low-income households to help reduce premium costs.

Potential benefits: Increases uptake of wind and flood insurance. Decreases reliance on local and federal aid. Speed recovery for residents and communities after future natural disasters.

Potential costs: \$450 million–\$1.1 billion in total estimated costs

Potential funder(s): CDBG–DR, FEMA NFIP, private insurance, Puerto Rico Housing Finance Authority, PRDH

Potential implementer(s): Office of the Commissioner of Insurance, Office of the Commissioner of Financial Institutions, insurance companies



HOU 19

Reduce Mortgage Delinquencies and Foreclosures

Stem the tide of delinquencies and foreclosures which has increased since Hurricane Maria by allowing delinquent borrowers to catch up on mortgage payments through an assistance program.

Potential benefits: Stabilizes rates of foreclosure to pre-Hurricane levels. Promotes financial and residential stability.

Potential costs: \$85 million–\$235 million in total estimated costs

Potential funder(s): CDBG-DR, private lenders, nongovernment sources

Potential implementer(s): Puerto Rico Housing Finance Authority, PRDH, Mortgage Bankers Association, private lenders, insurance companies

HOU 20

Assess and Renovate Vacant and Blighted Properties

Inventory vacant properties. Develop strategies to clarify legal ownership of properties and ways to incentivize redevelopment or relinquishing of properties for demolition or rehabilitation. Rehabilitate, redevelop, or demolish abandoned and blighted residential and commercial properties. Determine end uses of properties, including development of affordable rental housing and rent-to-own programs.

Potential benefits: Increases value of properties surrounding formerly blighted properties as well as increasing economic opportunities. Increases supply of available housing.

Potential costs: \$2 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, private sector, nongovernment sources

Potential implementer(s): Puerto Rico Housing Finance Authority, PRDH, PRPB, municipalities

CIT 3

Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, and consolidate dispatch at the PSAP.

Potential benefits: Improves the effectiveness of 911 service through new features (such as text, photo, video and GPS location sharing), improves 911 response times, and improves system resilience.

Potential costs: \$3 million–\$7 million in total estimated costs

Potential funder(s): DOC

Potential implementer(s): Puerto Rico 9-1-1 Service Governing Board

CIT 4

Rural Area Network Task Force

Establish a task force to develop communications networks and information systems in rural or disconnected areas, particularly for the elderly, limited-mobility individuals, and caregivers, for use in emergencies.

Potential benefits: Initiates establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

Potential costs: \$400,000–\$800,000 in total estimated costs

Potential funder(s): Government of Puerto Rico, private sector

Potential implementer(s): PRTRB, PREMA

**CIT 16**
Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

Potential benefits: Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): CINO, CIO

CIT 25
Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, in particular those of the Federal Communications Commission (FCC).

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): CDBG-DR, FCC

Potential implementer(s): PRTRB, FCC, private telecommunication companies

CIT 26
Wi-fi Hotspots in Public Housing and “Digital Stewards” Program

Establish a “Digital Stewards” program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

Potential benefits: Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

Potential costs: \$20 million in total estimated costs

Potential funder(s): CDBG-DR, PRDH

Potential implementer(s): CINO, HUD, PRDH

CIT 36
Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

Potential benefits: Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by developers.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): CINO, PREMA, GPR agencies



CPCB 1

Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 3

Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the Puerto Rico Planning Board (PRPB) so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions, and (2) hiring a risk officer for each of the 27 state-level agencies.

Potential benefits: Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

Potential costs: \$84 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): PRPB, infrastructure sectors



CPCB 4

Resilience Building in Collaboration with High-Risk Communities

Hire planners (on average 1.5 FTE per municipality) to develop and implement disaster response and recovery plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

Potential benefits: Builds community and individual resilience for both disaster response and long-term recovery

Potential costs: \$82 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS

Potential implementer(s): Government of Puerto Rico, municipal governments, local NGOs

CPCB 7

Capacity Building for Emergency Shelter Planning

Hire planners in each municipality and at the state-level to build a more robust emergency shelter system. This action will develop parameters, standards, and general design guidelines for shelters that can better support residents over the longer-term. This action also will establish a protocol with the National Guard for effective management of response commodities for shelters.

Potential benefits: Improves access to safe and appropriately resourced shelters within a reasonable distance that can accommodate community needs, such as disabilities and medical conditions.

Potential costs: \$57 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, public buildings sector

**ENR 1****Establish and Enforce Best Practices for Electricity Grid**

Align grid standards with industry best practices—tailored to the unique conditions in Puerto Rico—and ensure timely compliance and enforcement. May necessitate replacing some components of existing generation, transmission, and distribution assets.

Potential benefits: Increases knowledge of system components. Increases ready access to replacement parts. Lowers maintenance costs. Allows for faster repairs, a broader range of material and supplies that can be used, and synergies with other endeavors, e.g., the installation of new technologies and the establishment of a resilient grid.

Potential costs*: \$1 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PREC, U.S. Department of Energy

ENR 2**Design, Build, and Maintain “Islandable” Portions of the Electricity Grid**

Design and create an “islandable” grid that can balance generation and load to continue delivering localized electricity if other portions of the system fail. Strategically install, test, and maintain microgrids with an adequate inventory of replacement assets.

Potential benefits: Allows for more resilient electricity and potentially improved environmental performance (and improved public health). May save money depending on relative electricity rates. Promotes economic growth through less price volatility and potentially improved access to electricity.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy, private industry, public-private entities, municipalities



ENR 3

Design and Build a Supporting Infrastructure for the Electricity System, Including Communications

Strengthen the electricity system through improvements to supporting infrastructure such as control centers, communication systems, and collection systems.

Potential benefits: Improves communications and systems that allow faster response to disruptive events. Leads to an electricity supply that is less impacted by threats and hazards. Promotes economic growth with a more reliable and resilient energy supply.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, PREC, new private owner/operators

ENR 5

Design and Build Hardened Grid Assets to Support Critical Infrastructure

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure. This action includes (1) policy guidance to clarify a plan for outages of a reasonable duration at critical facilities and enforce these standards where they already exist, (2) energy solutions for homes with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pumps systems.

Potential benefits: Promotes economic growth by creating a reliable electricity supply that is less impacted by threats/hazards.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, U.S. Department of Energy



ENR 17

Promote and Provide Energy and Water to Emergency Infrastructure

Ensure appropriate energy and water infrastructure at critical facilities, e.g., schools and stadiums. This action includes (1) selectively investing in microgrids and islanding equipment for emergency services; (2) installing technologies to make communities more independently resilient, such as feeder automation controls, onsite backup generation, combined heat and power systems, rooftop solar, and battery storage; and (3) building energy management systems at strategically located sites.

Potential benefits: Creates a reliable energy source after a catastrophe. Enhances emergency response.

Potential costs*: \$500 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, U.S. Department of Energy, EPA, NOAA, PREPA, private equity

Potential implementer(s)*: PREPA, PRASA, PREMA, FEMA, USACE

ENR 23

Design Best Strategies for Renewable Energy Resources

Determine the appropriate strategies for all types of existing and potential renewable energy resources (wind, solar, biomass, hydro, tidal, etc.). Assess the possibility of revitalizing hydropower facilities across Puerto Rico, especially facilities with black start or “islanding” capabilities. Promote the development of prioritized siting of renewable energy.

Potential benefits: Changes the cost structure for the electricity utility. Improves resilience and faster recovery of the energy grid. Increases access and reliability. Reduces environmental and health costs. Promotes economic growth.

Potential costs*: \$800,000 in total estimated costs

Potential funder(s)*: CDBG-DR, U.S. Department of Energy, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PRASA, Government of Puerto Rico, municipalities



ENR 24

Design Best Strategies for Affordable and Stable Energy Prices

Prioritize strategies for energy generation resources that reduce prices and volatility faced by consumers. Establish goals for the quantity and type of energy sources to be generated. Evaluate the costs and benefits of alternative generation resources. Evaluate options and establish policies that incentivize private investment. Develop a workforce that can maintain generation investments.

Potential benefits: Establishes a system that provides affordable, reliable, and high-quality electric power to small businesses, commercial and industrial users, and the broader economy of Puerto Rico.

Potential costs*: \$3 billion in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: Government of Puerto Rico, PREPA, new private owner/operators, PREC

HSS 1

Increase Use of Solar-Powered Generators and Solar Backup Power Sources

Promote solar-powered generators for single-family homes (over 80% of all housing units), multi-family homes, and commercial properties to reduce air and noise pollution.

Potential benefits: Reduces noise and air pollution and thus the risk for respiratory and hearing-related illnesses. Reduces the number of residents who need to be evacuated due to lack of power. Reduces morbidity among residents with technological dependence for health issues, and mortality and risk associated with fossil fueled generators.

Potential costs: \$0.31 billion–\$4.9 billion in total estimated costs

Potential funder(s): EPA, USDA, EQB, private sector

Potential implementer(s): EQB, EPA's Caribbean Division



HSS 2

Prevent Disease Through a Capacity-Building Healthy Housing Initiative: Targeting Mold, Lead, and Other Stressors

Build capacity for the identification and management of mold and other environmental stressors through an integrated healthy homes/housing and buildings initiative to prevent respiratory-related and other health exacerbations. This action includes enforcement, an educational campaign, and promotion of case management guidelines as well as the proper use of medications.

Potential benefits: Decreases the public health burden of asthma and other respiratory-related diseases, and thus also decreases health care costs.

Potential costs: \$16 million–\$23 million in total estimated costs

Potential funder(s): CDC, DHHS HRSA

Potential implementer(s): EPA, CDC, other federal agencies, PRDH, PRDOH, other GPR agencies

HSS 10

Expand Care for Trauma and Chronic Stress

Expand the number of people and places (e.g., schools and other community centers) where people can get both long-term and immediate assistance for acute trauma and chronic stress. This action includes training nonprofessionals, such as health and physical education teachers, in supportive emotional well-being services.

Potential benefits: Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

Potential costs: \$8.4 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, nongovernment sources

Potential implementer(s): Mental health providers



HSS 20 **Improve Supports for the Elderly, Particularly Those Living Alone**

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities via continued support for Project 646. Encourage communities to participate in local emergency planning through activities such as community mapping that would help to identify people who might be at increased risk in a disaster, such as elderly who live alone.

Potential benefits: Increases the resiliency of the elderly population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

Potential costs: \$62 million in total estimated costs

Potential funder(s): DHHS, OPPEA, PRDF

Potential implementer(s): OPPEA, PREMA

MUN 14 **Repopulate Urban Centers**

Incentivize the redevelopment and repopulation of urban centers to improve social and health outcomes and improve access to services. Provide incentives for individuals and families living in outlying communities to relocate to urban centers.

Potential benefits: Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight—while spurring economic development in all sectors.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): CDBG-DR, SBA, Government of Puerto Rico

Potential implementer(s): Governor, municipal governments

**MUN 17**

Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

Potential benefits: Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

Potential costs: \$3.5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Government of Puerto Rico, municipal governments

NCR 8

Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 11

Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA



NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies

NCR 14

Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies

NCR 22

Promote Alternative Tourism for Economic Development

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

Potential benefits: Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

Potential costs: \$0–\$350 million in total estimated costs

Potential funder(s): DOC EDA, SBA, USDA, NPS, NOAA

Potential implementer(s): PRTC, DOC EDA, DNER

PBD 3

Establish Integrated Services Centers

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

Potential benefits: Simplifies access to services for the population and streamlines maintenance processes.

Potential costs: \$10 million–\$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, USDA WIC

Potential implementer(s): Puerto Rico Department of State, PRPBA

**PBD 9****Repair All Essential Public Buildings Damaged by Hurricanes Irma and Maria**

Complete repairs to essential public buildings that sustained hurricane damage, ensuring that repairs meet current building safety codes for wind, flood, and seismic events.

Potential benefits: Fixes damaged buildings and ensures that public buildings are more resilient to future hurricanes and other disasters.

Potential costs: \$4 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, U.S. Department of Education

Potential implementer(s): PRIFA

PBD 10**Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

Potential benefits: Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

Potential costs: \$7 million in total estimated costs

Potential funder(s): GPR agency operating budgets, EPA

Potential implementer(s): Government of Puerto Rico, municipal governments

TXN 5**Road Maintenance and Repair Program**

Adopt a "fix it first" policy: Give priority to cost-effective road maintenance and repair projects over new construction or expanding existing roadways. Select projects on the advice of traffic engineers to improve the condition, safety, and operation of roadways.

Potential benefits: Reduces vehicle operating costs, travel times, crash rates, the severity of crashes, pollutant emissions, and future road maintenance costs while increasing resilience.

Potential costs: \$1.4 billion–\$6.4 billion in total estimated costs

Potential funder(s): DOT, DTOP

Potential implementer(s): PRHTA

TXN 7**Incentivize a Variety of Mobility Options**

Provide additional travel options for people who do not drive or prefer to use other modes of transportation. Examples include ride-hailing/ride-sharing, expanded "publico" (jitney) service, inter-city bus service, bike/scooter-sharing, and peer-to-peer car-sharing.

Potential benefits: Increases mobility and quality of life for people who do not drive, reduces traffic congestion, reduces costs for people who give up driving, and promotes public health and decreases air pollution through the use of nonmotorized transportation.

Potential costs: \$5 million–\$190 million in total estimated costs

Potential funder(s): DOT, users, private sector

Potential implementer(s): PRHTA, private companies, Puerto Rico Metropolitan Bus Authority



TXN 16

Repair Damage to Surface Transportation Network

Repair roads that remain damaged and replace bridges that failed or were severely damaged during the hurricanes. Repair transit systems to meet codes.

Potential benefits: Restores Puerto Rico's surface transportation network to its pre-hurricane state and ensures efficient transportation of people, goods, and services.

Potential costs: \$820 million in total estimated costs

Potential funder(s): DOT, FEMA, Government of Puerto Rico

Potential implementer(s): PRHTA

WTR 1

Resilient Repair or Replacement of the PRASA Drinking Water System

Repair or replace PRASA drinking water system assets and facilities in a manner that enhances future resilience to extreme events.

Potential benefits: Ensures quality and quantity of service to PRASA clients, which safeguards public health and supports economic activity, including tourism and industry. Strengthens PRASA financial sustainability through a more resilient infrastructure system.

Potential costs: \$6.340 billion in total estimated costs

Potential funder(s): PRASA, EQB, EPA, PRDOH

Potential implementer(s): PRASA, EQB, EPA

WTR 10

Curtail Unauthorized Releases into Sanitary Sewers

Curtail the disposal of fats, oil and grease (FOG) and other unauthorized releases into wastewater collection systems by introducing educational programs, implementing mitigation measures, and creating incentive programs.

Potential benefits: Improves the performance of sanitary sewer systems, reduces overflow events and raw sewage exposure, and improves human health and the quality of receiving waters.

Potential costs: \$24 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRASA, EPA

Potential implementer(s): PRASA, EPA

WTR 19

Reduce Urban Nuisance Flooding

Reduce urban nuisance flooding and mitigate the discharge of contaminated stormwater runoff into bodies of water through improved stormwater infrastructure design standards, green infrastructure, enhanced stormwater permitting processes and land use regulations, improved system capacity, incentive programs for stormwater retention, and public outreach campaigns.

Potential benefits: Improves water and environmental quality and human health and reduces damages to public and private property from urban flood events.

Potential costs: \$1.005 billion in total estimated costs

Potential funder(s): EPA, USDA, Government of Puerto Rico, DNER

Potential implementer(s): Municipalities, DNER, PRASA, EPA, USGS, PRPB, OGP, NOAA, EQB, DTOP, private industry and NGOs

**WTR 23****Evaluate, Repair, and Improve Flood Control Infrastructure**

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

Potential benefits: Reduces flood risk for communities and infrastructure assets.

Potential costs: \$434.4 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA, USACE

Potential implementer(s): DNER, PRPB, PREMA, municipalities, USACE, EPA

WTR 28**Secure Potable Water Sources Against Contamination**

Secure potable water sources against contamination from domestic, agricultural, and industrial wastewater runoff and hazardous waste sites by raising awareness of source water protection measures, enforcing land use restrictions, and remediating contaminated areas.

Potential benefits: Improves water source protection and safeguards water supply, human health, and ecosystems.

Potential costs: \$49.3 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, DOC EDA, EPA, U.S. Bureau of Reclamation

Potential implementer(s): EPA, DNER, EQB, PRASA





Transform the education system

EDU 1

Create New—and Enhance Existing—After-School and Summer Learning Opportunities

Expand existing—and implement new—summer and after-school learning programs, including academic, health, nutrition, and mental health services, to address post-hurricane learning loss and provide consistency to snack or meal programs that are offered as part of these programs.

Potential benefits: Promotes faster recovery in student achievement from post-hurricane learning loss, a stronger sense of stability, better understanding of students' health and mental health needs, and creates a source of employment for young Puerto Ricans as summer and after-school instructors.

Potential costs: \$3.9 billion in total estimated costs

Potential funder(s): U.S. Department of Education, USDA, nongovernment sources

Potential implementer(s): PRDE, U.S. Department of Education, USDA Summer Food Program

EDU 2

Improve Longitudinal Data System to Support Evidence-Based Policy

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K-12 data to post-secondary outcomes and workforce data to better manage school-to-work transitions.

Potential benefits: Supports decisions by teachers and administrators in everyday practice, and helps inform students and their parents. Supports timely data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

Potential costs: \$7.7 million in total estimated costs

Potential funder(s): U.S. Department of Education (SLDS Grant Program), nongovernment sources

Potential implementer(s): PRDE



EDU 5 **Implement a Student-Based Budget System**

Review current budget practices to assess how funds are allocated to schools and identify unmet funding needs and inequities based on geographic location or school characteristics. Determine whether and how a new student-based budget formula would allow funding to be distributed more equitably, effectively, and transparently across both public and new charter schools.

Potential benefits: Helps increase equity, allocate more dollars to higher-need schools, and ensure consistency across all regions in terms of who has access to resources.

Potential costs: \$1.6 million in total estimated costs

Potential funder(s): U.S. Department of Education, nongovernment sources

Potential implementer(s): PRDE (Oficina para el Mejoramiento de las Escuelas Públicas)

EDU 6 **Expanding and Updating K-12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K-12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

Potential benefits: Helps build a skilled labor force for sectors key to Puerto Rico's recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K-12 schools and universities.

Potential costs: \$3 billion in total estimated costs

Potential funder(s): U.S. Department of Education, NSF, DoD, NIH, DOL, P3, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

Potential implementer(s): PRDE, schools, private industry

**EDU 7****Augment Tele-Education/
Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K–12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE’s initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners

EDU 8**Strengthen School Leadership Pipeline**

Strengthen the school director and district leader pipeline by improving recruitment, embedded training, support (e.g., mentoring, coaching), and retention practices.

Potential benefits: Positively impacts student learning. Reduces teacher and leadership turnover. Improves understanding of local education needs. Improves communication between schools and regional administrators. Increases capacity to function within newly-decentralized system.

Potential costs: \$290 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, principal training programs

Potential implementer(s): PRDE, professional development partners

EDU 9**Develop and Implement Teacher Pipeline Program**

Improve teacher preparation programs and instructional practice by (1) creating a residency model for teacher training, (2) reviewing teacher certification requirements, (3) aligning personnel decisionmaking processes with assessment of teacher quality, (4) strengthening teacher supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

Potential benefits: Develops a pipeline of teachers who can engage in high-quality instruction and support others in improving their practice. Reduces teacher turnover and promotes a closer relationship between K–12 schools and UPR.

Potential costs: \$350 million in total estimated costs

Potential funder(s): U.S. Department of Education

Potential implementer(s): PRDE, UPR, professional development partners, schools

EDU 10**Develop and Implement a Parent Education Program on School Choice**

Develop outreach and public education programs, with special emphasis on disadvantaged families, to ensure that all parents and guardians have the knowledge and tools they need to be effective consumers in a school-choice environment.

Potential benefits: Improves parents’ knowledge about their school choices, while also making parents and families happier and more invested in their chosen schools.

Potential costs: \$5.7 million in total estimated costs

Potential funder(s): U.S. Department of Education, PRDE, nongovernment sources

Potential implementer(s): PRDE (Family Engagement Office)



EDU 13
Landscape Analysis of Early Childhood Interventions and Care Opportunities

Determine the demographics of children 0–5 years of age (and their families), the current supply of interventions and care settings, and the cost of—and possible funding streams for—providing high-quality care to all children in Puerto Rico.

Potential benefits: Promotes children's school readiness and provides an important foundation for children's later academic and social success, as well as their health and well-being.

Potential costs: \$1 million in total estimated costs

Potential funder(s): DHHS ACF, Government of Puerto Rico, municipalities, philanthropic foundations

Potential implementer(s): Puerto Rico's Administration for the Care and Integral Development of Children, PRDE

EDU 14
Multisector Analysis to Support Resource Allocation Decisions Related to Schools

Engage a multi-disciplinary group of analysts and stakeholders to (1) review how economic, infrastructure, educational, and teacher workforce resources are currently co-located across communities; and (2) recommend strategies, ongoing analysis, decision rules, and other approaches to deciding where to invest in school infrastructure updates, where to reassign teachers, where to invest in school-to-work programs, and other related decisions.

Potential benefits: Improves educational outcomes and community impacts, and leads to better value for money.

Potential costs: \$2.2 million in total estimated costs

Potential funder(s): Nongovernment sources

Potential implementer(s): PRDE

CIT 4
Rural Area Network Task Force

Establish a task force to develop communications networks and information systems in rural or disconnected areas, particularly for the elderly, limited-mobility individuals, and caregivers, for use in emergencies.

Potential benefits: Initiates establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

Potential costs: \$400,000–\$800,000 million in total estimated costs

Potential funder(s): Government of Puerto Rico, private sector

Potential implementer(s): PRTRB, PREMA

CIT 19
Municipal Hotspots

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

Potential benefits: Reduces the "digital divide" and provides a priority post-disaster connection point for reaching a large number of residents in one place.

Potential costs: \$18 million in total estimated costs

Potential funder(s): CDBG–DR, DOC EDA

Potential implementer(s): CINO, PRTRB, GPR agencies, municipalities

**CIT 20****Continuity of Business at PRIDCO Sites**

Maintain key business activities at PRIDCO sites to provide continuity of services when primary communications methods are degraded after a disaster by using, for example, fiber-optic, satellite, microwave, and cloud-based or hosted services and information systems.

Potential benefits: Improves the resilience of business enterprises that are major contributors to the US economy, facilitates cross-sector economic development within Puerto Rico, and supports communications to impacted areas during a disaster.

Potential costs: \$24 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, Government of Puerto Rico

Potential implementer(s): PRIDCO

CIT 21**Government-Owned Fiber-Optic Conduits to Reduce Aerial Fiber Optic Cable and Incentivize Expansion of Broadband Infrastructure**

Design for the deployment of conduit for buried fiber optic cable and other utilities. Trench and lay empty conduit according to the design. Allow telecom providers to install their own fiber optic cable in GPR-owned conduit.

Potential benefits: Increases the resilience of telecom services while reducing costs to telecom providers to bury cable, facilitating the burial of aerial fiber optic cable, and provision of broadband deployment throughout the Island. Provides trenching and conduit adequate to accommodate other utilities. Minimizes the need for multiple roadway disturbances.

Potential costs: \$1.3 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, P3

Potential implementer(s): PRTRB, FCC, private telecommunication companies



CIT 22
Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through FCC’s E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies and GPR agencies to leverage these programs.

Potential benefits: Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): FCC, USDA, HUD, DOC EDA, NTIA

Potential implementer(s): PRTRB, FCC, PRDE

CIT 25
Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, in particular those of the Federal Communications Commission (FCC).

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): CDBG-DR, FCC

Potential implementer(s): PRTRB, FCC, private telecommunication companies

CIT 26
Wi-fi Hotspots in Public Housing and “Digital Stewards” Program

Establish a “Digital Stewards” program to train residents to install and service wi-fi hotspots in public housing and other publicly funded facilities.

Potential benefits: Decreases the “digital divide,” reduces costs for low-income residents who previously relied on expensive data plans, and provides a priority post-disaster connection point.

Potential costs: \$20 million in total estimated costs

Potential funder(s): CDBG-DR, PRDH

Potential implementer(s): CINO, HUD, PRDH

PBD 8
Mitigate Flood Risk for Critical Government Functions

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

Potential benefits: Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

Potential costs: \$2 billion in total estimated costs

Potential funder(s): PA, HMGP, U.S. Department of Education

Potential implementer(s): PRPB



PBD 9
Repair All Essential Public Buildings Damaged by Hurricanes Irma and Maria

Complete repairs to essential public buildings that sustained hurricane damage, ensuring that repairs meet current building safety codes for wind, flood, and seismic events.

Potential benefits: Fixes damaged buildings and ensures that public buildings are more resilient to future hurricanes and other disasters.

Potential costs: \$4 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, U.S. Department of Education

Potential implementer(s): PRIFA

PBD 10
Incentivize State-of-the-Art Building Design, Practices, and Technologies

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

Potential benefits: Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

Potential costs: \$7 million in total estimated costs

Potential funder(s): GPR agency operating budgets, EPA

Potential implementer(s): Government of Puerto Rico, municipal governments

PBD 11
Bring Public Buildings up to Code

Assess building safety code compliance for wind, flood, and seismic risks across the public building inventory and retrofit buildings with the appropriate structural hardening, making other code upgrades where needed.

Potential benefits: Increases ability of public buildings to withstand extreme weather events and natural hazards, improves energy and water efficiency, and reduces building operational costs.

Potential costs: \$3 billion–\$7 billion in total estimated costs

Potential funder(s): PA, HMGP, Government of Puerto Rico, U.S. Department of Education Emergency Impact Aid

Potential implementer(s): Government of Puerto Rico





Rebuild and enhance health and social services infrastructure and regional healthcare networks

HSS 1

Increase Use of Solar-Powered Generators and Solar Backup Power Sources

Promote solar-powered generators for single-family homes (over 80% of all housing units), multi-family homes, and commercial properties to reduce air and noise pollution.

Potential benefits: Reduces noise and air pollution and thus the risk for respiratory and hearing-related illnesses. Reduces the number of residents who need to be evacuated due to lack of power. Reduces morbidity among residents with technological dependence for health issues, and mortality and risk associated with fossil fueled generators.

Potential costs: \$0.31 billion–\$4.9 billion in total estimated costs

Potential funder(s): EPA, USDA, EQB, private sector

Potential implementer(s): EQB, EPA's Caribbean Division

HSS 2

Prevent Disease Through a Capacity-Building Healthy Housing Initiative: Targeting Mold, Lead, and Other Stressors

Build capacity for the identification and management of mold and other environmental stressors through an integrated healthy homes/housing and buildings initiative to prevent respiratory-related and other health exacerbations. This action includes enforcement, an educational campaign, and promotion of case management guidelines as well as the proper use of medications.

Potential benefits: Decreases the public health burden of asthma and other respiratory-related diseases, and thus also decreases health care costs.

Potential costs: \$16 million–\$23 million in total estimated costs

Potential funder(s): CDC, DHHS HRSA

Potential implementer(s): EPA, CDC, other federal agencies, PRDH, PRDOH, other GPR agencies



HSS 4

Improve Surveillance of Waterborne Disease

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

Potential benefits: Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

Potential costs: \$2.8 million–\$2.9 million in total estimated costs

Potential funder(s): EPA Water Finance Clearinghouse

Potential implementer(s): PRDOH, PRASA, CDC

HSS 6

Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

Potential benefits: Improves mosquito control in areas that have been difficult to reach.

Potential costs: \$2.1 million–\$3.8 million in total estimated costs

Potential funder(s): CDC

Potential implementer(s): PRVCU, PRDOH, municipalities

HSS 7

Reduce Gap in Medicaid/Medicare Reimbursement Rate

Analyze the extent to which reimbursement rates can be raised to help address the financial viability of the health care system, particularly in the context of disaster recovery needs over the long-term and future system robustness.

Potential benefits: Allows for a better understanding of the health care system's fragility, as well as where positive health care outcomes can be achieved by changes in payment structure.

Potential costs: To be determined

Potential funder(s): Government of Puerto Rico, nongovernment sources, AHRQ or CMS grant

Potential implementer(s): Independent research organization, Congress

HSS 9

Increase Access to Telehealth Options as Telecommunication Supports Become More Robust

Expand the use of telehealth across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services, and using phone and online applications to target those with trauma-related mental illness.

Potential benefits: Provides greater access to specialty care for rural, hard-to-reach populations, and quicker networking and best-practice sharing among health care professionals in an emergency.

Potential costs: \$21 million in total estimated costs

Potential funder(s): FCC, NIH, Medicaid 1115 waivers

Potential implementer(s): Health care providers, mental health care providers



HSS 10 Expand Care for Trauma and Chronic Stress

Expand the number of people and places (e.g., schools and other community centers) where people can get both long-term and immediate assistance for acute trauma and chronic stress. This action includes training nonprofessionals, such as health and physical education teachers, in supportive emotional well-being services.

Potential benefits: Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

Potential costs: \$8.4 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, nongovernment sources

Potential implementer(s): Mental health providers

HSS 11 Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and also for the long-term.

Potential benefits: Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to work satisfaction.

Potential costs: \$39 million in total estimated costs

Potential funder(s): DHHS HRSA, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Puerto Rican universities, associated hospitals and health care facilities

HSS 12 Augment Community Health Centers and Elements for Primary Care

Ensure that timely, accessible care can be provided after a disaster and over the long-term by strengthening Puerto Rico's network of community health centers (CHCs) and augmenting supporting elements, such as all-terrain vehicles and CHC mobile care clinics, especially in places with sustained damages or in isolated areas.

Potential benefits: Provides relatively efficient alternatives to standing up new hospitals or larger health care facilities. Improves access to services, especially in communities with health care provider shortages and significant hurricane-related damage.

Potential costs: \$250 million in total estimated costs

Potential funder(s): DHHS HRSA, Government of Puerto Rico, PRDOH, nongovernment sources

Potential implementer(s): CHCs, PRDOH



HSS 13

Expand Practice Laws for Health Care Providers

Increase the supply and practice capacity of licensed health care providers and public health practitioners in Puerto Rico. This action includes (1) allowing nurse practitioners (NPs) and physicians assistants (PAs) from other states to provide care in Puerto Rico, (2) providing incentives to attract licensed NPs and PAs from other locations, and (3) establishing and expanding NP and PA degree programs in Puerto Rico.

Potential benefits: Increases access to quality care. Helps identify and control diseases or outbreaks in a timely manner.

Potential costs: \$8 million in total estimated costs

Potential funder(s): Medicaid/Mi Salud reimbursement

Potential implementer(s): Independent health care licensure body, PRDOH

HSS 14

Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information, inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

Potential benefits: Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

Potential costs: \$3.3 million in total estimated costs

Potential funder(s): DHHS, Government of Puerto Rico

Potential implementer(s): Institute for Statistics, health care payors, health care providers, PRDOH



HSS 15

Advance Uptake of Evidence-based Practices/Quality of Care for Mental Health

Identify gaps in evidence-based mental health practice (EBP) in Puerto Rico. Train mental health care providers in the use of relevant EBPs and monitor how those practices are being applied.

Potential benefits: Increases the standards of care and access to quality care for those with mental and behavioral problems. Identifies people who are in need of, but not receiving, mental health care.

Potential costs: \$4 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, Medicaid, nongovernment sources

Potential implementer(s): Mental health care providers

HSS 16

Address Food Insecurity by Ensuring Flexible Nutrition Assistance Programs

Transition Puerto Rico back to the Supplemental Nutritional Assistance Program (SNAP) to allow greater flexibility after a disaster and to provide greater benefit to participants.

Potential benefits: Allows for a more efficient disaster response. Makes food assistance more readily available and thus prevents hunger. Minimizes the dangerous effects of hunger on people with chronic diseases such as diabetes, Crohn's disease, and hypertension.

Potential costs: \$204 million in total estimated costs

Potential funder(s): USDA, PRDF

Potential implementer(s): Congress

HSS 17

Ensure That There Are Nutrition Supports for Populations Disproportionately Affected by the Disaster

Create long-term (e.g., 3-months or longer) waivers to NAP regulations, that would be triggered upon declaration of a disaster, to enable greater flexibility in how program participants access food during a disaster.

Potential benefits: Prevents unnecessary gaps in benefits and averts negative health outcomes that could result from inadequate nutrition.

Potential costs: To be determined

Potential funder(s): USDA

Potential implementer(s): USDA Food and Nutrition Service

HSS 18

Improve Programs to Prevent and Address Abuse of Children and the Elderly after a Disaster

Initiate public education campaigns to raise awareness of child and elderly abuse and how to report it. Provide training to staff at integrated service centers and disaster shelters to detect and address abuse. Train health and physical education teachers to serve as liaisons with centers and shelters. Include, in the short term, detection and reporting efforts in a disaster case management system.

Potential benefits: Prevents physical, mental, and emotional abuse. Increases the availability of services for victims of abuse.

Potential costs: \$7.3–\$16 million in total estimated costs

Potential funder(s): DHHS, OPPEA, PRDF

Potential implementer(s): OPPEA, PRDF



HSS 19

Create Flex-Funding for Social Service Centers

Assess the social service center facility and develop an inventory of critical facilities and also a set of eligibility criteria. Create a flexible funding mechanism to assist critical facilities, such as domestic violence and homeless shelters and child- and elder-care facilities, in bearing the costs of long periods of generator use post-disaster.

Potential benefits: Avoids facility closures due to loss of fuel. Allows for continuity of service provision to populations disproportionately affected by disaster. Reduces the need to relocate shelters.

Potential costs: \$11 million–\$980 million in total estimated costs

Potential funder(s): U.S. Department of Energy, PREMA, PREPA, DHHS ACF, private sector

Potential implementer(s): PRDF, PREMA

HSS 20

Improve Supports for the Elderly, Particularly Those Living Alone

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities via continued support for Project 646. Encourage communities to participate in local emergency planning through activities such as community mapping that would help to identify people who might be at increased risk in a disaster, such as elderly who live alone.

Potential benefits: Increases the resiliency of the elderly population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

Potential costs: \$62 million in total estimated costs

Potential funder(s): DHHS, OPPEA, PRDF

Potential implementer(s): OPPEA, PREMA

HSS 21

Improve Public Awareness of Proper Storage of Insulin Post-Disaster

Increase public knowledge of guidelines for the storage of insulin by (1) training disaster shelter managers and health care providers to provide relevant information, (2) conducting mass media and social media campaigns, and (3) sending text messages to patients.

Potential benefits: Decreases medication gaps, and thus negative health impacts, for insulin-dependent individuals. Decreases medication waste and strain on insulin supply.

Potential costs: \$2.6 million in total estimated costs

Potential funder(s): DHHS, private sector, nongovernment sources

Potential implementer(s): Healthcare providers, PRDOH, private sector



HSS 22

Move to a More Regionally-Integrated Approach to Emergency Planning, Exercising, Response, and Recovery

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen and other critical supplies post-incident.

Potential benefits: Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

Potential costs: \$9.6 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, CMS, ASES, PRDOH

Potential implementer(s): PRDOH, hospital system, other health care organizations

HSS 26

Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Healthcare Disaster Resource Centers that would be equipped with extra supplies needed during a disaster.

Potential benefits: Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

Potential costs: \$23 million in total estimated costs

Potential funder(s): DHHS, PREMA, PRDOH

Potential implementer(s): PRDOH, PREMA

HSS 29

Revise Regulations on Food Stockpiling at Child- and Elder-Care Facilities

Require a minimum 14-day, healthy, shelf-stable food supply at all licensed facilities and provide guidance to facilities on stockpiling.

Potential benefits: Increases the availability of more nutritious foods post-disaster. Decreases the availability of salty and sugary foods.

Potential costs: To be determined

Potential funder(s): USDA, PRDF

Potential implementer(s): PRDF, child- and elder-care facilities

HSS 30

Review and Improve Plans, Systems, and Processes for Tracking and Responding to Physical and Mental Health Needs of First Responders

Deploy counselors and volunteers to provide monthly support services to first responders. Conduct a periodic (every 4 months for year 1; annually after) survey— Emergency Responder Health Monitoring and Surveillance (ERHMS)—to assess responder health needs and management of health symptoms.

Potential benefits: Lessens negative health impacts of the highly stressful circumstances of disaster response and recovery. Improves responder well-being and keeps responders prepared to attend to the needs of others.

Potential costs: \$18 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, PRDOH, nongovernment sources

Potential implementer(s): PRDOH, FEMA



HSS 33

Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

Potential benefits: Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

Potential costs: \$8.1 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, Government of Puerto Rico, nongovernment sources

Potential implementer(s): ASES, DHHS, CMS

HSS 34

Review and Improve Systems and Processes for Managing Volunteers and Donated Supplies

Track volunteers through a system such as the Emergency System for Advance Registration of Volunteer Health Professionals. Institute volunteer credentialing to ensure training and other competencies are up-to-date. Provide supports for volunteer capacity development and communication skills. Rent warehouse space for receiving and managing donated supplies. Contract specialized storage for receiving, managing and dispatching donated medications. Strengthen registries for inventorying donations.

Potential benefits: Facilitates quicker deployment of assets. Minimizes confusion and duplication of services. Helps match assets to areas of greatest needs.

Potential costs: \$4.1 million in total estimated costs

Potential funder(s): DHHS, Government of Puerto Rico

Potential implementer(s): PRDOH

HSS 37

Increase the Child Welfare Investigative Workforce

Increase funding to the Puerto Rico Department of the Family (PRDF) to hire additional child welfare investigators to manage existing backlog of child maltreatment cases.

Potential benefits: Decreases the backlog of child maltreatment cases. Promotes the long-term safety of children.

Potential costs: \$68 million in total estimated costs

Potential funder(s): Government of Puerto Rico, PRDF

Potential implementer(s): PRDF

HSS 40

Improve Current Epidemiological Surveillance to Better Respond to Natural and Man-Made Disasters

Develop a comprehensive epidemiological surveillance system, with the following components: infectious diseases, chronic diseases, maternal and child health, environmental health, injury, occupational health and behavioral health. Increase workforce access to technological advancements to support surveillance activities.

Potential benefits: Improves Puerto Rico's response capacity for monitoring short- and long-term adverse health hazards and health effects as a result of any disaster. Lessens disease burden and thus health-related costs after a disaster.

Potential costs: \$100 million in total estimated costs

Potential funder(s): CDC, DHHS, nongovernment sources

Potential implementer(s): PRDOH, FEMA, EPA, USDA, DoD, DHHS (e.g., CDC, CMS, SAMSHA, ACF, FDA, HRSA, ASPR, OASH)



HSS 41

Support the Development of a Suicide Prevention Campaign

Initiate a 6-part suicide prevention campaign that includes (1) promoting wellness and self-care through a public awareness campaign, (2) identifying people who are at risk of suicide, (3) identifying and addressing barriers to appropriate care for suicidality, (4) providing appropriate care procedures for responding to suicide (both acutely on the suicide hotline and in emergency rooms and long-term care), and (5) addressing environmental factors associated with suicide.

Potential benefits: Prevents an increasing suicide epidemic in Puerto Rico.

Potential costs: \$73 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, Medicaid, nongovernment sources

Potential implementer(s): PRDOH, Puerto Rico's Commission for the Implementation of Public Policy in the Prevention of Suicide

HSS 42

Increase Public Health Laboratory Capacity

Rebuild and/or develop up-to-date and well-equipped laboratories and staff appropriately. Engage advanced systems integrating laboratory and epidemiological activities. Provide a laboratory network infrastructure (including a patient information management system) whereby data can be communicated and shared between health care facilities to access data in a timely manner for rapid response.

Potential benefits: Allows for the implementation of early detection methodologies that would facilitate timely implementation of needed control measures to minimize disease transmission and additional health-related costs.

Potential costs: \$71 million in total estimated costs

Potential funder(s): Government of Puerto Rico, CDC (ELC, PHEP), APHL, NGOs

Potential implementer(s): PRDOH, DHHS (CDC, HRSA, APHL)



HSS 43

Develop and Implement an Integrated Electronic Reporting System for Vital Records

Develop and implement an electronic reporting system for vital events at the Puerto Rico Demographic Registry (PRDR).

Potential benefits: Improves accuracy of reports through timely data entry and increased accuracy and completeness of vital records, which will support public health surveillance systems. Increases efficiency in the death reporting process after a disaster and will allow the ability to monitor mortality data.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDC–NCHS, NAPHSIS, PAHO, private donors

Potential implementer(s): Puerto Rico Department of Health (PRDR, Office of Informatics and Technological Affairs, Planning and Development Office)

CIT 3

Upgrade and Enhance 911 Service

Upgrade the current 911 network to an Emergency Services IP Network, implement Next Gen 911, and consolidate dispatch at the PSAP.

Potential benefits: Improves the effectiveness of 911 service through new features (such as text, photo, video and GPS location sharing), improves 911 response times, and improves system resilience.

Potential costs: \$3 million–\$7 million in total estimated costs

Potential funder(s): DOC

Potential implementer(s): Puerto Rico 9–1–1 Service Governing Board

CIT 4

Rural Area Network Task Force

Establish a task force to develop communications networks and information systems in rural or disconnected areas, particularly for the elderly, limited-mobility individuals, and caregivers, for use in emergencies.

Potential benefits: Initiates establishment of information systems that will avoid loss of life and improve the health of people in areas with limited communications infrastructure.

Potential costs: \$400,000–\$800,000 in total estimated costs

Potential funder(s): Government of Puerto Rico, private sector

Potential implementer(s): PRTRB, PREMA

CIT 16

Government Digital Reform Planning and Capacity Building

Create a roadmap for digital transformation and determine priorities, assess needs, costs, and feasibility for a government-wide digital transformation strategy.

Potential benefits: Helps Puerto Rico benefit from best practices and avoid common pitfalls to digital transformation, ensures stakeholder buy-in, and provides a comprehensive strategy and set of metrics.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDBG–DR, DOC EDA

Potential implementer(s): CINO, CIO

**CIT 17****Puerto Rico Data Center**

Establish a robust and disaster-proof, scalable, cloud-enabled data center for governmental information systems that expands its capacity to perform essential governmental functions and deliver essential services.

Potential benefits: Enables highly reliable governmental IT services for tracking, supporting, and coordinating response and recovery needs within Puerto Rico and externally, while preserving the integrity of all essential information systems.

Potential costs: \$68 million–\$190 million in total estimated costs

Potential funder(s): Government of Puerto Rico, lease of excess capacity, nongovernment sources

Potential implementer(s): CIO, GPR agencies

CIT 18**Database of Critical Infrastructure**

Create an open, modular, and standards-based information system for up-to-date, geo-referenced, cross-sector data on government and privately owned critical infrastructure with near-real-time mapping capabilities.

Potential benefits: Improves visibility of critical infrastructure status, provides accurate data to inform emergency response, and increases private-sector awareness of government work affecting infrastructure availability.

Potential costs: \$8 million–\$15 million in total estimated costs

Potential funder(s): Private sector, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies

CIT 19**Municipal Hotspots**

Provide government-sponsored wi-fi in town centers and public buildings to address the digital disparity and provide a priority connection point after a disaster for reaching a large number of residents in one place. Maximize public access to government-sponsored wi-fi from the main centers of public life, including municipal buildings, parks, and town squares across Puerto Rico.

Potential benefits: Reduces the “digital divide” and provides a priority post-disaster connection point for reaching a large number of residents in one place.

Potential costs: \$18 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): CINO, PRTRB, GPR agencies, municipalities

CIT 22**Use Federal Programs to Spur Deployment of Broadband Internet Island-Wide**

Work with the FCC, HUD, other federal agencies, and GPR agencies to streamline and expedite applications and approvals for schools, libraries and clinics to receive funding for broadband services through FCC’s E-rate program, supplemented by other federal programs. Work with the FCC, federal agencies and GPR agencies to leverage these programs.

Potential benefits: Facilitates the deployment of internet services to schools, libraries and clinics as precursor to improving the provision of education, health and other services.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): FCC, USDA, HUD, DOC EDA, NTIA

Potential implementer(s): PRTRB, FCC, PRDE



CIT 25

Evaluate and Implement Alternative Methods to Deploy Broadband Internet Service Throughout Puerto Rico

Create a comprehensive plan for deploying broadband internet throughout Puerto Rico by leveraging existing fiber rings and assessing the availability of existing federal programs, in particular those of the Federal Communications Commission (FCC).

Potential benefits: Serves as an important step towards providing high-speed internet service to support education, health care, social services, the visitor economy, emergency services, and other sectors.

Potential costs: \$0.9 million in total estimated costs

Potential funder(s): CDBG-DR, FCC

Potential implementer(s): PRTRB, FCC, private telecommunication companies

CIT 29

Health Care Connectivity to Strengthen Resilience and Disaster Preparedness

Provide robust, resilient, multimodal connectivity to the 86 community clinics across Puerto Rico using satellite, low-power radio, and line-of-site technologies to complement fiber and cell systems and allow clinics to share bandwidth to support other recovery activities.

Potential benefits: Improves health care, emergency response, and medical innovation; provides real-time access to electronic health records, clinical data, and services, and bolsters situational awareness after a disaster.

Potential costs: \$140 million–\$280 million in total estimated costs.

Potential funder(s): HMGP, CDBG-DR, ASPR, FCC, DHHS, VA, DoD, Government of Puerto Rico

Potential implementer(s): CINO, PREMA, PRTRB, PRDOH

CIT 30

Resiliency Innovation Network Leading to Development of a Resiliency Industry

Create a Resiliency Innovation Network to build on existing Puerto Rico Science, Technology, and Research Trust (PRSTRT) and university facilities to develop, teach, test, and refine resiliency products and services.

Potential benefits: Stimulates new commercial ventures and jobs, empowers communities and individuals, and increases resilience to disasters.

Potential costs: \$29 million in total estimated costs

Potential funder(s): DOC EDA, SBA, NSF, PRSTRT, PRIDCO, private sector

Potential implementer(s): CINO, universities, PRSTRT, Resilient Puerto Rico Advisory Commission, DEDC, PRIDCO

CIT 34

Digital Citizen Services

Expand the scope of PRITs to include a focus on citizen-centered services and prioritizing a “one-stop-shop” experience for accessing government services and information in an easy-to-use fashion.

Potential benefits: Increases public trust, transparency, and accountability; increases adoption of digital services; and streamlines government processes.

Potential costs: \$33 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, Government of Puerto Rico

Potential implementer(s): CINO, GPR agencies

**CIT 35**
Government Digital Process Reform

Establish people-centered digital design and data science teams within the Government of Puerto Rico to tackle cross-cutting policy and operational challenges and coordinate government agencies.

Potential benefits: Establishes a “whole-of-government,” people-centered digital design and data-driven approach to continuously improve services, spend resources effectively, improve service delivery, better serve the public, and make better policy.

Potential costs: \$70 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, Government of Puerto Rico

Potential implementer(s): CINO, GPR agencies

CIT 36
Data Collection and Standardization for Disaster Preparedness and Emergency Response

Support expansion and ongoing development of status.pr website with data-sharing protocol in partnership with private sector to enable ongoing situational awareness.

Potential benefits: Creates a platform to publicly share data in a standardized, user-friendly format; provides valuable information for policymakers, the media, and emergency responders; and makes data available in formats that can be used by developers.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): CINO, PREMA, GPR agencies

CIT 37
Consolidated Government Information Systems

Implement an open, modular, standards-based platform for information systems and consolidate Government of Puerto Rico and municipal government systems to improve continuity of government and quality of government services in the context of a disaster.

Potential benefits: Eliminates current mix of legacy government systems, reduces operating costs, and improves reliability of government functions, including response and recovery coordination.

Potential costs: \$482 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): CIO, GPR agencies



CPCB 2 Capacity Building for Community-Level Preparedness and Response

Develop and implement preparedness and response plans for 50–100 priority vulnerable communities that face particularly high risk during disasters. This action includes (1) recruiting, training, and equipping Community Emergency Response Teams (CERT) so that these communities can better sustain themselves during the response period, when emergency responders and access to the communities will be limited; and (2) establishing and maintaining a cache of emergency supplies—e.g., water filters and generators—for these communities.

Potential benefits: Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

Potential costs: \$37 million in total estimated costs

Potential funder(s): CDBG–DR, PREMA

Potential implementer(s): FEMA, PREMA, municipal governments

CPCB 3 Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the Puerto Rico Planning Board (PRPB) so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions, and (2) hiring a risk officer for each of the 27 state-level agencies.

Potential benefits: Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

Potential costs: \$84 million in total estimated costs

Potential funder(s): HMGP, CDBG–DR

Potential implementer(s): PRPB, infrastructure sectors



CPCB 4

Resilience Building in Collaboration with High-Risk Communities

Hire planners (on average 1.5 FTE per municipality) to develop and implement disaster response and recovery plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

Potential benefits: Builds community and individual resilience for both disaster response and long-term recovery

Potential costs: \$82 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS

Potential implementer(s): Government of Puerto Rico, municipal governments, local NGOs

CPCB 6

Public Information and Communication Capability for Coordinated Recovery

Build a Public Information and Communication (PIC) capability to maintain continued engagement with Puerto Rican communities in the recovery process. Establish and maintain methods of two-way communication with Puerto Rican residents about recovery planning and implementation. This action also includes establishing effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

Potential benefits: Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

Potential costs: \$8.8 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico



CPCB 7

Capacity Building for Emergency Shelter Planning

Hire planners in each municipality and at the state-level to build a more robust emergency shelter system. This action will develop parameters, standards, and general design guidelines for shelters that can better support residents over the longer-term. This action also will establish a protocol with the National Guard for effective management of response commodities for shelters.

Potential benefits: Improves access to safe and appropriately resourced shelters within a reasonable distance that can accommodate community needs, such as disabilities and medical conditions.

Potential costs: \$57 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, public buildings sector

CPCB 10

Incentivize the Design of Creative Solutions to Addressing Disaster Hazards

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards, and including but not limited to hurricanes and flooding—while also offering added social or economic benefits to the community.

Potential benefits: Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

Potential costs: \$6 million in total estimated costs

Potential funder(s): HMPG, CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, general public of Puerto Rico

CPCB 15

Strengthen Local Nonprofit and NGO Involvement in Disaster Recovery

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

Potential benefits: Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term sustainable funding.

Potential costs: \$9 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): ODSEC, NGOs, local nonprofits

**EDU 1****Create New—and Enhance Existing—After-School and Summer Learning Opportunities**

Expand existing—and implement new—summer and after-school learning programs, including academic, health, nutrition, and mental health services, to address post-hurricane learning loss and provide consistency to snack or meal programs that are offered as part of these programs.

Potential benefits: Promotes faster recovery in student achievement from post-hurricane learning loss, a stronger sense of stability, better understanding of students' health and mental health needs, and creates a source of employment for young Puerto Ricans as summer and after-school instructors.

Potential costs: \$3.9 billion in total estimated costs

Potential funder(s): U.S. Department of Education, USDA, nongovernment sources

Potential implementer(s): PRDE, U.S. Department of Education, USDA Summer Food Program

EDU 7**Augment Tele-Education/ Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners



EDU 13

Landscape Analysis of Early Childhood Interventions and Care Opportunities

Determine the demographics of children 0–5 years of age (and their families), the current supply of interventions and care settings, and the cost of—and possible funding streams for—providing high-quality care to all children in Puerto Rico.

Potential benefits: Promotes children's school readiness and provides an important foundation for children's later academic and social success, as well as their health and well-being.

Potential costs: \$1 million in total estimated costs

Potential funder(s): DHHS ACF, Government of Puerto Rico, municipalities, philanthropic foundations

Potential implementer(s): Puerto Rico's Administration for the Care and Integral Development of Children, PRDE

ENR 1

Establish and Enforce Best Practices for Electricity Grid

Align grid standards with industry best practices—tailored to the unique conditions in Puerto Rico—and ensure timely compliance and enforcement.

Potential benefits: Increases knowledge of system components. Increases ready access to replacement parts. Lowers maintenance costs. Allows for faster repairs, a broader range of material and supplies that can be used, and synergies with other endeavors, e.g., the installation of new technologies and the establishment of a resilient grid.

Potential costs*: \$1 million

Potential funder(s)*: CDBG–DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, PREC, U.S. Department of Energy

ENR 2

Design, Build, and Maintain “Islandable” Portions of the Electricity Grid

Design and create an “islandable” grid that can balance generation and load to continue delivering localized electricity if other portions of the system fail. Strategically install, test, and maintain microgrids with an adequate inventory of replacement assets.

Potential benefits: Allows for more resilient electricity and potentially improved environmental performance (and improved public health). May save money depending on relative electricity rates. Promotes economic growth through less price volatility and potentially improved access to electricity.

Potential costs*: \$1 billion in total estimated costs

Potential funder(s)*: CDBG–DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, U.S. Department of Energy, private industry, public-private entities, municipalities



ENR 5 **Design and Build Hardened Grid Assets to Support Critical Infrastructure**

Prioritize the hardening of electricity and distribution assets. Design assets that enable rapid response time for electricity to support other critical infrastructure. This action includes (1) policy guidance to clarify a plan for outages of a reasonable duration at critical facilities and enforce these standards where they already exist, (2) energy solutions for homes with electricity-dependent medical needs, and (3) a program to increase energy reliability to critical water pumps systems.

Potential benefits: Promotes economic growth by creating a reliable electricity supply that is less impacted by threats/hazards.

Potential costs*: \$3 million in total estimated costs

Potential funder(s)*: CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, new private owner/operators, U.S. Department of Energy

ENR 11 **Design and Deploy Technologies to Improve Real- Time Information and Grid Control**

Improve centralized energy management and geographic information systems. Install a distributed energy resource management system and technologies to allow communities to operate off-grid after a disaster.

Potential benefits: Relieves pressure from response efforts. Improves access to life-sustaining resources. Makes the electricity supply adaptable to changing economic conditions. Improves the speed of response and recovery efforts.

Potential costs*: \$200 million in total estimated costs

Potential funder(s)*: HMGP, CDBG-DR, FEMA NFIP, U.S. Department of Energy, EPA, NOAA, PREPA, private sector, nongovernment sources

Potential implementer(s)*: PREPA, USACE, FEMA



HOU 5 **Collect, Integrate, and Map Housing Sector Data**

Create an integrated database of housing and home ownership information, including title, permits, land use, property tax and location.

Potential benefits: Supports planning, relocation and mitigation efforts needed to make these communities safer and resilient. Aids civic planning for efficient location of emergency and other public services, such as fire stations, hospitals, and schools. Improves overall GPR and municipal efforts to increase property tax revenues.

Potential costs: \$30 million–\$50 million in total estimated costs

Potential funder(s): CDBG–DR

Potential implementer(s): PRPB, PRDH, PRDOJ, OGPe, CRIM, private sector firms (banks, insurance)

MUN 14 **Repopulate Urban Centers**

Incentivize the redevelopment and repopulation of urban centers to improve social and health outcomes and improve access to services. Provide incentives for individuals and families living in outlying communities to relocate to urban centers.

Potential benefits: Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight—while spurring economic development in all sectors.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): CDBG–DR, SBA, Government of Puerto Rico

Potential implementer(s): Governor, municipal governments

NCR 1 **Historic and Cultural Properties Preservation**

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

Potential benefits: Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

Potential costs: \$64 million in total estimated costs

Potential funder(s): HMGP, DOI, Institute of Museum and Library Services, National Endowment for the Humanities, National Archives and Records Administration, Government of Puerto Rico

Potential implementer(s): SHPO, ICP, individual property owners



NCR 2 **Arts Recovery**

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

Potential benefits: Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA, Institute of Museum and Library Services, National Endowment for the Humanities, and National Archives and Records Administration, private sector, nongovernment sources

Potential implementer(s): Government of Puerto Rico, Heritage Emergency Task Force

NCR 5 **Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas**

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations, with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

Potential benefits: Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

Potential costs: \$74 million–\$120 million in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, P3, Government of Puerto Rico, DNER, municipalities, nongovernment sources

Potential implementer(s): DNER, USFS, municipalities



NCR 7

Develop Partner Networks for Recovering Plant and Animal Species

Grow a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities. Such partners would include federal and state-level agencies, local government, NGOs, universities, and private sector partners.

Potential benefits: Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, DNER, Government of Puerto Rico, municipalities, private sector, nongovernment sources

Potential implementer(s): DNER, federal agencies, University of Puerto Rico, NGOs

NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 15

Coral Reef and Seagrass Protection and Restoration

Restore damaged coral reef and seagrass sites to protect coastal communities, human health and safety, biodiversity and ecological function, and economic activity.

Potential benefits: Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

Potential costs: \$22.9 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 16

Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE



NCR 17

Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

Potential benefits: Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

Potential costs: \$80 million–\$82 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USACE, NOAA

Potential implementer(s): DNER, municipalities, USACE

NCR 18

Establish the San Juan Barrier Reef System as a Marine Protected Area

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing, and invest in the reef's restoration and long-term health.

Potential benefits: Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

Potential costs: \$800,000 in total estimated costs

Potential funder(s): NOAA, DOI, Government of Puerto Rico, P3, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 20

Redesign, Reorganize, and Rebuild Puerto Rican Parks

Conduct assessments to help the Puerto Rican parks system improve governance/operations efficiency, align park amenities to community needs, and re-engineer parks to serve as storm water infrastructure. Rebuild parks in compliance with building codes for hurricane-prone areas, and consistent with assessment findings.

Potential benefits: Promotes active recreation and reduces health care costs, improves flood control capability and mitigates future damage to community, and boosts economy through area attractiveness to tourists, businesses, and consumers.

Potential costs: \$340 million–\$650 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, NPS, P3, nongovernment sources

Potential implementer(s): DRD, DNER, National Parks Company

NCR 26

Resource Management Capacity Building

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

Potential benefits: Provides stronger decision-making support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

Potential costs: \$16 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): PRTC, NGOs, communities



NCR 29

Enhance Public Participation and Education Through Museum Exhibits

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

Potential benefits: Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

Potential costs: \$9.6 million–\$20 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): DNER, universities, host museums

PBD 15

Refurbish Community Centers and Community Technology Centers

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

Potential benefits: Improves access to community services, including training, medical support, emergency shelter, and technology.

Potential costs: \$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG–DR

Potential implementer(s): PRPB

TXN 1

Refine and Enforce Road Design Standards

Collect and refine guidance on road design, develop a set of engineering standards that promote innovative features, and ensure that roads meet these standards.

Potential benefits: Improves road safety through better roadway markings, signage, and lighting. Reduces maintenance costs, increases roadway life, and prevents damage from future disasters through improved roadway drainage systems and bridge design. Encourages people to walk and bicycle instead of driving by promoting sidewalks and bicycle lanes, which provides public health benefits and reduces traffic congestion.

Potential costs: \$6 million–\$100 million in total estimated costs

Potential funder(s): DOT

Potential implementer(s): PRHTA

TXN 8

Improve Bus Service

Improve existing bus service by giving priority to buses at intersections, providing real-time arrival information, upgrading bus stops, updating the payment system to use smart cards, adding dedicated bus lanes to some roads, and expanding the bus fleet.

Potential benefits: Increases the reliability and comfort of bus travel and expands transportation options for people who do not drive.

Potential costs: \$8 million–\$730 million in total estimated costs

Potential funder(s): DOT, users, P3

Potential implementer(s): Puerto Rico Metropolitan Bus Authority

**WTR 23****Evaluate, Repair, and Improve Flood Control Infrastructure**

Evaluate, repair, and improve the performance and resilience of flood control infrastructure, including dams, levees, channels, and water control structures, to safely manage 100-year floods events.

Potential benefits: Reduces flood risk for communities and infrastructure assets.

Potential costs: \$434.4 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, EPA, USACE

Potential implementer(s): DNER, PRPB, PREMA, municipalities, USACE, EPA





Rebuild, repair, and right-size the public buildings inventory

PBD 1 **Compile a Public Buildings Inventory**

Create a comprehensive, centralized database of buildings owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decision-making.

Potential benefits: Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decision-making and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

Potential costs: \$4 million in total estimated costs

Potential funder(s): PA, CDBG-DR, PRPB

Potential implementer(s): PRPB, PRIFA

PBD 2 **Right-Size Public Buildings**

Analyze demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Repurpose, reallocate, and refurbish buildings. Sell or demolish unneeded vacant buildings.

Potential benefits: Provides income (from the sale of buildings), reduces operations and maintenance costs, improves the effectiveness of government operations and service delivery, and removes the blight of long-abandoned, vandalized buildings.

Potential costs: \$200 million–\$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): PRPB

PBD 3 **Establish Integrated Services Centers**

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

Potential benefits: Simplifies access to services for the population and streamlines maintenance processes.

Potential costs: \$10 million–\$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, USDA WIC

Potential implementer(s): Puerto Rico Department of State, PRPBA

PBD 4 **Realign Public Building Ownership**

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

Potential benefits: Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): PRPB

Potential implementer(s): Office of the Governor, Legislative Assembly

**PBD 5**
Move Public Services to Public Buildings

House government agencies in public buildings rather than privately owned buildings.

Potential benefits: Ensures public funds are used more efficiently by avoiding paying building rental costs to the private sector when acceptable alternative publicly-owned buildings are available.

Potential costs: N/A

Potential funder(s): N/A

Potential implementer(s): Office of the Governor, Legislative Assembly

PBD 6
Study Whether Privatizing PRIDCO Would Improve Its Ability to Support Economic Development

Commission an independent analysis by a third party of whether converting PRIDCO into a nongovernmental entity would improve or reduce its ability to support economic development through the private-sector real estate market.

Potential benefits: Identifies whether there are potential significant economic gains in converting PRIDCO into a nongovernmental entity.

Potential costs: \$500,000 in total estimated costs

Potential funder(s): Government of Puerto Rico, nongovernment sources

Potential implementer(s): Independent research partner

PBD 8
Mitigate Flood Risk for Critical Government Functions

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

Potential benefits: Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

Potential costs: \$2 billion in total estimated costs

Potential funder(s): PA, HMGP, U.S. Department of Education

Potential implementer(s): PRPB

PBD 9
Repair All Essential Public Buildings Damaged by Hurricanes Irma and Maria

Complete repairs to essential public buildings that sustained hurricane damage, ensuring that repairs meet current building safety codes for wind, flood, and seismic events.

Potential benefits: Fixes damaged buildings and ensures that public buildings are more resilient to future hurricanes and other disasters.

Potential costs: \$4 billion in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, U.S. Department of Education

Potential implementer(s): PRIFA



PBD 10 **Incentivize State-of-the-Art Building Design, Practices, and Technologies**

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

Potential benefits: Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

Potential costs: \$7 million in total estimated costs

Potential funder(s): GPR agency operating budgets, EPA

Potential implementer(s): Government of Puerto Rico, municipal governments

PBD 11 **Bring Public Buildings up to Code**

Assess building safety code compliance for wind, flood, and seismic risks across the public building inventory and retrofit buildings with the appropriate structural hardening, making other code upgrades where needed.

Potential benefits: Increases ability of public buildings to withstand extreme weather events and natural hazards, improves energy and water efficiency, and reduces building operational costs.

Potential costs: \$3 billion–\$7 billion in total estimated costs

Potential funder(s): PA, HMGP, Government of Puerto Rico, U.S. Department of Education Emergency Impact Aid

Potential implementer(s): Government of Puerto Rico

PBD 13 **Develop Secondary Power Guidelines**

Develop guidelines for the design of secondary power systems for public buildings, possibly using existing standards for emergency and standby power systems as a resource.

Potential benefits: Facilitates the design of appropriate backup power systems to provide a redundant energy supply for essential public services.

Potential costs: \$400,000 in total estimated costs

Potential funder(s): PREC, PREPA, PA, HMGP, CDBG–DR

Potential implementer(s): SOEP

PBD 15 **Refurbish Community Centers and Community Technology Centers**

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

Potential benefits: Improves access to community services, including training, medical support, emergency shelter, and technology.

Potential costs: \$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG–DR

Potential implementer(s): PRPB



HOU 6

Enforce Land Use Plans and Improve Compliance with Building Permitting

Provide funding to update current municipal plans and align them with the State Land Use Plan (PUT) to align zoning and regulations for permitted land use and construction.

Provide funding for municipalities to develop municipal plans when lacking. Increase capacity to enforce both land use and building codes through permitting and inspections.

Potential benefits: Avoids construction in high-risk areas. Provides access to local jobs, services, and economic and transportation hubs. Reduces burden of providing services in new construction areas and remote areas.

Potential costs: \$102 million–\$317 million in total estimated costs

Potential funder(s): CDBG–DR, HMGP, Government of Puerto Rico, nongovernment sources

Potential implementer(s): PRPB, OGP, municipal governments

MUN 5

Reduce Barriers to Transferring Property to Municipal Governments and Provide Technical Assistance

Reduce administrative barriers to transferring property (such as closed schools and other public buildings) to municipalities.

Potential benefits: Enables municipalities to more efficiently repurpose buildings to enhance the delivery of services to the public or stimulate economic development through public–private partnerships or municipal corporations. Reduces costs to the GPR associated with maintaining closed facilities, and reduces the potential blight and safety risks associated with closed buildings. Provides municipalities and the communities they serve with additional facilities at low cost. Returns previous public investments to active use.

Potential costs: \$2.7 million in total estimated costs

Potential funder(s): HMGP, CDBG–DR, SBA

Potential implementer(s): Government of Puerto Rico, municipal governments

**MUN 6****Create and Maintain Central Repository of Municipal Assets and Associated Conditions**

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

Potential benefits: Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

Potential costs: \$13 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipal mayors

NCR 1**Historic and Cultural Properties Preservation**

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

Potential benefits: Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

Potential costs: \$64 million in total estimated costs

Potential funder(s): HMGP, DOI, Institute of Museum and Library Services, National Endowment for the Humanities, National Archives and Records Administration, Government of Puerto Rico

Potential implementer(s): SHPO, ICP, individual property owners



NCR 3

General Archives Mitigation and Modernization

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

Potential benefits: Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

Potential costs: \$11.5 million in total estimated costs

Potential funder(s): National Archives' National Historical Publications and Records Commission, Government of Puerto Rico, private sector, nongovernment sources

Potential implementer(s): ICP

NCR 4

Build Caribbean Cultural Collections Preservation and Research Center

Expand and fulfill SHPO and ICP plan to identify criteria for a new conservation center that provides preservation planning and conservation services for museum/library/archives and private client collections.

Potential benefits: Provides a local source of professional preservation advice and conservation treatment, boosts employment opportunities for professionals in preservation and curation, and establishes Puerto Rico as a regional leader in preservation and conservation.

Potential costs: \$225 million in total estimated costs

Potential funder(s): CDBG-DR, P3, nongovernment sources

Potential implementer(s): ICP, various foundations and donors



Restore, plan for, and develop the natural environment

NCR 5

Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations, with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

Potential benefits: Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

Potential costs: \$74 million–\$120 million in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, P3, Government of Puerto Rico, DNER, municipalities, nongovernment sources

Potential implementer(s): DNER, USFS, municipalities

NCR 6

Implement Individual At-Risk Species Recovery Activities

Develop and implement recovery actions for a set of the 10–15 identified at-risk species that were significantly affected by Hurricane Maria. Plans include species-appropriate habitat restoration, increasing wild populations, and addressing invasive species or predation.

Potential benefits: Improves resilience of habitats, especially for species that at risk of extinction; assists species recovery; improves biodiversity and ecological health; and contributes to agricultural production and tourism.

Potential costs: \$6 million in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, DNER, Government of Puerto Rico, municipalities, private sector, nongovernment sources

Potential implementer(s): DNER, FWS, other federal agencies, NGOs, universities



NCR 8

Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 9

Landfill Repair and Closure

Repair landfills and open dumps that sustained damage from the hurricanes and close unlined open dumps throughout Puerto Rico.

Potential benefits: Reduces or eliminates the impact of landfills on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Benefits public health and the environment.

Potential costs: \$160 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities, Solid Waste Authority

NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 11

Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA



NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies

NCR 14

Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies

NCR 15

Coral Reef and Seagrass Protection and Restoration

Restore damaged coral reef and seagrass sites to protect coastal communities, human health and safety, biodiversity and ecological function, and economic activity.

Potential benefits: Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

Potential costs: \$22.9 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 16

Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE



NCR 17

Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

Potential benefits: Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

Potential costs: \$80 million–\$82 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USACE, NOAA

Potential implementer(s): DNER, municipalities, USACE

NCR 33

Blue Shore Workforce Development

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

Potential benefits: Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

Potential costs: \$36 million in total estimated costs

Potential funder(s): EPA, USDA, DOC EDA, DOL

Potential implementer(s): Puerto Rico Department of Labor and Human Resources, DOC EDA

COURSES OF ACTION

Strategic Initiatives

FOCUS ON THE
FUTURE

As the actions within the infrastructure capital investment priorities are necessary prerequisites to the strategic initiatives, they are not duplicated here. The order of these actions first highlights actions from the sector most relevant to that initiative, listed numerically. Numerical assignment is random and does not indicate a specific prioritization. They are then followed by actions from other sectors that are also important to achieving the strategic initiative, which are listed in alphabetical order by code and number.



Ocean economy

ECN 3

Change Social Welfare and Benefits Policy

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

Potential benefits: Removes disincentives to work that have been created by the current system of benefit provision. Stimulates economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly

ECN 5

Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

Potential benefits: Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Legislative Assembly

ECN 7

Create Research Centers and Partnerships

Create research centers and partnerships across a variety of disciplines, for example, agricultural partnerships with universities; specialized research centers in technology, biotechnology, and marine economics; and a center devoted to developing and using blockchain technology.

Potential benefits: Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

Potential costs: \$110 million in total estimated costs

Potential funder(s): Federal agencies

Potential implementer(s): Universities, private industry

ECN 8

Define and Develop Economic Development Zones

Define geographically distinct economic development zones and establish policies to provide benefits, such as tax advantages and waivers of particular regulations.

Potential benefits: Incentivizes particular types of economic activity in specific areas, which in turn, increases the level of economic activity and employment.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly



ECN 9 **Invest in Agricultural Recovery Assistance**

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

Potential benefits: Allows farmers and other agricultural workers to reestablish operations. Stimulates development of innovative and efficient farming practices and use of next-generation agricultural technology, improving profitability of agriculture and increasing exports.

Potential costs: \$1.8 billion in total estimated costs

Potential funder(s): USDA, CDBG-DR

Potential implementer(s): Puerto Rico Department of Agriculture

ECN 10 **BLUETide Initiative**

Develop a whole-island approach to coastal resources management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, bio-compound extraction, aquaculture, policy, and enforcement.

Potential benefits: Increases tourism, international competitiveness, economic growth, and food security while diversifying the economic drivers of the Island and preventing future hurricane damage.

Potential costs: \$200 million–\$300 million in total estimated costs

Potential funder(s): CDBG-DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, NGOs

Potential implementer(s): FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

ECN 12 **Provide Innovation and Entrepreneurial Training**

Reinvigorate innovation and research in Puerto Rico by implementing a model and initiatives developed by Georgia Tech. The model consists of three strategies: bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

Potential benefits: Generates young, trained entrepreneurs who can start businesses that will produce goods and services for export; promotes public-private partnerships; and creates job opportunities.

Potential costs: \$26 million in total estimated costs

Potential funder(s): DOC EDA, NSF

Potential implementer(s): Georgia Tech or similar university, Puerto Rican universities, PRDE, PRSTRT, Grupo Guayacan, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante

ECN 13 **Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

Potential benefits: Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

Potential costs: To be determined

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO, SBA

Potential implementer(s): PRIDCO



ECN 14

Direct Small Business Investment

Provide small grants to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

Potential benefits: Allows businesses to reestablish operation, rebuild, recover, and grow, as well as becoming more resilient to disasters and able to plan for continued growth with more confidence.

Potential costs: \$2.7 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): SBA

ECN 17

Construct the Puerto Rico Science, Technology, & Research Trust's Research and Development Center at Science City

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

Potential benefits: Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts, while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

Potential costs: \$6 million in total estimated costs

Potential funder(s): DOC EDA, Opportunity Zone Funds (once established), New Markets Tax Credits

Potential implementer(s): DEDC

ECN 18

Compensate Farmers for Crop Losses

Compensate farmers directly for crop losses due to the hurricanes.

Potential benefits: Replaces lost income and increases consumption across all sectors of the economy.

Potential costs: \$250 million in total estimated costs

Potential funder(s): USDA

Potential implementer(s): USDA, Puerto Rico Department of Agriculture

ECN 19

Recover and Restore Fishing Facilities and Equipment

Construct and restore fishermen's wharves, docks, fishing centers, and equipment and supplies that were damaged in the hurricanes.

Potential benefits: Restores, recovers, or replaces equipment and working spaces that are essential to the fishing industry, to support the industry across the Island.

Potential costs: \$60 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, SBA

Potential implementer(s): DEDC, NOAA



ECN 23

Implement Job Creation Initiative

Create jobs within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

Potential benefits: Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

Potential costs: \$80 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, DOL

Potential implementer(s): To be determined

ECN 24

Revitalize the PR-127 Petrochemical Corridor in Guyanilla-Peñuelas

Undertake cleanup and revitalization of contaminated former petrochemical zone.

Potential benefits: Allows development of new industries that focus on production of next-generation renewable energy resources and products and that support microalgae-based pharmaceutical manufacturing, and responsible recycling industries.

Potential costs: \$30 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 25

Establish National Dislocated Workers Assistance

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with clean-up and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

Potential benefits: Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOL

Potential implementer(s): To be determined

ECN 27

Rehabilitate Esperanza Boardwalk and Waterfront

Revitalize the boardwalk that runs along the waterfront in the town of Esperanza on the island of Vieques, a popular tourist destination. The waterfront experienced significant damage from hurricanes Irma and Maria and is currently closed to visitors, along with most local businesses.

Potential benefits: Revitalizes the Boardwalk to allow the tourist business to resume. Provides assistance to local businesses to reopen, to become more resilient, and to be better protected from future disasters.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA, SBA

Potential implementer(s): DEDC, private companies



ECN 28
Implement Initiative to Promote Entrepreneurship

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The System will be established by the Government of Puerto Rico but managed by an organization outside the government.

Potential benefits: Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, in the hope of encouraging them to start operations.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 29
Design Puerto Rico Resiliency/ Rebuild/Open for Business Campaign

Design and launch marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

Potential benefits: Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

Potential costs: \$67 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): PRTC, DEDC

ECN 30
Help Revitalize Eco and Beach Adventure and Fleet Boat Assistance

Identify key businesses on the island of Culebra that were damaged by the hurricanes as well as other services the island could develop. Provide economic assistance to existing businesses and resources to repair the beach and create new business opportunities.

Potential benefits: Creates jobs and increases economic activity by creating or stimulating a viable, sustainable tourism industry. Results in better services and experiences for visitors.

Potential costs: \$2.5 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): DEDC, private companies

ECN 33
Assist Sport Fishing Industry

Restore and enhance sport fishery facilities and resources that were affected by the hurricanes.

Potential benefits: Helps spur economic growth in the areas surrounding the sport fishing facilities and encourages development of tourism and other industries.

Potential costs: \$4 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): DEDC, DNER



ECN 34

Create Business Resiliency Hubs

Create business resiliency hubs (BRH) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communications systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

Potential benefits: Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

Potential costs: \$4 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): To be determined

ECN 35

Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses.

Potential benefits: Provides financing to businesses in the communities served by the BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector, private equity

Potential implementer(s): SBA

ECN 38

Redevelop Former Roosevelt Roads Naval Station

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

Potential benefits: Results in economic growth, stabilization, and expansion in the surrounding communities.

Potential costs: \$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO

Potential implementer(s): DEDC, private developers

ECN 40

Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology driven agro-innovation to integrate veterans, youth, and marginalized populations into ag business opportunities.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by helping to increase the number of farmers in Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): FEMA, NOAA, DOI, EPA, USDA Rural Development, HUD

Potential implementer(s): To be determined



ECN 41

Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide Revolving Loan Funds to expand farmer access to capital and encourage innovation and ag modernization.

Potential benefits: Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): EDB

ECN 42

PRIDCO Agriculture Parks

Convert undeveloped PRIDCO Parks to host state of the art controlled environment agriculture infrastructure available, including hydroponics and aquaculture, for private lease using same current landlord model.

Potential benefits: Helps attract young entrepreneurs to ag industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the Economic Development Bank (EDB). Controlled environment ag can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

Potential costs: \$100 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined

ECN 43

Ag Industry Support

Change the current model of the PRDA Agrolological Laboratory to a P3 with greater resources to enable it to communicate effectively and in a timely manner with farmers and better serve its intended function as a support resource to enable optimal farm-level decision making.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by advising on better ag practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

Potential costs: \$27 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined

EDU 5

Implement a Student-Based Budget System

Review current budget practices to assess how funds are allocated to schools and identify unmet funding needs and inequities based on geographic location or school characteristics. Determine whether and how a new student-based budget formula would allow funding to be distributed more equitably, effectively, and transparently across both public and new charter schools.

Potential benefits: Helps increase equity, allocate more dollars to higher-need schools, and ensure consistency across all regions in terms of who has access to resources.

Potential costs: \$1.6 million in total estimated costs

Potential funder(s): U.S. Department of Education, nongovernment sources

Potential implementer(s): PRDE (Oficina para el Mejoramiento de las Escuelas Públicas)



EDU 6 **Expanding and Updating K-12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K-12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

Potential benefits: Helps build a skilled labor force for sectors key to Puerto Rico's recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K-12 schools and universities.

Potential costs: \$3 billion in total estimated costs

Potential funder(s): U.S. Department of Education, NSF, DoD, NIH, DOL, P3, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

Potential implementer(s): PRDE, schools, private industry

EDU 7 **Augment Tele-Education/ Online Education**

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners



HSS 3

Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive waste characterization and cost analysis, enforceable recycling and composting mandates, and public education.

Potential benefits: Creates a waste management program that would decrease negative health impacts across Puerto Rico.

Potential costs: \$6.4 million in total estimated costs

Potential funder(s): EPA, DHHS, nongovernment sources

Potential implementer(s): EPA, Quadratec Cares Energize the Environment Grant Program, DHHS

HSS 6

Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

Potential benefits: Improves mosquito control in areas that have been difficult to reach.

Potential costs: \$2.1 million–\$3.8 million in total estimated costs

Potential funder(s): CDC

Potential implementer(s): PRVCU, PRDOH, municipalities

HSS 9

Increase Access to Telehealth Options as Telecommunication Supports Become More Robust

Expand the use of telehealth across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services, and using phone and online applications to target those with trauma-related mental illness.

Potential benefits: Provides greater access to specialty care for rural, hard-to-reach populations, and quicker networking and best-practice sharing among health care professionals in an emergency.

Potential costs: \$21 million in total estimated costs

Potential funder(s): FCC, NIH, Medicaid 1115 waivers

Potential implementer(s): Health care providers, mental health care providers

HSS 10

Expand Care for Trauma and Chronic Stress

Expand the number of people and places (e.g., schools and other community centers) where people can get both long-term and immediate assistance for acute trauma and chronic stress. This action includes training nonprofessionals, such as health and physical education teachers, in supportive emotional well-being services.

Potential benefits: Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

Potential costs: \$8.4 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, nongovernment sources

Potential implementer(s): Mental health providers



HSS 11

Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and also for the long-term.

Potential benefits: Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to work satisfaction.

Potential costs: \$39 million in total estimated costs

Potential funder(s): DHHS HRSA, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Puerto Rican universities, associated hospitals and health care facilities

HSS 14

Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information, inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

Potential benefits: Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

Potential costs: \$3.3 million in total estimated costs

Potential funder(s): DHHS, Government of Puerto Rico

Potential implementer(s): Institute for Statistics, health care payors, health care providers, PRDOH



HSS 21

Improve Public Awareness of Proper Storage of Insulin Post-Disaster

Increase public knowledge of guidelines for the storage of insulin by (1) training disaster shelter managers and health care providers to provide relevant information, (2) conducting mass media and social media campaigns, and (3) sending text messages to patients.

Potential benefits: Decreases medication gaps, and thus negative health impacts, for insulin-dependent individuals. Decreases medication waste and strain on insulin supply.

Potential costs: \$2.6 million in total estimated costs

Potential funder(s): DHHS, private sector, nongovernment sources

Potential implementer(s): Healthcare providers, PRDOH, private sector

HSS 26

Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Healthcare Disaster Resource Centers that would be equipped with extra supplies needed during a disaster.

Potential benefits: Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

Potential costs: \$23 million in total estimated costs

Potential funder(s): DHHS, PREMA, PRDOH

Potential implementer(s): PRDOH, PREMA

MUN 17

Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

Potential benefits: Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

Potential costs: \$3.5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Government of Puerto Rico, municipal governments

**NCR 7****Develop Partner Networks for Recovering Plant and Animal Species**

Grow a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities. Such partners would include federal and state-level agencies, local government, NGOs, universities, and private sector partners.

Potential benefits: Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, DNER, Government of Puerto Rico, municipalities, private sector, nongovernment sources

Potential implementer(s): DNER, federal agencies, University of Puerto Rico, NGOs

NCR 8**Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste**

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 9**Landfill Repair and Closure**

Repair landfills and open dumps that sustained damage from the hurricanes and close unlined open dumps throughout Puerto Rico.

Potential benefits: Reduces or eliminates the impact of landfills on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Benefits public health and the environment.

Potential costs: \$160 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities, Solid Waste Authority



NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 11

Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA

NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies

NCR 14

Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies



NCR 15

Coral Reef and Seagrass Protection and Restoration

Restore damaged coral reef and seagrass sites to protect coastal communities, human health and safety, biodiversity and ecological function, and economic activity.

Potential benefits: Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

Potential costs: \$22.9 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 16

Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE

NCR 17

Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

Potential benefits: Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

Potential costs: \$80 million–\$82 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USACE, NOAA

Potential implementer(s): DNER, municipalities, USACE

NCR 18

Establish the San Juan Barrier Reef System as a Marine Protected Area

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing, and invest in the reef's restoration and long-term health.

Potential benefits: Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

Potential costs: \$800,000 in total estimated costs

Potential funder(s): NOAA, DOI, Government of Puerto Rico, P3, nongovernment sources

Potential implementer(s): DNER, NOAA



NCR 21 **Strategic Watershed, Landscape, and Conservation Corridor Approaches**

Implement strategic approaches at the watershed and landscape-scale to restore and protect Puerto Rico's natural resources, support human health, infrastructure, and economic outcomes, as well as create land and river conservation corridors.

Potential benefits: Protects natural areas and improves agricultural production, tourism, access to fresh drinking water, recreational opportunities, watershed and ecosystem health, and ecological functions.

Potential costs: \$48 million in total estimated costs

Potential funder(s): NOAA, DOI, NRCS, USFS, EPA, Government of Puerto Rico, DNER, nongovernment sources

Potential implementer(s): DNER, federal agencies, land trusts, NGOs

NCR 22 **Promote Alternative Tourism for Economic Development**

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

Potential benefits: Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

Potential costs: \$0–\$350 million in total estimated costs

Potential funder(s): DOC EDA, SBA, USDA, NPS, NOAA

Potential implementer(s): PRTC, DOC EDA, DNER

NCR 26 **Resource Management Capacity Building**

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

Potential benefits: Provides stronger decision-making support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

Potential costs: \$16 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): PRTC, NGOs, communities

NCR 27 **Expand Disaster Recovery Sister Cities Connections**

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

Potential benefits: Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits as well as professional development, educational, and tourism opportunities.

Potential costs: \$13 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): Government of Puerto Rico, NGOs, communities



NCR 28 **Identify Funding for Natural and Cultural Resources Research**

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

Potential benefits: Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

Potential costs: \$8.6 million–\$16 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): PRTC

NCR 29 **Enhance Public Participation and Education Through Museum Exhibits**

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

Potential benefits: Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

Potential costs: \$9.6 million–\$20 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): DNER, universities, host museums

NCR 30 **Create an Accessible Data Repository of Natural and Cultural Resources**

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

Potential benefits: Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

Potential costs: \$12 million in total estimated costs

Potential funder(s): DOI, USGS, NOAA, NPS, Government of Puerto Rico, DNER

Potential implementer(s): PRTC

NCR 33 **Blue Shore Workforce Development**

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

Potential benefits: Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

Potential costs: \$36 million in total estimated costs

Potential funder(s): EPA, USDA, DOC EDA, DOL

Potential implementer(s): Puerto Rico Department of Labor and Human Resources, DOC EDA



PBD 4
Realign Public Building Ownership

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

Potential benefits: Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): PRPB

Potential implementer(s): Office of the Governor, Legislative Assembly

PBD 8
Mitigate Flood Risk for Critical Government Functions

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

Potential benefits: Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

Potential costs: \$2 billion in total estimated costs

Potential funder(s): PA, HMGP, U.S. Department of Education

Potential implementer(s): PRPB



Visitor economy

ECN 3

Change Social Welfare and Benefits Policy

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

Potential benefits: Removes disincentives to work that have been created by the current system of benefit provision. Stimulates economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly

ECN 5

Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

Potential benefits: Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Legislative Assembly

ECN 7

Create Research Centers and Partnerships

Create research centers and partnerships across a variety of disciplines, for example, agricultural partnerships with universities; specialized research centers in technology, biotechnology, and marine economics; and a center devoted to developing and using blockchain technology.

Potential benefits: Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

Potential costs: \$110 million in total estimated costs

Potential funder(s): Federal agencies

Potential implementer(s): Universities, private industry

ECN 8

Define and Develop Economic Development Zones

Define geographically distinct economic development zones and establish policies to provide benefits, such as tax advantages and waivers of particular regulations.

Potential benefits: Incentivizes particular types of economic activity in specific areas, which in turn, increases the level of economic activity and employment.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly



ECN 9

Invest in Agricultural Recovery Assistance

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

Potential benefits: Allows farmers and other agricultural workers to reestablish operations. Stimulates development of innovative and efficient farming practices and use of next-generation agricultural technology, improving profitability of agriculture and increasing exports.

Potential costs: \$1.8 billion in total estimated costs

Potential funder(s): USDA, CDBG-DR

Potential implementer(s): Puerto Rico Department of Agriculture

ECN 10

BLUETide Initiative

Develop a whole-island approach to coastal resources management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, bio-compound extraction, aquaculture, policy, and enforcement.

Potential benefits: Increases tourism, international competitiveness, economic growth, and food security while diversifying the economic drivers of the Island and preventing future hurricane damage.

Potential costs: \$200 million–\$300 million in total estimated costs

Potential funder(s): CDBG-DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, NGOs

Potential implementer(s): FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

ECN 11

Medical Tourism Initiative

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

Potential benefits: Stimulates economic activity from tourist spending, and may reverse the departure of medical professionals from Puerto Rico.

Potential costs: \$8 million in total estimated costs

Potential funder(s): CDBG-DR, private sector, nongovernment sources

Potential implementer(s): PRTC, DEDC

ECN 12

Provide Innovation and Entrepreneurial Training

Reinvigorate innovation and research in Puerto Rico by implementing a model and initiatives developed by Georgia Tech. The model consists of three strategies: bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

Potential benefits: Generates young, trained entrepreneurs who can start businesses that will produce goods and services for export; promotes public-private partnerships; and creates job opportunities.

Potential costs: \$26 million in total estimated costs

Potential funder(s): DOC EDA, NSF

Potential implementer(s): Georgia Tech or similar university, Puerto Rican universities, PRDE, PRSTRT, Grupo Guayacan, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante



ECN 13

Develop PRIDCO's Abandoned Buildings for Business Incubators

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

Potential benefits: Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

Potential costs: To be determined

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO, SBA

Potential implementer(s): PRIDCO

ECN 14

Direct Small Business Investment

Provide small grants to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

Potential benefits: Allows businesses to reestablish operation, rebuild, recover, and grow, as well as becoming more resilient to disasters and able to plan for continued growth with more confidence.

Potential costs: \$2.7 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): SBA

ECN 16

Revitalize the Santurce Neighborhood of San Juan Through Business Development Activities

Establish Santurce as a center of business innovation that can serve as a replicable model for urban revitalization. This effort will be spearheaded by the Nuestro Barrio Creative Industries Acceleration and Commercialization Program at the Universidad del Sagrado Corazon.

Potential benefits: Increases retention and encourages expansion of business activity in a neighborhood that is transforming economically. Retains, diversifies, and commercializes creative industries. Develops affordable housing, bridging the university and the neighborhood.

Potential costs: \$3 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): Private developer, GPR agencies



ECN 17

Construct the Puerto Rico Science, Technology, & Research Trust's Research and Development Center at Science City

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

Potential benefits: Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts, while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

Potential costs: \$6 million in total estimated costs

Potential funder(s): DOC EDA, Opportunity Zone Funds (once established), New Markets Tax Credits

Potential implementer(s): DEDC

ECN 19

Recover and Restore Fishing Facilities and Equipment

Construct and restore fishermen's wharves, docks, fishing centers, and equipment and supplies that were damaged in the hurricanes.

Potential benefits: Restores, recovers, or replaces equipment and working spaces that are essential to the fishing industry, to support the industry across the Island.

Potential costs: \$60 million in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA, SBA

Potential implementer(s): DEDC, NOAA

ECN 20

Rehabilitate Plaza Dársenas

Fix concrete walkways, relocate benches, install new lighting, and plant new trees in Plaza Dársenas, a San Juan landmark and tourist destination, where local artisans show their work. Damage was sustained during Hurricane Maria.

Potential benefits: Improves Puerto Rico's image as a tourist destination, particularly for cruise ships, which in turn helps strengthen the economy.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): DEDC, PRTC

ECN 21

Study Hurricane Impacts on the Local Economy

Conduct an analysis of the main effects of Hurricane Maria on the local economy of Puerto Rico, as suggested in the Build Back Better plan. Prepare and evaluate economic estimates of the damages to the overall economy as well as by sector. Track recent demographic changes in the local economy, including movement of persons.

Potential benefits: Enables local businesses to plan better for the future and make strategic, efficient investments to stimulate growth. Helps provide a basis for the government to use in estimating revenues and in fiscal planning, including infrastructure planning.

Potential costs: \$300,000 in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): Private sector firm or university



ECN 22 **Rehabilitate Paseo de la Princesa and Princesa Building**

Revitalize the Paseo de la Princesa walkway and the Princesa Building, a historical site and popular tourist attraction in San Juan that experienced extensive damage from Hurricane's Irma and Maria. The revitalization project is based on the Build Back Better Plan.

Potential benefits: Restores an area that draws many tourists from cruise ships, and helps revitalize the tourist industry, which in turn helps local businesses, including restaurants, cafes, gift shops, the local artisans who display their work on the Paseo, and tour operators.

Potential costs: \$4.5 million in total estimated costs

Potential funder(s): DOC EDA, Opportunity Zone Funds (once established), New Markets Tax Credits

Potential implementer(s): PRIDCO, DEDC, PRTC

ECN 23 **Implement Job Creation Initiative**

Create jobs within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

Potential benefits: Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

Potential costs: \$80 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, DOL

Potential implementer(s): To be determined

ECN 27 **Rehabilitate Esperanza Boardwalk and Waterfront**

Revitalize the boardwalk that runs along the waterfront in the town of Esperanza on the island of Vieques, a popular tourist destination. The waterfront experienced significant damage from hurricanes Irma and Maria and is currently closed to visitors, along with most local businesses.

Potential benefits: Revitalizes the Boardwalk to allow the tourist business to resume. Provides assistance to local businesses to reopen, to become more resilient, and to be better protected from future disasters.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA, SBA

Potential implementer(s): DEDC, private companies

ECN 29 **Design Puerto Rico Resiliency/Rebuild/Open for Business Campaign**

Design and launch marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

Potential benefits: Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

Potential costs: \$67 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): PRTC, DEDC



ECN 30

Help Revitalize Eco and Beach Adventure and Fleet Boat Assistance

Identify key businesses on the island of Culebra that were damaged by the hurricanes as well as other services the island could develop. Provide economic assistance to existing businesses and resources to repair the beach and create new business opportunities.

Potential benefits: Creates jobs and increases economic activity by creating or stimulating a viable, sustainable tourism industry. Results in better services and experiences for visitors.

Potential costs: \$2.5 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): DEDC, private companies

ECN 33

Assist Sport Fishing Industry

Restore and enhance sport fishery facilities and resources that were affected by the hurricanes.

Potential benefits: Helps spur economic growth in the areas surrounding the sport fishing facilities and encourages development of tourism and other industries.

Potential costs: \$4 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): DEDC, DNER

ECN 34

Create Business Resiliency Hubs

Create business resiliency hubs (BRH) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communications systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

Potential benefits: Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

Potential costs: \$4 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): To be determined

ECN 38

Redevelop Former Roosevelt Roads Naval Station

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

Potential benefits: Results in economic growth, stabilization, and expansion in the surrounding communities.

Potential costs: \$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO

Potential implementer(s): DEDC, private developers



ECN 40

Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology driven agro-innovation to integrate veterans, youth, and marginalized populations into ag business opportunities.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by helping to increase the number of farmers in Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): FEMA, NOAA, DOI, EPA, USDA Rural Development, HUD

Potential implementer(s): To be determined

ECN 41

Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide Revolving Loan Funds to expand farmer access to capital and encourage innovation and ag modernization.

Potential benefits: Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): EDB

ECN 42

PRIDCO Agriculture Parks

Convert undeveloped PRIDCO Parks to host state of the art controlled environment agriculture infrastructure available, including hydroponics and aquaculture, for private lease using same current landlord model.

Potential benefits: Helps attract young entrepreneurs to ag industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the Economic Development Bank (EDB). Controlled environment ag can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

Potential costs: \$100 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined



CPCB 1

Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 2

Capacity Building for Community-Level Preparedness and Response

Develop and implement preparedness and response plans for 50–100 priority vulnerable communities that face particularly high risk during disasters. This action includes (1) recruiting, training, and equipping Community Emergency Response Teams (CERT) so that these communities can better sustain themselves during the response period, when emergency responders and access to the communities will be limited; and (2) establishing and maintaining a cache of emergency supplies—e.g., water filters and generators—for these communities.

Potential benefits: Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

Potential costs: \$37 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, municipal governments



CPCB 7

Capacity Building for Emergency Shelter Planning

Hire planners in each municipality and at the state-level to build a more robust emergency shelter system. This action will develop parameters, standards, and general design guidelines for shelters that can better support residents over the longer-term. This action also will establish a protocol with the National Guard for effective management of response commodities for shelters.

Potential benefits: Improves access to safe and appropriately resourced shelters within a reasonable distance that can accommodate community needs, such as disabilities and medical conditions.

Potential costs: \$57 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, public buildings sector

CPCB 8

Strengthening Emergency Management Capacity at Municipalities

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. Work with existing MEMOs to identify personnel and training needs. With PREMA/FEMA, create a training curriculum that more directly addresses municipal needs. Work with the Office of Human Resources to update job descriptions, specific classifications, tasks and responsibilities of all municipal staff during an emergency and response event. Train MEMOs to collect better information about people requiring evacuation (e.g., disabled, elderly).

Potential benefits: Strengthens municipalities' emergency management and response capacity.

Potential costs: \$165 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, Municipal Emergency Management Offices



EDU 6 **Expanding and Updating K-12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K-12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

Potential benefits: Helps build a skilled labor force for sectors key to Puerto Rico's recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K-12 schools and universities.

Potential costs: \$3 billion in total estimated costs

Potential funder(s): U.S. Department of Education, NSF, DoD, NIH, DOL, P3, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

Potential implementer(s): PRDE, schools, private industry

EDU 7 **Augment Tele-Education/ Online Education**

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners



EDU 9

Develop and Implement Teacher Pipeline Program

Improve teacher preparation programs and instructional practice by (1) creating a residency model for teacher training, (2) reviewing teacher certification requirements, (3) aligning personnel decisionmaking processes with assessment of teacher quality, (4) strengthening teacher supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

Potential benefits: Develops a pipeline of teachers who can engage in high-quality instruction and support others in improving their practice. Reduces teacher turnover and promotes a closer relationship between K-12 schools and UPR.

Potential costs: \$350 million in total estimated costs

Potential funder(s): U.S. Department of Education

Potential implementer(s): PRDE, UPR, professional development partners, schools

HSS 3

Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive waste characterization and cost analysis, enforceable recycling and composting mandates, and public education.

Potential benefits: Creates a waste management program that would decrease negative health impacts across Puerto Rico.

Potential costs: \$6.4 million in total estimated costs

Potential funder(s): EPA, DHHS, nongovernment sources

Potential implementer(s): EPA, Quadratec Cares Energize the Environment Grant Program, DHHS

HSS 4

Improve Surveillance of Waterborne Disease

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

Potential benefits: Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

Potential costs: \$2.8 million–\$2.9 million in total estimated costs

Potential funder(s): EPA Water Finance Clearinghouse

Potential implementer(s): PRDOH, PRASA, CDC



HSS 6

Reduce Opportunities for Vector-Borne Diseases

Support ongoing monitoring and engagement for mosquito control and provide support to establish additional innovative practices for mosquito control, including but not limited to using drones to detect breeding grounds and apply larvicide at abandoned properties.

Potential benefits: Improves mosquito control in areas that have been difficult to reach.

Potential costs: \$2.1 million–\$3.8 million in total estimated costs

Potential funder(s): CDC

Potential implementer(s): PRVCU, PRDOH, municipalities

HSS 9

Increase Access to Telehealth Options as Telecommunication Supports Become More Robust

Expand the use of telehealth across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services, and using phone and online applications to target those with trauma-related mental illness.

Potential benefits: Provides greater access to specialty care for rural, hard-to-reach populations, and quicker networking and best-practice sharing among health care professionals in an emergency.

Potential costs: \$21 million in total estimated costs

Potential funder(s): FCC, NIH, Medicaid 1115 waivers

Potential implementer(s): Health care providers, mental health care providers

HSS 11

Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and also for the long-term.

Potential benefits: Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to work satisfaction.

Potential costs: \$39 million in total estimated costs

Potential funder(s): DHHS HRSA, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Puerto Rican universities, associated hospitals and health care facilities

HSS 13

Expand Practice Laws for Health Care Providers

Increase the supply and practice capacity of licensed health care providers and public health practitioners in Puerto Rico. This action includes (1) allowing nurse practitioners (NPs) and physicians assistants (PAs) from other states to provide care in Puerto Rico, (2) providing incentives to attract licensed NPs and PAs from other locations, and (3) establishing and expanding NP and PA degree programs in Puerto Rico.

Potential benefits: Increases access to quality care. Helps identify and control diseases or outbreaks in a timely manner.

Potential costs: \$8 million in total estimated costs

Potential funder(s): Medicaid/Mi Salud reimbursement

Potential implementer(s): Independent health care licensure body, PRDOH



HSS 14

Develop a More Robust and Resilient Data System of Health Costs and Links to Health Outcomes

Create supports for measuring health care costs systematically, including (1) merging claims data, hospital and other health center discharge data, and disease and health outcome information; (2) solidifying the robustness of data systems for health outcomes information, inclusive or related social and human service data; and (3) ensuring greater data digitization to facilitate analysis.

Potential benefits: Ensures that systematic data are collected, through robust and resilient data systems, and that there is a mechanism to integrate and report on findings for overall health quality improvement.

Potential costs: \$3.3 million in total estimated costs

Potential funder(s): DHHS, Government of Puerto Rico

Potential implementer(s): Institute for Statistics, health care payors, health care providers, PRDOH

HSS 22

Move to a More Regionally-Integrated Approach to Emergency Planning, Exercising, Response, and Recovery

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen and other critical supplies post-incident.

Potential benefits: Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

Potential costs: \$9.6 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, CMS, ASES, PRDOH

Potential implementer(s): PRDOH, hospital system, other health care organizations



HSS 26

Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Healthcare Disaster Resource Centers that would be equipped with extra supplies needed during a disaster.

Potential benefits: Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

Potential costs: \$23 million in total estimated costs

Potential funder(s): DHHS, PREMA, PRDOH

Potential implementer(s): PRDOH, PREMA

HSS 33

Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

Potential benefits: Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

Potential costs: \$8.1 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, Government of Puerto Rico, nongovernment sources

Potential implementer(s): ASES, DHHS, CMS

MUN 14

Repopulate Urban Centers

Incentivize the redevelopment and repopulation of urban centers to improve social and health outcomes and improve access to services. Provide incentives for individuals and families living in outlying communities to relocate to urban centers.

Potential benefits: Helps improve community and municipal resilience by concentrating residents in easily accessible urban areas with more resilient infrastructure and services. Reduces the costs of providing these services and improves access these populations after emergencies. Eases the repurposing of abandoned properties in urban centers and reduces blight—while spurring economic development in all sectors.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): CDBG-DR, SBA, Government of Puerto Rico

Potential implementer(s): Governor, municipal governments

**NCR 1****Historic and Cultural Properties Preservation**

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

Potential benefits: Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

Potential costs: \$64 million in total estimated costs

Potential funder(s): HMGP, DOI, Institute of Museum and Library Services, National Endowment for the Humanities, National Archives and Records Administration, Government of Puerto Rico

Potential implementer(s): SHPO, ICP, individual property owners

NCR 2**Arts Recovery**

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

Potential benefits: Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA, Institute of Museum and Library Services, National Endowment for the Humanities, and National Archives and Records Administration, private sector, nongovernment sources

Potential implementer(s): Government of Puerto Rico, Heritage Emergency Task Force



NCR 3

General Archives Mitigation and Modernization

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

Potential benefits: Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

Potential costs: \$11.5 million in total estimated costs

Potential funder(s): National Archives' National Historical Publications and Records Commission, Government of Puerto Rico, private sector, nongovernment sources

Potential implementer(s): ICP

NCR 4

Build Caribbean Cultural Collections Preservation and Research Center

Expand and fulfill SHPO and ICP plan to identify criteria for a new conservation center that provides preservation planning and conservation services for museum/library/archives and private client collections.

Potential benefits: Provides a local source of professional preservation advice and conservation treatment, boosts employment opportunities for professionals in preservation and curation, and establishes Puerto Rico as a regional leader in preservation and conservation.

Potential costs: \$225 million in total estimated costs

Potential funder(s): CDBG-DR, P3, nongovernment sources

Potential implementer(s): ICP, various foundations and donors

NCR 5

Forest Recovery in Rural Protected Areas, Private Forests, Critical Watersheds, and Urban Areas

Develop and implement strategic forest recovery and conservation strategies throughout Puerto Rico through public and private collaborations, with a focus on rural protected forests, ecological corridors, private forested lands, agroforestry, and urban forests. Restore tree nurseries and seed banks to aid in the recovery process.

Potential benefits: Restores ecological functions of forests and the provision of ecosystem services, boosts economic viability of forest conservation, provides employment opportunities, improves public safety, and reduces the risk of pest and disease damage.

Potential costs: \$74 million–\$120 million in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, P3, Government of Puerto Rico, DNER, municipalities, nongovernment sources

Potential implementer(s): DNER, USFS, municipalities



NCR 7

Develop Partner Networks for Recovering Plant and Animal Species

Grow a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities. Such partners would include federal and state-level agencies, local government, NGOs, universities, and private sector partners.

Potential benefits: Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, DNER, Government of Puerto Rico, municipalities, private sector, nongovernment sources

Potential implementer(s): DNER, federal agencies, University of Puerto Rico, NGOs

NCR 8

Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 9

Landfill Repair and Closure

Repair landfills and open dumps that sustained damage from the hurricanes and close unlined open dumps throughout Puerto Rico.

Potential benefits: Reduces or eliminates the impact of landfills on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Benefits public health and the environment.

Potential costs: \$160 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities, Solid Waste Authority



NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 11

Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA

NCR 12

Develop Forest Products Industry

Build on a pilot USFS project to (1) manage valuable wood gathered in the post-hurricane vegetation waste removal process and (2) revive local markets for hardwoods.

Potential benefits: Builds long-term capacity to manage woody debris and provide economic, cultural, educational, ecological, and research benefits, including wood to rebuild historic structures, for art, and for businesses to develop new wood products. Stimulates the economy and reduces the amount of waste going into landfills.

Potential costs: \$10 million in total estimated costs

Potential funder(s): USFS, Government of Puerto Rico, DNER, PRTC

Potential implementer(s): DNER, USFS

NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS, EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies



NCR 14

Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies

NCR 15

Coral Reef and Seagrass Protection and Restoration

Restore damaged coral reef and seagrass sites to protect coastal communities, human health and safety, biodiversity and ecological function, and economic activity.

Potential benefits: Provides a cost-effective way to increase protection from disasters, creates jobs, increases biodiversity of coastal areas, and enhances fishing, tourism, and recreation economies.

Potential costs: \$22.9 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NOAA, EPA, USCG, USACE, DOI, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 16

Wetlands Restoration

Restore the capacity, resiliency, and ecological function of coastal wetlands through site-specific actions.

Potential benefits: Provides storm surge protection, erosion control, sediment trapping, wildlife habitat, water filtration, and flood water absorption. Facilitates habitat recovery and healthy ecosystems.

Potential costs: \$24.8 million–\$31.4 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USDA, NOAA, EPA, nongovernment sources

Potential implementer(s): DNER, USACE

NCR 17

Reduce Coastal Erosion and Provide Disaster Protection Through Beaches and Dunes

Restore, monitor, and maintain beaches and sand dunes to make them stable and resilient to both seasonal- and disaster-related coastal flooding, as well as long-term sea level rise.

Potential benefits: Increases coastal resilience and protects coastal infrastructure, human health and safety, wildlife habitats, and commerce from erosion and flood hazards.

Potential costs: \$80 million–\$82 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, DOI, USACE, NOAA

Potential implementer(s): DNER, municipalities, USACE



NCR 18

Establish the San Juan Barrier Reef System as a Marine Protected Area

Declare the San Juan Barrier Reef a Commonwealth of Puerto Rico Marine Protected Area, restrict fishing, and invest in the reef's restoration and long-term health.

Potential benefits: Provides long-term protection of infrastructure, tourism sites, and housing in San Juan; reduces flood risk to community; provides eco-tourism opportunities; and protects beaches.

Potential costs: \$800,000 in total estimated costs

Potential funder(s): NOAA, DOI, Government of Puerto Rico, P3, nongovernment sources

Potential implementer(s): DNER, NOAA

NCR 20

Redesign, Reorganize, and Rebuild Puerto Rican Parks

Conduct assessments to help the Puerto Rican parks system improve governance/operations efficiency, align park amenities to community needs, and re-engineer parks to serve as storm water infrastructure. Rebuild parks in compliance with building codes for hurricane-prone areas, and consistent with assessment findings.

Potential benefits: Promotes active recreation and reduces health care costs, improves flood control capability and mitigates future damage to community, and boosts economy through area attractiveness to tourists, businesses, and consumers.

Potential costs: \$340 million–\$650 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG–DR, NPS, P3, nongovernment sources

Potential implementer(s): DRD, DNER, National Parks Company

NCR 21

Strategic Watershed, Landscape, and Conservation Corridor Approaches

Implement strategic approaches at the watershed and landscape-scale to restore and protect Puerto Rico's natural resources, support human health, infrastructure, and economic outcomes, as well as create land and river conservation corridors.

Potential benefits: Protects natural areas and improves agricultural production, tourism, access to fresh drinking water, recreational opportunities, watershed and ecosystem health, and ecological functions.

Potential costs: \$48 million in total estimated costs

Potential funder(s): NOAA, DOI, NRCS, USFS, EPA, Government of Puerto Rico, DNER, nongovernment sources

Potential implementer(s): DNER, federal agencies, land trusts, NGOs

NCR 22

Promote Alternative Tourism for Economic Development

Catalyze experience-based tourism in key hub areas and enhance efforts to preserve unique natural, cultural, and historical assets.

Potential benefits: Supports economic growth; improves services and access; protects historical, cultural, and natural assets; incubates local entrepreneurship; and improves quality of life in underserved communities.

Potential costs: \$0–\$350 million in total estimated costs

Potential funder(s): DOC EDA, SBA, USDA, NPS, NOAA

Potential implementer(s): PRTC, DOC EDA, DNER



NCR 23

Protected Natural Area Land Management for Alternative Tourism

Create plans, policies, and actions to support, manage, and monitor the development of alternative tourism, such as nature tourism. Develops impact investment program for public-private tourism infrastructure.

Potential benefits: Protects natural and cultural resources over the long term, generates revenue from tourism on public land, and ensures legal protection while increasing accessibility of public lands for tourism.

Potential costs: \$14 million–\$25 million in total estimated costs

Potential funder(s): Government of Puerto Rico, NGOs

Potential implementer(s): DNER, Para La Naturaleza, other NGOs

NCR 24

Enterprise Development for Alternative Tourism

Develop small, medium, and micro enterprises in communities that lack populations with basic entrepreneurial skills to build creative tourism market concepts and launch new enterprises.

Potential benefits: Supports communities beyond traditional training and business assistance programs; includes the creative process of launching enterprises. Empowers communities through human capital development to plan their own future according to their local vision. Derives economic benefits and greater resiliency from having a diversified set of sustainable tourism products.

Potential costs: \$0.65 million–\$1.2 million in total estimated costs

Potential funder(s): Destination Marketing Organization, DOC EDA, NGOs

Potential implementer(s): Destination Marketing Organization, PRTC, municipalities, NGOs

NCR 26

Resource Management Capacity Building

Apply an updated framework for resource management and future disaster response that includes training support, data sharing, and educational outreach to enhance resilience in future disasters.

Potential benefits: Provides stronger decision-making support to natural and cultural resource stakeholders, promotes exchange of ideas, and encourages community involvement in resource management.

Potential costs: \$16 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): PRTC, NGOs, communities



NCR 27

Expand Disaster Recovery Sister Cities Connections

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

Potential benefits: Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits as well as professional development, educational, and tourism opportunities.

Potential costs: \$13 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): Government of Puerto Rico, NGOs, communities

NCR 28

Identify Funding for Natural and Cultural Resources Research

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

Potential benefits: Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

Potential costs: \$8.6 million–\$16 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): PRTC

NCR 29

Enhance Public Participation and Education Through Museum Exhibits

Design and install in-depth, participatory exhibits at museums, such as the Parque de las Ciencias, that describe how different aspects of the natural and cultural resource recovery plans work and their benefits and drawbacks.

Potential benefits: Helps facilitate common understanding of the purpose of recovery efforts and promotes commitment to recovery and disaster preparedness.

Potential costs: \$9.6 million–\$20 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): DNER, universities, host museums

NCR 30

Create an Accessible Data Repository of Natural and Cultural Resources

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

Potential benefits: Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

Potential costs: \$12 million in total estimated costs

Potential funder(s): DOI, USGS, NOAA, NPS, Government of Puerto Rico, DNER

Potential implementer(s): PRTC



NCR 33

Blue Shore Workforce Development

Create a locally sourced, skilled labor force to support recovery efforts in the short and long terms.

Potential benefits: Creates jobs, facilitates skill development, provides labor for recovery and restoration, and promotes more effective and efficient investment.

Potential costs: \$36 million in total estimated costs

Potential funder(s): EPA, USDA, DOC EDA, DOL

Potential implementer(s): Puerto Rico Department of Labor and Human Resources, DOC EDA

PBD 1

Compile a Public Buildings Inventory

Create a comprehensive, centralized database of buildings owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decision-making.

Potential benefits: Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decision-making and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

Potential costs: \$4 million in total estimated costs

Potential funder(s): PA, CDBG-DR, PRPB

Potential implementer(s): PRPB, PRIFA

PBD 3

Establish Integrated Services Centers

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

Potential benefits: Simplifies access to services for the population and streamlines maintenance processes.

Potential costs: \$10 million–\$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, USDA WIC

Potential implementer(s): Puerto Rico Department of State, PRPBA

PBD 15

Refurbish Community Centers and Community Technology Centers

Rebuild or refurbish 300 community centers in low-income communities and 172 community technology centers, including providing them with generators for backup power and building them to withstand hurricanes and earthquakes.

Potential benefits: Improves access to community services, including training, medical support, emergency shelter, and technology.

Potential costs: \$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR

Potential implementer(s): PRPB





Emergency services modernization and integration

CPCB 1

Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 2

Capacity Building for Community-Level Preparedness and Response

Develop and implement preparedness and response plans for 50–100 priority vulnerable communities that face particularly high risk during disasters. This action includes (1) recruiting, training, and equipping Community Emergency Response Teams (CERT) so that these communities can better sustain themselves during the response period, when emergency responders and access to the communities will be limited; and (2) establishing and maintaining a cache of emergency supplies—e.g., water filters and generators—for these communities.

Potential benefits: Puts into place fundamental preparedness and response capabilities at the state and municipal levels.

Potential costs: \$37 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, municipal governments



CPCB 3

Capacity Building to Incorporate Hazard Risk Reduction into Planning and Design

Strengthen hazard mitigation assessment, monitoring, and evaluation capabilities within the Puerto Rico Planning Board (PRPB) so that the board can promote the incorporation of risk reduction in all planning and design decisions. This action includes (1) enhancing GIS capabilities to generate hazard maps for each municipality to inform zoning decisions, and (2) hiring a risk officer for each of the 27 state-level agencies.

Potential benefits: Enables a standardized and systematic approach to hazard mitigation. Encourages a more data-driven implementation of Puerto Rico's hazard mitigation plan.

Potential costs: \$84 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR

Potential implementer(s): PRPB, infrastructure sectors

CPCB 4

Resilience Building in Collaboration with High-Risk Communities

Hire planners (on average 1.5 FTE per municipality) to develop and implement disaster response and recovery plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

Potential benefits: Builds community and individual resilience for both disaster response and long-term recovery

Potential costs: \$82 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS

Potential implementer(s): Government of Puerto Rico, municipal governments, local NGOs



CPCB 6 Public Information and Communication Capability for Coordinated Recovery

Build a Public Information and Communication (PIC) capability to maintain continued engagement with Puerto Rican communities in the recovery process. Establish and maintain methods of two-way communication with Puerto Rican residents about recovery planning and implementation. This action also includes establishing effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

Potential benefits: Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

Potential costs: \$8.8 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico

CPCB 7 Capacity Building for Emergency Shelter Planning

Hire planners in each municipality and at the state-level to build a more robust emergency shelter system. This action will develop parameters, standards, and general design guidelines for shelters that can better support residents over the longer-term. This action also will establish a protocol with the National Guard for effective management of response commodities for shelters.

Potential benefits: Improves access to safe and appropriately resourced shelters within a reasonable distance that can accommodate community needs, such as disabilities and medical conditions.

Potential costs: \$57 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, public buildings sector



CPCB 8
Strengthening Emergency Management Capacity at Municipalities

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. Work with existing MEMOs to identify personnel and training needs. With PREMA/FEMA, create a training curriculum that more directly addresses municipal needs. Work with the Office of Human Resources to update job descriptions, specific classifications, tasks and responsibilities of all municipal staff during an emergency and response event. Train MEMOs to collect better information about people requiring evacuation (e.g., disabled, elderly).

Potential benefits: Strengthens municipalities' emergency management and response capacity.

Potential costs: \$165 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, Municipal Emergency Management Offices

CPCB 10
Incentivize the Design of Creative Solutions to Addressing Disaster Hazards

Fund a design competition that fosters innovative solutions for risk reduction—specifically aimed at mitigating hazards, and including but not limited to hurricanes and flooding—while also offering added social or economic benefits to the community.

Potential benefits: Elicits original ideas, out-of-the-box solutions, and transdisciplinary approaches to mitigating disaster risks. Provides a valuable community-level perspective on existing problems and areas in need of improvement.

Potential costs: \$6 million in total estimated costs

Potential funder(s): HMPG, CDBG-DR, PREMA

Potential implementer(s): FEMA, PREMA, general public of Puerto Rico



CPCB 14

Building Grant Writing Capacity

Establish a set of 100 scholarships each year, for 5 years, for municipal government office workers and local NGO staff to receive ongoing training over a one-year period in grant writing from university-based certification programs (many of which are established in the mainland U.S.).

Potential benefits: Enables municipal government office workers to prepare competitive and compelling grant proposals to acquire funds for state-financed projects, including those in disaster recovery. Provides professional development for the governmental workforce and empowers members of the municipalities to seek solutions for their own communities.

Potential costs: \$14 million in total estimated costs

Potential funder(s): CDBG-DR, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipalities

CPCB 15

Strengthen Local Nonprofit and NGO Involvement in Disaster Recovery

Establish a unit within Puerto Rico's Office for the Socioeconomic and Community Development (ODSEC) to strengthen the engagement of local nonprofits and NGOs with government agencies and maximize their contributions as partners in the recovery process.

Potential benefits: Strengthens partnerships and drives more successful cross-sector collaboration. Improves coordination and communication among government agencies and NGOs and enhances resource allocation. Builds community resilience. Increases nonprofit and NGO capacity while helping them develop more long-term sustainable funding.

Potential costs: \$9 million in total estimated costs

Potential funder(s): CDBG-DR

Potential implementer(s): ODSEC, NGOs, local nonprofits



CPCB 16

Establishing a University-Based Center of Excellence for Disaster Preparedness and Recovery

Establish a Center of Excellence (COE) for Disaster Preparedness and Recovery at a university in Puerto Rico to (1) foster local, multidisciplinary research on disaster preparedness, response, and recovery; (2) develop innovative solutions to preparedness, resilience, hazard mitigation, and recovery problems; and (3) build preparedness, response, and recovery capacity in Puerto Rico through curriculum development and training.

Potential benefits: Translates knowledge on disaster preparedness and recovery to innovative and usable solutions. Increases university resources for research and teaching and fosters multidisciplinary and multiagency collaboration.

Potential costs: \$22 million–\$55 million in total estimated costs

Potential funder(s): CDBG-DR, private sector, nongovernment sources

Potential implementer(s): Universities, DHS S&T Directorate

ECN 3

Change Social Welfare and Benefits Policy

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

Potential benefits: Removes disincentives to work that have been created by the current system of benefit provision. Stimulates economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly

ECN 5

Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

Potential benefits: Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Legislative Assembly



ECN 25 **Establish National Dislocated Workers Assistance**

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with clean-up and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

Potential benefits: Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOL

Potential implementer(s): To be determined

HSS 20 **Improve Supports for the Elderly, Particularly Those Living Alone**

Provide pre-disaster support to seniors by investigating reimbursement policies for home care visits to allow greater independence and promote economic opportunities via continued support for Project 646. Encourage communities to participate in local emergency planning through activities such as community mapping that would help to identify people who might be at increased risk in a disaster, such as elderly who live alone.

Potential benefits: Increases the resiliency of the elderly population, including their ability to access aid or other needed supplies. Avoids the worsening of chronic conditions due to insufficient medicines or nutrition and promotes overall well-being.

Potential costs: \$62 million in total estimated costs

Potential funder(s): DHHS, OPPEA, PRDF

Potential implementer(s): OPPEA, PREMA

HSS 22 **Move to a More Regionally-Integrated Approach to Emergency Planning, Exercising, Response, and Recovery**

Create a disaster preparedness, response, and recovery network that will prepare hospitals and health care facilities to assist each other to surge during disasters. Hire 2 people in each of the 7 health regions to facilitate the regional planning and preparedness approach. Review and improve plans for ensuring power, water, oxygen and other critical supplies post-incident.

Potential benefits: Protects patients and communities from poor outcomes. Reduces morbidity and mortality. Ensures more efficient use of resources. Reduces costs.

Potential costs: \$9.6 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, CMS, ASES, PRDOH

Potential implementer(s): PRDOH, hospital system, other health care organizations



HSS 26

Review and Improve Systems for Stockpiling and Distributing Supplies and Pharmaceuticals Post-Disaster

Designate approximately 10 key health care facilities as Healthcare Disaster Resource Centers that would be equipped with extra supplies needed during a disaster.

Potential benefits: Avoids increased morbidity and mortality among electricity-dependent individuals. Makes emergency response supplies more readily available. Improves interagency coordination during and after a disaster.

Potential costs: \$23 million in total estimated costs

Potential funder(s): DHHS, PREMA, PRDOH

Potential implementer(s): PRDOH, PREMA

HSS 29

Revise Regulations on Food Stockpiling at Child- and Elder-Care Facilities

Require a minimum 14-day, healthy, shelf-stable food supply at all licensed facilities and provide guidance to facilities on stockpiling.

Potential benefits: Increases the availability of more nutritious foods post-disaster. Decreases the availability of salty and sugary foods.

Potential costs: To be determined

Potential funder(s): USDA, PRDF

Potential implementer(s): PRDF, child- and elder-care facilities

HSS 30

Review and Improve Plans, Systems, and Processes for Tracking and Responding to Physical and Mental Health Needs of First Responders

Deploy counselors and volunteers to provide monthly support services to first responders. Conduct a periodic (every 4 months for year 1; annually after) survey— Emergency Responder Health Monitoring and Surveillance (ERHMS)—to assess responder health needs and management of health symptoms.

Potential benefits: Lessens negative health impacts of the highly stressful circumstances of disaster response and recovery. Improves responder well-being and keeps responders prepared to attend to the needs of others.

Potential costs: \$18 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, PRDOH, nongovernment sources

Potential implementer(s): PRDOH, FEMA



HSS 34

Review and Improve Systems and Processes for Managing Volunteers and Donated Supplies

Track volunteers through a system such as the Emergency System for Advance Registration of Volunteer Health Professionals. Institute volunteer credentialing to ensure training and other competencies are up-to-date. Provide supports for volunteer capacity development and communication skills. Rent warehouse space for receiving and managing donated supplies. Contract specialized storage for receiving, managing and dispatching donated medications. Strengthen registries for inventorying donations.

Potential benefits: Facilitates quicker deployment of assets. Minimizes confusion and duplication of services. Helps match assets to areas of greatest needs.

Potential costs: \$4.1 million in total estimated costs

Potential funder(s): DHHS, Government of Puerto Rico

Potential implementer(s): PRDOH

MUN 5

Reduce Barriers to Transferring Property to Municipal Governments and Provide Technical Assistance

Reduce administrative barriers to transferring property (such as closed schools and other public buildings) to municipalities.

Potential benefits: Enables municipalities to more efficiently repurpose buildings to enhance the delivery of services to the public or stimulate economic development through public-private partnerships or municipal corporations. Reduces costs to the GPR associated with maintaining closed facilities, and reduces the potential blight and safety risks associated with closed buildings. Provides municipalities and the communities they serve with additional facilities at low cost. Returns previous public investments to active use.

Potential costs: \$2.7 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, SBA

Potential implementer(s): Government of Puerto Rico, municipal governments



MUN 6

Create and Maintain Central Repository of Municipal Assets and Associated Conditions

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

Potential benefits: Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

Potential costs: \$13 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipal mayors

NCR 1

Historic and Cultural Properties Preservation

Develop and implement an Island-wide Cultural Resources Management Plan and stabilization program to restore and protect resources, establish incentive programs and local historic districts to encourage private property preservation, and develop emergency plans for cultural institutions.

Potential benefits: Preserves historic buildings and collections; stabilizes property values; improves preparedness, shortens future recovery time, and prevents future losses from disasters; cost-effectively extends the lifespan of existing buildings; and ensures that cultural heritage will be accessible to communities.

Potential costs: \$64 million in total estimated costs

Potential funder(s): HMGP, DOI, Institute of Museum and Library Services, National Endowment for the Humanities, National Archives and Records Administration, Government of Puerto Rico

Potential implementer(s): SHPO, ICP, individual property owners



NCR 8

Increase Landfill Capacity to Dispose of Hurricane-Related Waste and to Properly Manage Future Waste

Increase landfill capacity, including building transfer stations, to meet the waste management needs of Puerto Rico. Meet the permitting and inspection needs to permit new landfills and inspect existing landfills.

Potential benefits: Meets Puerto Rico's landfill capacity needs and improves environmental quality and public health, with spillover benefits for municipal operations, the local economy, and tourism.

Potential costs: \$176 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities

NCR 9

Landfill Repair and Closure

Repair landfills and open dumps that sustained damage from the hurricanes and close unlined open dumps throughout Puerto Rico.

Potential benefits: Reduces or eliminates the impact of landfills on natural resources (including soil, air, and water quality) and helps bring lined landfills back into compliance. Benefits public health and the environment.

Potential costs: \$160 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), municipalities, Solid Waste Authority

NCR 10

Clean Up and Eliminate Illegal Dumps

Identify, sort, and recycle or dispose of waste at approximately 1,600–2,000 illegal dumps throughout Puerto Rico and identify steps to prevent future recurrence of illegal dumps.

Potential benefits: Removes environmental and public health threats associated with illegal open dumps and helps ensure the overall success of a sustainable solid waste management plan.

Potential costs: \$104 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, EPA, USDA

Potential implementer(s): DNER (EQB), EPA

NCR 13

Reduce Sediment Pollution and Risk from Landslides

Stabilize soils and slopes in critical areas across Puerto Rico that were impacted by landslides areas through vegetative, bioengineering, and structural approaches.

Potential benefits: Protects public safety and road access, reduces sedimentation-related water quality problems, restores native habitat for species, provides soil materials for other applications, and protects infrastructure and communities from future damage.

Potential costs: \$1.05 billion in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, USDA, USACE, DOT

Potential implementer(s): DNER, federal agencies



NCR 27
Expand Disaster Recovery Sister Cities Connections

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

Potential benefits: Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits as well as professional development, educational, and tourism opportunities.

Potential costs: \$13 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): Government of Puerto Rico, NGOs, communities

PBD 11
Bring Public Buildings up to Code

Assess building safety code compliance for wind, flood, and seismic risks across the public building inventory and retrofit buildings with the appropriate structural hardening, making other code upgrades where needed.

Potential benefits: Increases ability of public buildings to withstand extreme weather events and natural hazards, improves energy and water efficiency, and reduces building operational costs.

Potential costs: \$3 billion–\$7 billion in total estimated costs

Potential funder(s): PA, HMGP, Government of Puerto Rico, U.S. Department of Education Emergency Impact Aid

Potential implementer(s): Government of Puerto Rico

PBD 8
Mitigate Flood Risk for Critical Government Functions

Relocate critical public functions to buildings outside of flood hazard zones or elevate the building in which the critical function is housed to prevent service disruptions and reduce damages due to flooding.

Potential benefits: Ensures continuity of critical public services due to flooding and reduces costs of maintaining buildings in flood zones.

Potential costs: \$2 billion in total estimated costs

Potential funder(s): PA, HMGP, U.S. Department of Education

Potential implementer(s): PRPB



Agricultural modernization and processing

ECN 9

Invest in Agricultural Recovery Assistance

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

Potential benefits: Allows farmers and other agricultural workers to reestablish operations. Stimulates development of innovative and efficient farming practices and use of next-generation agricultural technology, improving profitability of agriculture and increasing exports.

Potential costs: \$1.8 billion in total estimated costs

Potential funder(s): USDA, CDBG-DR

Potential implementer(s): Puerto Rico Department of Agriculture

ECN 18

Compensate Farmers for Crop Losses

Compensate farmers directly for crop losses due to the hurricanes.

Potential benefits: Replaces lost income and increases consumption across all sectors of the economy.

Potential costs: \$250 million in total estimated costs

Potential funder(s): USDA

Potential implementer(s): USDA, Puerto Rico Department of Agriculture

ECN 40

Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology driven agro-innovation to integrate veterans, youth, and marginalized populations into ag business opportunities.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by helping to increase the number of farmers in Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): FEMA, NOAA, DOI, EPA, USDA Rural Development, HUD

Potential implementer(s): To be determined

ECN 41

Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide Revolving Loan Funds to expand farmer access to capital and encourage innovation and ag modernization.

Potential benefits: Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): EDB



ECN 42 **PRIDCO Agriculture Parks**

Convert undeveloped PRIDCO Parks to host state of the art controlled environment agriculture infrastructure available, including hydroponics and aquaculture, for private lease using same current landlord model.

Potential benefits: Helps attract young entrepreneurs to ag industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the Economic Development Bank (EDB). Controlled environment ag can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

Potential costs: \$100 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined

ECN 43 **Ag Industry Support**

Change the current model of the PRDA Agrological Laboratory to a P3 with greater resources to enable it to communicate effectively and in a timely manner with farmers and better serve its intended function as a support resource to enable optimal farm-level decision making.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by advising on better ag practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

Potential costs: \$27 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined



Digital transformation

As the actions within the communications/IT, energy, and other infrastructure capital investment priorities are necessary pre-requisites for Digital Transformation, they are not duplicated here.

CPCB 1 Disaster Preparedness Data Analysis and Decision Support Capability

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 6 Public Information and Communication Capability for Coordinated Recovery

Build a Public Information and Communication (PIC) capability to maintain continued engagement with Puerto Rican communities in the recovery process. Establish and maintain methods of two-way communication with Puerto Rican residents about recovery planning and implementation. This action also includes establishing effective communication with Puerto Rican communities on the mainland to better understand whether and when people decide to return to Puerto Rico for recovery planning purposes.

Potential benefits: Allows the Government of Puerto Rico to communicate more clearly with the public, thus increasing transparency and improving public trust.

Potential costs: \$8.8 million in total estimated costs

Potential funder(s): CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico

ECN 35

Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses.

Potential benefits: Provides financing to businesses in the communities served by the BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector, private equity

Potential implementer(s): SBA

EDU 2

Improve Longitudinal Data System to Support Evidence-Based Policy

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K-12 data to post-secondary outcomes and workforce data to better manage school-to-work transitions.

Potential benefits: Supports decisions by teachers and administrators in everyday practice, and helps inform students and their parents. Supports timely data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

Potential costs: \$7.7 million in total estimated costs

Potential funder(s): U.S. Department of Education (SLDS Grant Program), nongovernment sources

Potential implementer(s): PRDE



EDU 7

Augment Tele-Education/ Online Education

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners

HSS 4

Improve Surveillance of Waterborne Disease

Increase the robustness of the surveillance system for waterborne disease by (1) ensuring that equipment is operational through QA/QC, (2) developing communication tools, and (3) establishing interagency partnerships.

Potential benefits: Reduces the transmission of infectious pathogens and harmful chemicals and toxins in the water system.

Potential costs: \$2.8 million–\$2.9 million in total estimated costs

Potential funder(s): EPA Water Finance Clearinghouse

Potential implementer(s): PRDOH, PRASA, CDC

HSS 33

Review and Improve Systems for Administration and Finance of Response-Related Activities

Implement temporary waivers for a range of emergency health service needs, including, but not limited to, authorization, payment deadlines, prescription coverage, enrollment, and mortuary services.

Potential benefits: Ensures uninterrupted access to care post-disaster. Prevents potential delays in time-sensitive care.

Potential costs: \$8.1 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS, Government of Puerto Rico, nongovernment sources

Potential implementer(s): ASES, DHHS, CMS

MUN 6

Create and Maintain Central Repository of Municipal Assets and Associated Conditions

Collect or update data on municipal assets. Create and maintain a central database of this information, including documentation of property condition.

Potential benefits: Helps municipalities and the Government of Puerto Rico identify, manage, and maintain assets. Helps with filing claims with the federal government for damage repair. Enables more efficient budgeting and disaster mitigation. Facilitates leveraging resources and utilization of assets.

Potential costs: \$13 million in total estimated costs

Potential funder(s): CDBG-DR, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Government of Puerto Rico, municipal mayors

MUN 17**Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations**

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

Potential benefits: Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

Potential costs: \$3.5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Government of Puerto Rico, municipal governments

NCR 3**General Archives Mitigation and Modernization**

Protect essential government records and other collections in the Archivo General de Puerto Rico through architecture/engineering planning and design.

Potential benefits: Preserves historical records and collections, reinvests in existing buildings and infrastructure, and protects historic character of San Juan, with benefits to community and tourism.

Potential costs: \$11.5 million in total estimated costs

Potential funder(s): National Archives' National Historical Publications and Records Commission, Government of Puerto Rico, private sector, nongovernment sources

Potential implementer(s): ICP



21st Century workforce

ECN 12 **Provide Innovation and Entrepreneurial Training**

Reinvigorate innovation and research in Puerto Rico by implementing a model and initiatives developed by Georgia Tech. The model consists of three strategies: bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

Potential benefits: Generates young, trained entrepreneurs who can start businesses that will produce goods and services for export; promotes public-private partnerships; and creates job opportunities.

Potential costs: \$26 million in total estimated costs

Potential funder(s): DOC EDA, NSF

Potential implementer(s): Georgia Tech or similar university, Puerto Rican universities, PRDE, PRSTRT, Grupo Guayacan, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante

ECN 13 **Develop PRIDCO's Abandoned Buildings for Business Incubators**

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

Potential benefits: Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

Potential costs: Amount will vary

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO, SBA

Potential implementer(s): PRIDCO

ECN 21

Study Hurricane Impacts on the Local Economy

Conduct an analysis of the main effects of Hurricane Maria on the local economy of Puerto Rico, as suggested in the Build Back Better plan. Prepare and evaluate economic estimates of the damages to the overall economy as well as by sector. Track recent demographic changes in the local economy, including movement of persons.

Potential benefits: Enables local businesses to plan better for the future and make strategic, efficient investments to stimulate growth. Helps provide a basis for the government to use in estimating revenues and in fiscal planning, including infrastructure planning.

Potential costs: \$300,000 in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): Private sector firm or university

ECN 23

Implement Job Creation Initiative

Create jobs within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

Potential benefits: Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

Potential costs: \$80 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, DOL

Potential implementer(s): To be determined

ECN 25

Establish National Dislocated Workers Assistance

Provide funding through Disaster Dislocated Worker Grants to create temporary employment opportunities to help with clean-up and recovery efforts. This funding is provided to areas declared eligible for public assistance by FEMA or other federal agencies.

Potential benefits: Creates temporary jobs that will provide income to workers who lost their sources of income due to the hurricanes, promotes economic activity, and supplies workers who can assist in the cleanup and rebuilding efforts.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOL

Potential implementer(s): To be determined

ECN 26

Conduct Studies for Workforce Development and Rapid Response

Assess available labor supply and demand for workers with various skills to determine need for training and to better align available workers with needs of local employers.

Potential benefits: Helps local businesses better understand the available labor supply; helps government decisionmakers modify its workforce development efforts and develop strategies to better align labor supply with labor demand.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Private sector firm or university



ECN 28 **Implement Initiative to Promote Entrepreneurship**

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The System will be established by the Government of Puerto Rico but managed by an organization outside the government.

Potential benefits: Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, in the hope of encouraging them to start operations.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 35 **Establish Business and Industrial Development Corporations (BIDCOs)**

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses.

Potential benefits: Provides financing to businesses in the communities served by the BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector, private equity

Potential implementer(s): SBA

EDU 1 **Create New—and Enhance Existing—After-School and Summer Learning Opportunities**

Expand existing—and implement new—summer and after-school learning programs, including academic, health, nutrition, and mental health services, to address post-hurricane learning loss and provide consistency to snack or meal programs that are offered as part of these programs.

Potential benefits: Promotes faster recovery in student achievement from post-hurricane learning loss, a stronger sense of stability, better understanding of students' health and mental health needs, and creates a source of employment for young Puerto Ricans as summer and after-school instructors.

Potential costs: \$3.9 billion in total estimated costs

Potential funder(s): U.S. Department of Education, USDA, nongovernment sources

Potential implementer(s): PRDE, U.S. Department of Education, USDA Summer Food Program

EDU 2**Improve Longitudinal Data System to Support Evidence-Based Policy**

Complete prior work to develop a longitudinal data system. Provide training on how to integrate data into operations and decisionmaking. Link K-12 data to post-secondary outcomes and workforce data to better manage school-to-work transitions.

Potential benefits: Supports decisions by teachers and administrators in everyday practice, and helps inform students and their parents. Supports timely data-driven decisions about school closures, reallocation of teachers and students to consolidated schools, resource allocation, and targeted professional development.

Potential costs: \$7.7 million in total estimated costs

Potential funder(s): U.S. Department of Education (SLDS Grant Program), nongovernment sources

Potential implementer(s): PRDE

EDU 6**Expanding and Updating K-12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K-12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

Potential benefits: Helps build a skilled labor force for sectors key to Puerto Rico's recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K-12 schools and universities.

Potential costs: \$3 billion in total estimated costs

Potential funder(s): U.S. Department of Education, NSF, DoD, NIH, DOL, P3, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

Potential implementer(s): PRDE, schools, private industry

**EDU 7****Augment Tele-Education/
Online Education**

Provide “emergency instruction” in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE’s initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners

EDU 8**Strengthen School Leadership
Pipeline**

Strengthen the school director and district leader pipeline by improving recruitment, embedded training, support (e.g., mentoring, coaching), and retention practices.

Potential benefits: Positively impacts student learning. Reduces teacher and leadership turnover. Improves understanding of local education needs. Improves communication between schools and regional administrators. Increases capacity to function within newly-decentralized system.

Potential costs: \$290 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, principal training programs

Potential implementer(s): PRDE, professional development partners

EDU 9**Develop and Implement
Teacher Pipeline Program**

Improve teacher preparation programs and instructional practice by (1) creating a residency model for teacher training, (2) reviewing teacher certification requirements, (3) aligning personnel decisionmaking processes with assessment of teacher quality, (4) strengthening teacher supports and career pathways, and (5) rewarding high-quality teachers working in demanding environments.

Potential benefits: Develops a pipeline of teachers who can engage in high-quality instruction and support others in improving their practice. Reduces teacher turnover and promotes a closer relationship between K-12 schools and UPR.

Potential costs: \$350 million in total estimated costs

Potential funder(s): U.S. Department of Education

Potential implementer(s): PRDE, UPR, professional development partners, schools



Entrepreneurship

ECN 3

Change Social Welfare and Benefits Policy

Modify the distribution of social welfare benefits and income by altering policies pertaining to eligibility for social welfare benefits, such as Medicaid and the Nutrition Assistance Program. Examples include establishing work requirements, using income tax credits to eliminate thresholds for eligibility, and lowering individual income tax rates to stimulate consumption.

Potential benefits: Removes disincentives to work that have been created by the current system of benefit provision. Stimulates economy by encouraging consumption. Improves fiscal spending by reducing benefit payments.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly

ECN 5

Improve Retention of Educated Workforce Through Policy Change

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

Potential benefits: Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Legislative Assembly

ECN 7

Create Research Centers and Partnerships

Create research centers and partnerships across a variety of disciplines, for example, agricultural partnerships with universities; specialized research centers in technology, biotechnology, and marine economics; and a center devoted to developing and using blockchain technology.

Potential benefits: Leverages the intellectual capital of Puerto Rico to stimulate technological development that will potentially increase productivity across diverse sectors of the economy.

Potential costs: \$110 million in total estimated costs

Potential funder(s): Federal agencies

Potential implementer(s): Universities, private industry

ECN 11

Medical Tourism Initiative

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

Potential benefits: Stimulates economic activity from tourist spending, and may reverse the departure of medical professionals from Puerto Rico.

Potential costs: \$8 million in total estimated costs

Potential funder(s): CDBG-DR, private sector, nongovernment sources

Potential implementer(s): PRTC, DEDC



ECN 13
Develop PRIDCO's Abandoned Buildings for Business Incubators

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

Potential benefits: Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

Potential costs: To be determined

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO, SBA

Potential implementer(s): PRIDCO

ECN 14
Direct Small Business Investment

Provide small grants to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

Potential benefits: Allows businesses to reestablish operation, rebuild, recover, and grow, as well as becoming more resilient to disasters and able to plan for continued growth with more confidence.

Potential costs: \$2.7 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): SBA

ECN 28
Implement Initiative to Promote Entrepreneurship

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The System will be established by the Government of Puerto Rico but managed by an organization outside the government.

Potential benefits: Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, in the hope of encouraging them to start operations.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 34
Create Business Resiliency Hubs

Create business resiliency hubs (BRH) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communications systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

Potential benefits: Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

Potential costs: \$4 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): To be determined



ECN 35

Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses.

Potential benefits: Provides financing to businesses in the communities served by the BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector, private equity

Potential implementer(s): SBA

CPCB 4

Resilience Building in Collaboration with High-Risk Communities

Hire planners (on average 1.5 FTE per municipality) to develop and implement disaster response and recovery plans in collaboration with 50–100 selected communities. This action includes (1) investments into programs—e.g., workforce development, microfinance, education—that address long-term stressors, as well as the improvement of essential services; and (2) resilience building events for community residents and local businesses, including fostering connections among governmental agencies, community groups, and NGOs.

Potential benefits: Builds community and individual resilience for both disaster response and long-term recovery

Potential costs: \$82 million in total estimated costs

Potential funder(s): CDBG-DR, DHHS

Potential implementer(s): Government of Puerto Rico, municipal governments, local NGOs



EDU 6 **Expanding and Updating K-12 Vocational Programs**

Implement a one-year pilot program and subsequent full-scale program to expand and update K-12 vocational programs to include entrepreneurship training and accommodate growth in economic sectors such as manufacturing, finance, renewable energy, construction, hospitality, and health care.

Potential benefits: Helps build a skilled labor force for sectors key to Puerto Rico's recovery. Helps address the needs of those disproportionately affected by disasters. Helps create and/or strengthen private-public consortiums to support long-term recovery. Creates closer ties between K-12 schools and universities.

Potential costs: \$3 billion in total estimated costs

Potential funder(s): U.S. Department of Education, NSF, DoD, NIH, DOL, P3, DEDC, Puerto Rico Department of Labor and Human Resources, nongovernment sources

Potential implementer(s): PRDE, schools, private industry

EDU 7 **Augment Tele-Education/ Online Education**

Provide "emergency instruction" in the event of a school closure of more than 2 weeks. This action includes building an online repository of free open educational resources, available in English and Spanish and appropriate for various subject areas, grade levels (K-12), and technology platforms.

Potential benefits: Compensates for loss of instructional time due to school closures of all types. Provides a supplemental remedial instructional resource. Increases access to instruction in advanced STEM areas. Builds on PRDE's initiative to integrate technology into the classroom.

Potential costs: \$22 million in total estimated costs

Potential funder(s): U.S. Department of Education, philanthropic foundations, corporate sponsorships

Potential implementer(s): PRDE, professional development partners



Advanced manufacturing

ECN 5 **Improve Retention of Educated Workforce Through Policy Change**

Decrease the proportion of college students and educated workers who are leaving Puerto Rico by adopting policies that create incentives to stay.

Potential benefits: Increases retention of those who would otherwise migrate after completing their studies and increases production of goods and services through enhanced labor quality.

Potential costs: To be determined

Potential funder(s): To be determined

Potential implementer(s): Legislative Assembly

ECN 8 **Define and Develop Economic Development Zones**

Define geographically distinct economic development zones and establish policies to provide benefits, such as tax advantages and waivers of particular regulations.

Potential benefits: Incentivizes particular types of economic activity in specific areas, which in turn, increases the level of economic activity and employment.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): Puerto Rico Executive Branch, Legislative Assembly

ECN 9 **Invest in Agricultural Recovery Assistance**

Provide a direct investment in recovery assistance to farming efforts. This action targets poultry; dairy milking; livestock breeding; specialty animals; and horticulture, including vegetables and tubers, grain production, orchards (fruit and nut trees), melons, and coffee facilities.

Potential benefits: Allows farmers and other agricultural workers to reestablish operations. Stimulates development of innovative and efficient farming practices and use of next-generation agricultural technology, improving profitability of agriculture and increasing exports.

Potential costs: \$1.8 billion in total estimated costs

Potential funder(s): USDA, CDBG-DR

Potential implementer(s): Puerto Rico Department of Agriculture

ECN 10 BLUEtide Initiative

Develop a whole-island approach to coastal resources management for disaster mitigation and resilience, workforce development, and advanced manufacturing. Start a marine business innovation and research center and an incubator network to develop ocean-related technologies. Leverage waterborne infrastructure to support sports anglers, tourism, bio-compound extraction, aquaculture, policy, and enforcement.

Potential benefits: Increases tourism, international competitiveness, economic growth, and food security while diversifying the economic drivers of the Island and preventing future hurricane damage.

Potential costs: \$200 million–\$300 million in total estimated costs

Potential funder(s): CDBG-DR, FEMA, DOC EDA, NOAA, DOI, EPA, USDA, NGOs

Potential implementer(s): FEMA, DOC EDA, NOAA, DOI, EPA, USDA, HUD, DEDC, DNER, PRSTRT, municipal governments, NGOs

ECN 11 Medical Tourism Initiative

Establish and fund a not-for-profit Medical Tourism Corporation (MTC) to be run by the Destination Management Organization. Continue to fund the MTC until it becomes self-sustaining. Consider including an initiative to retain local health care workers.

Potential benefits: Stimulates economic activity from tourist spending, and may reverse the departure of medical professionals from Puerto Rico.

Potential costs: \$8 million in total estimated costs

Potential funder(s): CDBG-DR, private sector, nongovernment sources

Potential implementer(s): PRTC, DEDC

ECN 12 Provide Innovation and Entrepreneurial Training

Reinvigorate innovation and research in Puerto Rico by implementing a model and initiatives developed by Georgia Tech. The model consists of three strategies: bring talented workers into startup and research teams, screen the teams to identify those with strong potential, and scale up high-potential startup teams.

Potential benefits: Generates young, trained entrepreneurs who can start businesses that will produce goods and services for export; promotes public-private partnerships; and creates job opportunities.

Potential costs: \$26 million in total estimated costs

Potential funder(s): DOC EDA, NSF

Potential implementer(s): Georgia Tech or similar university, Puerto Rican universities, PRDE, PRSTRT, Grupo Guayacan, DEDC, PRiMEX, Small Business Technology Development Center, Echar Pa'lante

ECN 13 Develop PRIDCO's Abandoned Buildings for Business Incubators

Find tenants to occupy abandoned PRIDCO-owned buildings, ideally entrepreneurs seeking to develop business incubators who will benefit from reduced operating costs and the capacity building that can result from networking with other startup entrepreneurs.

Potential benefits: Avoids neighborhood blight, improves ease of doing business, and provides opportunities for communities as well as for startups. Creates community anchor points for business development.

Potential costs: To be determined

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO, SBA

Potential implementer(s): PRIDCO



ECN 14

Direct Small Business Investment

Provide small grants to small businesses, startups, and entrepreneurs affected by the hurricanes to ensure they can continue to grow. Grants would cover working capital assistance, inventory losses, equipment and fixture replacement costs, hurricane repairs, and mitigation projects.

Potential benefits: Allows businesses to reestablish operation, rebuild, recover, and grow, as well as becoming more resilient to disasters and able to plan for continued growth with more confidence.

Potential costs: \$2.7 billion in total estimated costs

Potential funder(s): CDBG-DR, DOC EDA

Potential implementer(s): SBA

ECN 17

Construct the Puerto Rico Science, Technology, & Research Trust's Research and Development Center at Science City

Construct the Forward Center—the research, development, and prototyping facility for the proposed Puerto Rico Science, Technology, and Research Trust—at Science City. This effort represents one of Puerto Rico's Comprehensive Economic Development Strategy approaches.

Potential benefits: Provides science and technology companies, such as Boston Scientific, space to expand their research and development efforts, while helping to move Puerto Rico to the forefront of innovation. Establishes new co-working space for other high-tech ventures that have arisen from Parallel18 Ventures.

Potential costs: \$6 million in total estimated costs

Potential funder(s): DOC EDA, Opportunity Zone Funds (once established), New Markets Tax Credits

Potential implementer(s): DEDC

ECN 23

Implement Job Creation Initiative

Create jobs within or near communities hardest hit by job loss and structural damage due to Hurricanes Irma and Maria. Target job creation efforts toward women and young adults, focusing on social and physical reconstruction projects.

Potential benefits: Helps rebuild communities, restore jobs, decrease the rate of unemployment, strengthen the local economy, and build resilience.

Potential costs: \$80 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR, DOL

Potential implementer(s): To be determined

ECN 24

Revitalize the PR-127 Petrochemical Corridor in Guyanilla-Peñuelas

Undertake cleanup and revitalization of contaminated former petrochemical zone.

Potential benefits: Allows development of new industries that focus on production of next-generation renewable energy resources and products and that support microalgae-based pharmaceutical manufacturing, and responsible recycling industries.

Potential costs: \$30 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 28

Implement Initiative to Promote Entrepreneurship

Establish a Business and Entrepreneurial Intelligence System to provide statistics, information, and data to simplify preparation of business plans, strategies, and market studies. The System will be established by the Government of Puerto Rico but managed by an organization outside the government.

Potential benefits: Allows potential business owners to view the investment and business climate and opportunities in Puerto Rico more clearly, in the hope of encouraging them to start operations.

Potential costs: \$50 million in total estimated costs

Potential funder(s): DOC EDA, CDBG-DR

Potential implementer(s): DEDC

ECN 29

Design Puerto Rico Resiliency/Rebuild/Open for Business Campaign

Design and launch marketing strategy to inform the world that Puerto Rico is ready to resume receiving tourists and inviting visitors to see that the natural resources have been preserved and that the tourism industry is ready to serve them.

Potential benefits: Fills information gaps and promotes tourism to Puerto Rico, which will lead to enhanced exports and economic development. May complement private initiatives.

Potential costs: \$67 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): PRTC, DEDC

ECN 34

Create Business Resiliency Hubs

Create business resiliency hubs (BRH) in areas not prone to flooding to provide space for business operations after a disaster. Obtain satellite communications, if feasible, to enhance resiliency of communications systems. These BRHs would be community facilities, possibly closed schools, built to code, with sufficient backup generating capacity and fuel supply for the response phase of a disaster.

Potential benefits: Helps businesses survive and recover from disasters by assisting with continuity of operations, enabling them to communicate with employees, customers, and vendors.

Potential costs: \$4 million in total estimated costs

Potential funder(s): DOC EDA

Potential implementer(s): To be determined

ECN 35

Establish Business and Industrial Development Corporations (BIDCOs)

Establish BIDCOs, i.e., state-chartered private lending institutions designed to help businesses that conventional lenders consider too high-risk and that lack the high growth potential to attract venture capitalists. BIDCOs obtain their funding by selling the guaranteed portions of their government loans on the secondary market and subsequently re-lending their earnings to other businesses.

Potential benefits: Provides financing to businesses in the communities served by the BIDCO that could not otherwise obtain financing, thereby saving and/or creating jobs.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, SBA, private sector, private equity

Potential implementer(s): SBA



ECN 38

Redevelop Former Roosevelt Roads Naval Station

Redevelop the former Roosevelt Roads naval station to include housing, mixed-use retail establishments, industrial parks, and maritime and air transportation. Redevelopment will require a spectrum of investment partners to help with the required infrastructure developments.

Potential benefits: Results in economic growth, stabilization, and expansion in the surrounding communities.

Potential costs: \$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, PRIDCO

Potential implementer(s): DEDC, private developers

ECN 40

Center of Excellence for Agricultural Technologies Training

Establish a fully operational agricultural training center to catalyze applied technology driven agro-innovation to integrate veterans, youth, and marginalized populations into ag business opportunities.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by helping to increase the number of farmers in Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): FEMA, NOAA, DOI, EPA, USDA Rural Development, HUD

Potential implementer(s): To be determined

ECN 41

Agricultural Financial Support for Access to Capital

Establish an Agricultural Enterprise program in the Economic Development Bank (EDB) exclusively for agricultural innovation enterprises supported by federal programs that provide Revolving Loan Funds to expand farmer access to capital and encourage innovation and ag modernization.

Potential benefits: Helps increase the number and productivity of farmers in Puerto Rico while contributing to hurricane mitigation and food security by encouraging innovation.

Potential costs: \$5 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): EDB

ECN 42

PRIDCO Agriculture Parks

Convert undeveloped PRIDCO Parks to host state of the art controlled environment agriculture infrastructure available, including hydroponics and aquaculture, for private lease using same current landlord model.

Potential benefits: Helps attract young entrepreneurs to ag industry to help achieve critical mass, especially when combined with the technical expertise of the Center of Excellence and Operational Capital provided by the Economic Development Bank (EDB). Controlled environment ag can reduce climate vulnerability, overcome land constraints, and increase food security and exports.

Potential costs: \$100 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined

ECN 43**Ag Industry Support**

Change the current model of the PRDA Agrolological Laboratory to a P3 with greater resources to enable it to communicate effectively and in a timely manner with farmers and better serve its intended function as a support resource to enable optimal farm-level decision making.

Potential benefits: Contributes to human capital development, hurricane mitigation and food security by advising on better ag practices. May also increase and optimize the technical resources needed to improve the productivity of agriculture.

Potential costs: \$27 million in total estimated costs

Potential funder(s): CDBG-DR, USDA Rural Development, DOC EDA

Potential implementer(s): To be determined

CPCB 1**Disaster Preparedness Data Analysis and Decision Support Capability**

Enhance disaster-related data analysis and decision support capability within PREMA to support both disaster preparedness and hazard mitigation activities. This action includes collecting and analyzing data on hazards, environmental risks, housing, infrastructure, economic barriers, preparedness, etc. by geography (municipality or smaller) and disseminating this information to planners in PREMA, other state-level agencies, and municipalities.

Potential benefits: Allows the government of Puerto Rico to make informed choices about how to efficiently and effectively spend available funds to improve disaster preparedness.

Potential costs: \$21 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA

Potential implementer(s): Government of Puerto Rico, municipal governments

CPCB 8**Strengthening Emergency Management Capacity at Municipalities**

Establish Municipal Emergency Management Offices in municipalities where they do not yet exist. Work with existing MEMOs to identify personnel and training needs. With PREMA/FEMA, create a training curriculum that more directly addresses municipal needs. Work with the Office of Human Resources to update job descriptions, specific classifications, tasks and responsibilities of all municipal staff during an emergency and response event. Train MEMOs to collect better information about people requiring evacuation (e.g., disabled, elderly).

Potential benefits: Strengthens municipalities' emergency management and response capacity.

Potential costs: \$165 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, PREMA, Government of Puerto Rico, municipalities

Potential implementer(s): FEMA, PREMA, Municipal Emergency Management Offices

EDU 10**Develop and Implement a Parent Education Program on School Choice**

Develop outreach and public education programs, with special emphasis on disadvantaged families, to ensure that all parents and guardians have the knowledge and tools they need to be effective consumers in a school-choice environment.

Potential benefits: Improves parents' knowledge about their school choices, while also making parents and families happier and more invested in their chosen schools.

Potential costs: \$5.7 million in total estimated costs

Potential funder(s): U.S. Department of Education, PRDE, nongovernment sources

Potential implementer(s): PRDE (Family Engagement Office)



HSS 3 Implement Integrated Waste Management Program and Expand Programs to Increase Recycling Rates

Establish an integrated materials recovery and waste management program and increase the proportion of waste that is diverted from landfills. This action includes a comprehensive waste characterization and cost analysis, enforceable recycling and composting mandates, and public education.

Potential benefits: Creates a waste management program that would decrease negative health impacts across Puerto Rico.

Potential costs: \$6.4 million in total estimated costs

Potential funder(s): EPA, DHHS, nongovernment sources

Potential implementer(s): EPA, Quadratec Cares Energize the Environment Grant Program, DHHS

HSS 9 Increase Access to Telehealth Options as Telecommunication Supports Become More Robust

Expand the use of telehealth across Puerto Rico and train the health care workforce in its use, including mental health. This action includes using social media to screen and enroll more geographically isolated populations in services, and using phone and online applications to target those with trauma-related mental illness.

Potential benefits: Provides greater access to specialty care for rural, hard-to-reach populations, and quicker networking and best-practice sharing among health care professionals in an emergency.

Potential costs: \$21 million in total estimated costs

Potential funder(s): FCC, NIH, Medicaid 1115 waivers

Potential implementer(s): Health care providers, mental health care providers

HSS 10 Expand Care for Trauma and Chronic Stress

Expand the number of people and places (e.g., schools and other community centers) where people can get both long-term and immediate assistance for acute trauma and chronic stress. This action includes training nonprofessionals, such as health and physical education teachers, in supportive emotional well-being services.

Potential benefits: Improves quality of care outcomes for traumatic stress and addresses the mental health care provider shortage and distribution issues.

Potential costs: \$8.4 million in total estimated costs

Potential funder(s): DHHS SAMHSA grants, nongovernment sources

Potential implementer(s): Mental health providers

HSS 11 Add Incentives and Other Supports to Increase and Retain Supply of Health Care Providers and Public Health Practitioners

Use incentives and loan repayment programs to ensure that Puerto Rico has a robust and stable health care provider and public health practitioner workforce, including primary care providers, specialists, and mental health practitioners, for both disaster-related health issues and also for the long-term.

Potential benefits: Helps retain high-quality talent in health care, and creates communities of practitioners that can better serve their populations due to work satisfaction.

Potential costs: \$39 million in total estimated costs

Potential funder(s): DHHS HRSA, Government of Puerto Rico, nongovernment sources

Potential implementer(s): Puerto Rican universities, associated hospitals and health care facilities

HSS 19

Create Flex-Funding for Social Service Centers

Assess the social service center facility and develop an inventory of critical facilities and also a set of eligibility criteria. Create a flexible funding mechanism to assist critical facilities, such as domestic violence and homeless shelters and child- and elder-care facilities, in bearing the costs of long periods of generator use post-disaster.

Potential benefits: Avoids facility closures due to loss of fuel. Allows for continuity of service provision to populations disproportionately affected by disaster. Reduces the need to relocate shelters.

Potential costs: \$11 million–\$980 million in total estimated costs

Potential funder(s): U.S. Department of Energy, PREMA, PREPA, DHHS ACF, private sector

Potential implementer(s): PRDF, PREMA

MUN 10

Provide Technical Assistance to Improve Municipal Finances by Generating Additional Revenues, Reducing Costs, and Balancing Budgets

Design and implement technical assistance programs to help municipalities find innovative ways to improve their finances by generating more revenue, cutting unnecessary costs, increasing productivity, and improving their ability to forecast revenue and spending.

Potential benefits: Helps municipalities balance their budgets. Improves their capacity to function and deliver services. Leads to improved fiscal situation throughout Puerto Rico.

Potential costs: \$6 million in total estimated costs

Potential funder(s): CDBG-DR, SBA

Potential implementer(s): Independent research partner, municipal governments

MUN 17

Provide Municipalities with Technical Assistance and Support for Best Practices in Public Management and Operations

Provide municipal governments with technical assistance and other forms of support to implement best practices in public management including human resources and fiscal issues. Improve municipal workforces by standardizing salary rates, position descriptions, and qualification requirements and by providing professional development and training.

Potential benefits: Improves public management at the municipal level by promoting best practices in core operations. Improves ability of municipal governments to provide an array of services maintaining fiscal well-being. Leads to a more highly skilled, professional workforce.

Potential costs: \$3.5 million in total estimated costs

Potential funder(s): CDBG-DR, DOL

Potential implementer(s): Government of Puerto Rico, municipal governments



NCR 2 **Arts Recovery**

Implement an integrated strategy to help artists and arts organizations recover while supporting Puerto Rico's economic and emotional recovery. Options include recovery grants, workspaces, global arts exchange programs, preparedness and recovery training, an arts tourism service sector, and arts outreach to facilitate community recovery.

Potential benefits: Helps artists and arts organizations resume practice and livelihoods, reduces future recovery costs and time, and promotes sustainability and resiliency of the arts.

Potential costs: \$10 million in total estimated costs

Potential funder(s): DOC EDA, Institute of Museum and Library Services, National Endowment for the Humanities, and National Archives and Records Administration, private sector, nongovernment sources

Potential implementer(s): Government of Puerto Rico, Heritage Emergency Task Force

NCR 7 **Develop Partner Networks for Recovering Plant and Animal Species**

Grow a comprehensive network of partners to work together to help fund actions for plant and animal species preservation, develop human capital and capacity in species management, educate the public, and cultivate experiential/tourism opportunities. Such partners would include federal and state-level agencies, local government, NGOs, universities, and private sector partners.

Potential benefits: Improves management of plant and animal species, helps prevent species from becoming extinct, and expands and enhances educational, tourism, and other economically beneficial opportunities.

Potential costs: \$100,000 in total estimated costs

Potential funder(s): DOI, USFS, NRCS, USDA, DNER, Government of Puerto Rico, municipalities, private sector, nongovernment sources

Potential implementer(s): DNER, federal agencies, University of Puerto Rico, NGOs

NCR 11**Establish a Long-Term, Sustainable, Integrated Solid Waste Management Program**

Implement an updated Solid Waste Management Plan to address disaster debris management and changes to waste streams after disasters, including diverting organic and recyclable waste from landfills.

Potential benefits: Extends the life of landfills, helps ensure a sustainable, economically viable, and compliant solid waste management plan, reduces waste going to unlined landfills, provides economic opportunities, and improves soil for agriculture.

Potential costs: \$263 million in total estimated costs

Potential funder(s): CDBG-DR, USDA, P3

Potential implementer(s): DNER (EQB), EPA, USDA

NCR 14**Water Quality Improvements at the Watershed Scale to Protect Human Health, Infrastructure, Freshwater, and Marine Environments**

Implement watershed restoration and management strategies in four priority watersheds (Arecibo, San Juan Metropolitan Area, Cabo Rojo/Guánica, and Northeast Corridor) and sensitive coastal areas.

Potential benefits: Reduces the potential for excessive sedimentation from future storm runoff, reduces pollution in waterways, improves soil retention, reduces landslide risk, maintains reservoir storage capacity, provides ecological corridors, improves water quality, and restores coastal areas.

Potential costs: \$142 million in total estimated costs

Potential funder(s): HMGP, CDBG-DR, NRCS EQIP, EPA, DOI, NOAA, EQB State Revolving Fund

Potential implementer(s): DNER, federal agencies

NCR 27**Expand Disaster Recovery Sister Cities Connections**

Establish plans for twinning Puerto Rican cities with other disaster-affected cities around the world to promote professional exchange about disaster recovery and preparedness, as well as general cultural and economic exchange.

Potential benefits: Promotes sharing of lessons learned elsewhere, helps ensure continued success of Puerto Rico's recovery effort, and provides economic benefits as well as professional development, educational, and tourism opportunities.

Potential costs: \$13 million in total estimated costs

Potential funder(s): To be determined

Potential implementer(s): Government of Puerto Rico, NGOs, communities

NCR 28**Identify Funding for Natural and Cultural Resources Research**

Establish a public-private fund for innovative scientific research that supports recovery goals and enhances understanding of the effects of the hurricanes.

Potential benefits: Encourages innovative and multidisciplinary research, expands opportunities for Puerto Rico's research community, and provides timely information to inform decisions about recovery projects, future plans, and actions.

Potential costs: \$8.6 million–\$16 million in total estimated costs

Potential funder(s): Private sector, nongovernment sources

Potential implementer(s): PRTC



NCR 30

Create an Accessible Data Repository of Natural and Cultural Resources

Create a complete and accessible geo-referenced data repository of Puerto Rico's natural and cultural resources using reliable data standards and systems (such as cloud-based computing) to facilitate response and recovery and inform investment decisions.

Potential benefits: Provides data to inform damage assessments and strengthens support for decisions about natural and cultural resource recovery options. Benefits infrastructure, community capacity building, economics, and education.

Potential costs: \$12 million in total estimated costs

Potential funder(s): DOI, USGS, NOAA, NPS, Government of Puerto Rico, DNER

Potential implementer(s): PRTC

PBD 1

Compile a Public Buildings Inventory

Create a comprehensive, centralized database of buildings owned by the Government of Puerto Rico that includes building characteristics, which will allow analysis of emergency response needs and general operational decision-making.

Potential benefits: Provides clear visibility of building inventories to facilitate system-wide infrastructure-related decision-making and support hazard mitigation programs, damage assessment, and recovery from natural disasters.

Potential costs: \$4 million in total estimated costs

Potential funder(s): PA, CDBG-DR, PRPB

Potential implementer(s): PRPB, PRIFA

PBD 2

Right-Size Public Buildings

Analyze demand for government services to estimate the appropriate building capacity, program requirements, and proposed improvements for government operations. Repurpose, reallocate, and refurbish buildings. Sell or demolish unneeded vacant buildings.

Potential benefits: Provides income (from the sale of buildings), reduces operations and maintenance costs, improves the effectiveness of government operations and service delivery, and removes the blight of long-abandoned, vandalized buildings.

Potential costs: \$200 million–\$500 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico

Potential implementer(s): PRPB

PBD 3

Establish Integrated Services Centers

Continue supporting the Government of Puerto Rico's ongoing project to cluster public services in a single location to improve efficiency and accessibility to the public. A center is already operating in San Juan, where residents can access a variety of social services in a single location.

Potential benefits: Simplifies access to services for the population and streamlines maintenance processes.

Potential costs: \$10 million–\$20 million in total estimated costs

Potential funder(s): PA, HMGP, CDBG-DR, Government of Puerto Rico, USDA WIC

Potential implementer(s): Puerto Rico Department of State, PRPBA

PBD 4

Realign Public Building Ownership

Transfer ownership of buildings so that buildings of the same type (e.g., schools or government centers) are all owned by the same agency.

Potential benefits: Resolves complications from buildings of the same type owned by different agencies, improving government efficiency, accessibility, and communication.

Potential costs: \$600,000 in total estimated costs

Potential funder(s): PRPB

Potential implementer(s): Office of the Governor, Legislative Assembly

PBD 10

Incentivize State-of-the-Art Building Design, Practices, and Technologies

Modify or develop policies and programs that establish clear standards for energy and water efficiency in public buildings and provide incentives for energy and water efficiency, renewable energy systems, increased resilience to natural hazards, and innovative redesign or reconfiguration of spaces to better support delivery of critical public services.

Potential benefits: Reduces resource use and building operational costs, meets Government of Puerto Rico energy goals, reduces potential future damages, increases reliability of critical public services, and potentially creates jobs.

Potential costs: \$7 million in total estimated costs

Potential funder(s): GPR agency operating budgets, EPA

Potential implementer(s): Government of Puerto Rico, municipal governments



DETAILED LOOK AT HOW THE PLAN WAS DEVELOPED

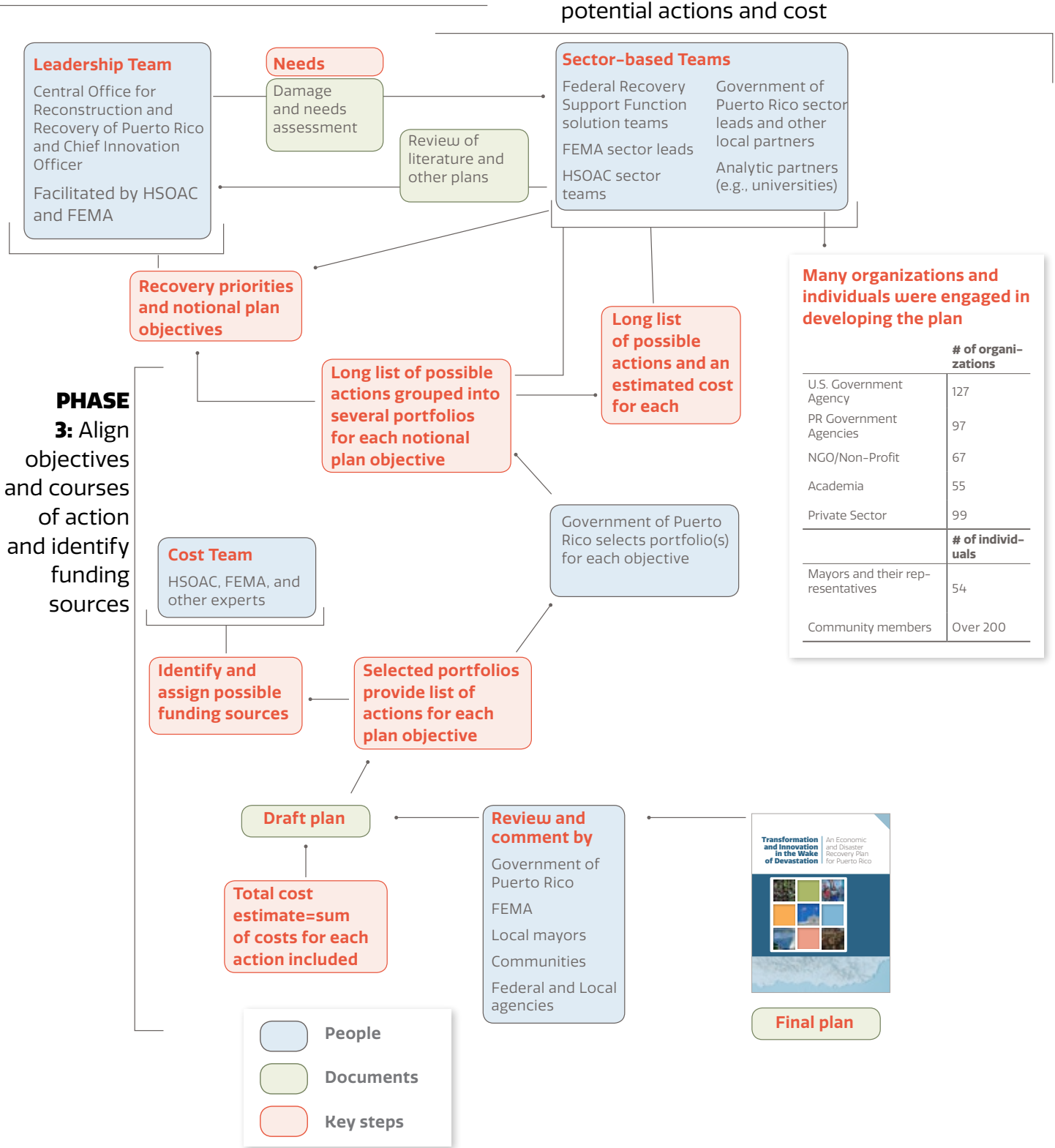
The Government of Puerto Rico—in particular the Central Recovery and Reconstruction Office, also known as the Central Office of Recovery, Reconstruction, and Resilience (COR3)—was supported by FEMA and the Homeland Security Operational Analysis Center (HSOAC—a federally funded research and development center [FFRDC] operated by the RAND Corporation under contract with the Department of Homeland Security) in the development of this recovery plan. The effort involved extensive outreach to and collaboration with a broad group of federal agencies, state-level and municipal government agencies within Puerto Rico, private-sector and nonprofit entities, and those most affected by the hurricanes—the people of Puerto Rico.

The plan was developed over the course of three dynamic and—given the urgency—overlapping phases:

1. Identifying damage, needs, and priorities for recovery
2. Identifying potential courses of actions (and their related costs)
3. Aligning the priorities and courses of action and identifying funding sources.

PHASE 1: Identify needs and priorities

PHASE 2: Phase 2: Identify potential actions and cost



Phase 1: Identify damage, needs, and priorities

Assess damage and needs

To ensure the recovery plan is as robust as possible and in response to the requirements established by Congress, the team of experts supporting the Government of Puerto Rico in developing the plan conducted an assessment of damage from the hurricanes and remaining needs across the Island, both within specific sectors and for challenges that cut across sectors. The damage and needs assessment documents conditions before Irma and Maria, the damage caused by the hurricanes (both direct physical damage and the impact on Puerto Rico's population and economy), conditions 6–9 months after the hurricanes, and remaining needs. This damage and needs assessment provides the baseline needed to define and then compare and prioritize the courses of action considered for recovery planning.

More than 100 separate data sources and hundreds of individual datasets of varied types (qualitative, quantitative, secondary, primary) and time periods (historic, baseline, immediately post-hurricane, post-hurricane recovery) were used in development of the damage and needs assessment. FEMA, the RSFs, other federal partners, and the Government of Puerto Rico provided the majority of the data. As with any assessment of damage and needs, it is important to note that the data are as comprehensive as possible but not always without gaps. Literature reviews, interviews with subject-matter experts and key stakeholders within and outside of Puerto Rico, media reporting (to gather or cross-check data), and open-source data available through a variety of platforms supplemented the initial information. HSOAC also conducted primary data collection via a survey of municipalities, roundtables with municipal staff, and focus groups with vulnerable populations.

Set priorities

While the damage and needs assessment was being conducted, the Government of Puerto Rico developed the vision, goals, and objectives for the recovery plan, which was then laid out for the team that FEMA convened to aid in the development of the recovery plan. This highly iterative process involved a series of coordination meetings and interactive workshops, along with a review of completed and forthcoming plans for Puerto Rico. Updates to objectives were made throughout the



MUNICIPALITY ASSESSMENT

In May and June of 2018, HSOAC conducted site visits to each of Puerto Rico's 78 municipalities to deliver a standardized data collection instrument developed by the International City County Management Association (ICMA) in consultation with HSOAC, FEMA, and the University of Puerto Rico. ICMA developed a standardized data collection instrument to guide data collection during these visits. While ICMA's tool was created specifically for this assessment, it is based on similar data collection instruments ICMA has validated and used successfully in its prior work with municipal governments throughout the world and includes questions about the municipality's capacity to provide services, how they are structured and operate, and the damage they incurred during the storms.

Site visits were conducted by interdisciplinary teams led by professional city management staff affiliated with ICMA or UPR professors. HSOAC staff participated in a number of site visits as well to observe the process. During the visits, team members met with municipal personnel and delivered the survey instrument. The objective of the site visits is to develop baseline data at the individual municipality level on municipal finances, capacity (including human capital), services and service delivery, as well as hurricane impacts and outstanding needs.

plan development to account for insights gained through this iterative process and the development of the damage and needs assessment itself, ensuring that the plan is responsive to the most current and complete picture of damage and needs, as well as long-term goals. Recovery plan objectives (focused on precursors, capital investments, and strategic initiatives) detailed earlier in this plan are the ultimate outcome of this iterative process.

Incorporate information from existing plans

Many plans, critical guidance, and other documents relevant to the Island as a whole or directed toward specific sectors were produced in parallel to the recovery plan. These plans were reviewed to identify relevant data, courses of action, and guidance about the Government of Puerto Rico's transformative vision. Four documents, in particular, provided overarching guidance for the structure and vision of the recovery plan: *Plan for Puerto Rico*, *Build Back Better*, the various *New Fiscal Plan(s)* for Puerto Rico (and its agencies), and the *National Disaster Recovery Framework*. Sector-specific plans detailing the goals and day-to-day operations of state-level and federal agencies offered essential context for priorities and actions, both before the hurricanes and how they are modifying these priorities and actions in the new post-disaster reality. The variety of economic and disaster recovery plans, some produced before the hurricanes as solely economic recovery plans, illustrate the breadth of views for how Puerto Rico should move forward.



Phase 2: Identify potential actions and estimated costs

Phase 2 activities involved identifying and defining potential courses of action that could contribute to recovery, and also estimating the associated costs. These courses of actions are a collection of potential activities, policies and policy changes, and other actions that are intended to contribute to the vision and goals prioritized by the Government of Puerto Rico. Each action describes an approach to address an issue associated with hurricane damage, a pre-existing condition that inhibits economic recovery, and/or a factor that contributes to economic and disaster recovery.

Many plans contributed
data | vision | solutions
to **The Promise of Puerto Rico**



Most Influential Plans

- Build Back Better Puerto Rico (GPR) | ☒
- New Fiscal Plan for Puerto Rico (GPR, FOMB) | ☒
- Plan Para Puerto Rico (GPR) | ☒
- National Disaster Recovery Framework (FEMA) | ☒

Economic Recovery and Disaster Recovery Plans

From the Commonwealth (14 plans) | ☑ ☒ 🏠 🎓 ⚡ 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠

- INCLUDING:
- Comprehensive Economic Development Strategy (Planning Board) | ☒
 - Integrated Economic Development Plan (PRIDCO) | ☒
 - Community Development Block Grant Disaster Recovery (CDBG-DR) Action Plan (GPR) | 🏠
 - Puerto Rico Energy Working Group (PREWG) Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico (GPR) | ⚡

From private/nonprofits (2 plans) | ☒ ☒ ⚡

- INCLUDING:
- Reimagina Puerto Rico (100RC) | ☒

From the U.S. Government (5 plans) | ☒ ☑ 🏠 🎓 ⚡ 🏠

- INCLUDING:
- Congressional Task Force on Economic Growth in Puerto Rico: Report to the House and Senate (U.S. Congress)

Standard Operations Plans (Pre- and Post-Hurricanes) (23 plans)

From Commonwealth, U.S. Government, and private/non-profit | ☑ ☒ 🏠 🎓 ⚡ 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠 🏠

Sectors represented in the plans

- 🏠 Economy
- ☑ Community Planning and Capacity Building
- 🏠 Municipalities
- 🏠 Housing
- ⚡ Energy
- 🌳 Natural and Cultural Resources
- 🚗 Transportation
- 🏠 Public Buildings
- 📶 Communications/IT
- 💧 Water
- 🏠 Health and Social Services
- 🎓 Education
- ☒ Cross-sector



ECONOMY

COMMUNITY/
CAPACITY

MUNICIPALITIES



HOUSING



ENERGY

NATURAL/CULTURAL
RESOURCES

TRANSPORTATION

PUBLIC
BUILDINGSCOMMUNICATIONS/
IT

WATER

HEALTH/SOCIAL
SERVICES

EDUCATION

Identify potential actions

Dedicated teams of experts—each focused on a specific sector such as energy or economic activity—were formed to develop possible courses of action responsive to the needs identified in phase one. Consisting of experts from HSOAC and other partners, these sector teams worked closely with the RSF Solutions-based teams, FEMA sector-specific teams, GPR representatives, and local partners and stakeholders to develop the courses of action.

Building on the information coming to light from the damage and needs assessment and from information gleaned through partners and experts, the sector teams conducted background research; engaged with sector stakeholders and subject-matter experts in Puerto Rico and beyond; and reviewed existing plans, proposals, and the literature to identify strategies, best practices, and possible innovations to meet those needs. The sector teams consulted stakeholders and subject-matter experts from federal and state-level government agencies, the Government of Puerto Rico and municipal governments, nonprofits, nongovernmental organizations, academics, private industry, and professional associations.

The courses of action developed by the sector teams also drew heavily from discussions held in larger sector-specific working groups and task forces and were often formulated in partnership

TRACKING COURSES OF ACTION

Each course of action presented in this plan has an identifier based on a) the sector in which it was developed, and b) an arbitrary number used for tracking (e.g., TXN 3). All courses of action included in the Detailed Actions chapter include their respective tracking identifiers for easy reference.

with RSF Solutions-based teams, who brought practical knowledge, experience with relevant programs, and a deep understanding of the federal system. Given the diverse set of goals stakeholders are striving to meet, which vary in terms of ambition and aspiration, there is no single dimension of merit or performance along which to analyze courses of action.

While formal cost-benefit and feasibility analyses for each course of action were not possible, the teams developed the courses of action considering characteristics such as responsiveness to needs, level of innovation, and alignment with the evidence base (e.g., based on best or promising practices). As a part of this process, some courses of action were eliminated from consideration or adjusted to try and roughly align the costs and benefits. For example, a course of action to create a microgrid to improve the resilience of Tren Urbano was eliminated because of the prohibitive costs, and another proposing to

turn some roads from paved to gravel was eliminated because the estimated costs of maintaining the gravel road over time exceeded the potential savings from the modification. Since actions address diverse needs and priorities based on the overall plan vision, they varied in terms of strategic versus tactical design.

Estimate costs

Where possible, for each proposed course of action, the relevant sector team made rough-order-of-magnitude cost estimates to support high-level planning and inform decisionmaking. Where available, costs are presented in 2018 dollars. Costs are included for the period FY 2018 through FY 2028, which is the time horizon for the fiscal plans. They include both initial costs (e.g., construction investment) and future costs (e.g., operations and maintenance) over the 11-year period. Incremental operations and maintenance costs are included if they are an increase from pre-hurricane levels (e.g., because of structural improvements or technological upgrades) and thus would represent a new expense that would have to be covered. Similarly, full operations and maintenance costs are included for facilities that were not being maintained prior to the hurricane. And it is worthy to note that these estimates represent only those costs for which a specific payment is made by some source to carry out a specific action; they do not include all of the costs to society that may be associated with recovery actions (e.g., the costs that better enforcement of regulations incurs on the individuals and business owners who must comply). Costs are included for the period FY 2018 through FY 2028, which is the time horizon for the *New Fiscal Plan*. They include both initial costs (e.g., construction investment) and future costs (e.g., operations and maintenance) over the 11-year period. Incremental operations and maintenance costs are included if they are an increase from pre-hurricane levels (e.g., because of structural improvements or technological upgrades). Full operations and maintenance costs are included for facilities that were not being maintained prior to the hurricane.

The approach to estimating the cost of each individual course of action was based on its specific nature and the available sources of information robust enough to inform the estimate. As such, ranges and point estimates are given for courses of actions depending on the methods and information used. Some cost estimates are much more precise than others, and for

these courses of action, the scale of implementation could vary between the discrete alternatives presented—which would vary the estimated costs. Based on future policy choices, different levels of implementation for some courses of action may also be established to constrain costs. Cost information presented in this plan should be regarded as preliminary since more specific cost estimates will require both more specificity in the manner in which recovery options will be implemented and the completion of ongoing damage assessments. Some courses of action do not have costs that require specific recovery funding (policy changes, for example), though these actions may require administrative time or other resource. Other courses of action included in the plan that do not have costs assigned are likely costly, but not enough information is available to provide even rough-order-of-magnitude estimates so these items remain un-costed. One example of a cost estimation methodology is presented on the next page.

THE COMPLEX PROCESS OF ESTIMATING COSTS

EXAMPLE

INSTALL UNDERGROUND CONDUIT ALONG ROADWAYS TO BURY FIBER-OPTIC CABLE (CIT 21)

To prevent future damage to fiber-optic cable, one proposal is to install underground conduit along roadways so that telecommunications providers can run their fiber-optic cable underground instead of on poles. To estimate the costs of this initiative, there are precedents to draw on: The U.S. Federal Highway Administration white paper Rural Interstate Corridor Communications Study estimates the costs of installing 48-SMFO cable along Interstate 90 (through South Dakota, Minnesota, and Wisconsin) and Interstate 20 (through Louisiana, Mississippi, and Alabama). We also corroborated our unit cost estimates with an expert with local knowledge of Puerto Rico roadways and extensive experience laying fiber-optic cable for the U.S. military in different types of terrain.

Construction Costs

TRENCHING

Uses these directional boring costs as a proxy:

- \$8/foot** for rural areas,
- \$11/foot** for urban areas, and
- \$270/foot** for mountain road

BUILDINGS TO HOUSE SIGNAL REGENERATION EQUIPMENT

Assumes these costs:

- Each building will cost \$340,000**
- Buildings will be required:**
 - » Every 50 miles in flat terrain
 - » Every 35 miles in rocky terrain



LAYING CONDUIT

Assumes these costs:

- \$1/foot** for laying conduit
- \$1,600 per handhole** installed every 1,500 feet of roadway (\$750 in materials and equipment, and \$830 in installation costs)

CONSTRUCTION OVERHEAD

Assumes an **overhead rate of 48.5%** for design, engineering, mobilization, administration, traffic control, and contingencies

Amount of Conduit Needed

How many miles of roads are there?

- 4,600 miles** of roadways are operated by Department of Transportation and Public Works (DTOP)
- » We used Geographic Information System (GIS) data to assess that the roadway network reached every municipality

Is conduit needed along every roadway?

- 50 percent**—about **2,300 miles** of roads—will need cable
- » We arrived at this number because more than one road reaches most municipal centers, so laying cable along all of them is duplicative.



Are the roads in tough terrain?

- Approximately 25 percent** of roadways are in mountainous regions
- » We arrived at this number using GIS data overlaying all DTOP roadways on a topographical map of Puerto Rico to estimate how many miles of roadway are in mountainous terrain.

What is the cost per mile?

- Based on the unit costs above and accounting for the higher cost of construction in mountainous terrain, we estimate an average cost of \$580,000 per mile.**
- In comparison, the costs of laying broadband along rural U.S. interstates (in generally flat terrain) ranged from \$150,000 to \$210,000 per mile.**

TOTAL ESTIMATED COST

\$1.3 billion

Phase 3: Align objectives and courses of action and identify funding sources

Align priorities and courses of action

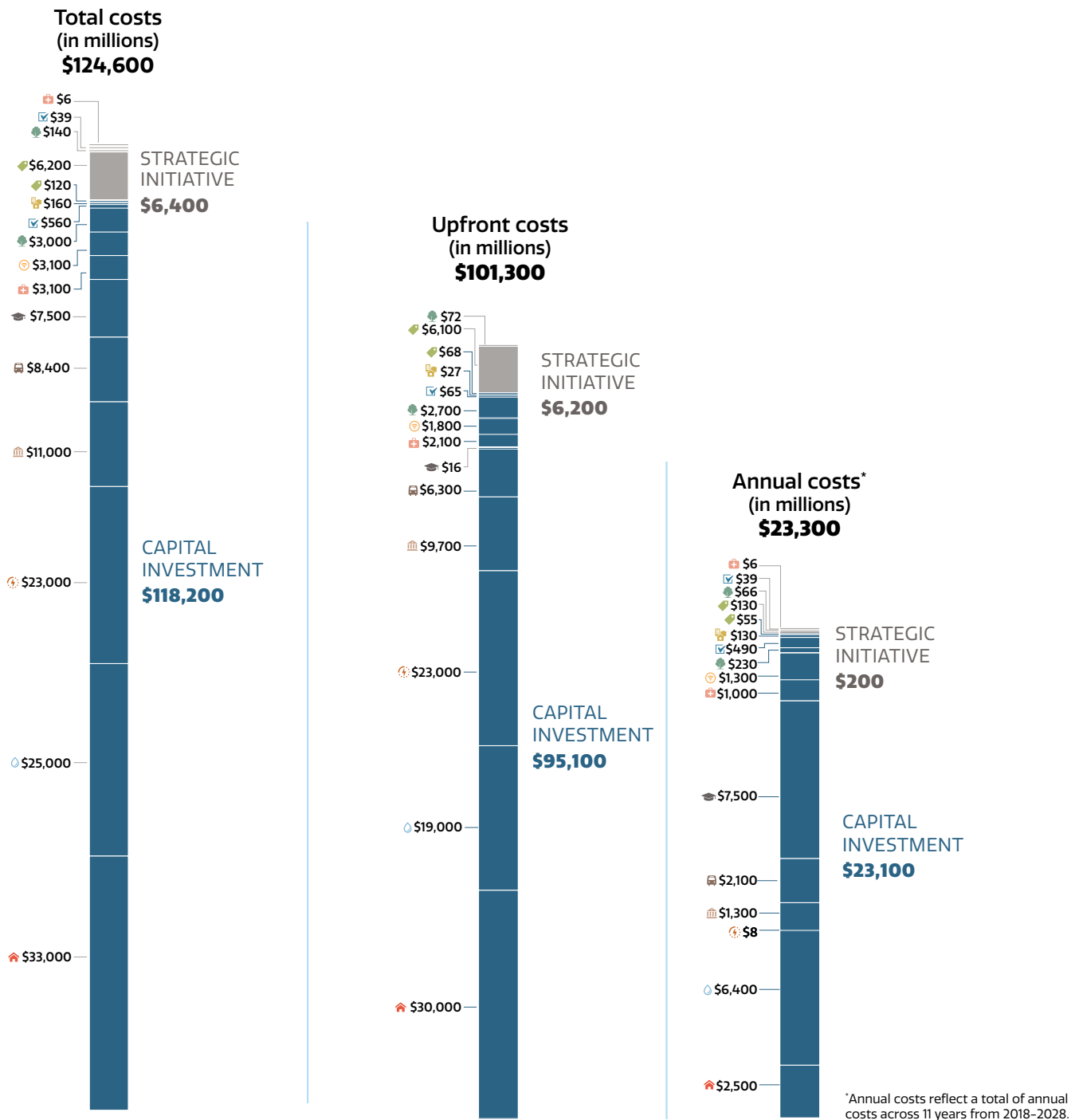
The courses of action were sorted into the notional recovery plan objectives, as they evolved: nine objectives focused on capital investments (such as water and telecommunications) and eight focused on strategic initiatives (such as enhancing the visitor economy).

Between two and six portfolios (sets of actions) were developed for each objective. Portfolios build upon courses of action to get one step closer to an actionable recovery plan that, in turn, meets the top-down vision and goals of this plan. The portfolios were based upon themes that aligned with the objectives and in most cases varied in cost and comprehensiveness (e.g., more resilience or lower cost). Grouping courses of action into portfolios to achieve Governor Ricardo Rosselló's vision benefited in many cases from contributions by HSOAC and other subject matter experts, to factor-in the damages and needs of the sectors, their interplay in achieving a strategic objective, the feasibility of groupings of courses of action, and an understanding of precursors and interdependencies across sectors.

When developing portfolios, a new portfolio of precursor actions emerged from courses of action that were consistently listed as precursors across all the capital investment portfolios. Thus, the team developed a precursors portfolio to capture in a single portfolio these critical actions that provide the foundation for recovery.

The HSOAC team developed draft portfolios (precursor portfolio, as well as between two to six portfolios for each objective) in collaboration with partners, held numerous engagements with the representatives from the Government of Puerto Rico in which the portfolios were reviewed and compared, developed new courses of action when necessary, and then developed updated portfolios reflecting this Government of Puerto Rico feedback. For example, to simplify the portfolios, economic actions were removed from capital investment portfolios and infrastructure courses of action were removed from strategic initiative portfolios. These changes did not affect the final choice of portfolios (and the courses of action that comprise them) for the plan but simplified the nature of the portfolios.

Total, upfront, and annual costs of this plan by sector and the type of investment



The three bars are not in proportion to each other for legibility. Sector costs have been rounded so may not add up to the totals shown.

Sectors represented in the plans

- Economy
- Community Planning and Capacity Building
- Municipalities
- Housing
- Energy
- Natural and Cultural Resources
- Transportation
- Public Buildings
- Communications/IT
- Water
- Health and Social Services
- Education
- Cross-sector

Estimated potential costs for the energy sector were derived from a cross-walk of courses of action against those in Build Back Better Puerto Rico and the Puerto Rico Energy Working Group (PREWG) Build Back Better: Reimagining and Strengthening the Power Grid of Puerto Rico plans. In both of these reports, the total cost to "build back better" was just under \$18 billion. Our courses of action included some additional activities (e.g., studies and analysis to support decisions as provided by cost team) and total to \$22 billion.

The Government of Puerto Rico examined and compared these final portfolios and their preferred solution for each of the strategic objectives identified by the Government of Puerto Rico. The recovery plan was then constructed from a combination of the chosen portfolios that addresses the full set of those objectives. The detailed list of approximately 270 actions from the portfolios viewed as relevant for each objective by the Government of Puerto Rico provided the basis for total cost estimates for the plan.

Most of these actions (roughly 90 percent) are focused on the capital investments needed for Puerto Rico to recover. To meet the plan objectives will require approximately \$125 billion to fully fund. The figure on the previous page provides the breakdown of costs (the initial upfront and annual operations and maintenance) by sector. The total, upfront, and annual costs of the plan are shown by sector because funding sources align most closely with the sectors represented by the actions in the portfolios. Actions in the precursor portfolio are included with the capital investments because they are fundamental to the success of all the capital investments

A detailed list of the selected portfolios and the specific actions that comprise each of these portfolios are presented at the end of this plan. There was no cost constraint put on the decisionmaking process—but estimated costs of actions were presented to the Government of Puerto Rico as part of the portfolio development process.

Identify funding sources

Given the significant damage and the Government of Puerto Rico's vision to "build back better," the sector teams considered both U.S. government aid and nongovernmental funding sources as resources for the possible courses of action they identified. Low, medium, and high estimates of the level of funds that might be available from the Disaster Relief Fund; special appropriations for disaster relief and recovery; steady-state federal programs funded via normal annual program budgets; and private insurance were estimated and reviewed with FEMA and other outside experts. Nongovernmental funders (charitable and corporate foundations, institutional investors, and venture capitalists) were also examined as potential sources of funding. For each course of action, HSOAC and FEMA sector teams then worked to assign possible funding sources to the extent possible given current available information. Eligibility requirements for many supplemental funding elements are still unspecified, and thus possible funding sources are

notional at this time. Optimizing constrained funds across courses of action specifically and recovery efforts generally will require additional analysis.



CASA ALCALDIA

ACKNOWLEDGMENTS

Transformation and Innovation in the Wake of Devastation incorporates the views of many federal and state agencies, experts, and other stakeholders. This section—which acknowledges some of the key contributors to this plan—is in progress and will be populated after the comment period.



Aerial view of a damaged home in the mountainous area of Barranquitas, Puerto Rico, October 9, 2017.

Photo by Andrea Booher/FEMA

ABBREVIATIONS

ABBREVIATION	EXPLANATION
ACF	Administration for Children and Families
ACS	American Community Survey
APHL	Association of Public Health Laboratories
ASES	Administración de Seguros de Salud de Puerto Rico [English: Puerto Rico Health Insurance Administration]
ASPR	Office of the Assistant Secretary for Preparedness and Response
ATM	automated teller machine
AUXCOMM	auxiliary communications
CDBG-DR	Community Development Block Grant-Disaster Recovery [HUD program]
CDC	Centers for Disease Control and Prevention
CHC	community health center
CINO	Office of the Chief Innovation Officer
CIO	Office of the Chief Information Officer
CMS	Centers for Medicare & Medicaid Services
COG	continuity of government
COOP	continuity of operations
COR3	Central Office for Recovery, Reconstruction, and Resilience
CRIM	Centro de Recaudación de Ingresos Municipales [English: Municipal Revenues Collection Center]
CRRO	Central Recovery and Reconstruction Office of Puerto Rico
CSR	corporate social responsibility
DEDC	Puerto Rico Department of Economic Development and Commerce
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
DNER	Puerto Rico Department of Natural and Environmental Resources
DOC	U.S. Department of Commerce
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior

ABBREVIATION	EXPLANATION
DOL	U.S. Department of Labor
DPS	Puerto Rico Department of Public Safety
DRD	Department of Sports and Recreation
DRF	Disaster Relief Fund
DTOP	Puerto Rico Department of Transportation and Public Works
EDA	Economic Development Administration
EDB	Economic Development Board
ELC	Epidemiology and Laboratory Capacity
EOC	emergency operations center
EPA	U.S. Environmental Protection Agency
EWDJT	Environmental Workforce Development and Job Training
EQB	Environmental Quality Board
FCC	Federal Communications Commission
FDA	U.S. Food and Drug Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHA	Federal Housing Administration
FirstNet	First Responder Network Authority
FOMB	Financial Oversight Management Board
FWS	U.S. Fish and Wildlife Services
FY	fiscal year
GIS	geographic information system
GNP	gross national product
GPR	Government of Puerto Rico
HM	hazard mitigation
HMGP	Hazard Mitigation Grant Program
HRSA	Health Resources and Services Administration
HSOAC	Homeland Security Operational Analysis Center
HUD	U.S. Department of Housing and Urban Development
IA	Individual Assistance [FEMA program]
ICP	Instituto de Cultura Puertorriqueña [Institute of Puerto Rican Culture]
IoT	Internet of Things
IT	information technology
KPI	key performance indicators
LMR	land mobile radio
LNG	liquified natural gas
NAP	Nutrition Assistance Program
NAPHSIS	National Association for Public Health Statistics and Information Systems
NCHS	National Center for Health Statistics
NDRF	National Disaster Recovery Framework

ABBREVIATION	EXPLANATION
NFIP	National Flood Insurance Program
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
NTIA	National Telecommunications and Information Administration
O&M	operations and maintenance
OASH	Office of the Assistant Secretary for Health
ODSEC	Oficina para el Desarrollo Socioeconómico y Comunitario [English: Office for Socioeconomic and Community Development]
OGPe	Oficina de Gerencia de Permisos [English: Office of Permit Management]
OIGPe	Oficina del Inspector General de Permisos [English: Office of Inspector General of Permits]
OPPEA	Oficina del Procurador de las Personas de Edad Avanzada [English: Office of the Ombudsman for the Elderly]
OT	operational technology
P3	public-private partnerships
PA	Public Assistance [FEMA program]
PAHO	Pan American Health Organization
PBA	Public Buildings Authority
PDADs	populations disproportionately affected by disasters
PDM	Pre-Disaster Mitigation Grant Program
PHEP	Public Health Emergency Preparedness
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRBP	Puerto Rico Planning Board
PRDE	Puerto Rico Department of Education
PRDF	Puerto Rico Department of the Family
PRDEDC	Puerto Rico Department of Economic Development and Commerce
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PRDH	Puerto Rico Department of Housing
PRDOH	Puerto Rico Department of Health
PRDOJ	Puerto Rico Department of Justice
PREC	Puerto Rico Energy Commission
PREMA	Puerto Rico Emergency Management Agency
PREPA	Puerto Rico Electric Power Authority
PREQB	Puerto Rico Environmental Quality Board
PRHTA	Puerto Rico Highway and Transportation Authority
PRIDCO	Puerto Rico Industrial Development Company
PRIFA	Puerto Rico Infrastructure Financing Authority
PRiMEX	Puerto Rico Manufacturing Extension

ABBREVIATION	EXPLANATION
PRITS	Puerto Rico Innovation and Technology Service
PROMESA	Puerto Rico Oversight, Management, and Economic Stability Act
PRPA	Puerto Rico Ports Authority
PRPB	Puerto Rico Planning Board
PRPBA	Puerto Rico Public Buildings Authority
PRSTRT	Puerto Rico Science, Technology, and Research Trust
PRTC	Puerto Rico Tourism Company
PRTTB	Puerto Rico Telecommunications Regulatory Board
PRVCU	Puerto Rico Vector Control Unit
PSAP	public safety answering point
QA/QC	quality assurance / quality control
RIN	Resiliency Innovation Network
RSF	Recovery Support Function
S&T	Science & Technology Directorate
SAMHSA	Substance Abuse and Mental Health Services Administration
SBA	Small Business Administration
SHPO	State Historic Preservation Office
SOEP	State Office of Energy Policy
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STEM	science, technology, engineering, and mathematics
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USG	U.S. government
USGS	U.S. Geological Survey
VA	U.S. Department of Veterans Affairs
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children
WWTP	wastewater treatment plant