Recovery in the U.S. Virgin Islands

Progress, Challenges, and Options for the Future

SHELLY CULBERTSON, BLAS NUÑEZ-NETO, JOIE D. ACOSTA, CYNTHIA R. COOK, ANDREW LAULAND, KRISTIN J. LEUSCHNER, SHANTHI NATARAJ, BENJAMIN LEE PRESTON, SUSAN A. RESETAR, ADAM C. RESNICK, PATRICK ROBERTS, HOWARD J. SHATZ

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Preface

The U.S. Virgin Islands (USVI) are moving forward on the long road to recovery after the devastation caused by category 5 Hurricanes Irma and Maria in 2017. The USVI government conducted robust response operations and has made much progress in key areas since the hurricanes, including repairing and improving infrastructure, buildings, and services and developing planning documents and a priority list for recovery. However, recovery in the USVI has progressed at a slower pace than some other disaster recoveries in the United States and not as quickly as many Virgin Islanders would like. This report offers analyses and strategies to enhance the USVI's capacity for managing recovery and to build the evidence base to support the implementation of the USVI's recovery plans.

As in all recoveries, the plans that are made need to be reconciled and updated to give territory authorities an opportunity for midcourse corrections. This report focuses specifically on updating recovery directions and on supporting the further development of capacities needed for implementing recovery (management, fiscal, workforce, and supply-chain capacities). In it, we consider priorities for infrastructure (e.g., infrastructure services, energy, housing, and natural resources) and the economic and social foundations of the tourism economy, education, and health. In our research, we assessed progress to date, accomplishments, the vision for recovery, challenges and gaps that pose barriers to recovery, and the crosscutting management-capacity challenges across the recovery. And we offer recommendations for steps that could mitigate barriers and reduce risks in the recovery process.

Although this report is structured around particular sectors and topics, FEMA is not using a sector-based approach for FEMA-4340-DR-VI operations.[1] In coordination with the government of the USVI, a new national Public Assistance delivery model is currently in use in the USVI.

The report's research was completed before coronavirus disease 2019 (COVID-19) changed many aspects of work and life in the United States. The pandemic has implications for the analysis in the report, but many of the issues that we identified still

[1] FEMA-4340-DR-VI is the disaster declaration for Hurricane Maria in the USVI.

have important long-term considerations. In a brief section in each chapter, we address the disease's possible implications for recovery .

The findings should be of interest to the USVI territory government, nonprofits, and private-sector leaders managing the recovery; the Federal Emergency Management Agency and other federal agencies contributing to the USVI's recovery; engaged citizens of the territory;[2] philanthropies contributing to USVI recovery; and anyone interested in the progress of recovery in the territory. It will also be of interest to people in dealing with disaster recovery elsewhere in the United States and to scholars because it highlights challenges and opportunities for recovery in a key case.

This research was sponsored by the Federal Emergency Management Agency and conducted within the Recovery Cost Analysis Program of the Homeland Security Operational Analysis Center (HSOAC) federally funded research and development center (FFRDC).

About the Homeland Security Operational Analysis Center

The Homeland Security Act of 2002 (Section 305 of Public Law 107-296, as codified at 6 U.S.C. § 185) authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more FFRDCs to provide independent analysis of homeland security issues. The RAND Corporation operates HSOAC as an FFRDC for the U.S. Department of Homeland Security under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-sector organizations that make up the homeland security enterprise. The HSOAC FFRDC's research is undertaken by mutual consent with the Department of Homeland Security and is organized as a set of discrete tasks. This report presents the results of research and analysis conducted under task 70FBR219F00000067, United States Virgin Islands Hurricane Recovery Planning.

The results presented in this report do not necessarily reflect official Department of Homeland Security opinion or policy.

For more information on HSOAC, see www.rand.org/hsoac. For more information on this publication, see www.rand.org/t/RRA282-1.

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[2] In this report, we sometimes use terms, such as *citizen* or *resident*, that can have a legal meaning (referring to immigration status, for instance) in addition to the everyday meaning. We are using them not in the legal sense but the everyday sense.

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Summary

In September 2017, two category 5 hurricanes, Hurricane Irma and Hurricane Maria, hit the U.S. Virgin Islands (USVI) in quick succession, causing extensive damage to the society, infrastructure, and economy of the territory. Recovery activities began soon after the storms, and, in the weeks and months that followed, the USVI was able to address many immediate response needs—restoring power and water; reopening airports, ports, and roads; clearing debris; reopening schools and health care facilities; stabilizing key public buildings and historic properties; and repairing homes. The USVI government also took significant steps to support long-term recovery, establishing an initial recovery plan and developing priorities for long-term recovery projects (USVI Hurricane Recovery and Resilience Task Force, 2018).

Although recovery actions have continued and progress has been made in key areas, recovery in the USVI has progressed at a slower pace than in some other disaster recoveries in other parts of the United States, and not as quickly as Virgin Islanders would like. As of this writing, more than 2.5 years after the hurricanes, the territory still has substantial recovery needs, with few permanent reconstruction projects having begun and USVI public revenues reduced by roughly half (Austin, 2020).

Long-term recovery from a disaster of this magnitude requires sustained efforts from federal and territory stakeholders. To fully recover from damage caused by Hurricanes Irma and Maria, the USVI government estimates that it will need to execute $11.25 billion in recovery work—a heavy responsibility for a territory with a nearly $4 billion annual economy. Many recovery projects need to be done simultaneously, be carefully phased, or both. Additionally, many projects are complex and at a scale that does not occur regularly in the USVI, let alone in concert with other, equally complex projects.

At the same time, the recovery process also presents an opportunity for the USVI to reenvision the territory's future. Once the immediate response is over, disasters can open up space for investment, deliberation, and debate, allowing for alternative visions and transformative change. The USVI similarly has an opportunity to leverage recovery funding to create a more modern, resilient, and equitable territory for its residents.

It is important to note that the research and analysis presented in this report predate the coronavirus disease 2019 (COVID-19)–related emergency declaration and its

impact on the USVI. It is clear that COVID-19 will have significant and far-reaching implications for the USVI's recovery from Hurricanes Irma and Maria. Reconstruction projects will likely be delayed, many for a substantial period of time. The USVI economy will be affected by the pandemic's impact on logistics and tourism, and particularly the lasting adverse impacts it likely will have on the cruise ship industry. Per Federal Emergency Management Agency's (FEMA's) guidance, this report does not address, directly and in-depth, the pandemic's implications for the USVI's recovery. However, as FEMA and the USVI consider how to improve recovery processes and speed recovery work, it will be important to think through what the likely short-, medium-, and long-term impacts of COVID-19 are, to better inform decisions about how to allocate funds and resources to enhance the USVI's recovery.

Purpose of This Report

In late 2018, FEMA offered then–USVI governor Kenneth Mapp the same kind of analytical support that it had provided the government of Puerto Rico as it developed its recovery plan. In Puerto Rico, FEMA had contracted with the Homeland Security Operational Analysis Center, a federally funded research and development center operated by the RAND Corporation, to coordinate the drafting of a congressionally mandated recovery plan intended to guide future appropriations that was submitted to the U.S. Congress in August 2018. In 2019, Governor Albert Bryan Jr., working through the USVI's Office of Disaster Recovery (ODR), agreed that there was value in updating the USVI's recovery plans through the analytical support that we could provide.

Through this report, we aim to help the USVI accelerate its recovery by identifying the key recovery goals and accomplishments to date, assessing the roadblocks and challenges it faces, and suggesting actionable recommendations that can help it chart a path forward to more efficiently implement recovery. As part of this effort, we reviewed the USVI's prior recovery plans and updates, analyzed available data, considered good practice in disaster recovery in other contexts, held more than 170 discussions with stakeholders across the USVI, and identified 76 recommendations, presented in this report, that can help enhance recovery efforts. Each recommendation includes a series of steps to support implementation. Some of these recommendations are already being considered or implemented, but we believe that there is considerable value in presenting them as a cohesive, comprehensive, and integrated plan that ties them directly to the main challenges facing the USVI and that helps support recovery. Some recommendations—particularly those related to FEMA's procedures—would require policy or statutory changes that are unlikely to take place in time to affect the USVI's recovery. Future steps in this effort may involve the USVI government undertaking efforts to prioritize and phase these recommendations.

This report addresses multiple recovery needs: a set of crosscutting capacities required for progress in general (management, fiscal, workforce, and supply chain), the rebuilding of physical infrastructure (infrastructure services, energy, housing, and natural and cultural resources), and the development of key aspects of the economy and public services (the tourism economy, education, and health). These topics were decided in a collaborative process that included both the territory government and FEMA.

The rest of this summary describes the USVI's visions for recovery, main barriers and challenges, and key recommendations that resulted from our analysis.

Crosscutting Capacities

A unique feature of this report is that, in addition to focusing on specific sectors, it first addresses overarching capacities needed to successfully implement recovery efforts in the coming years. To do so, the USVI will need to rely on four crosscutting capacities: management, fiscal, workforce, and supply chain (Table S.1). These capacities will establish the foundation for lasting recovery in the USVI.

Recovery Progress to Date

The USVI has made progress in building capacity in these areas. For example, the USVI has taken concrete steps to organize its government to support recovery and manage recovery processes. It created ODR, which is charged with overseeing recovery efforts. ODR identified a list of its 100 highest-priority recovery projects, which it calls the Top 100, and put mechanisms in place to engage key stakeholders, such as

Table S.1
Crosscutting Capacities in the USVI Recovery

Capacity Area	Recovery Direction
Management	Ensuring that the USVI government has sufficient capacity to effectively manage recovery efforts, including the governance structures, staffing, and processes needed to achieve recovery goals
Fiscal	Improving the USVI's liquidity, capacity to pay for recovery, and ability to navigate the process to access federal recovery funds while ensuring the territory's long-term financial stability
Workforce	Ensuring that the USVI has enough workers with the appropriate skills to meet recovery needs while still sustaining the other sectors of the USVI economy
Supply chain	Ensuring that the USVI has effective processes and tools to procure contractor services, efficient distribution and logistics processes and assets to transport materials to the USVI, and adequate storage capacity to hold materials until they are needed

NOTE: A recovery direction is the type of strategy that an entity, either now or in the future, might consider useful for guiding recovery implementation.

nongovernmental organizations. The territory has taken steps to improve the capacity of existing agency staff through training and brought in contractors to provide management support. To boost the territory's fiscal capacity, the USVI has designated $169 million of the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery program to be used as the federally required matching funds for $1.7 billion of FEMA Public Assistance (PA) projects. The USVI has also pursued a $50 million line of credit with a local bank; this line of credit could be expanded to $80 million. Because FEMA operates its programs on a reimbursement basis, with the USVI government required to first pay for reconstruction and then seek reimbursement, this funding can be used to start projects as part of that process. Depending on the rate of project execution and reimbursement, this revolving loan could support between $50 million and $200 million in spending per year, allowing the USVI to expand its ability to begin recovery projects.

Barriers to Recovery

The scope and complexity of the recovery mean that the USVI must expand capacity and address challenges in each of these areas:

- **Management capacity:** Recovery governance structures are complex, and ODR has lacked the resources needed to lead recovery in a sustainable way. USVI government agencies require personnel capable of managing and overseeing the large number and wide variety of recovery projects. Yet, many territory agencies have not been able to hire personnel dedicated to managing recovery projects because of lack of funding for these positions and lengthy administrative procedures. Some territory agencies have made slower progress than others because of the size of their responsibility in comparison with their resources.
- **Government fiscal capacity:** The federal government has made a variety of funding sources available to support recovery, including FEMA's PA program, FEMA's Hazard Mitigation Grant Program, and HUD's Community Development Block Grant Disaster Recovery program. FEMA grants require the USVI government to pay for recovery and wait for reimbursement, as well as to provide matching funds. However, the process of navigating and accessing these programs is complex, and the USVI government has lacked the liquidity needed to start reconstruction. Territory agencies often use their operating budgets to start reconstruction while waiting for reimbursement.
- **Workforce capacity:** A significant increase in workforce capacity—in terms of both the number of workers and workforce skills—is required to facilitate recovery. We estimate that the USVI will need more than 5,000 new workers for recovery efforts. In addition to hiring USVI residents, given the relatively small size of the local workforce, supporting recovery efforts will likely require bringing more USVI residents into the labor market and training them in needed skills, and

bringing in skilled workers from the continental United States and Puerto Rico.[1] A shortage of housing is a key constraint for bringing in workers.

- **Supply-chain capacity:** The USVI recovery has led to a substantial increase in demand for construction services, thus requiring a corresponding increase in supply-chain capacity. Two areas of supply-chain management pose the greatest challenges to USVI recovery efforts: (1) purchasing and acquisition (i.e., how organizations procure contracting services for recovery and contracting firms perform recovery work, including procuring necessary building materials and labor) and (2) distribution and logistics (i.e., how materials are brought into the USVI via the seaborne supply chain and where they are stored until they can be transported to where they are needed).

Key Recommendations for Expanding Capacity

Recommendations in this report highlight ways in which the USVI can expand its management, fiscal, workforce, and supply-chain capacity. We detail these recommendations in the rest of this section.

Create clear governance structures and processes for recovery. We make some recommendations that seek to strengthen recovery governance structures and empower ODR to play the key role that it has been given. These include adequately resourcing ODR and placing it directly in the governor's office, putting in place robust coordination mechanisms across the USVI government, and creating and disseminating metrics and reports that can be used to manage and communicate recovery processes. The USVI, FEMA, and HUD could clarify and disseminate flowcharts that simplify the steps needed for each of the major federal funding programs.

Expand liquidity and financing options. We also recommend steps that the USVI could take to improve its liquidity to finance recovery while waiting for reimbursement. In the near term, the USVI could develop a central recovery spending budget, coordinated across territory agencies, that includes phased and sequenced spending plans across projects. Such a document would provide not only a road map but also more certainty throughout the government about priorities to address when money becomes available. The USVI can also consider increasing its $50 million line of credit to accelerate recovery projects. The USVI could explore refinancing of its debt to reduce near-term payments, making additional money available to fund recovery work. However, in the near term, given the current COVID-19 pandemic, financial markets could be less receptive to new issuance of debt that, like the USVI's current debt, is below investment grade.

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[1] Workers with the skills necessary for recovery currently residing in the continental United States may be hired and asked to relocate to the USVI to supplement the workforce in order to meet recovery demands.

In this report, we use *continental United States* to mean the 48 contiguous states plus the District of Columbia.

FEMA could help the USVI address liquidity issues by exploring its existing mechanisms that are rarely used because of their complexity (such as allowing some up-front funding). FEMA could also consider further broad waivers of matching-fund requirements, an action that Governor Bryan has requested and has testified is authorized at 48 U.S.C. § 1469a, commonly referred to as the Insular Areas Act. FEMA has already invoked the Insular Areas Act to waive matching requirements for the Hazard Mitigation Grant Program and has waived cost-share requirements for several individual PA projects. In the longer term, Congress could authorize FEMA, HUD, or other funding agencies to provide funding consistently in advance of project spending.

Streamline contracting. To streamline contracting, the USVI—with FEMA technical assistance—could develop templates and approval mechanisms for procurement contracts and explore opportunities to create flexible contracting mechanisms for recovery services.

Support individual territory agencies through recovery projects. To address government recovery staffing challenges, the USVI might develop procedures that allow territory agencies to hire staff with incremental or rolling reimbursement, using FEMA PA category Z funds.[2] The USVI could also create a specific class or process for recovery positions, such as term positions or emergency hires, to enable faster hiring. FEMA could support territory agency efforts by using data related to how projects are progressing to help USVI agencies making slower progress improve their project management and procurement processes.

Build the workforce. The biggest barrier to bringing in off-island workers is the limited supply of housing; recommendations to address that challenge are discussed in the "Infrastructure" section next. In particular, the use of temporary prefabricated or modular housing would help to accommodate the short-term increase in housing demand associated with the recovery without creating a long-term oversupply of housing stock. To develop the local workforce, we include recommendations for creating short-term training and credentialing programs for key recovery-related occupations and sending USVI residents to the continental United States for training.

Enhance supply-chain efficiency. Recommendations for enhancing the supply chain focus on increasing berth capacity in ports by extending operating hours, using the additional piers on St. Croix and St. Thomas, or doing both. We also include recommendations for increasing stackyard storage capacity at the Crown Bay Port in St. Thomas by acquiring additional acreage or improving the efficiency of unloading, handling, and transporting materials off-site.

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[2] FEMA PA category Z funds are those PA funds that may be used for management costs, including indirect costs, direct administrative costs, or other administrative expenses related to a specific project incurred while completing work in other funding categories as defined by FEMA.

Infrastructure

Infrastructure supports every aspect of life in the USVI, including the movement of people, production of goods and services, emergency response and management, housing, tourism, education, health, and the delivery of goods and services. Infrastructure systems represent large capital investments that persist for long periods of time; thus, the cost of repairing or replacing physical infrastructure is substantial, and its performance and resilience have long-term implications for the territory. Infrastructure systems are also interdependent—for example, electricity is needed to pump water and to power housing and other buildings. Therefore, the physical infrastructure systems need to recover in parallel. Natural and cultural resources constitute a different kind of infrastructure, contributing broadly to well-being in the USVI by supporting residents' health, contributing to the economy, creating a sense of place, and building community resilience by providing some natural protections against weather events.

Hurricanes Irma and Maria caused catastrophic damage to the USVI's physical infrastructure systems, including a complete loss of electrical power and damage to roads, ports, and airports; communications; water and wastewater systems; and public buildings. The storms damaged housing structures across the territory and created an additional strain on USVI housing stock because of increased demand for housing from the recovery workforce. The hurricanes caused extensive damage to cultural landmarks and historic buildings. Natural resources also suffered harm, including damage to corals, beach and soil erosion, and damage to the mangrove ecosystem on St. John. The storms exacerbated the USVI's existing solid-waste problem, resulting in a significant amount of mixed debris. Table S.2 shows the major recovery directions for infrastructure.

Recovery Progress to Date

Since the hurricanes, the USVI has identified, funded, and implemented a broad variety of recovery projects, including plans for permanent improvements to federal highways, water and wastewater systems, communications, and public buildings. In many cases, the territory is working to implement upgrades to existing infrastructure, including compliance with federal highway standards and plans to enhance the energy system's resilience to shocks and stresses, and to implement undergrounding of power lines, hardening of infrastructure, and other improvements. The USVI's housing needs to date have been addressed through a combination of services offered through private insurers, nonprofits, and payouts from FEMA programs and the HUD-funded EnVIsion Tomorrow housing recovery program. USVI residents, territory organizations, and federal agencies have also made significant strides toward recovering and rebuilding the territory's natural and cultural resources. The U.S. Department of the Interior's National Park Service has rehabilitated trails, cleared debris, assessed reefs, and documented traditional homes and construction methods for preservation.

Table S.2
Infrastructure

Capacity Area	Recovery Direction
Infrastructure services	• Hardening and fortifying infrastructure • Reconfiguring utility, waste, technology, and transportation systems for resilience and redundancy • Strengthening governance and regulation • Planning, preparing, and training for future storms
Energy	• Conducting regulatory planning and implementing reforms • Ensuring grid reliability and resilience • Improving emergency management readiness • Upgrading infrastructure • Transforming the grid
Housing	• Repairing damaged homes • Replacing damaged public housing • Ending homelessness and providing housing • Building more-resilient new housing • Housing recovery workers
Natural and cultural resources	• Protecting and restoring natural resources • Stabilizing, restoring, and fortifying cultural resources • Establishing and maintaining sustainable solid-waste management practices

Through a coordinated effort, federal, territory, and private partners removed nearly 900,000 cubic yards of debris of all types—vegetative, marine, power systems, construction, and demolition—from the territory (Government of the USVI, 2018).

Barriers to Recovery

The amount of physical damage to the USVI's infrastructure presents a significant challenge in itself. In addition, territory and federal partners collectively face some key financial, institutional, and technical barriers to infrastructure recovery—in many cases, because of the need to address long-standing issues and gaps that predate the hurricanes:

- **Design-constrained, insufficient infrastructure:** Much of the USVI's physical infrastructure is operating at increased risk of failure beyond its intended service life, and its functionality has degraded because of deferred maintenance, exposure to the elements, and a low level of hardening. Electrical infrastructure significantly past its engineered design life contributes to both the Virgin Islands Water and Power Authority's debt and high energy prices. Both of the USVI's landfills are near capacity, resulting in additional pollution, fires, and numerous violations.
- **Infrastructure interdependencies:** The needs and priorities of colocated and interdependent infrastructures are not fully considered in recovery phasing and implementation yet. If not addressed, this can lead to higher costs and delays when trenches for buried infrastructure are dug or uncovered (or both) multi-

ple times. In the long term, strategic decisions about infrastructure hardening, upgrades, and other improvements should be coordinated systematically among territory agencies to maximize investments from federal funding.

- **Insufficient affordable-housing stock:** Housing in the USVI faced challenges of affordability and availability even before Hurricanes Irma and Maria damaged existing housing stock and brought an influx of workers from outside the territory, increasing demand and raising prices for housing. Progress in repairing government-funded housing—including project-based public housing and permanent supportive housing for people experiencing homelessness—is constrained by limited management and fiscal capacity. Imprecision in records of property ownership and location has also caused delays.
- **Lack of awareness of recovery needs for natural and cultural resources:** Although the USVI Hurricane Recovery and Resilience Task Force recovery plan acknowledges the importance of the natural environment to the well-being of USVI residents, an overall vision and more-specific recovery objectives and goals for natural and cultural resources have not been articulated, making it difficult to identify priorities and coordinate efforts.
- **Communication and community outreach:** To date, nongovernmental organizations, private-sector companies, and communities have generally not been included in the formal recovery process for infrastructure services, resulting in lost capacity and a lack of understanding of the challenges and actions required in transitioning to more-modern and -integrated systems. Inconsistencies in federal funding have hampered the use of nonprofits and volunteers to assist in housing recovery, while natural and cultural resources lack a clear champion who can communicate community priorities and needs, create broader awareness in other recovery areas, share information, celebrate success, and drive accountability.

Key Recommendations for Rebuilding and Restoring Infrastructure

Recommendations related to infrastructure are designed to address both damage caused by the hurricanes and legacy infrastructure challenges.

Improve the management of infrastructure services. A key recommendation is to focus the attention of local, state, territory, and federal agencies involved in recovery on projects that address both hurricane damage and legacy management challenges associated with territory infrastructure. To build public confidence, the USVI should develop a broader range of criteria for evaluating infrastructure recovery success, such as service delivery, service utilization, access to services, regulatory compliance, and customer satisfaction. We also describe steps for creating an implementation plan for improving solid-waste management and public accountability.

Coordinate infrastructure interdependencies. Enhancing mechanisms for project coordination among USVI agencies will be particularly important as the USVI moves forward to upgrade the energy infrastructure and modernize the way it oper-

ates and performs for a better quality of service. Consolidating the administration of federal agency funding programs under a single lead federal agency is one option for enhancing federal agency coordination on recovery. Other recommendations focus on improved coordination for natural and cultural resources, along with greater use of comprehensive land- and water-use planning that takes into account interactions and synergies with other areas of recovery.

Increase the affordable-housing stock. Several recommendations focus on options for increasing the USVI's housing stock. These include actions to speed up repairs on damaged homes, such as by providing training about how to develop clear criteria to qualify for the EnVIsion Tomorrow program and taking steps to clarify property ownership and location records. Increasing the use of modular temporary housing could provide a means of addressing the housing shortage for recovery workers, and tenant protections and supply-side incentives could be used to prevent displacement of existing residents while encouraging the creation of new housing units for recovery workers.

Raise awareness and improve communication. Natural and cultural resources in particular could benefit from a champion—ideally, someone with authority in the territorial government—to lead and facilitate recovery, raise awareness of issues, and help develop a data repository of natural and cultural resources in the USVI. Another recommendation pertains to how the related field coordinator position in the FEMA office might be leveraged (with enough staff) to provide a single source of information for all recovery efforts in this area and to coordinate other federal agency grants and activities.

Economy and Public Services

The hurricanes affected the USVI's economy and public services by causing substantial damage to their infrastructure—schools, hospitals, and other public buildings—and by their effects on the people providing and receiving services.

Tourism is "the single most important stream of revenue" for the USVI and has long been of vital importance to the territory's economy (Virgin Islands Housing Finance Authority, 2019a, p. 9). The tourism industry in the USVI was particularly hard hit immediately after the hurricanes, and its recovery has been slow and uneven.

The USVI's public kindergarten through grade 12 (K–12) school system faced challenges even prior to the 2017 hurricanes, including decades-old buildings, a high level of student poverty, and low standardized test scores. The hurricanes brought new hardships for schools, including extensive physical damage, school closures, strains on children and the families and teachers responsible for caring for them, and out-migration of teachers and students from the territory. Educational quality and teacher

and student well-being were also affected as some schools closed, others began offering double sessions, and schools lacked educational materials and supplies.

The hurricanes also caused significant damage to the USVI's hospitals, clinics, Head Start centers, and the USVI Department of Health, with almost all of the health and human service infrastructure in the USVI damaged or destroyed. Many hospital patients were shifted to medical tents in parking lots, and patients whose needs exceeded available resources were evacuated to outside the territory for care. The well-being of territory residents, including people struggling with mental health issues and other vulnerable individuals, also suffered. The USVI experienced a significant drop in the health care workforce because of out-migration, compounding an existing shortage of health care providers and services. The hurricanes also exposed gaps in the territory government's capacity to monitor mortality and disease morbidity and in the trauma care system. Table S.3 shows the recovery directions for the three service-related areas.

Recovery Progress to Date

Recovery in these areas has been slow. Hotels, retail shops, and other tourism-focused businesses varied in the extent of damage sustained and the speed with which they were able to reopen. The USVI has experienced a decline in tourism employment overall, likely driven by both damage to tourism infrastructure and a decrease in the number of tourists, as well as competition for workers from other sectors, such as construction. At the same time, just before the COVID-19 pandemic, many damaged hotel rooms had been reopened and cruise ship tourism had rebounded. Although one goal of the USVI government is to diversify the economy away from its dependence on tourism, such diversification will take time and requires a vision of what other options are feasible and how to implement them.

Table S.3
The Economy and Public Services

Capacity Area	Recovery Direction
Tourism economy	• Accessing a sufficient workforce with appropriate training and skills • Accessing sufficient housing for tourism-sector workers • Reducing obstacles in the way of business owners who want to start or continue tourism-related businesses • Developing sufficient infrastructure to support tourist arrivals and experiences • Exploring the changing nature of tourism and diversification of the economy
Education	• Providing school buildings that support safety and quality education • Ensuring the well-being of teachers and students • Improving the quality of education and academic achievement • Enabling graduates to find opportunities in the recovery workforce
Health and human services	• Repairing, rebuilding, and modernizing the health and human service infrastructure • Upgrading surveillance capacity • Augmenting the health and human service workforce • Improving conditions and the future preparedness of vulnerable populations • Addressing the increase in behavioral health concerns

The education system was able to restart full school days and had plans underway to rebuild or repair a smaller number of higher-quality schools. Some mental health training has been provided to help teachers, and some supports have been provided to students, although not in a consistent way. Educational quality and opportunity initiatives have progressed, with the USVI offering tuition to USVI high school graduates who attend the University of the Virgin Islands and launching the Cradle to Career Initiative to support workforce development.

Critical health care services have been restored—in a limited way—while key infrastructure projects, such as hospital construction, are just getting started. FEMA obligated $68 million in funding to replace the Governor Juan F. Luis Hospital and Medical Center on St. Croix and obligated $10.5 million for architectural and engineering design work for the hospital. Plans have been made to rebuild other health care facilities; in the meantime, the USVI is providing health care services in several temporary modular units. The USVI has taken some steps to facilitate workforce development in health care, such as allowing license reciprocity so that medical professionals licensed in other parts of the United States can practice in the USVI.

Barriers to Recovery

The economy and public services have been affected by many of the barriers already described, including delays in repairing damaged infrastructure, insufficient management capacity, workforce gaps, lack of access to capital needed to initiate projects while waiting for reimbursement, and housing-related challenges. In addition, our research identified the following other key barriers to their recovery:

- **Constraints on providing services:** The tourism economy, education, and health care are facing challenges in providing services. A common theme for the tourism sector is concern that some of the territory's regulatory processes limit innovation and expansion. The tourism industry is also facing challenges from outside competition and customers' changing vacation preferences. For education, ongoing delays in repairing school buildings and declining numbers of teachers and students affect the educational environment. For health care, key constraints also include delays in repairing infrastructure, ongoing health care workforce shortages, and slow procurement and hiring procedures.
- **Ongoing impacts on individuals' well-being:** Recovery in these areas is heavily dependent on the health and well-being of those who provide and those who receive the services. Education and health care have been particularly affected in these areas. Some students continue to experience anxiety about storms, depression, emotional vulnerability, behavioral problems, and aggression. Teachers lack consistent support for their own challenges and training in how to help students cope. The health and human service workforce shortages present before the hur-

ricanes have continued to grow, and there are severe shortages in providing much-needed behavioral health care.

- **Gaps in services for vulnerable populations:** Certain populations in the USVI are experiencing especially significant challenges. Student poverty is prevalent, with nearly all K–12 public school students qualifying for free or reduced-price lunch (Community Foundation of the Virgin Islands, 2019). The lack of appropriate behavioral health care for vulnerable populations in the USVI is well known, and both the prior and current governors have declared behavioral health an emergency. This is compounded by the fact that adults in the USVI are more than 2.5 times more likely to be uninsured than adults living in one of the 50 U.S. states.
- **Challenges in envisioning the future:** All of these areas face the common challenge of envisioning and adapting to the future needs of the USVI public. The tourism sector has not adapted to challenges from outside competition and the changing vacation preferences of its customers, remaining largely stagnant and reliant on cruise ships. The K–12 public school system has long had low performance on standardized tests, although it is developing an integrated plan for rebuilding schools that better meet the territory's needs. The health care system must rebuild critical infrastructure, lacks adequate surveillance systems, and needs new initiatives for building and sustaining the health and human service workforce.

Key Recommendations

Many of the recommendations for these focus on finding ways to not only "get back to normal" in terms of providing services but also to take steps to reenvision the services they offer and how they can provide their services more effectively.

Address barriers to providing services. Many recommendations describe solutions for addressing infrastructure, workforce, management, and other specific challenges faced by the USVI's service sectors. Others focus on removing constraints to doing business. For example, recommendations to support recovery of the tourism economy include clarifying and streamlining business approvals and creating a *one-stop shop*—or streamlined and transparent process—for new construction projects and new business ventures to encourage business growth and entrepreneurship. Expanding the use of telemedicine was recommended to extend access to health care providers outside the USVI.

Focus on individuals' well-being and opportunities. Recommendations for education focus on student and teacher well-being and education quality. Improving teacher and student access to mental health resources through additional staff, services, and training is critical for supporting the resilience and emotional growth of teachers and students. Developing a plan is the first step to improve access to behavioral health care, including both outpatient and inpatient therapy.

Expand services for vulnerable populations. Several recommendations address options for improving services for the USVI's vulnerable populations. For example, developing a registry of populations that might require special assistance would provide information about specific vulnerabilities, functional limitations, and needs.

Establish a vision of the future of the USVI's service sectors. Other recommendations are designed to help USVI stakeholders build a vision of what the future might look like. One recommendation outlines steps for leveraging tourism service providers to help promote the territory and adapt to changing tourist preferences. The recovery process has also reinvigorated discussions of school quality, and other recommendations outline steps for implementing quality and accountability initiatives in K–12 schools and increasing the quality and relevance of, and access to, career and technical education and workforce preparation programs. To improve health, recommendations pertain to the development of a strategic community health need assessment, which could inform reconstruction efforts to ensure that the health care infrastructure is rightsized, given population shifts after the hurricanes and emerging needs from hurricane impacts.

Support specific management-capacity steps among relevant territory agencies. All agencies struggle with rebuilding, having enough staff to manage recovery, and finding financing for capital projects, as also discussed in the "Crosscutting Capacities" section earlier in this summary. Another education-focused recommendation is about how the USVI could develop integrated public plans for school rebuilding, with timelines. Other recommendations focus on the need for transparent accountability metrics and reporting on the progress to rebuild health care infrastructure. Finally, a cohesive disaster surveillance system capable of assessing disaster-associated mortality and morbidity would help the USVI better prepare for future disasters and other emergencies.

Conclusion

We hope that the analysis presented here can help policymakers identify, validate, and set priorities for recovery in the USVI. Although this report does not prioritize or phase recommendations, the USVI government may wish to build on the analysis presented here to craft more-detailed implementation strategies for some of the key recommendations in this report and to prioritize and phase projects associated with these recommendations to maximize their efficiency and make the best use of recovery funding. Another important step for the USVI is to identify and develop metrics and indicators that can be used to measure the progress toward recovery and success and communicate this to the public and key stakeholders. Such metrics can be used to evaluate how equitable, timely, efficient, and transparent recovery in the USVI is.

Last, as we write this report in the spring of 2020, the COVID-19 pandemic has not been contained, and its effects on the public and economy of the tourism-reliant USVI are not yet clear. What is clear, however, is that the pandemic will have enormous economic and public health consequences for the United States as a whole, including the USVI. Some of the recommendations in this report might not be feasible to implement during the COVID-19 crisis, and others might need to be substantially modified to be implemented during the pandemic. However, many of the recommendations address fundamental issues within the USVI that will continue to require action even after the current crisis subsides. In Box S.1, we highlight some key issues for the USVI related to COVID-19.

We appreciate the opportunity to provide analysis and recommendations that are intended to accelerate the process of implementing recovery toward a more prosperous and resilient USVI.

Box S.1
COVID-19 and Recovery

The advent of COVID-19 has implications for many of the analyses in this report.

Crosscutting Capacities

The response to COVID-19 will almost certainly consume a significant portion of the USVI's management capacity, including the time and attention of key senior leaders who would otherwise be focused on recovery. It is clear that there will be a major decline in employment in the USVI in the short term, as tourism and retail—two of the sectors hardest hit by the physical-distancing measures—made up more than 25 percent of the workforce at the end of 2019. The loss of tourism revenue also has the potential to create potentially long-lasting challenges for the USVI's fiscal capacity. These challenges might make some of our recommendations, such as hiring new government personnel, less viable in the near term, although, to the extent that additional federal aid or insurance payouts are available, these could provide valuable sources of financial support for recovery. Cross-training of government personnel and creating redundancy and lines of succession are also especially important.

The longer-term impacts of COVID-19, especially on the USVI workforce, are uncertain. If the tourism sector takes a long time to recover, there might be a surfeit of workers who could contribute to the recovery efforts when those efforts can resume. However, COVID-19 might also cause more USVI residents to leave the territory. Regardless of labor market conditions going forward, it is likely that skill training for the local workforce will be important, although the mix of specific skills that are needed could change.

Infrastructure

Although COVID-19 does not pose a direct threat to infrastructure systems, the indirect effects could be significant. COVID-19 is poised to disrupt global trade and transportation, which could disrupt the supply chains that bring equipment and materials to the territory. The availability of workers to administer and undertake recovery work is likely to be constrained, and it may become more challenging to get contractors to the territory. The challenges for energy provision generally mirror those for infrastructure more broadly. Of particular importance is the disruption of fuel deliveries to the territory for both primary generation and backup generators.

COVID-19 is likely to have mixed effects on the housing market. In the nearer term, increased demand might come from people seeking more space to accommodate physical distancing, while decreased demand will come from a slowdown in recovery projects and a decrease in the number of off-island workers supporting those projects and from a decline in tourism. In the long term, the disease could slow construction and investment, making this report's housing recommendations even more urgent.

Box S.1—Continued

The pandemic's effects on natural and cultural resources are likely to be focused on concerns about transmission risk to sanitation workers from handling potentially contaminated waste. In the long term, the pandemic could increase support for preserving natural areas, and contraction of cruise ship markets could spur the pursuit of alternative tourism, providing incentives to sustain and protect natural and cultural resources.

Economy and Public Services

Even after the initial clamp-down on tourism ends, it is likely to be a long time before tourists are willing to resume leisure travel—particularly via cruise ships. As a result, it will be even more important to consider recommendations regarding how the USVI could diversify its tourism sector toward a broader demographic and how it could diversify its economy more generally to reduce its dependence on tourism.

The pandemic could increase risks for recovery of education in the near term. Temporary school closures could increase inequities of educational outcomes. High school students might have an increased rate of dropping out because in-person supports are not available. Standardized testing could be postponed or not provided as widely. Mental health supports for children could become more difficult to access, and free and reduced-price lunches might not be available for takeout or delivery. At the same time, many of the recommendations described in this report will remain highly relevant, including the focus on reconstruction of buildings, well-being of teachers and students, quality of education, and opportunities in the recovery workforce.

The barriers and gaps and the priorities in health care have become even more critical in the wake of COVID-19. There is currently a shortage of supplies, including personal protective equipment, ventilators, oxygen, beds in the intensive care unit and across the hospitals, and other health care essentials (e.g., gloves, swabs). There is also a shortage of tests to identify those affected by COVID-19. Many of the health recommendations become even more urgent in light of the pandemic. For example, physical-distancing measures emphasize the importance of knowing who and where vulnerable populations are and what they need. In addition, the need to address behavioral health needs—already significant—has grown because of the impacts of COVID-19 (from grieving lost loved ones, to anxiety about loved ones, to added economic and child care burdens).

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Project Leadership
Shelly Culbertson, project lead
Blas Nuñez-Neto, project co-lead

Project Senior Adviser
Cynthia R. Cook

Communications
Kristin J. Leuschner

Project Management
Paige Rudin
Erica Robles

Editing and Formatting
Rachel Ostrow
Laura Coley
Kayla Howard
Daniel Spagiare
Lisa Bernard

Chapter Authors

Management Capacity
Andrew Lauland, lead
Brian Koski
Shreyas Bharadwaj
Alexandra Mendoza-Graf
Etienne Rosas
Paige Rudin
Melissa Shostak

Government Fiscal Capacity
Howard J. Shatz, co-lead
Benjamin M. Miller, co-lead

Workforce Capacity
Shanthi Nataraj, lead
Troy D. Smith
Sean McKenna

The Supply Chain
Adam C. Resnick, lead
Jeremy M. Eckhause
Vikram Kilambi
Keenan D. Yoho

Infrastructure Services
Benjamin Lee Preston, lead
Michelle E. Miro

Energy
Benjamin Lee Preston, lead
Noha Abdel-Karim

Housing
Patrick Roberts, lead
Sean McKenna
Cynthia R. Cook
Max Izenberg

Natural and Cultural Resources
Susan A. Resetar, lead
Rahim Ali
Rachel Liang

The Tourism Economy
Shanthi Nataraj, lead
Troy D. Smith
Sean McKenna

Education
Shelly Culbertson, lead
Shreyas Bharadwaj
Katheryn Giglio
Michelle Grisé
Alexandra Mendoza-Graf
Paige Rudin

Health
Joie D. Acosta, lead
Molly M. Simmons

Abbreviations

BIT	Bureau of Information Technology
BLS	U.S. Bureau of Labor Statistics
CDBG-DR	Community Development Block Grant Disaster Recovery
CDC	Centers for Disease Control and Prevention
CFVI	Community Foundation of the Virgin Islands
COVID-19	coronavirus disease 2019
CPCB	community planning and capacity building
CTE	career and technical education
CZM	coastal zone management
DHS	U.S. Department of Homeland Security
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DPNR	Department of Planning and Natural Resources
DPP	U.S. Virgin Islands Department of Property and Procurement
DPW	U.S. Virgin Islands Department of Public Works
DSPR	Department of Sports, Parks, and Recreation
EFL	Eastern Federal Lands Highway Division
EPA	U.S. Environmental Protection Agency
FCC	Federal Communications Commission

FEMA	Federal Emergency Management Agency
FFRDC	federally funded research and development center
FHWA	Federal Highway Administration
FQHC	federally qualified health center
FY	fiscal year
HHS	U.S. Department of Health and Human Services
HMGP	Hazard Mitigation Grant Program
HSOAC	Homeland Security Operational Analysis Center
HUD	U.S. Department of Housing and Urban Development
IA	Individual Assistance
IRP	integrated resource plan
IT	information technology
JFL	Governor Juan F. Luis Hospital and Medical Center
K–12	kindergarten through grade 12
KSA	knowledge, skill, or ability
kV	kilovolt
LFPR	labor force–participation rate
LPG	liquefied petroleum gas
LPN	licensed practical nurse
LSS	Lutheran Social Services of the Virgin Islands
LTRG	long-term recovery group
MW	megawatt
NCR	natural and cultural resources
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
ODR	Office of Disaster Recovery

O&M	operations and maintenance
OMB	Office of Management and Budget
PA	Public Assistance
PFA	Virgin Islands Public Finance Authority
PMO	portfolio management office
PV	photovoltaic
RFP	request for proposals
RHPP	Randolph Harley Power Plant
RN	registered nurse
RSF	recovery support function
SBA	U.S. Small Business Administration
SHPO	state historic preservation officer
SOC	Standard Occupational Classification
SSO	sanitary-sewer overflow
STEP	Sheltering and Temporary Essential Power
T&D	transmission and distribution
TEU	20-foot-equivalent unit
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USVI	U.S. Virgin Islands
USVIBER	U.S. Virgin Islands Bureau of Economic Research
UVI	University of the Virgin Islands
VICS	Virgin Islands Community Survey
VIDA	Virgin Islands Department of Agriculture
VIDE	Virgin Islands Department of Education
VIDOH	U.S. Virgin Islands Department of Health
VIDOL	Virgin Islands Department of Labor

VIEDA	U.S. Virgin Islands Economic Development Authority
VIHA	Virgin Islands Housing Authority
VIHFA	Virgin Islands Housing Finance Authority
VIPA	Virgin Islands Port Authority
VIPD	Virgin Islands Police Department
VITEMA	Virgin Islands Territorial Emergency Management Agency
VIWMA	Virgin Islands Waste Management Authority
WAPA	Virgin Islands Water and Power Authority
WICO	West Indian Company

CHAPTER ONE

Introduction

In September 2017, two category 5 hurricanes hit the U.S. Virgin Islands (USVI) in quick succession. On September 6, Hurricane Irma made landfall on St. Thomas and St. John. Two weeks later, Hurricane Maria struck St. Croix on September 20. The hurricanes caused extensive damage to the society, infrastructure, and economy of the USVI. The USVI government conducted robust response operations and has made much progress in key areas since then. However, recovery in the USVI has progressed at a slower pace than some other disaster recoveries in the United States (Bram, 2019; Walker and Kanno-Youngs, 2019) and not as quickly as many Virgin Islanders would like.

As of this writing, more than 2.5 years after the hurricanes, the USVI continues to face substantial recovery needs even as it confronts a new disaster in the form of the coronavirus disease 2019 (COVID-19) pandemic, which will have sweeping ramifications for the U.S. economy as a whole and the USVI in particular. As the USVI considers how to best organize and implement recovery efforts, it must address a wide variety of needs, including boosting the overall economy and employment, coordinating long-term reconstruction, strengthening public and private critical infrastructure, and enhancing public services. Recovery in the USVI will depend on substantial investments and extensive planning, coordination, and implementation activities by the USVI government, the Federal Emergency Management Agency (FEMA), and other key stakeholders.

Although the recovery process poses many challenges, it also presents an opportunity for the USVI to rebuild and modernize its infrastructure and economy to secure a more prosperous future for its residents. With careful planning, the USVI can use the promised substantial federal investments to deliver higher-quality public services, support its vibrant communities, and sustain its abundant natural resources. Indeed, USVI governor Albert Bryan Jr. has pledged a "transformative change in the way our government approaches its duty" (Bryan, 2020b). Moving forward in recovery offers an opportunity for transformation.

The Purpose of This Report

This project was originally conceived of by Michael Byrne, the former federal coordinating officer and federal disaster-recovery coordinator for Puerto Rico and the USVI, who approached then–USVI governor Kenneth Mapp in late 2018 to offer the same kind of analytical support from the Homeland Security Operational Analysis Center (HSOAC) that FEMA had offered Puerto Rico. HSOAC had coordinated the writing of Puerto Rico's recovery plan that was submitted to the U.S. Congress in August 2018 (Central Office for Recovery, Reconstruction and Resiliency, 2018). Governor Bryan, working through the USVI Office of Disaster Recovery (ODR), agreed that there was value in updating the territory's recovery plans through analytical support from HSOAC.

Per the guidance provided by FEMA and the USVI government, one of the main goals of this effort was to provide an overarching and consolidated overview of how recovery is progressing in the USVI, informed by feedback from a diverse group of stakeholders. In particular, FEMA asked us to (1) update the USVI government and its federal partners on the progress that has been made to date, (2) analyze the challenges and barriers that have delayed progress, and (3) make actionable recommendations to improve the efficiency of recovery processes. Future steps that prioritize and phase these recommendations will be important for recovery.

This report builds on the strong foundation the USVI government laid with its previous recovery planning documents (Government of the U.S. Virgin Islands, 2018; USVI Hurricane Recovery and Resilience Task Force, 2018; Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019), which were developed after the 2017 hurricanes and presented a long-term vision for recovery and development. It provides an assessment of the current state of recovery progress in the USVI in the key sectors damaged by the hurricanes; synthesizes the general vision or directions for recovery in each sector; identifies the main challenges or barriers to recovery in each sector, including the sources of delays in recovery processes; and makes actionable recommendations to address the issues identified and accelerate the recovery process overall. As part of this effort, HSOAC research staff held more than 170 discussions with stakeholders (each involving multiple people) across the USVI and derived 76 key recommendations, organized by sector, that can help the USVI enhance its recovery efforts.

The recommendations in this report were developed through a bottom-up process that involved the aforementioned discussions with hundreds of stakeholders in the USVI government, its federal partners, the private sector, and nonprofit organizations. This report presents some recommendations that are new, some that are currently being considered, and some that are being implemented. We believe that there is considerable value in presenting them as a cohesive and comprehensive plan that ties them directly to the main challenges facing the USVI. Additionally, each recommendation includes a series of key steps to take to ensure that that the policy actions being consid-

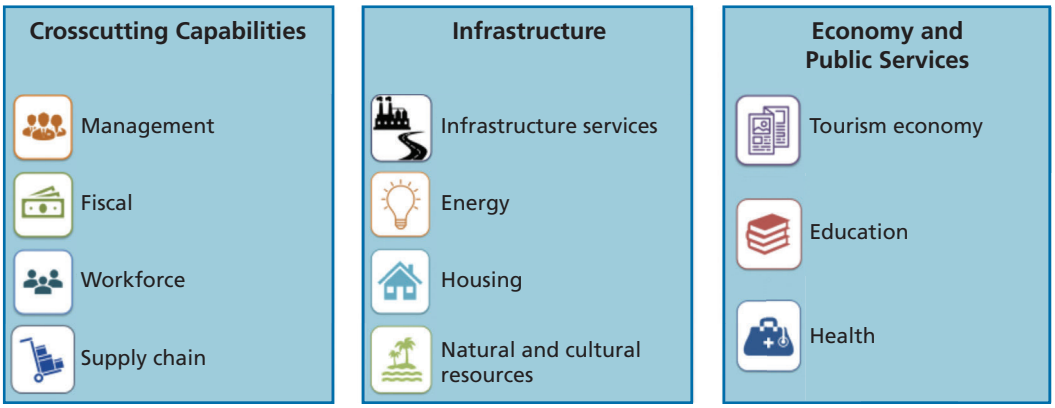
ered or taken are ultimately successful. We offer these in the spirit of adaptive management (Wise, 2006), recognizing that leaders face urgent needs and must make decisions and that plans and strategies can and should be regularly updated throughout the recovery process. We also recognize that some recommendations—particularly those related to FEMA's financing procedures—would require policy or statutory changes that are unlikely to take place in time to affect the USVI's recovery.

Figure 1.1 shows the report's organization. It begins with chapters that analyze four overarching, crosscutting capacities: management, fiscal, workforce, and supply chain. It then moves on to chapters that focus on infrastructure (infrastructure services, energy, housing, and natural and cultural resources [NCR]), followed by the economy and public services (tourism economy, education, and health). These topics were identified in collaboration with the USVI territory government and FEMA at the beginning of the project.

This report differs from the previous recovery plans developed for the USVI, in part because of its focus on the USVI's overall capacity to implement recovery, the recovery needs in specific sectors, and implementation considerations. It highlights the important role that capacity—related to government management, fiscal, workforce, and supply-chain issues—will play in determining how well and how quickly the USVI's recovery succeeds. It highlights areas of strength for the USVI government's capacity and areas that will likely need to be enhanced, either through internal USVI government measures or through the provision of assistance from federal partners or other interested parties.

Finally, the analysis presented in this report shows that many of the capacity recommendations are foundational to the USVI government's ability to implement recovery projects across all sectors of its economy. These recommendations are "prereq-

Figure 1.1
Sectors and Crosscutting Capacities Examined in This Study



uisites" in that, if the challenges they are designed to overcome are not addressed, the USVI's overall recovery likely will continue to be significantly delayed.

In the remainder of this introduction, we provide a brief overview of the USVI, the damage caused by Hurricanes Irma and Maria, and recovery activities to date. We then discuss recovery directions and timelines, summarize the methods used in this project, and provide a map for the rest of the report.

Background on the USVI, Hurricane Damage, and Recovery Activities to Date

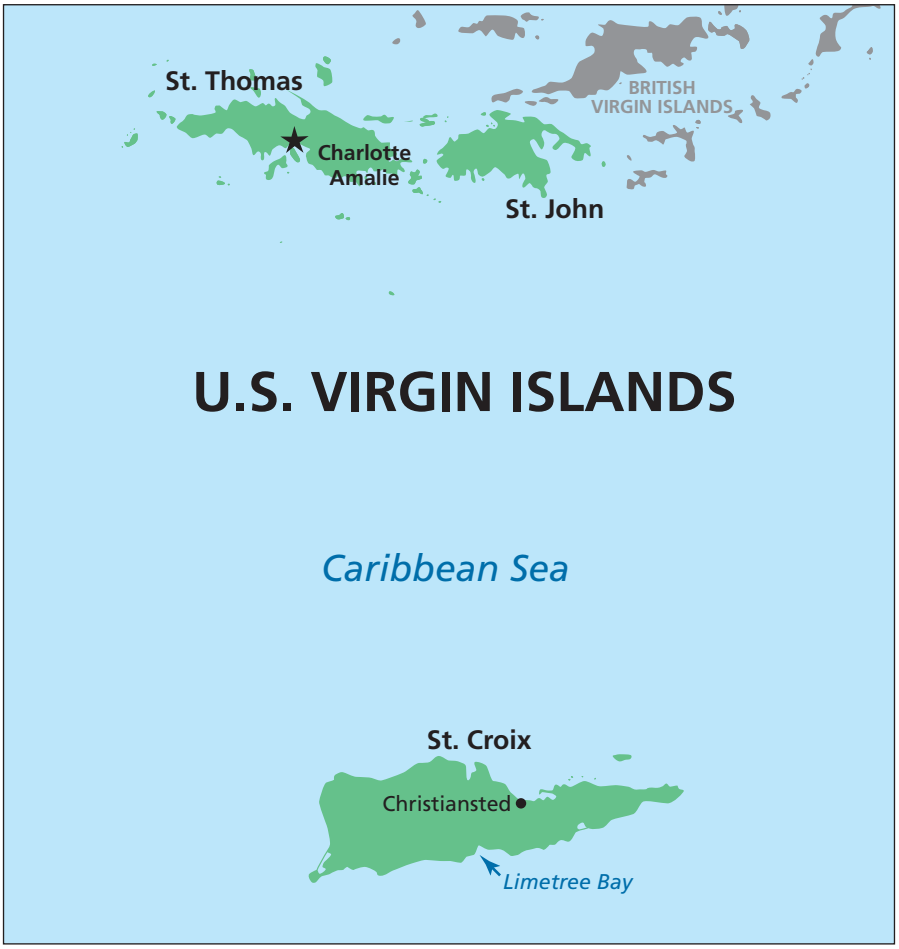
The USVI is an unincorporated U.S. territory consisting of three main islands—St. Croix, St. Thomas, and St. John—and many other small surrounding islands (Figure 1.2). One prominent smaller island is Water Island, just off St. Thomas.

The total land area of the USVI is just under 134 square miles. St. Croix is the largest of the islands, although the territory's capital, Charlotte Amalie, is located on St. Thomas. At the time of the 2015 USVI Community Survey (Eastern Caribbean Center, 2018), the USVI had a total population of about 100,000, with 52,266 people on St. Thomas and St. John and 48,502 on St. Croix. The population since the hurricanes is currently unknown, although there is some evidence that substantial outmigration has taken place (Bureau of Transportation Statistics, undated, p. 57).

The 2017 hurricanes inflicted significant damage on the USVI's critical infrastructure, including widespread damage to the electrical transmission and distribution network, telecommunications, water and wastewater facilities, roads, ports, and airports. The hurricanes damaged more than half of the USVI's housing stock, devastated historic buildings and natural resources, and generated hundreds of thousands of tons of debris (USVI Hurricane Recovery and Resilience Task Force, 2018). Both the territory's hospitals and more than half of USVI schools were severely damaged. The hurricanes also affected the local economy, particularly the tourism industry. Employment in the tourism sector—which accounted for around 25 percent of nongovernment employment in 2017—fell by 50 percent in the period directly following the hurricanes (a loss of around 4,000 jobs). Estimates put the cost of repairing USVI hurricane damage at $11.25 billion (Virgin Islands Housing Finance Authority [VIHFA], 2019a, p. 37). This high amount is particularly notable when compared with the USVI's annual gross domestic product of nearly $4 billion in 2018 (Bureau of Economic Analysis, 2019).

In the weeks and months following the hurricanes, many immediate response needs were addressed: restoring power and water; reopening airports, ports, and roads; clearing debris; reopening schools and health care facilities; stabilizing key historic properties; and obligating funds for the repair of public buildings. Over time, the tourism industry began to slowly rebound, with cruise ship arrivals—a major source

Figure 1.2
Map of the USVI and Neighboring Islands



SOURCE: CDC, 2019.

of tourism revenue—recovering to prehurricane levels and some leisure and hospitality jobs starting to return by early 2020. The construction industry began to expand because of the reconstruction projects on all three major islands. However, the COVID-19 pandemic—which has led to the shutdown of the tourism economy and most other economic activity in the USVI—is likely to set this progress back substantially.

The USVI has taken significant steps to respond to the hurricanes' immediate impacts and plan for and support long-term recovery. After the hurricanes, then-governor Kenneth Mapp asked the USVI Hurricane Recovery and Resilience Task Force to examine the USVI response to the hurricanes and to lay out the "best path forward to rebuilding" and protecting USVI communities over the long term, henceforth called the 2018 USVI task force recovery plan (USVI Hurricane Recovery and

Resilience Task Force, 2018). This task force reported on the USVI's recovery progress in 2018 and 2019. The first-year progress report, *Transforming Through Recovery* (Government of the U.S. Virgin Islands, 2018), focuses on disaster response activities that had been completed, including restoration of power, reopening of airports and cruise ship terminals, resumption of public water distribution, emergency repairs to homes, and reopening of health care services and schools. The second-year report, *Building a Legacy of Resilience* (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019), describes additional steps that had been taken to support a broader recovery in the USVI, including repairing more than 6,500 homes through the FEMA-funded Sheltering and Temporary Essential Power (STEP) program; installing more than 1,600 composite power poles; approving a Community Development Block Grant Disaster Recovery (CDBG-DR) action plan for tranches, advancing a major power generation project, and authorizing the replacement of two major health care facilities on St. Croix.

Recovery Directions and Timelines

In the long term, disasters can present an opportunity for positive social change (Prince, 1920; Quarantelli, 1999; Tierney and Oliver-Smith, 2012). Once the immediate response is over, disasters can open up space for deliberation and debate about the future, allowing for alternative visions and transformative change. Many societies have used disaster-recovery periods to remake themselves in line with their visions for the future. The USVI similarly has an opportunity to leverage recovery funding to create a more modern, resilient, and equitable territory for its people.

Disaster recovery involves all the steps necessary to bring the territory back to a sense of normalcy and move toward its vision for the future. Infrastructure and buildings are important to recovery, but societies are also defined by their public services, cultural institutions, economic activity, and civic life. Recovery entails returning to normal on human and social terms, as well as restoring the built environment. Recovery includes both near-term goals and long-term planning. It involves the whole community, including those who are most vulnerable, and it extends to many areas of society, including education, natural and cultural resources, and health (Tierney and Oliver-Smith, 2012). Recovery does not necessarily mean a return to the status quo (Daniels, Kettl, and Kunreuther, 2006; G. Smith and Birkland, 2012). This is particularly true in the USVI, where much of the infrastructure that was destroyed by the hurricanes did not adhere to modern codes and therefore was more vulnerable to damage than it would have been had it been up to code.

Following from the vision laid out in the USVI's recovery documents, we begin with the assumption that the recovery should be equitable, timely, efficient, and transparent. *Equitable* refers to the concern for the most vulnerable as a part of planning for

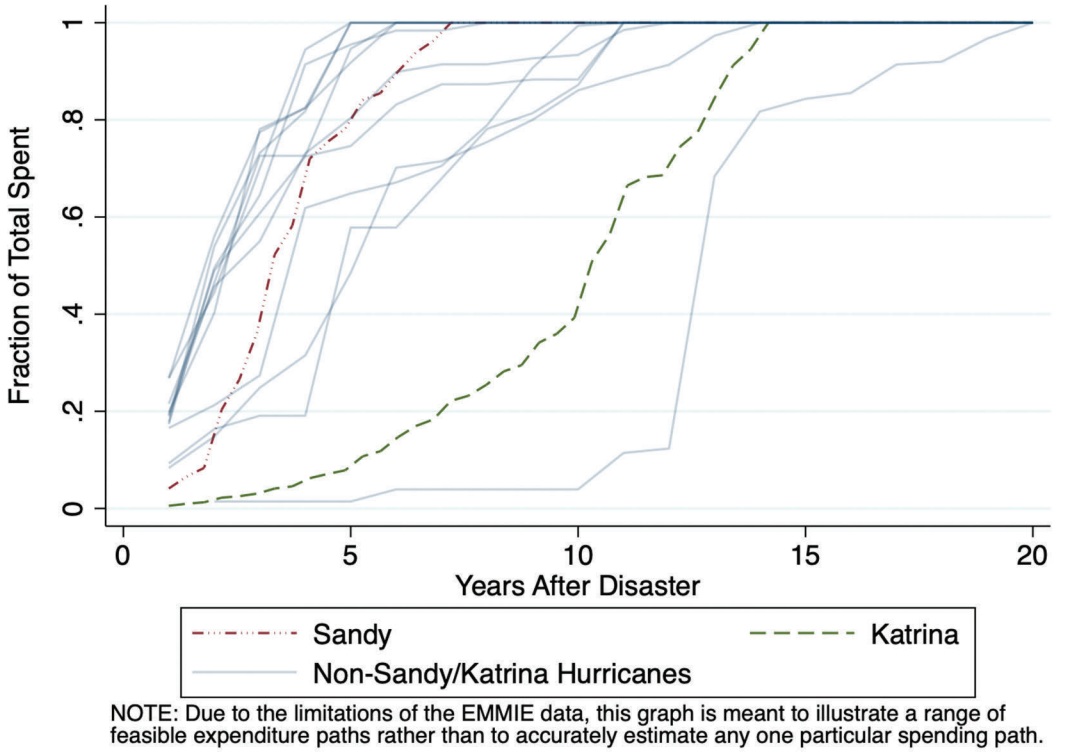
recovery across sectors. *Timely* means that recovery should proceed as fast as possible, and *efficient* means that recovery resources should be used for the purposes intended and should minimize waste. *Transparent* means that recovery goals, spending, and project progress should be communicated to and understood by stakeholders.

Timelines of postdisaster recovery efforts can vary considerably and can last decades (Sword-Daniels et al., 2016). One of the fastest timelines was in New York and New Jersey after Hurricane Sandy in 2012. In prior HSOAC analysis (Strong, Wenger, Anderson, et al., unpublished research; Strong, Wenger, Opper, et al., unpublished research) of nonemergency FEMA Public Assistance (PA) expenditures on projects of more than $1 million from the Emergency Management Mission Integrated Environment system, researchers found that, five years after Hurricane Sandy, more than 80 percent of PA funds had already been obligated (Strong, Wenger, Anderson, et al., unpublished research; Strong, Wenger, Opper, et al., unpublished research). In contrast, a full decade after Hurricane Katrina in the U.S. Gulf states, only slightly more than half of the PA funds had been obligated (Figure 1.3). The scope and nature of the disaster, the capacity and resources of the state agencies tasked with spending the funds, and the technical assistance provided after the disaster all likely make a difference in speed of recovery. The speed of recovery also differs across sectors (L. Johnson and Hayashi, 2012), and the speed of recovery in one sector can be increased or slowed by changing trends in economic growth or decline. Similarly, recovery in the USVI will be a long-term process, requiring sustained effort from federal and territory governments, nonprofit and private-sector organizations, and individuals and communities.

For Figure 1.4, HSOAC analysts constructed potential spending paths for the USVI (Bureau of Economic Analysis, 2019; Strong, Wenger, Anderson, et al., unpublished research; Strong, Wenger, Opper, et al., unpublished research).[1] According to this analysis, feasible peak spending in the USVI in any given year ranges from $600 million to $800 million. It may take 15 to 20 years for the USVI to spend the $11.25 bil-

[1] HSOAC did this using a random sampling of spending paths from prior hurricanes and available estimates of likely PA expenditures. The baseline scenario (Figure 1.4) shows annual PA expenditures using sampling from prior spending paths in which less than 25 percent of spending was completed during the first two years after the hurricane and expenditure growth was limited to no more than $200 million per year for the first four years (e.g., $200 million in the first year, $400 million in the second year) and to 5-percent growth per year afterward. The unconstrained scenario removes this latter constraint. The aggressive scenario samples from prior spending paths, in which less than 50 percent of spending was completed during the first two years, and the super-aggressive scenario samples from all prior spending paths. However, peak annual expenditure in the super-aggressive scenario is approximately $1.8 billion, and prior HSOAC analysis indicates that it is unlikely that the USVI economy (which had a size of nearly $4 billion in 2018) would be able to accommodate this level of spending. The Emergency Management Mission Integrated Environment data include information on when funds were obligated and when projects were closed but do not identify exactly when work was done; the percentage of a project completed as of a certain date is typically given as either 0 percent or 100 percent. As described in more detail in Strong, Wenger, Anderson, et al., unpublished research, and Strong, Wenger, Opper, et al., unpublished research, we therefore estimated when the work was done based on the information available, including the date when funds were allocated. Given these limitations, the spending paths should be viewed as estimates.

Figure 1.3
Obligation Curves for Hurricanes Katrina and Sandy and for All Other Hurricanes

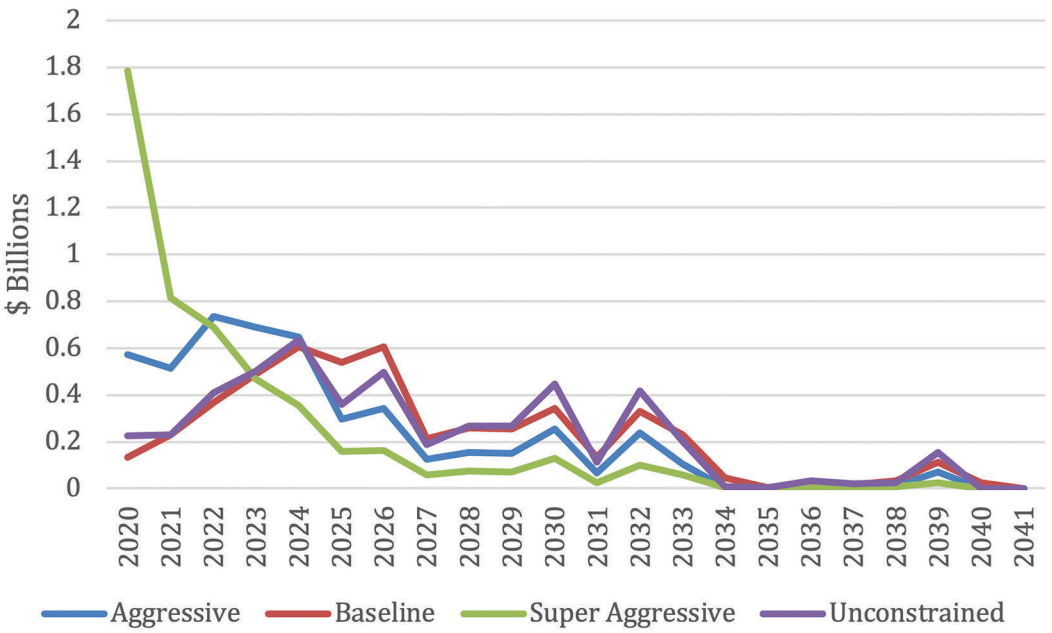


NOTE: Due to the limitations of the EMMIE data, this graph is meant to illustrate a range of feasible expenditure paths rather than to accurately estimate any one particular spending path.

SOURCE: Strong, Wenger, Opper, et al., unpublished research, based on FEMA Emergency Management Mission Integrated Environment (EMMIE) data.

lion it estimates will be needed to fully recover from the hurricanes. However, its ability to spend the funds that are needed will be partly determined by its ability to foster its crosscutting capacities (management, fiscal, workforce, and supply chain) as detailed in Chapters Two through Five of this report.

Figure 1.4
Average Recovery Expenditure in the USVI for Each Scenario



SOURCE: Strong, Wenger, Opper, et al., unpublished research.

Methodology

In support of FEMA and the government of the USVI, this report addresses the following questions, which are applicable to both the crosscutting capacities and the sectors listed previously:

- What is the recovery vision for this sector?
- What is the current status of recovery for this sector? What has been accomplished?
- What are the main challenges and gaps that pose barriers to recovery in this sector?
- What are the main management-capacity challenges in this sector?
- What steps are needed to mitigate barriers to and risks of recovery?

To develop answers to these questions, we drew on multiple perspectives, data sources, and methods. Although each chapter has a discussion of the specific meth-

ods used and the limitations to those methods, we provide here an overview of our common approach.

We coordinated with FEMA and ODR. We worked closely with FEMA and ODR throughout the project, with FEMA and ODR providing guidance, inputs, and feedback on the interim analysis and facilitating access to a wide variety of stakeholders.

FEMA and ODR held public and stakeholder presentations. FEMA facilitated group presentations to federal partners both to describe the purpose of this implementation planning exercise and to solicit stakeholder feedback. For the same purposes, Governor Bryan and ODR hosted group presentations by our team to the territory's 100 highest-priority recovery projects, which the territory calls the Top 100 Group, a convening of heads of territory government agencies that meet to discuss the Top 100. ODR hosted our presentations to the territory's consortia of community groups, known as long-term recovery groups (LTRGs), specific to each island.[2]

We reviewed existing plans and available literature. We drew on recent studies and reports, including the 2018 USVI task force recovery plan, as well as studies conducted by FEMA, other federal agencies, and the USVI territory government. We undertook a comprehensive review of all the plans that have been developed across the sectors included in this report and compiled and analyzed other available sources of data and documentation. We also drew on relevant literature on good practice in disaster recovery.

We analyzed data from FEMA's Grants Manager database. Grants Manager is FEMA's central repository for information on FEMA-funded projects. The Grants Manager database contains critical project information, organized by applicant, including information about each grant's status and its estimated cost. We used these data to analyze (1) projects by recovery phase, (2) costs by recovery phase (an estimate of how recovery dollars move through the approval process), and (3) time to obligation (average number of days from project initialization to FEMA's commitment to fund a project). We also focused on identifying cross-sector issues and trends. Limitations to these data are that they do not follow the status of projects after they have been obligated by (received funding approval from) FEMA; cost estimates were not complete as of this writing.

We analyzed data sets available by sector. These included data sets from multiple agencies in the USVI government, employment and wage data from the U.S. Bureau of Labor Statistics (BLS), geographic information system data, housing data from the Eastern Caribbean Center, tourism data from the U.S. Virgin Islands Bureau of Economic Research and the U.S. Virgin Islands Hotel and Tourism Association,

[2] An LTRG is a structure stood up by the FEMA community planning and capacity-building (CPCB) recovery support function (RSF) present on each of the three largest islands; there is no singular LTRG but rather three distinct entities.

Smarter Balanced standardized test score data, and others. Specific data sources for each chapter are described in methodology text boxes.

We held discussions with stakeholders. We held more than 170 discussions (typically with several stakeholders in each discussion) with four categories of stakeholders:

- FEMA and other federal agencies
- territory government agencies
- representatives from the private sector
- nongovernmental community groups.

Our inclusion of perspectives from this broad set of stakeholders is, to us, a key feature of this report because it enabled our analysis to reflect considerations from many of the main stakeholders involved in the USVI's recovery. During these discussions, we explored a broad set of topics, including recovery accomplishments to date, the current status of recovery across the sectors, barriers to implementation of needed recovery steps, ideas for future steps, and access to data sources. The research team for each sector also conducted a thematic analysis of relevant discussion data. Our discussions with stakeholders were conducted under the supervision of HSOAC's Human Subjects Protection Committee.

COVID-19's Implications for USVI Recovery

Last, it is important to note that the research and analysis presented in this report predate the COVID-19–related emergency declaration and its impact on the USVI. It is clear that COVID-19 will have significant and far-reaching implications for the USVI's recovery from Hurricanes Irma and Maria. Reconstruction projects will likely be delayed, many for a substantial period of time. The health care and education systems—which have been struggling to recover to their prehurricane levels—will face new and unprecedented tests from the pandemic's impact on the USVI's public. And the USVI economy will be affected by the pandemic's impact on logistics and tourism, particularly the lasting adverse impacts it will likely have on the cruise ship industry. Although each chapter provides a brief discussion of how the pandemic might affect recovery options for that sector, per FEMA's guidance, this report does not address, directly and in-depth, the pandemic's implications for the USVI's recovery. However, as FEMA and the USVI consider how to improve recovery processes and speed recovery work, it will be important to think through what the short-, medium-, and long-term impacts of COVID-19 are likely to be to better inform decisions about how to allocate funds and resources to enhance the USVI's recovery.

Organization of This Report

The remainder of this report is organized as follows:

- crosscutting capacities
  - Chapter Two: Government Management Capacity
  - Chapter Three: Government Fiscal Capacity
  - Chapter Four: Workforce Capacity
  - Chapter Five: The Supply Chain
- infrastructure
  - Chapter Six: Infrastructure Services
  - Chapter Seven: Energy
  - Chapter Eight: Housing
  - Chapter Nine: Natural and Cultural Resources
- economy and public services
  - Chapter Ten: The Tourism Economy
  - Chapter Eleven: Education
  - Chapter Twelve: Health and Human Services
- conclusion
  - Chapter Thirteen: Conclusion

CHAPTER TWO

Government Management Capacity in the U.S. Virgin Islands

Box 2.1
Key Findings About Management Capacity

- The USVI government will need to build its management capacity to successfully oversee and execute recovery projects estimated at $11.25 billion, in the context of an economy of roughly $4 billion per year.
- The USVI has already taken multiple steps to address these needs, including establishing ODR, administering recovery funding through other agencies, hiring contractor support, engaging communities and public and private entities, and completing significant emergency work. The USVI has also identified the Top 100 projects and most-urgent sectors. Some agencies have made quicker progress in their permanent work than others.
- However, the USVI territory government faces barriers to its capacity to manage recovery in three areas:
  - **Governance structures:** Challenges include unclear or overlapping lines of authority for recovery leadership and the lack of a fully resourced lead entity for recovery.
  - **Staffing:** Government agencies face staffing shortages in general, lack personnel dedicated to recovery with needed skill sets, operate in buildings still damaged by the hurricanes, face funding and administrative barriers to hiring needed staff, and must manage large amounts of funding in comparison with their staffing and experience.
  - **Process:** The processes for securing federal funding—involving multiple territory agencies and FEMA—are overly complex, causing confusion and delays. Systematic coordination processes among staff in territory agencies engaged in recovery are lacking.
- Key recommendations to address gaps and barriers include the following:
  - **Build robust governance structures for recovery.** Clarify roles, responsibilities, and recovery structures, including
    - establishing clean and clear lines of authority and responsibility
    - adequately and sustainably resourcing ODR
    - developing formal and regular coordination structures across agencies
    - increasing public engagement.
  - **Increase recovery staffing.** Take measures to enhance and expand the workforce, including
    - designating enough territory staff for recovery
    - streamlining the hiring process for recovery positions and using federal funding for territory government recovery managers.
  - **Simplify processes:** Improving recovery coordination, systems, and processes, including
    - using data about agency capacity to target FEMA and territory government technical assistance
    - creating a process chart for territory and federal procedures for accessing main sources of federal funding
    - appointing a single, permanent FEMA point of contact with decisionmaking authority to each subapplicant
    - developing management reports and metrics to actively manage the recovery
    - pursuing digitization
    - creating mechanisms for the executive branch, with authorization from the legislature, to provide additional flexibility and transparency.

Recovery from the catastrophic damage caused to the USVI by Hurricanes Irma and Maria is imposing historic management demands on the territory government. The workload from recovery projects significantly exceeds the previous experiences of the USVI government. For example, in fiscal year (FY) 2017, the total predisaster territory budget was $1.4 billion (Government of the USVI, 2017). In comparison, through January 2020, $2.17 billion in FEMA PA grants had been obligated to the territory (ODR, undated a).

The USVI government's capacity and ability to manage these projects will be crucial to implementing a successful recovery. We propose that management capacity in this recovery context refers to having sufficient *governance structures*, *government staff*, and *processes* in place to plan, coordinate, and execute recovery activities. This definition builds on a robust body of literature on management capacity. For example, *capacity* can be defined as being able to execute core administrative functions—that is, having the right governance structures, information, infrastructure, analytic capabilities, processes, procedures, funds, and skilled personnel in place and at the scale necessary to execute the functions needed for recovery (Ingraham and Donahue, 2000). At the same time, in a recovery context, *management capacity* refers to the ability to manage the burden of recovery projects. The ability to "get things done" depends on many organizational and individual characteristics, including credibility, transparency, coordination, communication, prioritization, engagement, regulation, oversight, and workplace culture (Christensen, Lægreid, and Rykkja, 2016). Another dimension of management capacity is the ability to demonstrate *progress in achieving recovery goals* and to measure and track performance relative to recovery objectives (Lodge and Wegrich, 2014).

In this chapter, we describe government management-capacity strengths and needs in the USVI. We set the stage by describing management-capacity demands created by the 2017 hurricanes. Next, we discuss the USVI's steps toward creating sufficient management capacity for recovery and review reconstruction demands and capacity for individual USVI agencies. We then describe barriers to recovery and conclude with actionable recommendations to address these issues. Box 2.2 describes our methods.

Box 2.2
Methodology for Analysis of Management Capacity

- **Literature review:** We searched academic databases and journals published between 1995 and 2020 to cover key issues related to public governance. Some of the journals consulted are *Disaster Prevention and Management*, *International Journal of Disaster Risk Reduction*, and *Public Administration Review*.
- **Discussions:** We completed in-person and phone discussions with various stakeholders from both FEMA and the USVI territory government. Between October 22, 2019, and February 28, 2020, we completed 70 discussions.
- **Coding and analysis:** We applied a directed content analysis approach (Hsieh and Shannon, 2005) to process the data from these discussions using qualitative data analysis software, the Dedoose web application (version 8.2.32). Topics included issues of capacity constraints related to fiscal and personnel insufficiencies; instances of coordination breakdowns; logistics and optimization; metrics to support decisionmaking; priorities and phasing; and evaluative metrics, performance, and measurement.
- **Data analysis:** Data on PA projects were sourced from FEMA's Grants Manager database and the Emergency Management Mission Integrated Environment, FEMA's portal for managing PA projects (FEMA, undated b; Grants Manager, undated). These figures were used to assess agencies' PA project burden and the stage in which funding for these projects was currently obligated. From these data, we assembled a list of the 23 agencies with the highest total project worth, representing around 98 percent of permanent work.
- **Information about agency capacity:** For executive agencies, we analyzed the executive budgets for FYs 2017 and 2020 to capture potential changes in agency capacity pre- and post-storm. We created individual profiles of each of the 23 agencies with measures related to their staffing capacity and recovery responsibilities.

Setting the Stage

The USVI government must manage recovery in the midst of multiple demands, challenges, and constraints:

- **Phasing and timing:** Many recovery projects need to be done simultaneously, be carefully phased, or both. Additionally, many projects are complex and at a scale that does not occur regularly in the USVI, let alone in concert with other, equally complex projects.
- **Multiple funding options:** Individual projects may be eligible for funding from multiple sources, requiring the ability to identify the best use of available funds, as well as mastery of and compliance with multiple processes and policies.[1] Territory officials need to learn, enforce, and document adherence to federal funding rules with which they might previously have been unfamiliar.
- **Population size and government responsibilities:** The USVI had a population of about 100,000 prior to the hurricanes. The USVI government has the organizational structures and responsibilities of a state government but lacks intermediate levels of government, such as city or county governments, with which other

[1] Federal programs providing disaster assistance to the Virgin Islands include FEMA's PA and Hazard Mitigation Grant Program (HMGP); the U.S. Department of Housing and Urban Development's (HUD's) CDBG-DR; and funding from other federal agencies, insurance companies, and nongovernmental organizations (NGOs).

states typically have to share and implement responsibilities (Eastern Caribbean Center, 2018).

- **Distant island geography:** Small island–based communities face unique and substantial supply-chain issues and workforce constraints that increase the costs of doing business, including being remote and having a relatively small economy and small population. The geography of the USVI, with its three main islands, adds additional complexity.
- **Mix of staffing needs:** The USVI government faces a complex mix of staffing needs, including the need to develop short-, intermediate-, and long-term surges in staffing in various areas. Many recovery functions require individual positions that might not be permanent but that also might not be suitable for contractors.
- **Possibility of another disaster:** The USVI faces the ongoing threat of another significant disaster, such as a hurricane or earthquake, while still in the midst of recovering. At the time of this writing, the USVI is confronting yet another disaster, the COVID-19 global pandemic.

Recovery Progress Since the Hurricanes

Despite the significant demands placed on its management capacity, the USVI has made progress in key areas of recovery, as highlighted in this section. In particular, the USVI has developed governance structures, staffing, and processes to support recovery. These steps have, in turn, translated to progress in several areas, principally in terms of obligation of emergency funding and identifying priorities for the longer-term recovery.

Emergency-Response Activities

Most emergency recovery work activities (from clearing debris to restoring power to reopening schools) have been completed. FEMA defines PA category A work as debris removal and category B work as "emergency protective measures" (FEMA, 2018c). Obligated funding for category A and B work in the USVI represents $902 million of the total disaster funding. At the same time, representatives of several territory agencies with whom we spoke noted that they were still waiting for reimbursement from FEMA for this completed work. Completing reimbursement for emergency-response activities is also a critical milestone in recovery because it has implications for the overall fiscal health of the territory government and, until completed, might require managerial attention that would otherwise be devoted to recovery work. Not receiving reimbursements might also mean that agencies forgo responsibilities that would have used such funding.

The Office of Disaster Recovery

In February 2019, Governor Bryan established ODR by executive order with a mandate to coordinate and oversee territorywide disaster-recovery efforts (ODR, undated b). ODR was funded through a grant from the Office of Insular Affairs in the U.S.

Department of the Interior (DOI) through March 2020. Prior to the creation of ODR, the recovery was managed by the Virgin Islands Territorial Emergency Management Agency (VITEMA).

ODR's mission is to provide "broad programmatic oversight and centralize coordination across the government, semiautonomous, and non-profit agencies" (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). The executive order gives ODR oversight responsibilities for the USVI's federal funding, including FEMA PA and HMGP, HUD's CDBG-DR, and the Federal Highway Administration's (FHWA's) Emergency Relief programs. ODR's oversight roles include certifying that territory agencies receiving funds from these and other programs have complied with all program regulations and timelines (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). ODR also has responsibility for providing relevant training to territory personnel and developing tracking and control systems. The ODR director reports directly to the governor, although ODR is located administratively within the Virgin Islands Public Finance Authority (PFA). As of February 2020, ODR had ten staff, including its director.

Development of Recovery Plans

Formal plans are another structural element of recovery. Since 2017, a series of recovery plans and associated materials has been produced by public and private entities in concert with community stakeholders in the USVI. Most prominently, the *U.S. Virgin Islands Hurricane Recovery and Resilience Task Force: Report 2018* served as the initial framework for recovery spending (USVI Hurricane Recovery and Resilience Task Force, 2018). Consecutive progress reports aligned with the plan reported progress toward sector goals: *Transforming Through Recovery: U.S. Virgin Islands First-Year Progress Report—Hurricanes Irma and Maria* (October 2018) (Government of the USVI, 2018), and *Building a Legacy of Resilience: United States Virgin Islands Hurricanes Irma and Maria Recovery Progress Report* (September 2019) (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019).

Community recovery plans focused on local, grassroots efforts. In August and September 2018, FEMA facilitated a series of community engagements on St. Croix, St. Thomas, and St. John to develop individual island community recovery plans. Each community recovery plan identifies projects that are aligned with the community's vision for recovery, increased resilience, and future development (Microsoft Power BI, undated). The 72 projects identified in the three community recovery plans were developed and executed through grassroots efforts. They are independent of other recovery plans and tailored to meet community needs as characterized by residents. Discussion of the activity of nonprofit organizations and other USVI community efforts is continued in Box 2.5, in the "Key Barriers and Gaps" section later in this chapter.

Identification of Recovery Priorities

Governor Bryan has identified the Top 100 recovery projects that have the "greatest criticality to the community" (FEMA, 2018c). The ODR website provides a complete listing of the Top 100 projects. As of March 23, 2020, one project was complete (Water Island Composite Poles), eight are under construction, 33 are in the design phase, and the remaining 58 have not been started (Figure 2.1).

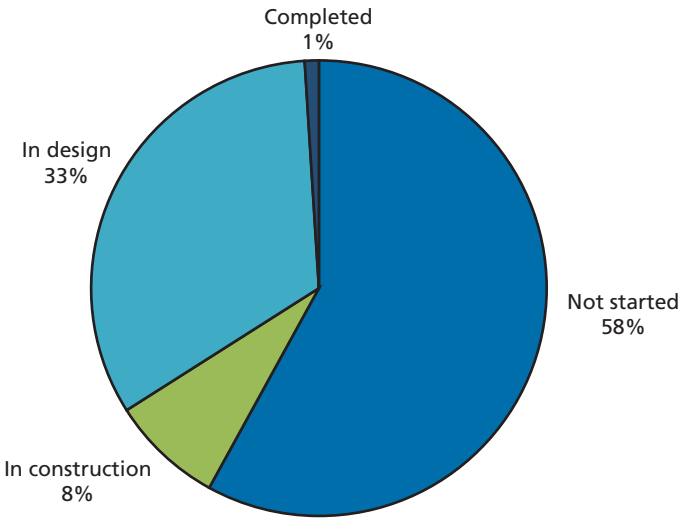
The governor also identified five sectors as "priorities of the priorities": electricity, housing, health, education, and transportation. Completing the temporary facility for Governor Juan F. Luis Hospital and Medical Center (JFL) is the top recovery priority, with a target of the spring of 2020 for completion (ODR, 2019b).

Interagency Coordination and Progress Tracking

After its creation, ODR conducted initial Recovery Project Status Meetings with 19 territory subapplicants. ODR continues to hold standing meetings with some entities, such as the Water and Power Authority (WAPA) and JFL. ODR also maintains a website tracking recovery progress (ODR, undated a). In late 2019, Governor Bryan and ODR established a government-wide Top 100 Projects Group, involving meetings by heads of territory agencies to update project statuses, "identify cross cutting impediments to project completion," and promote information sharing (ODR, 2019b).

After its creation, ODR conducted initial Recovery Project Status Meetings with 19 territory subapplicants. ODR continues to hold standing meetings with some entities, such as WAPA and JFL. ODR also maintains a website tracking recovery progress

Figure 2.1
Progress of the Top 100 Recovery Projects as of March 23, 2020



SOURCE: ODR, undated i.

(ODR, undated a). In late 2019, Governor Bryan and ODR established a government-wide Top 100 Projects Group, involving meetings by heads of territory agencies to update project statuses, "identify cross cutting impediments to project completion," and promote information sharing (ODR, 2019b).

Staff Training and Certification

The territory is taking steps to improve the capacity of its existing agency staff through training. For example, the USVI Department of Property and Procurement (DPP) created a system to train procurement professionals who are placed into home agencies but who report through a central structure to DPP (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). The University of the Virgin Islands (UVI) is developing a certification program for new procurement professionals.

Accessing Contractor Support Using Federal Funding

The territory government also has access to federal funds to augment its management capacity. FEMA category Z funds, totaling as much as 12 percent of the project award, can be used to reimburse management costs for PA projects. Of these funds, 7 percent is designated for the applicant and 5 percent for the subapplicant (FEMA, 2018f). Category Z funds are designed to help agencies offset costs associated with project management. According to FEMA's Grants Manager database, FEMA has obligated $169 million in category Z funds to the USVI.

Category Z funds are being used to pay for the USVI's support contracts. These contractors are coordinated by ODR, with territory agencies able to ask for help via ODR; ODR assists requesting agencies in developing a work plan. Beginning in 2017, the PFA retained Witt O'Brien's and Ernst and Young to assist with "navigating the complexity of adhering to and managing federally funded disaster recovery programs" (ODR, 2019b). Witt O'Brien's acts as the main consultant for VITEMA and subapplicants on applying for and administering FEMA funds, including undertaking damage assessments and navigating Grants Manager processes. Ernst and Young is focused on assessing USVI agency management; for example, representatives are working with ODR to assess capacity issues in selected agencies and finalize process maps of the finance function in each agency (ODR, 2019b). We were unable to determine whether the contracts exhaust all of the USVI's available category Z funding (PFA, 2017a; PFA, 2017b). In studies of other disasters, researchers have found that contractors can play a crucial role in helping governments recover from disasters when governments align contractor responsibilities with government expectations (see for example, Culbertson, Bordeaux, et al., 2020).

Disbursement of Recovery Funding

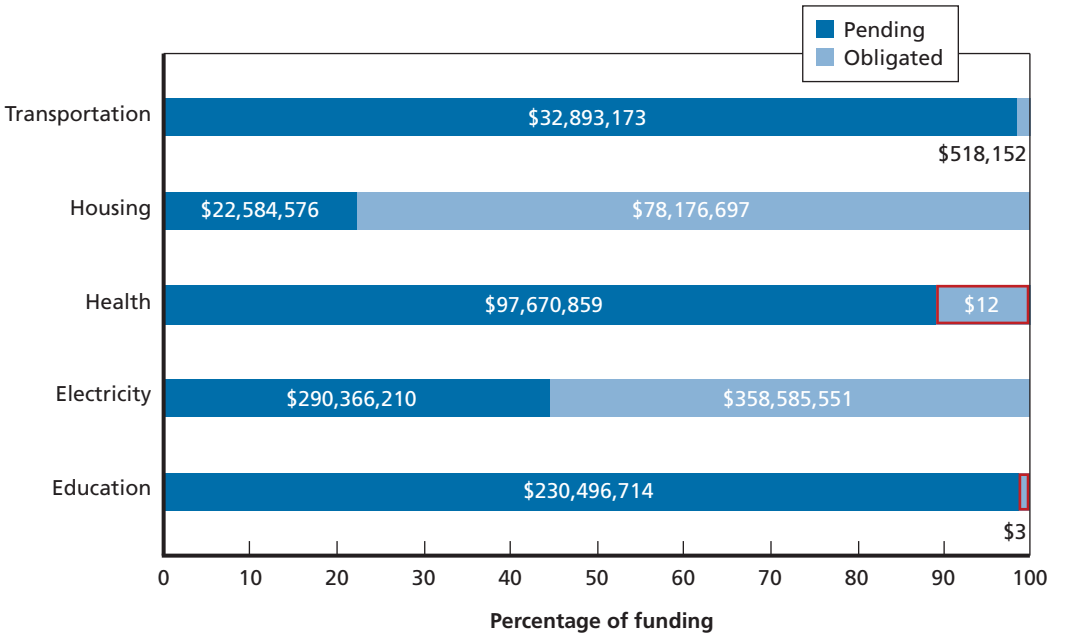
Some, though not all, reimbursement funding has been allocated, obligated, or disbursed. As of January 31, 2020, $2.17 billion of an anticipated $5 billion in FEMA PA had been allocated, obligated, or disbursed; $65.09 million of $461.9 million expected

in FEMA HMGP; $38.7 million of $48.3 million designated by the U.S. Department of Transportation's (DOT's) FHWA Emergency Relief program; and $237.68 million of $1.8 billion by HUD CDBG-DR. An additional $548.7 million in funding from the Federal Communications Commission (FCC), the U.S. Department of Health and Human Services (HHS), the U.S. Department of Education, and the U.S. Army Corps of Engineers (USACE) have also been made available (ODR, undated e; ODR, 2019b). Of the Top 100 recovery projects, 68 seek funds from either PA or HMGP (ODR, 2019b). Box 2.4 later in this chapter provides a comprehensive overview of all federal funding available to the USVI for recovery.

Progress in Priority Sectors

Progress in priority sectors is uneven and varies depending on how progress is measured. Figure 2.2 shows progress, as evidenced by Grants Manager data, across the five sectors that the USVI government has identified as "priorities of priorities." It shows the amount of FEMA funding pending and obligated, by sector. Entities in the housing and energy sectors have obligated a majority of the funds for which they have applied, while the transportation, health, and education sectors are substantially

Figure 2.2
Progress, by Sector, Along FEMA Project Funding Phases, as of February 18, 2020



SOURCE: FEMA Grants Manager database, accessed on February 18, 2020.
NOTE: The amounts listed indicate the best available cost. The "Electricity" bar includes all power-related projects in WAPA's portfolio at the time of data acquisition and might not include all energy-related projects in other agencies' portfolios.

behind (most funds are "pending" in the intake and eligibility, scoping and costing, or final field review phases of the FEMA national workflow model).

Recovery Direction

The recovery direction for this capacity is summarized in Box 2.3.

Box 2.3
Recovery Direction for Management Capacity

Ensuring that the USVI government has sufficient capacity to effectively manage recovery efforts, including the governance structures, staffing, and processes needed to achieve recovery goals

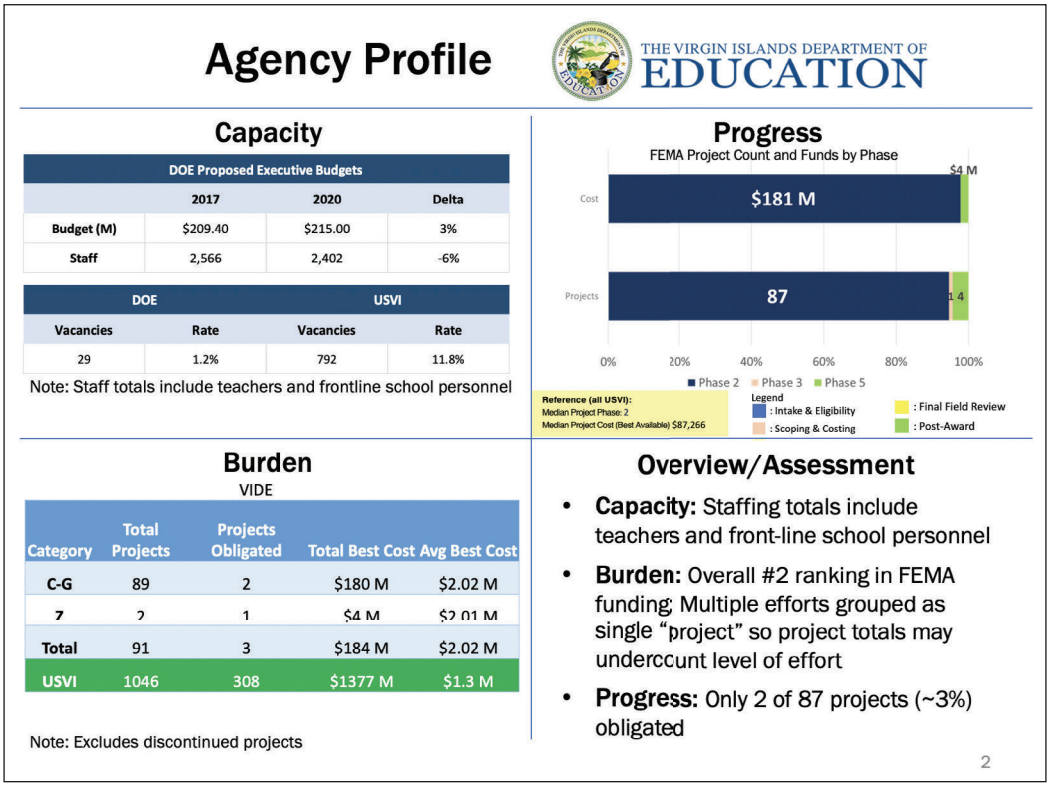
Agency Management Capacity, Recovery Burden, and Progress

USVI agencies do not have the same levels of capacity, and different agencies face different recovery workloads. Accordingly, we developed summary profiles of individual agencies, in which we attempted to capture three key aspects of recovery management. The intent of these comparisons is to allow decisionmakers to put an agency into context with the rest of the territory government, and management tools such as these can point to areas in which additional attention or technical assistance might be merited. The summaries are organized as follows:

- **capacity**, reflected by
  - the agency or department's prior experience managing funds, measured in total budget in the last full fiscal year prior to Hurricanes Irma and Maria
  - actual current staffing levels relative to the agency's total authorized personnel levels and compared with the rest of the territory government
- **burden of recovery projects**, representing the number of FEMA projects and total amount of funding the agency or department is responsible for overseeing
- **progress**, as measured by how far along the FEMA project is in the PA phases, compared with the average project in the USVI.

For an example, Figure 2.3 shows an agency profile for the Virgin Islands Department of Education (VIDE). Appendix A provides profiles for other agencies. The left sides of the profiles show capacity and burden, while the right sides show progress and provide additional explanatory notes. The profiles also show how an agency's capacity and progress relate to overall progress across all of the territory government by including measures of average agency capacity, such as average vacancy rate. We also identified a median or "typical" recovery project; as shown in the figure, for the USVI

Figure 2.3
Example Agency Profile



SOURCES: FEMA Grants Manager database, accessed on February 18, 2020; USVI executive budgets for FY 2017 and FY 2020 (Government of the USVI, 2016; Government of the USVI, 2019).

recovery as a whole, a median project has a cost of around $87,000 and is in phase 2 (intake and eligibility).

WAPA and the VIDE were selected as examples because they have, respectively, the highest and second-highest recovery funding burdens but very different rates of progress as measured by FEMA phasing. This suggests that the VIDE might have barriers or gaps that would benefit from additional attention or technical assistance from the territory government, federal government, or nonprofit organizations—or that FEMA could improve related processes with the VIDE on its end. In addition, WAPA might have promising practices, systems, or conditions worthy of emulating at other agencies. For example, as a semiautonomous agency, WAPA's process requirements differ from those of nonautonomous agencies; this could suggest process changes that the territory government might wish to consider.

There are limitations to the profiles. Each of the measures is, at best, an imperfect proxy for what we are interested in measuring. Although we selected measures based

on data availability, data were not available for some indicators for some agencies. The indicators are themselves limited. For example, the number of staff cannot capture some key information, such as the nature of their duties; staff augmentation through contracting would also not be captured. Although most agencies are receiving FEMA funds, some are also managing large amounts of funding from other sources, such as HUD CDBG-DR, which creates management burdens not accounted for in our indicators. Regardless, a framework such as this—which compares the capacity and workload of various agencies with progress—can help the USVI and federal decisionmakers identify how to focus their attention and technical assistance. Box 2.4 describes types of federal funding available to the USVI for recovery.

Key Barriers and Gaps

The USVI faces some management-capacity gaps and related barriers to addressing its recovery-related responsibilities and lines of efforts. We have divided these barriers and gaps into three general areas—governance structures, staffing, and processes—which align with the recovery direction for this capacity.

Recovery Governance Structures Are Not Clear

Organizational Lines of Authority Overlap in Key Areas

Many stakeholders with whom we met expressed confusion about the roles and responsibilities of various USVI agencies in managing recovery processes. There were two main reasons for this.

First, ODR is housed within another agency, the PFA, but reports directly to the governor. Although ODR is responsible for overseeing the recovery, this nesting might not position it structurally to coordinate the recovery work of more than 20 departments and agencies.

Second, although ODR is charged with overall oversight of recovery, the USVI's two largest sources of recovery funding are managed on a day-to-day basis by two other agencies, VITEMA and the VIHFA, each of which plays a key role in administering recovery projects.

VITEMA managed recovery activities before the creation of ODR and remains the primary applicant for all FEMA funds, including PA and HMGP. This has created a complicated day-to-day management process for these grant programs. ODR is responsible for the reporting requirements associated with PA and HMGP grants and assists subapplicants with administrative capacity. VITEMA is responsible for performing subapplicant documentation review and project approvals, requesting manual drawdown of funds from FEMA, and performing day-to-day management tasks. VITEMA has dedicated staff for PA in St. Croix and St. Thomas (nine and ten,

respectively) and for HMGP (seven on each island), making it the forward face of the programs to other agencies and to subapplicants.

Box 2.4
An Overview of Federal Funding Available to the USVI for Recovery

The two largest sources of federal funds are from FEMA and HUD. FEMA is expected to provide approximately $2.6 billion, while HUD will provide approximately $1.86 billion, divided between $1.09 in funding for unmet needs through the CDBG-DR process and $0.77 million in mitigation funds (HUD, 2019a). HUD's funding was provided by supplemental appropriation, and the VIHFA is the territory's grantee for the full total of CDBG-DR funds, primarily devoted to housing. The mitigation funds are intended to reduce the risk of future disasters across a variety of sectors (VIHFA, 2019a).

Among FEMA funds, PA is the largest funding source, and it is divided into different streams. Categories A and B are for emergency work. Categories C through G are for permanent work. Category Z is for management costs. As of 2019, the USVI had spent $1.1 billion, with emergency work (categories A and B) making up the largest share (U.S. Government Accountability Office, 2019b).

Category	Type of Work	Purpose
A	Emergency	Debris removal
B	Emergency	STEP program for repairs to housing, other non-STEP emergency services
C	Permanent	Roads, bridges, related infrastructure
D	Permanent	Water control and facilities
E	Permanent	Buildings and equipment
F	Permanent	Utilities
G	Permanent	Parks, recreation, and other facilities
Z	Permanent	Management costs, including indirect costs, direct administrative costs, and other administrative expenses related to a specific project

The primary way to follow the progress of PA projects is through FEMA's Grants Manager database, which tracks projects through obligation (which is FEMA's commitment to execute a project). As of February 2020, Grants Manager showed 1,047 active projects, but only 29.5 percent of those had been obligated. Among those projects, it took an average of 221 days to obligate the project. The database is limited because it does not track projects after obligation; in other words, it does not track the extent to which projects are underway. However, HSOAC discussions indicated that there was a lag after obligation, and the funds were not immediately converted into spending and project work.

Many other federal agencies have active operations in the USVI, and many of those have funds devoted to recovery. The most important agencies for infrastructure spending are the FCC, USACE, the U.S. Small Business Administration (SBA), and FHWA. For health and social services, HHS, especially the Centers for Disease Control and Prevention (CDC), the U.S. Department of Agriculture (USDA), and the U.S. Environmental Protection Agency (EPA) are the most prominent. Later chapters address some of these agencies' programs.

Beyond federal funds, private insurance is an important source of recovery funds for businesses and homeowners, but the extent paid out is unknown. Nonprofit organizations, including the Community Foundation of the Virgin Islands (CFVI) and LTRGs on each island, have raised funds, managed cases, and implemented specific projects funded by their donors or government grants.

In turn, HUD's CDBG-DR funding—another key source of recovery project funding—is managed by the VIHFA (VIHFA, 2020). The VIHFA is tasked with providing affordable housing within the USVI and includes a division dedicated to federal grant management (Government of the USVI, 2019). After the 2017 hurricanes, the VIHFA managed the flow of $1.86 billion in funds for housing repair, largely from HUD CDBG-DR assistance provided by supplemental appropriation to address disaster-related impacts (VIHFA, 2019a). Chapter Eight discusses VIHFA's role in more detail.

ODR is responsible for certifying VITEMA's and the VIHFA's work in managing the grant and funding mechanisms, despite the fact that these are substantially larger entities than ODR and report to ODR on only certain matters. This structure would not enable simple resolution of conflicts over resource allocation, decisionmaking, and prioritization of recovery and nonrecovery workloads within agencies with crosscutting requirements.

However, the research literature identifies the presence of clear governance structures as important for implementing disaster recovery. Such structures include clearly defined roles and responsibilities, performance information based on these roles, and tools for transparency in order to evaluate progress and build legitimacy (Ahrens and Rudolph, 2006; Cumbie and Sankar, 2012; Head, 2007; L. Johnson and Mamula-Seadon, 2014; van Kersbergen and van Waarden, 2004; L. O'Toole, 1997; Paton and Johnston, 2001; Raju and Becker, 2013; United Nations International Strategy for Disaster Reduction, 2008). Clear governance structures are intended to promote long-term coordination to achieve collective recovery goals (Cumbie and Sankar, 2012; Raju and Becker, 2013).

The Office of Disaster Recovery Does Not Have the Full Resources Required for Its Role in the USVI's Recovery

ODR does not have sufficient or sustained resources needed to manage its responsibilities. With only ten staff, ODR may be understaffed to manage a recovery of this magnitude. ODR's offices are small and unable to accommodate meetings of more than a few people. ODR also lacks the tools for managing such a large and complex endeavor. At the time of this writing, the territory lacked a system to manage data on the recovery, although the USVI Office of Management and Budget (OMB) was beginning the roll-out of eCivis, a data-management system for tracking federal funding. The territory also lacked a set of comprehensive metrics for progress across the USVI's full portfolio of recovery projects, although ODR's website contains some such measures (e.g., dollars obligated) and general status measures (such as "in progress") (ODR, undated e). ODR staff, in some cases, do not have access to training in the specific recovery programs they were responsible for overseeing. Finally, ODR's funding was scheduled to expire in May 2020, although applications were underway as of that time for additional funding.

The USVI Has Gaps in Its Government Staffing for Recovery

Agencies Are Not Fully Staffed and Staff Lack Needed Skill Sets

USVI government agencies lack sufficient numbers of personnel with experience in managing the volume, level, and complexity of projects required for recovery management, according to our discussions with territory agencies and the analysis of staffing levels we detail in this section. These gaps affect all agencies to some extent and are discussed in more-specific detail in the individual sector chapters of this report. Recovery management capacity requires skills and experience in project planning, prioritization, contracting, execution, budgeting, permitting, communication, engineering, project management, proposal and grant writing, and coordination. Government staff must either perform these functions directly or oversee contractual staff taking on these roles.

Table 2.1 shows the total number of authorized personnel positions for territory agencies, broken down by filled and vacant positions. Of note is that 11.8 percent of the total authorized positions within the USVI government are vacant. Some individual agency vacancy rates are as high as 44 percent. VITEMA, which is critical to recovery efforts, had a 15.5-percent vacancy rate. Understaffing can affect an agency's ability to manage its recovery effort because staff who are already overburdened with routine tasks might not be able to complete tasks associated with recovery efforts. Although we did not have data on contractual staff by agency or for the government as a whole, some agencies are likely offsetting the impact of vacancies by leveraging contractual resources. However, some functions are inherently governmental, and there are long-term benefits to the USVI from maintaining and developing institutional knowledge.

Territory Agencies Lack Dedicated Recovery Personnel and Face Administrative and Funding Barriers to Making New Hires

As of May 2020, few territory agencies had been able to hire a full-time staff person responsible for recovery responsibilities—that is, a staff person who works exclusively on recovery without having other duties. ODR requested recovery staff for nine territory agencies from OMB and received approval for several; as of May 2020, the Bureau of Corrections and DSPR had hired recovery staff. For the most part, other departments and agencies (for example, VIDE) have not. As one government stakeholder noted in a discussion, "There's no capacity to actually write grants here. We need good folks. We have a lot of supplemental money, and they [territory government staff] can't fill out the applications to win money in support of good projects."

There are multiple barriers to hiring. First, personnel with whom we spoke described a hiring "chicken or the egg" situation, in which agencies are unable to develop projects without hiring additional staff but do not have sufficient funds to hire staff to develop federally funded projects. Category Z funds could potentially be used to hire government recovery management staff. However, representatives of many agencies with whom we spoke did not know how to access the category Z fund-

Table 2.1
Authorized Personnel for Selected USVI Government Entities for FY 2020

Entity	Filled	Vacant	Total	Vacancy Rate, as a Percentage
Department of Tourism	24	19	43	44.2
OMB	37	22	59	37.3
BIT	18	8	26	30.8
VIDOL	96	39	135	28.9
VIDOH	299	102	401	25.4
DPNR	155	50	205	24.4
Department of Human Services	632	180	812	22.2
VIDA	53	12	65	18.5
DPP	69	14	83	16.9
VITEMA	71	13	84	15.5
Department of Justice	135	23	158	14.6
DPW	207	28	235	11.9
Bureau of Internal Revenue	130	15	145	10.3
VIPD	523	52	575	9.0
DSPR	109	9	118	7.6
Department of Finance	47	2	49	4.1
Division of Personnel	45	1	46	2.2
VIDE	2,373	29	2,402	1.2
All USVI entities	**5,920**	**792**	**6,712**	**11.8**

SOURCE: Government of the USVI, 2019.

NOTE: BIT = Bureau of Information Technology. VIDOL = USVI Department of Labor. VIDOH = U.S. Virgin Islands Department of Health. DPNR = USVI Department of Planning and Natural Resources. VIDA = USVI Department of Agriculture. DPW = USVI Department of Public Works. VIPD = Virgin Islands Police Department. DSPR = Department of Sports, Parks, and Recreation. Totals shown are not the sum of the data shown; they are for all USVI agencies, and not all agencies are included.

ing for hiring. They also noted difficulty in using these funds: They must pay staff or contractors for recovery management up front with their own funds and then seek reimbursement from FEMA for these expenses. As discussed in more depth in Chap-

ter Three, many agencies lack the liquidity to start this process and therefore hire staff using category Z funding.

In addition, the territory government faces competition for scarce workforce talent in the USVI, with competition among government agencies and with FEMA and the private sector, which are able to pay higher wages.

Finally, administrative procedures and long hiring timelines required under the USVI's personnel processes stymie the hiring of needed staff. The territory does not have a specific mechanism that could be used to quickly hire recovery-related positions. Instead, all positions are hired in one of two employment categories: exempt positions, which are appointed positions and can be hired more rapidly but are generally less popular because they are perceived to (and do) lack job security, and classified positions, which personnel across multiple agencies and departments reported can take months to bring on board.

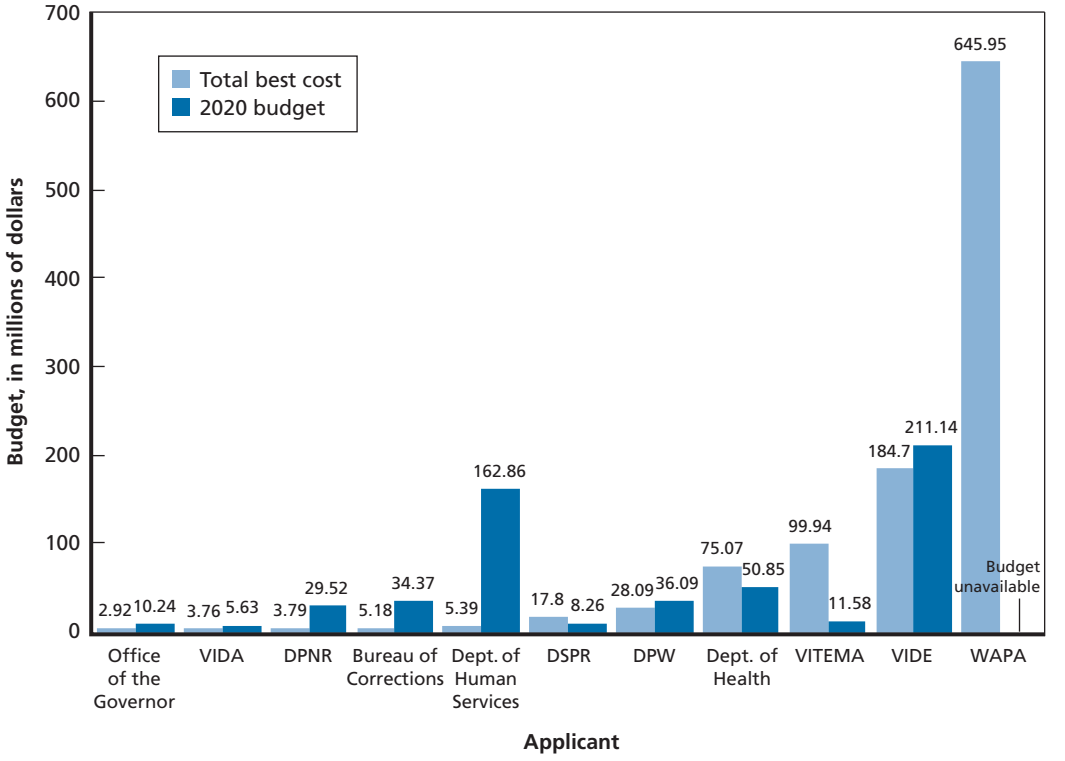
Office Building Working Conditions Impede Management of the Recovery

Working conditions in buildings for some of the territory's workforce also have negative impacts on staff productivity and on the USVI's ability to attract and retain sufficient and well-qualified staff. For example, several of the VIPD's key facilities suffered damage from the hurricanes, and the VIPD reported that some staff were refusing to work in the facilities because of the environmental hazards. During our meetings, we observed that department office space in the VIDE had water stains on the ceiling, exposed electrical wires, and missing ceiling tiles. Community stakeholders described internet access as "really spotty" and inaccessible during periods of electricity failure. However, in the case of the VIPD, the department works out of leased facilities owned by multiple private landlords who do not have access to federal recovery funds and with whom the VIPD has very limited leverage to negotiate, given the shortage of available office space in the USVI.

Some Territory Agencies Are Managing Large Amounts of Funding Compared with Their Staffing and Experience

Some territory agencies are managing much more funding than they typically do, suggesting that they might face staffing constraints related to the number of personnel with needed skills and experience. One way to assess this is to compare projected recovery funding (which may be spent in the coming several years) with annual operating budgets. Figure 2.4 shows 2020 operating budgets for key departments and agencies in comparison with FEMA PA funds. Best cost reported is the sum of either applicant-provided estimates or FEMA-derived assessments, depending on projects' status in the funding approval process. Several entities will be required to manage recovery budgets that constitute a significant proportion, are equal to, or exceed their typical total annual budgets. It is unlikely that these responsibilities can be successfully absorbed without hiring additional staff with requisite skills and experience.

Figure 2.4
Agency 2020 Budgets Compared with the Best-Cost Recovery Budget



SOURCE: Government of the USVI, 2019.

Interagency Coordination and Troubleshooting Are Not Done Through Systematic Management Structures and Processes

Discussions suggested that many recovery coordination issues are addressed on an "issue-by-issue basis," rather than through routine mechanisms. Lacking these supportive coordination structures can reduce the opportunity to collaborate across agencies and maintain broad situational awareness of issues and needs in a given area (such as hiring) and could be costly to senior officials in terms of time and attention. Robust mechanisms to coordinate management processes that cross organizations or agencies are particularly important for the USVI government, given how recovery responsibilities have been divided among ODR, VITEMA, the VIHFA, and other agencies. Successful recovery will require integrating and coordinating activities across multiple agencies within the USVI territory government; between the territory and federal levels; and across the public and private sectors to fund, plan, and execute the recovery work.

Key Processes Required for Recovery Are Overly Complex, and Some Agencies and Stakeholders Lack Understanding of Them

Key processes associated with federal recovery funding, such as FEMA PA and HMGP, are not universally understood across agencies or stakeholder groups; this was a repeated theme across our discussions (see Box 2.5 for more on how nonprofit organizations affect management capacity in the USVI). This has manifested in several ways. For example, the PA obligation and funding processes are complicated, cross several organizations, and, as indicated by some USVI officials, lack transparency. Figure 2.5 provides a diagram that we prepared to depict the relationships among the various entities involved in the flow of information, reporting, and funding for FEMA PA funds. The difficulty conveying the process in a simple process map could be one reason so many agencies expressed a lack of understanding about how the PA process was supposed to work in the USVI.

Box 2.5
USVI Nonprofit Organizations and Management Capacity

Although this chapter focuses on territory government management capacity, we present a brief overview of nonprofit management roles and capacity here. Nonprofit organizations lead roughly one-quarter of recovery projects, according to Grants Manager data. They fill gaps in government recovery programs, particularly for vulnerable populations, and they innovate new approaches. Most nonprofits in the USVI are small, grassroots organizations with budgets of less than $1 million. Health and human services, including housing, make up the largest proportion of nonprofit services. Nonprofits also provide education and stewardship of cultural resources and includes churches, temples, and mosques. Nonprofits have engaged in immediate response, ongoing service provision, and long-term planning. For example, the CFVI contributed to the development of the 2018 USVI task force recovery plan (USVI Hurricane Recovery and Resilience Task Force, 2018). Many programs targeting care for elderly and disabled populations and children depend on the nonprofit sector for case management and implementation.

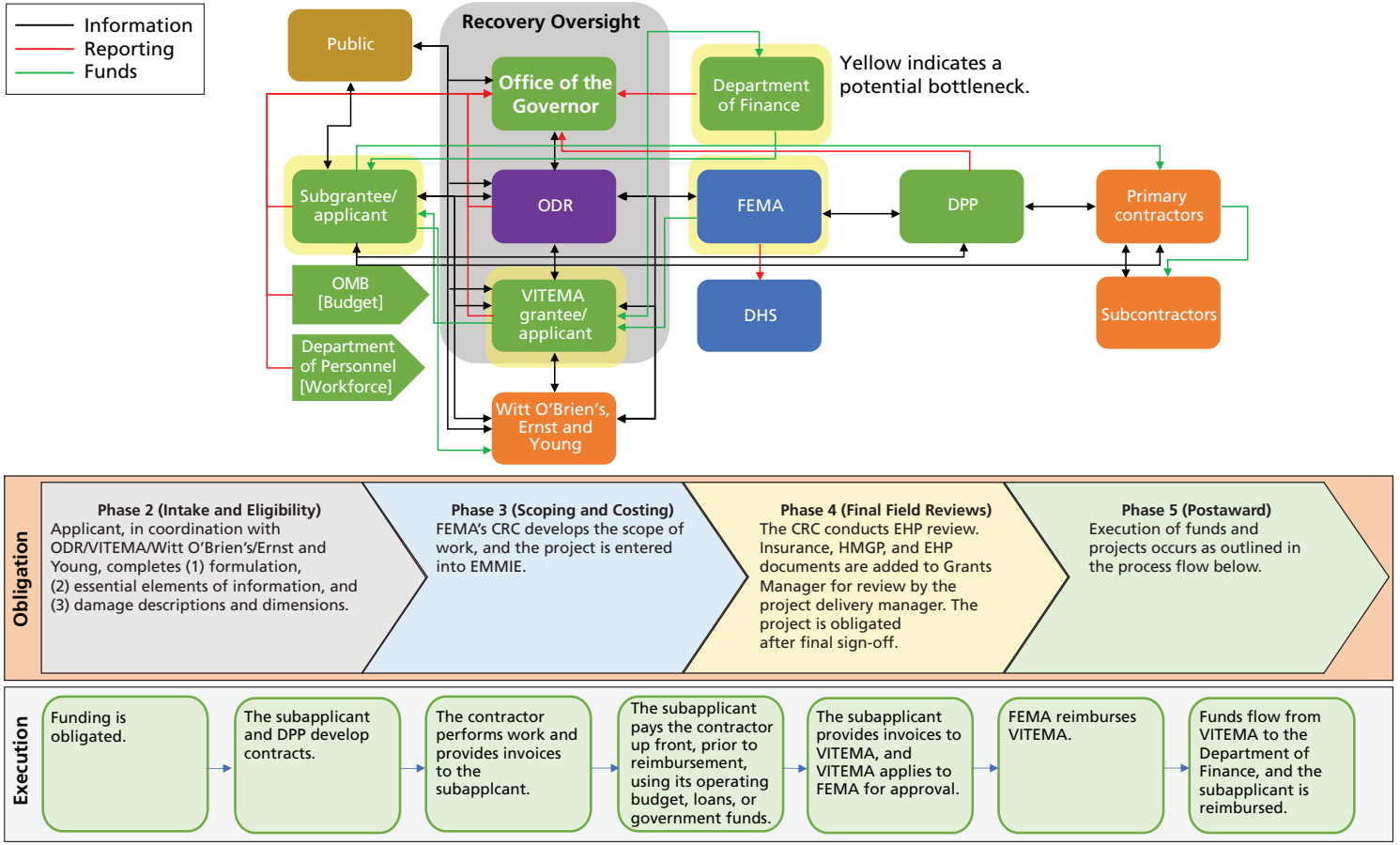
The territory's nonprofit sector is fragmented, separated by the three main islands' distance and distinct cultures, as well as by gaps that separate nonprofits from the governmental and private sectors. The LTRG, or consortium of nonprofits collaborating for common purposes on each of the three largest islands, has been a focal point for recovery, with St. Croix's nonprofit recovery network being the most developed. The groups developed new approaches to recovery, including a survey of island food systems to build food security and a program to train island residents in mold remediation, a pervasive problem made worse by the storms.

Nonprofits also face challenges in implementing recovery projects. Some nonprofits have the same difficulty finding qualified workers that other parts of the economy do. A lack of affordable housing squeezes nonprofit workers and makes it difficult to attract newcomers to the territory. Some nonprofits in our discussions reported challenges in accessing federal funds because of what they view as opaque and changing rules, requirements to submit the same information multiple times, or inconsistent communication with territory agencies.

Yet nonprofits remain vital to recovery because they possess knowledge of the territory at a neighborhood level, and they have demonstrated a willingness to help in cases in which standard rules and procedures or capacity gaps make it difficult for larger government programs to find solutions. For example, they have helped residents without sufficient access to capital or the ability to navigate the assistance process to rebuild their roofs, usually at a lower cost than other programs. In many cases, nonprofits perform case management for government programs.

Nonprofits in our discussions sometimes reported being left out of long-term planning decisions, but they remain committed to generating new ideas for the territory's' future. For example, nonprofits own and operate a wealth of historic properties that could be part of a vision for sustainable tourism.

Figure 2.5
Diagram of Territory Government Relationships for FEMA Public Assistance Funding



NOTE: DHS = U.S. Department of Homeland Security. CRC = consolidated resource center. EHP = environmental and historical preservation. Phase 1 (operational planning) is conducted prior to entry into Grants Manager. Net cost estimate is the value after insurance and HMGP.

Other Processes, Such as Hiring, Procurement, and Permitting, Are Not Adapted to Recovery

Several core processes and functions, such as hiring and procurement, did not appear to be fully adapted to accommodate recovery needs. We discussed the hiring processes above. In terms of procurement, multiple agency stakeholders described complex procurement procedures that require interaction and approvals from DPP. DPP officials indicated that they had worked to increase the threshold for procurements requiring DPP approvals for expenditures to $50,000 so that agencies could manage any procurements below this amount on their own to accommodate the surge in recovery projects. However, these thresholds are not within the direct control of DPP or the executive branch but are instead subject to legislative approval. This limits the ability of DPP and the territory government more widely to alter policies as needed, institute pilots, and either rescind or take those pilots to scale based on performance. Semiautonomous agencies, such as WAPA, have fewer steps than other agencies with regard to both procurement and hiring and thus are able to complete these key functions more rapidly because they do not need to go back to agencies with crosscutting functions, such as OMB or DPP, for multiple approvals. Last, we found that the USVI lacks readily available documentation on how to conduct basic administrative business processes—such as permitting—which are critical to recovery operations.

Information Systems to Meet Recovery Demands Are Nascent

Information systems (both territory and federal) in the USVI were, in some cases, not available or not fully meeting information needs, according to multiple stakeholder discussions. These gaps were both specific to the recovery and present in business systems that predate the recovery but are critical to it, such as property records.

At the time of this report's writing, no single database cataloged federal funding from all of the federal agencies that provide funding to all of the territory agencies. Although OMB, through the eCivis platform, was rolling out an information system that aimed to create a single database, stakeholders described a need for territory government–wide information systems for managing different funding streams from FEMA, HUD, and other federal agencies. One general theme in discussions was that this gap presented difficulties in coordinating recovery efforts, gaining visibility into the status of recovery projects, understanding overlapping areas of responsibility, and supporting decisionmaking.

Furthermore, according to our discussions, many systems—including those that predate the recovery but are critical to it—are manual or paper processes, although there are a few new efforts to digitize systems (such as an initiative involving DPP, OMB, Finance, and Personnel considering a transition of the government to digital).

In addition, FEMA's Grants Manager database also faced limitations, with differences in how different stakeholders defined and used key indicators. For example, how a "project" is counted in the system varies; some agencies cataloged a large effort

as a single project, while other agencies cataloged large efforts as multiple component projects.

FEMA's Manual Drawdown Process and Staff Turnover Slow the Reimbursement Process

Federal processes also add to recovery delays. USVI officials noted that FEMA had instituted a manual drawdown process for funding because of concerns that the agency had noted about the territory's systems and controls. By the territory officials' account, this requirement added ten to 15 days to the process, although they acknowledged that the delay was also at least partially because territory agencies were being slow to respond to FEMA requests for information and taking the maximum 15 days allowed to respond.

USVI personnel also noted that FEMA staff turnover as a result of policies that require FEMA staff to rotate on a regular basis added time and created confusion, in that agreements worked out with outgoing staff were reported to not be honored by incoming staff sometimes. Applicants reported being asked for information that they had previously provided or having their applications rereviewed when their points of contact at FEMA changed. FEMA expressed awareness of problems with document and case handoff and was working on a solution as of early February 2020.

Box 2.6
COVID-19 and Management Capacity

This chapter's assessment of the USVI's management capacity was informed by discussions and analysis conducted largely between November 2019 and February 2020. The advent of COVID-19 has the potential to create further challenges for the USVI's management capacity.

First and foremost, response to COVID-19 will almost certainly consume a significant portion of the USVI's management capacity, including the time and attention of key senior leaders who would otherwise be focused on hurricane recovery. Departments and agencies that are critical to the recovery might need to reprioritize staff, financial, and other resources toward efforts related to managing response to COVID-19. Work-from-home orders for government personnel will reduce the efficiency of government operations, including the ability to communicate and coordinate on project management issues. The USVI's underlying power and internet infrastructure might not be able to support work from home for large numbers of government staff, some of whom might essentially be unable to work.

Some recommendations in this chapter might be significantly less viable during the COVID-19 pandemic. Hiring new personnel or designating existing personnel solely to recovery operations could be impossible. Recommendations that are contingent on holding large meetings, such as interagency coordination meetings, will likely require other, more physically distant approaches. The pandemic also increases the importance of other recommendations presented in this chapter. Perhaps most importantly, we recommend that the USVI government maximize existing territory government staff capacity by cross-training personnel and creating redundancy and lines of succession. This is likely to be especially critical should significant numbers of government employees become unable to work because of illness or poor connectivity.

Recommendations

Hurricane recovery has placed significant demands on the USVI's existing management capacity. Although progress has been made in key areas, the USVI continues to face challenges related to governance structures, staffing, and processes. In this section, we offer recommendations to address each of these areas and to enhance the USVI's overall ability to manage and oversee the many recovery projects underway in the USVI.

Recommendations Related to Governance Structures

Establish and Implement a Plan to Lay Out Unambiguous Lines of Authority and Responsibility for the Office of Disaster Recovery's Recovery Leadership with Sustainable Funding

Goal	Clarify ODR's long-term role in disaster recovery and deconflict and streamline the roles of territory agencies in disaster recovery.
Rationale	Clear lines of authority and responsibility are essential for coordinating and managing the recovery effectively and efficiently. The responsibilities of the lead entity in the recovery must be clear, and its roles and functions—and most importantly, lines of authority in regard to the recovery—must be well understood and unambiguous. ODR operates on temporary funding that is not sustainably budgeted into the future and has significant responsibilities in coordinating other agencies' activities. Governance and management best practices encourage clear delineation of roles and responsibilities to optimize efficiency.
Implementation considerations	Clarify roles and responsibilities in disaster recovery: Identify and sustainably fund ODR as a clear recovery leader with a long-term (five- to ten-year) charter to make overall authority over the recovery unambiguously clear now and in the future (responsible party: Office of the Governor). Develop a straightforward, unambiguous written plan showing lines of authority among and between territory entities and federal recovery partners (responsible party: ODR or VITEMA). Avoid shared responsibilities or variable reporting relationships, favoring singular, clear lines of authority. Design and implement a communication plan to promote understanding of recovery leaders' roles and responsibilities (responsible party: ODR or VITEMA). Consider moving ODR from the PFA to directly under the governor to avoid confusion (responsible party: Office of the Governor).
Leading entities	Office of the Governor, ODR, official recovery lead and Ernst and Young management, and VITEMA—the primary recipients of Witt O'Brien's services—jointly lead implementation and coordination.

Provide the Office of Disaster Recovery with Resources Commensurate to Its Responsibilities, Including Oversight of a Fully Staffed Portfolio Management Office and Enhanced Work and Meeting Space

Goal	Provide ODR with access to staff, facilities, and other resources equivalent to its roles and responsibilities in the recovery.
Rationale	With only ten full-time staff, ODR is too small to effectively execute its myriad roles and responsibilities in the recovery; ODR's existing staff also reported needing specialized training in the programs that the office oversees. ODR has proposed creating a portfolio management office (PMO) to improve its ability to manage and oversee the recovery. The PMO would be charged with creating an integrated portfolio-management approach, project life-cycle methodology, and risk-management methodology to centralize and standardize the USVI's approach to recovery project management (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). Several personnel with whom we spoke indicated that a request for proposals (RFP) to establish the PMO was underway. A PMO or similar entity—composed of individuals drawn from territory departments and agencies with crosscutting roles in the recovery, personnel with skills in the diverse areas required by the recovery (project management, personnel, procurement, planning), or both—should report directly to or be part of ODR. ODR's physical space is too small for interagency meetings. Colocation with representatives from other agencies would facilitate information exchange and have immediate communication and coordination benefits. In municipal government settings, physical space and colocation have tangible benefits to efficiency, particularly with regard to breaking down interagency barriers, miscommunication, and red tape, all of which hinder recovery work.
Implementation considerations	A few implementation steps could be considered: • Fully fund the proposed PMO and embed it administratively within ODR. • Consider supplementing the PMO by identifying departments and agencies with crosscutting recovery roles and expertise (e.g., personnel, procurement) and with major recovery workloads (e.g., WAPA, DPW) and detailing personnel to ODR. • Identify dedicated office space for ODR that is sufficient to host large interagency management meetings.
Leading entity	DPP should lead assessment and assignment of a new facility that is better aligned to serve ODR and its mission.

Develop Formal Intra- and Interagency Coordination Structures Hosted at the Office of Disaster Recovery to Improve Coordination Among Agencies

Goal	Institute recurring standing meetings of all critical interagency stakeholders at the decisionmaker level to eliminate information silos, and provide a consistent and predictable forum to facilitate cross-agency coordination and actively manage the USVI's portfolio of recovery projects on an enterprise basis.
Rationale	A scalable coordination approach is needed across the agencies, projects, and issues that must be managed throughout the recovery effort. A formal, consistent, well-resourced coordination structure is essential to ODR's success, particularly given its small size relative to the agencies it oversees. Agencies and departments play critical roles in the success of one another's recovery projects. Central coordination of recovery through such mechanisms as standing meetings and formalized and consistent reporting could serve as an important planning and problem-solving mechanism.
Implementation considerations	A robust system for coordination between territory agencies can be achieved through the following steps: 1. Institute frequently recurring standing meetings which convene all relevant interagency stakeholders (responsible party: ODR). 2. Set standing agendas for meetings, and collect and publish data and reports in a standardized format to facilitate discussions to troubleshoot problems in real time (responsible party: ODR). 3. Develop agency portfolios based on FEMA's recovery sectors, and assign individuals in ODR responsibility for overseeing those portfolios, reporting to the director (responsible party: ODR). 4. Provide a feedback loop as the grants move through the approval process, and designate a single point of contact for status monitoring and reporting (responsible party: ODR). 5. Clearly defining and communicating the requirements, approval authorities, and steps involved in the grant application and reimbursement processes (responsible party: ODR). 6. Train personnel in recovery operations and key federal programs; provide direct, tailored instruction rather than unsupported access to web portals or written material (responsible party: ODR).
Leading entity	ODR should organize and implement interagency coordination mechanisms, serving as the central hub to connect and synthesize progress tracking.

Establish an Overarching Process and Structure to Drive Understanding and "Ownership" of the Recovery Plan with Sector-Specific Outreach

Goal

Improve public trust through recovery actions by establishing an overarching process and structure, emanating from the governor's office, to drive territory understanding and "ownership" of the recovery plan. Adopt a hub-and-spoke model in which sector-specific outreach is structured as spokes attached to the main hub.

Rationale

There is a need for increased public and stakeholder engagement, both for the recovery overall and within individual sectors. USVI personnel raised issues in transparency and accountability in grant applications, disbursement of recovery funds, establishment of recovery priorities, and the public's confidence in achieving recovery outcomes. Disaster-recovery and management-capacity literature suggests the importance of credibility of governance. Credibility, in addition to management capacity, is required for an effective disaster-recovery effort (Christensen, Lægreid, and Rykkja, 2016). Strengthening transparency also increases stakeholder and public confidence in the recovery effort (Global Facility for Disaster Reduction and Recovery, 2015).

Implementation considerations

Implementation considerations are drawn from the Sendai framework for disaster risk reduction and FEMA natural disaster–recovery frameworks, achieving improved public confidence through the following actions:

- Consider adapting a system, such as the U.S. Trade Representative's advisory committee system, by implementing a hub-and-spoke model with tiered advisory committees focusing on overall recovery matters, crosscutting issues, and individual sectors (International Trade Centre, undated; Rogowsky, 2015).
- Leverage models, such as that of the Millennium Challenge Corporation, to engage the local community and collaborate across the public and private sectors to build public support for recovery priorities with good communication by developing and implementing a public communication strategy to raise public awareness and establish the public's expectations of the recovery process (responsible party: ODR) (Dunning, Rose, and McGillem, 2017; Millennium Challenge Corporation, 2009).
- Leverage existing or newly created local bodies to form "stakeholder committees" that are broadly representative of society (government, private sector, civil society) to both inform the design of the recovery and increase transparency (responsible party: ODR).
- Adopt parallel streams of internal and external monitoring by leveraging external new stakeholder groups and existing internal oversight entities, such as Office of the Virgin Islands Inspector General (responsible parties: ODR, the governor's office, and VITEMA).
- Ensure broadly accessible communication by pursuing platforms and dissemination strategies targeting displaced or vulnerable populations and people with diverse cultural backgrounds; recovery leaders must bridge gaps created by compromised social networks and public and community structures as they seek community engagement critical to recovery planning (FEMA, undated d) (responsible parties: ODR, the governor's office, and VITEMA).

Leading entities

ODR, in coordination with the governor's office, VITEMA, supporting agencies, and subapplicants, would be the leading entity to create the recovery framework to enhance public confidence.

Recommendations Related to Staffing

Designate Sufficient Territory Staff to Manage Recovery Efforts

Goal	Increase the number of positions dedicated to the recovery effort for key agencies through new hires or by reassigning existing personnel. Decrease the time to hire for these positions.
Rationale	Few territory agencies have been able to either hire new personnel solely focused on recovery or detail existing personnel from day-to-day duties. Hiring can take a significant amount of time under the territory's traditional hiring process. Existing personnel are pulled between recovery-related duties and prestorm roles. Having even one or two people per agency focused solely on recovery would improve that agency's ability to navigate recovery while allowing operations to continue at prestorm levels.
Implementation considerations	The territory government might consider institutionalizing a hiring process for personnel to meet recovery needs: • Create a specific class or process for recovery positions (e.g., term positions or emergency hires) beyond exempt or classified (responsible parties: OMB and Personnel). – Exempt positions can be hired quickly but do not offer long-term job security. – Classified positions are more secure but require months to onboard. • Define, document, and clearly communicate the process required for territory agencies to acquire recovery-specific personnel (responsible party: Personnel). • Provide guidance to agencies for the suggested number of recovery positions based on existing management-capacity and recovery demands using the data presented in Appendix A (responsible parties: Personnel and OMB). • Consider the use of quarterly or incremental reimbursement of positions to offset the costs of new hires to the territory or, if they are not already dedicated to other uses, apply FEMA category Z funding (responsible parties: OMB and Personnel).
Leading entities	The USVI legislature would need to pass legislation enabling the creation of recovery positions and outlining updated hiring processes to be operationalized by the Division of Personnel and OMB.

Maximize Existing Territory Government Staff Capacity by Cross-Training Personnel and Creating Redundancy and Lines of Succession

Goal	Increase the capacity of existing territory staff.
Rationale	There is often only one person in an agency with institutional knowledge and access to key pieces of information needed for their role. This creates bottlenecks, with the ceiling for production being set by the incumbent's rate of work and, in the worst case, stopping entirely when the incumbent is out because of vacation or illness. Cross-training personnel, sharing responsibilities, and developing lines of succession would improve the workforce's capacity, make it more resilient to outside shocks, and incentivize taking government positions by supporting future employment opportunities. FEMA continuity-of-operations guidance suggests that these steps would lead to improved resilience of government operations (FEMA, undated a).
Implementation considerations	To decrease the likelihood of system failure or delay in government processes, the territory could take one or more of the following actions: • Take inventory of essential functions, defined as tasks that create critical points of failure or bottlenecks across one or more government processes (responsible party: Personnel). • Cross-train personnel to complete identified key tasks, ensuring that more than one person has been trained to perform essential functions (responsible party: Personnel). • Document and archive information needed to complete key tasks, ensuring that it is accessible to backup personnel (responsible party: Personnel). – Ideally, information should be digitized and in a central repository (e.g., TeamSpace) to promote standardization of similar tasks and across islands. • Develop a system to record and coordinate changes or updates to processes or tasks and train personnel accordingly (responsible party: Personnel). – If changes are made to organizational structure, key tasks, or processes or occur because of staff turnover, lines of succession and cross-training should be realigned.
Leading entities	The USVI Division of Personnel would lead implementation and ongoing management of cross-training initiatives.

Recommendations Related to Processes

Use the Agency Profiles and Related Data to Target FEMA and Territory Government Technical Assistance

Goal	Identify agencies and departments that need additional management capacity to successfully implement their recovery project portfolios.
Rationale	Agencies and departments have uneven levels of management capacity and recovery-project workloads. Entities that are not making progress as fast as others are most likely to require additional assistance. Resources for technical assistance are limited and should be prioritized for agencies and departments that are managing projects that are critical to the recovery, have large workloads, and are not making sufficient progress.
Implementation considerations	Technical assistance could be directed to agencies and departments that need it most, on the basis of their capacity, and could be periodically reevaluated through recurring processes: • Review agency and department profiles provided in this report and update them with improved capacity, burden, and, where available, progress data. • Identify agencies (based on our analysis) with the largest recovery responsibilities, biggest staffing gaps, and slowest progress to target for technical assistance and resources in hiring, process improvement, and contractor support; these might include the following: – WAPA – VIDE – Virgin Islands Housing Authority (VIHA) – VIDOH – DPW – JFL. • Identify agencies in critical nodes in recovery processes for additional technical assistance; these might include the following: – Department of Finance – DPP. • Identify technical assistance resources available to help with greatest needs.
Leading entities	ODR and FEMA would be the leading entities for these processes.

FEMA and the Virgin Islands Territorial Emergency Management Agency Should Create and Disseminate a Process Chart for Public Assistance; the U.S. Department of Housing and Urban Development and the Virgin Islands Housing Finance Authority Should Create and Disseminate a Process Chart for Community Development Block Grant Disaster Recovery

Goal	Reduce confusion about the reimbursement process.
Rationale	Stakeholders with whom we spoke in multiple agencies and departments lacked clarity regarding the full process and document flow related to getting project approval and then reimbursement under any of the programs.
Implementation considerations	Clarity can be achieved through coordinated action: • FEMA and VITEMA working together to clarify and disseminate a detailed flowchart for subgrantees showing, in the clearest and simplest manner possible, how the PA process works • HUD and VIHFA similarly collaborating to produce a flowchart for the CDBG-DR process • widely distributing these flowcharts among territory agencies and departments managing recovery projects, and posting them publicly on ODR's website • creating a separate, more complex flowchart for more-complex projects in which multiple lines of funding are involved. If points of confusion stem from inconsistent implementation or frequently evolving processes, this might not help financing. To the extent that confusion about the processes is stopping agencies and nonprofits from applying for money or getting reimbursement, the flowcharts or other assistance (including more-transparent communication) can help.
Leading entities	For their respective sectors, FEMA, VITEMA, HUD, and the VIHFA would take the lead here.

For Each Subgrantee, Assign a Single, Permanent FEMA Point of Contact with Decisionmaking Authority

Goal	Reduce confusion about reimbursement process.
Rationale	Having a single point of contact would ensure that applicants are getting consistent advice throughout the process and know to whom they could address questions. We note that applicants also reported that, when their point of contact at FEMA changed, they were asked for previously provided information or had their application rereviewed. FEMA has expressed awareness of problems with document and case handoff and was working on a solution at the time we were writing this report.
Implementation considerations	Efforts to operationalize improved communication between FEMA and USVI agency officials are ongoing, and actions should be taken collaboratively: • Determine the appropriate level of decisionmaking authority to delegate to such individuals. • Recommend that the point of contact periodically visit USVI agency officials and remain in constant contact with their USVI counterparts remotely; this would address concerns from FEMA staff regarding the need for face-to-face meetings.
Leading entities	FEMA should take the lead here.

Develop a Set of Core Management Reports and Metrics Used to Actively Manage the Recovery, and Share with the Office of Disaster Recovery and the Governor

Goal	Develop metrics with sufficient granularity to allow active management of agency recovery portfolios and a set of recovery performance metrics that can be communicated to a diverse variety of stakeholders. Develop or improve needed information systems to manage recovery.
Rationale	Decisionmakers would benefit from access to better management tools and data. Key information is not represented by a single set of official, commonly used figures beyond what appears on ODR's website. Information on ODR's website is related largely to process rather than outcomes. From our experience with government systems, we believe that the lack of standardized measures, data, and reporting likely hinders recovery management and accountability to funders and constituents.
Implementation considerations	In addition to ODR's website, the territory might consider • defining internal performance metrics and reports and integrating them into a new interagency information system under ODR • developing externally sharable metrics for measuring recovery progress that focus on outcomes, not process (responsible parties: ODR, Office of the Governor, VITEMA, and FEMA) • creating a multipronged communication plan and system for territory leadership to communicate plans and progress to territory agencies and the public (responsible party: ODR) • generating and publishing reports that detail progress through these key statistics using a standardized template and on a consistent timeline to analyze recovery progress (responsible party: ODR).
Leading entities	The Office of the Governor and ODR would lead the recovery effort with assistance from VITEMA and FEMA.

Actively Pursue Digitization

Goal	Create more-connected digital information systems to remove information silos and allow easy access to information and continuity of essential functions in emergencies.
Rationale	The USVI should continue to pursue and, if possible, accelerate digitization of systems and records to increase the capacity of existing territory staff and to facilitate more-effective and efficient project management. Work too often relies on inefficient and time-consuming manual searches of paper files. This hinders information sharing across islands and between agencies. Data in systems that do exist are often poorly maintained and incomplete. A lack of cross-training, combined with the use of paper records, contributes significantly to information and progress bottlenecks, which can impede coordination on recovery projects and active project management. Digitization and updating data are time-consuming and expensive but high-return activities.
Implementation considerations	In establishing electronic systems, a few key priorities should be considered: • Prioritize systems, processes, and records that will return revenue (such as fee collection) or reduce process times for receiving federal funding (responsible parties: Office of the Governor and BIT) • Ensure that digitized paper files are uploaded to an accessible and secure database, rather than maintained on individual staff members' hard drives • Develop a culture of information sharing by encouraging shared job duties and redundancy among territory staff.
Leading entities	The Office of the Governor would provide strategic oversight and direction of digitization activities to be completed by BIT.

Develop Mechanisms to Provide the Executive Branch with Additional Flexibility to Develop and Test Pilot Policies and Initiatives to Accelerate Recovery in Exchange for Increased Transparency

Goal	Increase the speed and agility with which the executive branch can develop, implement, test, and revise policy changes and other initiatives to accelerate progress on recovery while maintaining institutional controls.
Rationale	The USVI appears to have had some success experimenting with changing thresholds for procurements to reduce steps in the procurement process and to speed up transactions below a given cost threshold. Other processes, such as hiring, could be ripe for similar changes. However, these changes are often not under the direct control of the executive branch and require legislative action, which can take time to implement and, if unsuccessful, reverse. Given the time pressures of the recovery, a more-flexible, agile system allowing experimentation with trial policy changes would be useful.
Implementation considerations	Both the Office of the Governor and the territory's legislative body should take steps to promote maximum flexibility: • Identify key areas, such as hiring and procurement, in which additional flexibility might be safely employed to accelerate the speed of recovery, and establish tracking mechanisms and institutional controls to ensure adherence to territory rules that are not subject to discretion. • Identify agencies and departments to serve as pilot sites for flexible recovery policy pilots; consideration might include demonstrated past performance. • Partner with the USVI legislature to obtain additional flexibility in regard to policymaking to speed up the recovery (responsible party: Office of the Governor). • Couple changes explicitly to increase transparency and reporting to improve the legislature's visibility on recovery activities and progress (responsible party: USVI legislature). • Collect data to assess the effectiveness of pilot policy changes and to identify and assess associated risks, costs, and benefits. • Expand successful pilot policies to other parts of the territory government.
Leading entities	The Office of the Governor and the USVI legislature should collaborate to improve efficiency.

CHAPTER THREE

Government Fiscal Capacity

Box 3.1
Key Findings on Government Fiscal Capacity

- The USVI has identified $11.25 billion in damage from Hurricanes Irma and Maria, a heavy burden relative to the USVI's nearly $4 billion economy (Bureau of Economic Analysis, 2019). In recovering, the USVI faces two significant financial challenges:
  - First, although the federal government has obligated approximately $4.5 billion to date in financial assistance to support recovery, this still leaves the USVI with insufficient funds to address all identified damage.
    - Agencies providing funding include FEMA, HUD, the FCC, USACE, SBA, and FHWA.
  - Second, the USVI has a liquidity challenge. FEMA's PA payment model requires the USVI to pay contractors up front and then seek reimbursement. However, the USVI has limited revenue and significant amounts of preexisting debt. As a result, the USVI government has limited access to the funds needed to quickly initiate and advance projects that would ultimately receive reimbursement.
    - To undertake recovery work while waiting for reimbursement, the USVI has taken funds from agency operating budgets, reducing the territory's ability to sustain quality public services. At the same time, agencies are struggling to hire the additional staff needed to manage recovery projects and the process of seeking reimbursement.
- USVI officials are seeking ways to expand the territory's financial capacity to enable recovery while also seeking to obtain a sustainable fiscal status within five years.
  - Meeting this goal requires the USVI to overcome a challenging budget environment, including corporate income-tax volatility, revenue shortages for both hospitals in the USVI, a highly stressed government employee pension system with mounting unfunded obligations, and uncertain technology costs with no identified revenue source. The USVI also has a heavy debt load, with payments of $178 million annually. There are several actions that could be or are being considered to accelerate recovery spending:
  - To address the liquidity challenge:
    - The USVI is pursuing a $50 million line of credit with a local bank, which could be expanded to $80 million.
    - For many jurisdictions facing financial shortfalls, bond financing can be helpful. At this time, the USVI maintains that its revenue stream and current debt load leave it unable to support increased debt, meaning the USVI will have difficultly taking on new debt through bond issuance.
    - Under typical conditions, the USVI could seek to refinance its debt to reduce near-term payments, making additional money available. However, under current conditions in the spring of 2020, financial markets may not be receptive to new issuance of debt that is below investment grade, as is the case for USVI debt.
  - To address the local match:
    - USVI is planning to use $169 million of HUD's CDBG-DR grants. However, navigating two agencies' reporting requirements to initiate and reimburse recovery efforts may slow the USVI's ability to obtain and use recovery funds.

Box 3.1—Continued

- In addition, the federal government could consider actions that would help address these challenges both for the USVI and for others in similar settings in the future:
  - Congress could authorize FEMA or HUD to provide the federal portion of the project as a lump sum at the start of a project. For example, if a project requires a 10-percent local match, FEMA could grant the 90 percent and leave it to the USVI to produce the 10 percent when and how it can. If providing the entire lump-sum payout at the start of a project is too risky, then a portion could be paid up front, with the rest of the payout made in continued partial portions or made based on reimbursements.
  - The separate application processes for FEMA PA and HUD CDBG-DR funds could be combined into a unified application process to help expedite funding.

Following Hurricanes Irma and Maria, the USVI identified $11.25 billion in damage from these two hurricanes (VIHFA, 2018; VIHFA, 2019a). A large portion of this damage—although potentially not the majority—is expected to be paid using a variety of federal sources, and the U.S. federal government moved quickly to authorize monetary aid. However, most federal aid is provided on a reimbursement basis, meaning that the USVI must initially fund recovery projects, which are then eligible for federal compensation (FEMA, 2019).[1] The territory government has a small budget, with little slack to provide initial funding for recovery projects. Opportunities to raise additional funds through various forms of borrowing are limited because of high amounts of existing debt and uncertainty about future revenue. As of March 2020, the challenges facing the USVI had grown with the emergence of the novel coronavirus and its associated disease, COVID-19, because of the virus's potential negative consequences on the tourism industry and related tax base.

To manage its financial responsibilities, the USVI must continue to balance recovery and financial stability. As discussed in this report, although there are many challenges, paths forward remain available. Indeed, a few of the approaches identified in this report are already being pursued. And all parties involved are committed to seeing the USVI achieve a bright and stable future.

In this chapter, we describe the USVI's fiscal responsibilities and discuss options for managing them. We begin by describing the USVI's existing budget and options for funding recovery, then discuss gaps and challenges to financing recovery, as well as potential solutions. Box 3.2 shows the methods used in this analysis and related limitations.

[1] An applicant can be reimbursed for charges incurred as a project progresses but still must provide funding up front. The exception is Immediate Needs Funding, which is earmarked for urgent work in the initial aftermath of a disaster. Immediate Needs Funding can be provided in advance of incurred expenses but only after a preliminary damage assessment. The funded work "must be performed immediately and paid for within the first 60 days following declaration. Eligible work typically includes debris removal, emergency protective measures, and removal of health and safety hazards" (FEMA, 2018f).

Box 3.2
Methodology and Limitations on Analysis of Government Fiscal Capacity

Methods Used in This Analysis

To conduct research on the USVI's fiscal capacity for paying for recovery, we drew from two broad types of sources: documentation of financial records, fiscal plans, and relevant policies and semistructured discussions with subject-matter experts.

- Documentation examined included USVI planning documents, such as the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan and its updates, and the action plans created for CDBG-DR funds; USVI budget documents; FEMA documents, such as information from FEMA's Grants Manager database; federal government reports, such as those produced by the U.S. Government Accountability Office and the Congressional Research Service; documents produced by independent and private-sector organizations, such as credit-rating agencies; and selected media reports.
- The project team for this chapter made two visits to the USVI, in November 2019 and February 2020. During these visits, we had semistructured in-person discussions with experts. We also conducted telephone discussions with selected experts after these trips. Discussions included a broad variety of knowledgeable people, including USVI financial officials, officials in other USVI government agencies and departments, businesspeople operating in the USVI, and people knowledgeable about the USVI bond market and local government finance. Those with whom we spoke were selected based on key stakeholders identified during the document reviews, through recommendations from FEMA and our USVI partners, and through snowball sampling. Overall, we conducted discussions with FEMA, six local government agencies, six local private-sector businesses or business associations, and two individuals knowledgeable about the USVI bond market and local government finance. We also talked informally with residents of the USVI to get a ground-level sense of how recovery was proceeding. In all cases, we promised anonymity to people with whom we spoke, including ensuring that not only they but also their organizations would not be identifiable. Most discussions were arranged in coordination with our USVI partners.

Limitations to This Analysis

There are several limitations to our analysis:

- First, we do not have full visibility into USVI revenues and expenditures. However, we believe this to be a modest limitation because the USVI publishes a great deal of information and USVI financial officials have been open and candid in their discussions with us.
- Second, we do not have full visibility into recovery spending. Specifically, although we have data on how much federal aid has been promised or obligated, we do not know how much has actually been spent. We did receive many indications that promised or obligated funds are not immediately being converted into on-the-ground spending. Furthermore, we do not have good data on private-sector recovery spending. We heard anecdotal stories of private-sector spending occurring—and of businesses failing because funding could not be secured—but we cannot speak to the magnitude of either.
- Third, we—along with even many USVI officials and businesspeople—do not fully understand all of the process steps that territory government agencies and nonprofits need to take to successfully receive federal government funding.

We believe these limitations to be modest in terms of their effect on our analysis. The difficulty of obtaining this information in and of itself is a finding that reflects limitations faced in managing the recovery effort.

Setting the Stage

USVI officials are seeking ways to expand the territory's financial capacity to enable recovery while also seeking to obtain a sustainable fiscal status within five years. The main financial challenge facing the USVI is a liquidity challenge. The FEMA's PA payment model requires the USVI to pay contractors up front and then seek reimbursement. However, the USVI has limited revenue and significant amounts of preex-

isting debt. As a result, the USVI government has limited access to the funds needed to initiate and advance projects that would ultimately receive reimbursement.

Absent additional debt, any USVI expenditure on recovery must be drawn from its $818 million general fund (Government of the USVI, 2019). The USVI is in the process of negotiating a $50 million line of credit with a local bank. In addition, it has almost $1.9 billion in CDBG-DR funds, of which allocations of $1.0 billion have been approved.

The USVI is too heavily indebted already to take on additional debt, and it has an aversion to any type of debt restructuring, as happened in Puerto Rico. As of March 2020, the USVI was still not considering going back to the bond market to pay for recovery. However, refinancing existing debt could free up the revenue needed to support additional funds.

The rate of spending on recovery projects depends on several factors, including how quickly projects are approved, how quickly they can be put under contract, and how quickly reimbursements are processed.

USVI Revenues and Expenses

The USVI government budget, as proposed for FY 2020, totaled $1.27 billion, including $818 million for the general fund, $216 million in federal funds, and $88 million for "other appropriated funds" (Government of the USVI, 2019). Any USVI expenditure on recovery must be drawn from the $818 million in the general fund. Second, the $216 million in federal funds includes federal grants, as well as some federal recovery funds. Total federal grant funding has varied dramatically relative to the USVI's overall budget, with $727 million in FY 2019 and $232 million in FY 2018. Finally, the $88 million in "other appropriated funds" goes to funds established by the legislature for specific purposes, such as the Anti-Litter and Beautification Fund, the Business and Commercial Properties Revolving Fund, the Natural Resources Reclamation Fund, and the Public Parking Lot Fund.

In 2019, the USVI's OMB projected that expenses would essentially equal revenues in FY 2020. For FY 2020, individual income taxes were expected to contribute 53 percent of general-fund revenues. Other major sources include gross receipt tax (28 percent); corporate income tax (9 percent); real property tax (8 percent); and licenses, fees, and permits (3 percent) (Government of the USVI, 2019).

Challenges to the budget environment include corporate income tax volatility, revenue shortages for both hospitals in the USVI, a highly stressed government employee pension system with mounting unfunded obligations, and uncertain technology costs with no identified revenue source (Government of the USVI, 2019). Many funds established by the legislature for specific purposes have significantly overdrawn balances. For example, as of March 31, 2019, the Government Insurance Fund, which covers lost wages and medical expenses associated with on-the-job injuries, had a balance of –$33.7 million (Government of the USVI, 2019).

In addition, the USVI has less control over its revenues than U.S. state governments might. Although income earned within the USVI is generally exempt from federal taxation, the USVI is a *mirror-code jurisdiction*, which means that USVI tax law must mirror the U.S. Internal Revenue Code (Lowry, 2016). For example, if the federal government increases the earned income tax credit, the USVI must also increase its payments under that program. Although the USVI has the authority to enact additional local income taxes, it had not done so as of 2016.

Our discussions in February 2020 suggested that, although the territory government was meeting existing debt obligations, it might have been struggling to meet current operating expenses. We were told by a government representative that it is common for the USVI government to have trouble meeting its obligations at certain times of year because of uneven tax or revenue receipt flows. In that case, fiscal authorities might delay payments to some suppliers or otherwise find ways to conserve cash and then restore payments when revenues pick up. We were told that revenue can be particularly tight from February through early April, with government revenue being greater after taxes are due in April and during the winter vacation season.

USVI Debt Load

The USVI's preexisting debt load has significantly hampered its ability to finance the recovery process. Beyond the heavy debt load, the USVI has a balanced-budget requirement (2 V.I.C. § 254); together, these make it extremely difficult for the USVI to responsibly take on the additional debt required to finance recovery projects. As of April 1, 2019, the USVI's outstanding principal amounted to slightly more than $2 billion (Government of the USVI, 2019). This makes total debt per capita in the USVI significantly higher than in any U.S. state, despite income per capita in the USVI being lower than that in almost every U.S. state. Total anticipated principal and interest payments for FY 2020 are expected to be $178 million (Government of the USVI, 2019).[2]

USVI bonds are backed by two revenue streams. The first is the gross receipt tax. Outstanding principal on bonds backed by this revenue stream amounted to approximately $862 million as of April 1, 2019 (Government of the USVI, 2019). The second is from excise taxes on rum produced in the USVI and sold in the United States. The federal government returns these excise taxes to the USVI. Outstanding principal on bonds backed by this revenue stream amounted to almost $1.1 billion as of April 1, 2019 (Government of the USVI, 2019).

To ensure that bondholders receive their payments, the USVI has created two "lockboxes," one for each set of bonds. Gross receipt taxes and excise taxes flow to the Bank of New York Mellon Trust Company, which then pays the bondholders. In the

[2] There are two exceptions: a bond issue that is to be paid by FHWA grants and a small debt issuance that is to be paid by property tax and the gross receipts tax.

case of the bonds paid via the gross receipt tax, the bank transmits any surplus back to the USVI general fund after the bondholders are paid (USVI Investor Relations, undated). These lockboxes are maintained under USVI law, but no legal provision prevents the USVI from accessing the funds if needed (U.S. Government Accountability Office, 2019a). Focusing on the bonds backed by the excise taxes, one analysis noted that "this mechanism has not been tested in a stress situation, in which the government attempts to divert pledged revenue for general government purposes" (Moody's Investors Service, 2019a).

There are many risks that could impair the USVI's ability to pay back its debt and therefore to take on new debt. These include its small and undiversified economy, the potential for future operating deficits, and the public pension system's large unfunded liabilities (Moody's Investors Service, 2019a). As of September 2019, the USVI debt was maintained at a grade commonly referred to as "speculative" or "junk" status (Harvey, undated; Moody's Investors Service, 2019a).[3] The USVI last went to the bond market in January 2017, with a proposed $219 million issuance. However, the government received orders for only $140 million and withdrew the bond sale (Slavin, 2017). Following that withdrawal, the USVI temporarily ceased reporting to the credit agencies, and reporting submitted since then has been incomplete.

During our interviews, USVI finance officials expressed awareness of these long-term financial risks, as well as their intention to repay all debt obligations and improve financial communications. For example, as part of a new transparency initiative, USVI officials have established a website that provides frequently updated information on the USVI's current budget (Government of the USVI, undated b). However, significant work remains. The USVI's most-recent audited financial statement is from FY 2017 (Virgin Islands Department of Finance, undated), and authorities have not released audits for subsequent years as quickly as they had hoped.[4] USVI officials noted that these increases in reporting and transparency are for the purpose of good governance and do not signal an interest in pursuing new bond debt.

Sources of Federal Financial Assistance to Support Recovery

The federal government has made available a variety of sources of financial assistance. Agencies providing funding include FEMA, HUD, the FCC, USACE, SBA, and FHWA. Federal tax benefits are also available for individuals for offsetting losses. Of

[3] According to Moody's, which confirmed its Caa rating, "obligations rated Caa are judged to be of poor standing and are subject to very high credit risk." Caa ratings can run from Caa1, the better end, to Caa3, the worse end (Moody's Investors Service, 2019a). Obligations with this rating are considered "speculative" or "junk" (Harvey, undated).

[4] Audited FY 2017 financial statements were dated September 30, 2019. During interviews in November 2019, we were told that the audited statements for FY 2018 would be issued by March 2020. That goal was updated during our February interviews, when discussants indicated that the government was aiming to have the audited statements for FY 2018 issued by June 2020 and those for FY 2019 issued by October 2020.

these sources of federal aid, the largest are FEMA's PA grant program, FEMA's HMGP, HUD's CDBG-DR, and the FHWA Emergency Relief program (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). This chapter concentrates on the FEMA and CDBG-DR funding. See Chapter Two for a description of the different streams of funding within FEMA PA.

In 2013, the Stafford Act, which defines the procedures for implementing FEMA PA, was amended to add the option for recipients to elect to pursue new alternative procedures for specific projects. These alternative procedures, commonly referred to as "Section 428" procedures, enable the USVI to have more flexibility in what it chooses to rebuild or repair after obtaining estimates for repair or reconstruction. The USVI can use those amounts to rebuild or repair fewer or more sites. For example, the USVI can receive money equivalent to the cost of rebuilding or repairing all 31 of its damaged schools but could instead opt to use those funds to build fewer, higher-quality schools. Although Section 428 gives the USVI more flexibility, the territory also bears the risk of cost overruns—unlike in the normal PA process, the total amount awarded by FEMA cannot be adjusted upward. As a result, the cost estimates are high stakes and can therefore take longer to complete. As of May 2020, the USVI government had decided to use Section 428 for rebuilding its schools, while decisions about its use for other sectors were pending.

The federal government requires a 25-percent cost share for FEMA PA funds. However, upon FEMA's recommendation, the president may decrease that cost share to 10 percent for both emergency and permanent work and can even eliminate the cost share for emergency work for a limited time (Brown and Richardson, 2015, p. 14; FEMA, 2020b, p. 25). Indeed, category B (non-STEP) and categories C through G require a 10-percent match on the part of the USVI government. Categories A and B (STEP) were initially 100-percent federal and then shifted to requiring a 10-percent match (USVI Hurricane Recovery and Resilience Task Force, 2018; VIHFA, 2019a). Table 3.1 provides details on funding sources and their matching requirements.

As of September 2018, the USVI anticipated almost $2.6 billion worth of projects in total across several forms of FEMA assistance (USVI Hurricane Recovery and Resilience Task Force, 2018). As of January 17, 2020, FEMA had obligated more than $2.1 billion in FEMA PA funds, of which $1.3 billion was for emergency work (FEMA, 2020a). Another $462 million is available under the HMGP, which does not require a local match (ODR, undated d).

The other major block of funding for recovery is HUD CDBG-DR. Awarded funds total almost $1.9 billion; of this, approximately $1 billion has been allocated (HUD, 2020a; VIHFA, 2019a). There are three allocations of funding to address unmet needs in housing, infrastructure, and economic revitalization. The first allocation totals $243 million and was announced on February 2, 2018. The plan for its use was approved July 10 of that year (VIHFA, 2018). The second allocation totals more than $779 million and is included in the allocation plan published on March 2019

Table 3.1
Funding Sources, Amount of Funding, Use, and Matching Requirements Applicable to the USVI

Funding Source	Amount of Funding Obligated, in Millions of Dollars	Use	Matching Requirement
FEMA PA category A or B (STEP)	2,100	Emergency work	Initially 100% federal, shifted to requiring a 10% territory match
FEMA PA category B (non-STEP), C, D, E, F, or G		Emergency work (B non-STEP); permanent work (C–G)	Requires a 10% match
FEMA HMGP	462[a]	Hazard mitigation	No match required
HUD CDBG-DR initial allocation for unmet needs	243	Housing, infrastructure, economic needs, and mitigation	Can be used as a match
HUD CDBG-DR second allocation for unmet needs	779	Housing, infrastructure, economic needs, and mitigation	Can be used as a match
HUD CDBG-DR third allocation for unmet needs	54	Housing, infrastructure, economic needs, and mitigation	Can be used as a match
HUD mitigation funding	774	Investments that reduce risk attributable to natural disasters	Can be used as a match
HUD electrical grid funding	68	Investments in the USVI's electric grid	Can be used as a match

SOURCES: U.S. Government Accountability Office, 2019b; ODR, undated d; VIHFA, 2019a; HUD, 2020a.
[a] Total amount available.

(VIHFA, 2019a). A third allocation, which is awarded but not yet allocated, contains $54 million. In addition, another $774 million is available for investments that would mitigate future disasters, and another $68 million is available specifically to support the USVI's electric grid (HUD, 2020a). CDBG-DR funds can be used to supplement other federal programs, as long as the project is eligible for CDBG-DR funds. CDBG-DR fundings cannot supplant other sources of funding.

The USVI can use the CDBG-DR funds for its matching portion of FEMA PA funds. Notably, the USVI has requested a waiver of requirements for matching for any FEMA PA funds. Such a waiver was granted for the FEMA HMGP (VIHFA, 2019a), and waivers have been granted in some cases for FEMA PA funds. Even were such a

waiver to be granted for all FEMA PA funds, the USVI would still need to provide about $4.5 billion worth of recovery spending (VIHFA, 2019a).[5]

Progress to Date

Despite financial constraints, the USVI has accomplished substantial reconstruction with assistance from the federal government. By September 2018, for housing, $1.43 billion had been obligated or disbursed, including federal sources, private insurance, and other sources; by August 2018, for economic revitalization, recovery funds of $1.2 billion had been disbursed the largest component of which was $1 billion in private insurance payments (VIHFA, 2019a).

Other sources provide more-complete information on FEMA funding. Data up to June 30, 2019, show large public expenditures—largely federal—although nowhere near the USVI's self-reported damage of $11.25 billion (VIHFA, 2018; VIHFA, 2019a). FEMA PA had obligated $1.8 billion, of which the USVI had spent almost $1.1 billion. This $1.1 billion included $857.5 million for emergency projects (categories A and B), $211.3 million for permanent projects (categories C through G), and $29.9 million for management costs (category Z) (U.S. Government Accountability Office, 2019b). FEMA had also obligated $60.6 million for HMGP, of which the USVI had spent about $1.7 million (U.S. Government Accountability Office, 2019b).

Annual progress reports detail a variety of achievements (Government of the USVI, 2018; Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). The USVI funded its share of the work during the first year after the hurricanes largely with insurance proceeds from policies held by the USVI government, which amounted to more than $120 million. Of this total, the USVI government used $30 million for the VIDE, $25 million for DPW, and $9 million for community and health centers (VIHFA, 2019a).

Our discussions indicated that the private sector has paid for its recovery largely out of its own funds and insurance proceeds, as opposed to through government support. Bank financing has been available to companies that have assets to pledge. Other sources have included insurance and capital injections from business owners and investors. In some cases, businesses have had trouble getting financing and have shut down. We do not have an estimate of the number of businesses that have experienced this or of their total employment. However, discussions suggested that some contractors had worked while expecting payment from federal grant sources, not received payment, and gone out of business.

[5] We calculated this from what the USVI describes as $6.41 billion worth of "unmet needs" minus the $1.86 billion in CDBG-DR funding.

Recovery Direction

To manage its financial responsibilities, the USVI must continue to balance its objectives for recovery and long-term financial stability. The recovery direction for this sector is summarized in Box 3.3.

Box 3.3
Recovery Direction for Government Fiscal Capacity

Enhancing fiscal capacity in the USVI to (1) improve the USVI's liquidity and (2) enhance the USVI's ability to navigate the process to access federal recovery funds while ensuring the territory's long-term financial stability

Key Barriers and Gaps

Insufficient Funds Are Available to Address All Identified Damage

Although the federal government has obligated approximately $4.5 billion to date in financial assistance through FEMA and HUD, as well as significantly smaller amounts through other agencies, the USVI had identified $11.25 billion in damage. As discussed above, the USVI government does not have the revenue or borrowing capacity to fully fund addressing the remaining damage. As discussed in the next section, there are ongoing efforts by USVI officials to obtain additional funds, and some of the recommendations in this chapter could also help increase available funds. But despite these efforts, unless additional external funding becomes available, USVI officials will be forced to make difficult choices about which damage will and will not be addressed.

Liquidity Constraints (Along with Limits on Bonding Capacity and Ability to Borrow) Make It Difficult to Fund Recovery Projects, but Options Remain

The USVI is extremely liquidity-constrained in its efforts to pay for recovery. As noted at the beginning of this chapter, federal aid is provided on a reimbursement basis. Therefore, the applicant—for example, a USVI government agency—must pay for recovery work up front. If all paperwork is in order, FEMA releases funds to VITEMA, which, in turn, provides reimbursement to the applicant. It is our understanding that this general process applies for both the standard procedure and Section 428 alternative procedures, although the reporting requirements are less complex under alternative procedures. Government agencies, nonprofits, businesses, and homeowners all frequently have insufficient funds to initiate construction projects and are therefore unable to make use of reimbursement-based assistance. Where funds for recovery are obtained, they often come at the expense of normal operations. Although USVI's financial situation makes it difficult to take on additional debt, particularly from the bond market, additional funds, such as a revolving loan or line of credit, are needed to

initiate projects that should eventually be reimbursed without sacrificing normal government operations.

Provided that federal aid for recovery remains on a reimbursement basis, the highest-impact solution for the USVI government would be to borrow the money needed to initiate projects. Federal reimbursement would eventually offset most of the direct project costs, but the USVI government would still need to cover matching requirements and any interest costs and fees associated with borrowing. Indeed, as of early February 2020, territory officials were negotiating a line of credit with a local bank. The legislature has authorized a line of credit of up to $80 million, but financial officials are opting to start with $50 million. Several loan terms were under negotiation as of early February 2020, including the interest rate and fees. Although $50 million is a small amount relative to the overall need, it could seed larger amounts of recovery spending if federal reimbursements are paid promptly, the specific loans are retired, and then new loans are taken out. Even if this process were completed quarterly, this would provide only $200 million per year of up-front funding. And completing this process quarterly may be an ambitious timeline, in that some reimbursement efforts to date have taken significantly longer. Although this line of credit will be helpful, additional sources would be required to reach more-aggressive recovery spending goals.

The number of projects this line of credit can seed depends on how quickly reimbursements can be processed to free up the credit for additional projects, although, given the magnitude of needs that have been documented, the line of credit is only a partial solution at best. One alternative would be to raise money through bonds. Although the USVI government has resumed providing financial information to the bond market, it still prefers to use local banks over bonds to address liquidity challenges associated with the recovery. It has an aversion to any type of debt restructuring, as happened in Puerto Rico. As of March 2020, the USVI was still not considering going back to the bond market to pay for recovery.

USVI Agencies Also Lack Sufficient Funds to Hire Management Staff

USVI agencies also lack sufficient funds to hire staff who could prepare and manage projects in the manner required to obtain reimbursement in a timely manner. At least one agency from which we met a representative said that, with new staff, it could carry out its tasks related to recovery. The agency said that qualified applicants are available and that it is prepared to train new staff. The costs of these new staff are eligible to be covered by FEMA-PA category Z funds, which are set aside to cover the management costs associated with recovery projects. However, category Z funds are similarly reimbursement-based under both standard and alternative procedures. The agency does not have the budget to hire the staff in the first place, so its recovery efforts are stalled.

Uncertainty Inhibits Banks from Helping Address Liquidity Constraints Among Nongovernment Public Assistance Recipients

Some nonprofits are also eligible for federal assistance. Similarly to other recipients, they must pay for work up front and then get reimbursement, but they often lack funding to initiate recovery projects. Bank loans could provide a solution, but banks face several challenges. First, they have no visibility as to when the borrower will receive federal reimbursement, so they put themselves at heightened risk. Second, banks have questions about whether federal reimbursement is *assignable*. In a standard construction loan, if the borrower fails to pay, the bank can take over the project and arrange its completion, or sell the asset, receiving at least part of its loan back. However, in a federally funded recovery project, if the borrower fails to pay, it is not clear that the bank can take over the project or receive the federal reimbursement. This question of *assignability* therefore acts as a barrier to lending. Finally, banks are uncertain about which costs can be reimbursed if they make recovery loans to be repaid under federal grants. For example, banks are unclear about whether loan interest is reimbursable (it is not). For these reasons, banks are loath to treat promised federal reimbursements as they would other forms of collateral.

Process Challenges Include Lack of Understanding of the Reimbursement Process and Attempts to "Borrow" Matching Funds

Beyond liquidity issues, some process issues stall the financing of recovery. As discussed in Chapter Two, many USVI government officials lacked clarity regarding the full process and document flow related to getting project approval and then reimbursement under any of the programs. In addition, one applicant reported that, after the terms had been agreed to, FEMA changed reimbursement conditions. Specifically, we heard complaints of a project that was deemed temporary, carried out, and then subsequently ruled permanent, resulting in a different—and lower—reimbursement rate. With private-sector financing of recovery spending by nonprofits, there was also uncertainty about what charges were eligible for reimbursement by the federal programs. Furthermore, the issue of assignability of the federal grant amount, whether FEMA PA or CDBG-DR, also presented a barrier to bank lending for recovery when federal reimbursement would be involved.

As noted previously, uncertainty about the timing of payouts also created disincentives for bank financing. But beyond this, slow reimbursement could also lead to stress for the small businesses involved in recovery (such as small construction subcontractors) and could even lead to bankruptcy. In some cases, private-sector companies reportedly ran into liquidity issues when the government did not have money with which to pay them for work.

Another process challenge arises from the USVI's intention to use HUD CDBG-DR funding as part of its local match for FEMA PA funding, which is an allowed and intended use of CDBG-DR funds. The challenge is that, even if a project receives

HUD approval, it might not receive FEMA approval, and vice versa. Therefore, two separate and sometimes lengthy approval processes must proceed before the project can be initiated. We are unsure about the extent to which proceeding with a project before approval increases the applicant's risk of not receiving reimbursement. Because many applicants cannot afford a project that will not eventually be reimbursed, there is significant hesitation to proceed without affirmation that the project is approved for reimbursement.

Some—or even many—of these problems might be the responsibility of the USVI rather than FEMA or HUD. FEMA has granted PA money to VITEMA, and VITEMA, as the grantee, deals with further recipients, the subgrantees. The grantee for HUD CDBG-DR funds is the VIHFA, which then deals with the subgrantees.

Other Issues Unique to the USVI Pose Barriers to Recovery

Beyond reconstruction from the hurricanes, the territory faces other systemic challenges, and those must be addressed eventually. The pension system, like many around the United States, is overcommitted and needs reform. In addition, WAPA is unsustainably indebted. As of October 1, 2019, WAPA debt totaled $550 million, of which $252 million was bonded debt, $95.5 million was a community disaster loan, $38 million stemmed from credit lines, and $160 million was for repayment on a turnkey master agreement that involved infrastructure construction and supply and delivery of liquefied propane gas. Rates appear not to allow for full-cost recovery, and customers are slow to pay their bills. One of the customers that had been slow was the territory government: Outstanding receivables from the government at one time amounted to $30 million, and other charges WAPA had not been able to collect raised the total amount of missing revenue to $40 million to $50 million annually. The "historically slow payment patterns of VI WAPA's government customers" (Moody's Investors Service, 2015) were regularly cited in steady downgrading of WAPA debt by both Moody's and Fitch, along with WAPA's large pension liabilities and its sensitivity to the financial and economic stresses that face the USVI as a whole ("Fitch Downgrades Great Plain Regional Medical Center," 2016; Moody's Investors Service, 2017; Moody's Investors Service, 2019b). Promisingly, as of July 30, 2019, the territory government had addressed outstanding debts to WAPA (St. Croix Chamber of Commerce, 2019).

As further discussed in Chapter Seven, one result of WAPA's financial situation is that electricity on the islands is both expensive and unreliable. Production costs are high, and demand for grid power has fallen from approximately 619,000 megawatt-hours (MWh) in FY 2017 to 523,000 MWh in FY 2019. In addition to the direct cost of electric bills, power-quality issues impose significant costs on households and businesses through damage to appliances.

Box 3.4
COVID-19 and Government Fiscal Capacity

This chapter's assessment of the USVI's fiscal capacity was developed using discussions and analysis conducted largely between November 2019 and February 2020. The advent of COVID-19 has the potential to create further challenges for the USVI's fiscal capacity. Although the territory's tourism season was largely completed before the COVID-19 pandemic and associated policy responses disrupted travel and tourism in the United States, it is unclear when or the extent to which tourism revenue—particularly cruise ship revenue—will return. Any loss of revenue is particularly problematic for the USVI because its fiscal situation was precarious even prior to COVID-19.

The pandemic puts increased importance on some of the recommendations presented in this chapter. The USVI lacks the revenue to take on additional costs associated with COVID-19 and lacks the capacity to take on additional debt to finance those costs. To the extent that additional federal aid or insurance payouts are available, those could provide valuable sources of financial support. FEMA is using its Community Disaster Loan program to support local governments that have revenue loss because of COVID-19; this program is one potential source of federal financial support that merits further investigation. Debt refinancing becomes both more helpful and more difficult—although USVI leadership has been seeking to avoid debt restructuring, refinancing the debt to spread out repayments over a longer period of time could reduce monthly costs at a time when money is tight. However, any refinancing will need to wait; the current risk-averse market offers little demand for risky USVI bonds, so any borrowing or refinancing options would likely come with unmanageable interest rates. If USVI leadership can find favorable terms with local lenders, it should pursue those options; otherwise, USVI leadership's best option among the tough choices might be to make painful spending cuts while awaiting more-favorable borrowing rates to refinance.

One way to keep the local economy moving is to keep recovery projects—and the associated reimbursement process—moving. Recovery projects offer much-needed work, using a source of funds that has already been obligated. Enabling the USVI to continue to tap that lifeline might help keep the territory financially afloat through the economic aspects of this crisis.

Recommendations

Recovery in the USVI is a multifaceted problem that defies easy or painless solutions. As explained in this chapter, the USVI faces two core financial problems: (1) identified damage exceeds available recovery funds by billions of dollars, and (2) the lack of liquidity needed to access reimbursement-based recovery funds will slow the recovery process. USVI officials have few options available for raising additional funds, and many are unappealing:

1. USVI officials could expand the line of credit from $50 million to $80 million.
2. USVI officials could refinance their existing debt and use the freed cash flow to finance recovery projects.
3. USVI officials could raise local taxes.
4. USVI officials could cut back on local services.

The third and fourth options could easily end up imposing more economic pain than benefit. The first and second options are less painful, although USVI officials are rightly hesitant to take on additional debt. The first option is under consideration, and we discuss the second option further in our recommendation that the USVI refinance its debt, below.

Additional challenges are presented in navigating the process for receiving these reimbursement-based recovery funds. In the short term, borrowing more money could address the first core financial problem and perhaps the second. But the USVI must responsibly balance the need for fiscal capacity with the need for long-term financial stability—additional funds are needed, but the USVI's ability to borrow at responsible interest rates is limited by its current financial status. Despite this tension, certain changes would help to improve the current situation. USVI officials are seeking ways to expand the territory's financial capacity to enable recovery while also seeking to obtain a sustainable fiscal status within five years.

In the rest of this section, we present both near- and long-term recommendations to address these issues. In addition, to address challenges raised in this chapter, we also refer the reader to two recommendations in Chapter Two: developing a public process chart for PA and other funding, and providing a single FEMA point of contact to territory agencies to provide continuity in the reimbursement process.

The movement of federal recovery functions to Puerto Rico creates tension on another issue of concern. Residents, businesses, and government all consistently emphasize that they are not Puerto Rico and do not want perceptions of the way Puerto Rico has managed its economy to flavor views of the USVI. The biggest contrast is in the USVI government's insistence that it will pay its debt obligations without a restructuring. Indeed, resistance to restructuring might be, in part, because of the desire to emphasize that—as was often said to us—"USVI is not Puerto Rico."

Near-Term Options

Lay Out Phase Priorities in a Recovery Budget to Show Spending Sequence

Goal	Enable reliable planning for use of funds as they become available.
Rationale	Budgeting recovery funds will avoid taking them from operating budgets and give USVI departments more certainty.
Implementation considerations	Such a budget, placed within the executive budget but separate from the operating budget, will help plan for predictable spending as financing becomes available: • Create an explicitly designated recovery funding program in proposed territory executive budgets (responsible party: Office of the Governor). In the meantime, to expedite projects, • adopt, independently or in conjunction with the legislature, provisions to ease process requirements when applying for recovery funding (responsible party: Office of the Governor) – adopt expedited review of procurement and hiring of key positions – expand the USVI's ongoing pilots to increase DPP review and approval thresholds.
Leading entities	The Office of the Governor prepares the annual executive budget with approval and support from the legislature, OMB, the Department of Finance, and Division of Personnel.

Engage with Private-Sector Financial Institutions

Goal	Increase access to finance in the recovery process.
Rationale	Federal government, local government, and private-sector financial institutions all have a common goal: to see individual USVI residents and the USVI as a whole recover and regain a stable financial footing. More could and should be done to collaborate. This can be especially helpful to nonprofits seeking recovery funding.
Implementation considerations	• FEMA, working with ODR, could conduct direct outreach to the banks in the USVI or to continental U.S. banks interested in funding recovery to explain processes and answer questions. This may provide local banks with the information they need to feel comfortable lending to nonprofit organizations that are seeking FEMA PA funds. • FEMA might learn that the reforms that banks need to free up capital might be within FEMA's legal authority to institute. And if they are not, FEMA could work with political authorities to make those reforms possible. • More generally, we emphasize that private-sector financial institutions have the skills and resources to be valuable partners to both FEMA and the territory government during this recovery.
Leading entities	FEMA, ODR, and private-sector financial institutions would be the leading entities in this effort.

The USVI Could Seek to Refinance Its Debt to Reduce Near-Term Payments

Goal	Reduce liquidity constraints.
Rationale	The territory could free up funds by recalling callable debt and re-funding it in a way that stretches out payments, capitalizes interest during the early years, or otherwise defers debt service payments. Such an action could either keep the total debt load the same or raise it, but it would make more cash available for recovery and potentially have positive economic effects.
Implementation considerations	• Going in this direction would require issuing audited financial statements for FY 2018 and FY 2019—catching up on disclosure—and meeting with the rating agencies and potentially major bondholders. It would also require the USVI government to overcome its hesitation to considering changing its debt by acknowledging that such a move could potentially improve its long-term financial status. This especially could be palatable because it could be done without reducing the bondholders' returns. • It is unlikely that the market would be receptive to bonds backed by FEMA PA and HUD CDBG-DR reimbursements. The same barriers to funding by banks may apply to the bond market. Any decision to approach the bond market will require detailed financial analysis and advice beyond the scope of this report. But doing so should be among the options considered by the USVI government.
Leading entities	The USVI Office of the Governor and the PFA would be the leading entities.

The Federal Government Could Eliminate the Requirement for a Local Match

Goal	Reduce the cost of recovery for the USVI.
Rationale	One option for making it less expensive for the USVI to make use of recovery funds is for the federal government to completely eliminate the requirement for a local match, as the USVI has requested.
Implementation considerations	• The USVI has noted that FEMA has the authority to make this change under the Insular Areas Act (48 U.S.C. § 1469a) or that Congress can direct FEMA to do so. There could be appropriate hesitancy to waive the local match because of concerns about raising future expectations about the expected role of the federal government in financing disaster recovery. • This change would free up additional funds to go toward recovery projects but would not solve the issue of liquidity. The USVI would still need potentially billions of dollars to access reimbursement-based recovery funds.
Leading entities	FEMA and Congress would take the lead.

Where Legal Authorities Allow, Ensure That FEMA Public Assistance Approvals Are Irrevocable

Goal	Ensure consistency in the reimbursement process.
Rationale	At least one agency official said that a project was reclassified following its approval, which changed the reimbursement rate (although we cannot verify the extent to which this occurs).
Implementation considerations	• Even if this did not occur, a clear procedural description—as provided in the flowchart or by a single point of contact—could have prevented the misunderstanding. FEMA should create and disseminate such a product. • Regardless of whether reclassification issues have or have not occurred, FEMA PA approvals should be treated as contractual agreements.
Leading entity	FEMA would be the leading entity here.

Long-Term Solutions

Many of the reforms that could free up financing for recovery could require legislative changes and so are beyond FEMA's ability to institute. We present them here in the event that FEMA can institute them or so FEMA can better communicate needed reforms to political authorities. As with near-term solutions, long-term solutions can be divided into liquidity and process solutions.

Congress Could Authorize FEMA or the U.S. Department of Housing and Urban Development to Provide Federal Funds as a Lump Sum with Strong Audits

Goal	Resolve liquidity issues while limiting potential moral hazard and corruption issues.
Rationale	Shifting from a reimbursement-based federal assistance program to a lump-sum transfer with audits could resolve liquidity challenges while minimizing potential moral hazard and corruption issues. This could increase waste, so a strong audit function with penalties would be useful. But there is also a trade-off between speed and verification. Soon after the hurricanes, a local private-sector entity paired with a nonprofit to deliver small grants of $1,000 or less to low-income residents. The entity opted not to verify income but instead distributed based purely on trust. Certainly, some higher-income people might have claimed the grants. But it is also likely that many low-income individuals were helped by both the speed of disbursement and the ability to get money without having to provide proof that they might not have had in the wake of the storm. Representatives of the private-sector entity speculated that 90 percent probably went to low-income residents, and they felt they that this represented success in the trade-off between speed and verification. We acknowledge that federal grants have additional auditing requirements to meet and that larger grants might be more likely to attract unqualified claimants. Nevertheless, how federal policy treats this trade-off—and the ramifications of that decision—deserves renewed attention.
Implementation considerations	• To address liquidity, Congress could authorize FEMA or HUD to provide the federal portion of the project as a lump sum at the start of a project. For example, if a project requires a 10-percent local match, FEMA could grant the 90 percent and leave it to the USVI to produce the 10 percent when and how it can. • If providing the entire lump-sum payout at the start of a project is too risky, a portion could be paid up front, with the rest of the payout made in continued partial portions or based on reimbursements. Even that small action could provide liquidity to get recovery projects moving. This could occur conditionally with evidence that the USVI match will be available. • Such a process would require a strong review of bids for work to make sure that they were not inflated so the 90-percent amount actually covered the entire project cost.
Leading entities	Congress, FEMA, and HUD would be the leading entities.

Create a Unified Application Process for Recovery Funds

Goal	Simplify the reimbursement process.
Rationale	The reimbursement process is slow and confusing and involves too many duplicative efforts.
Implementation considerations	The USVI currently needs to obtain separate approvals from HUD and FEMA if it wishes to use CDBG-DR funds as the local match for a FEMA PA project. In terms of process, a unified application with approval by one agency automatically engendering approval by the other would help expedite funding. This would involve FEMA and HUD officials trusting each other and federal oversight authorities agreeing that one process is sufficient.
Leading entities	FEMA, HUD, and potentially Congress would take the lead here.

CHAPTER FOUR

Workforce Capacity

Box 4.1
Key Findings About Workforce Capacity

- Prior to the 2017 hurricanes, the USVI workforce was concentrated in a few employment sectors, such as leisure and hospitality and the retail trade.
- The hurricanes led to a sharp drop in employment and a reduced labor pool; since then, the leisure and hospitality and retail sectors have begun to rebound, and the construction workforce has grown.
- At the peak of the potential recovery spending, approximately 5,520 more workers—an increase of 17 percent from the 2018 level—may be required to support the recovery efforts.
- The occupations with the greatest increases in demand are likely to include some construction trades (for example, construction laborers, carpenters, and electricians), as well as a variety of nonconstruction jobs (for example, retail sales, cashiers, and office clerks).
- There are challenges involved in meeting the demand for recovery workers:
  - There are likely too few unemployed USVI residents with the requisite skills to meet demand with local labor.
  - Many new labor-force participants will likely lack necessary literacy and numeracy skills and the "soft" skills needed for many recovery-related jobs.
  - Recovery efforts have increased competition for workers.
  - Although many recovery workers from outside the USVI will likely be needed, the lack of available housing poses a significant barrier.
- Recommendations include the following:
  - Install temporary housing units for recovery workers engaged in ongoing hurricane recovery projects (see Chapter Eight).
  - Create training and credentialing programs for key tourism- and recovery-related occupations that require short-term on-the-job training, and connect USVI residents with those programs.
  - Send eligible applicants to the continental United States for longer-term training (in, for example, construction trades, such as carpentry).

The USVI's recovery efforts will require a large increase in the number of workers in the private sector—largely in the construction sector—employed on the islands. The workers to support these efforts could and likely will come from a variety of sources, including the islands themselves, Puerto Rico, and the continental United States. One challenge involved in drawing significantly on local workers is the small size of the current USVI population and workforce and the requisite construction skills needed to complete the recovery effort. The 2018 USVI task force recovery plan identified increased workforce capacity—in terms of both the number of workers and workforce skills—as key factors that will be required to facilitate recovery. In addition,

the task force recovery plan highlights the tension between short-term workforce needs for recovery and longer-term workforce needs.

Governor Bryan recently called for a Cradle to Careers plan that strengthens and connects the USVI education and workforce-development systems; he also identified the gaps in the local labor force as one of the key challenges to developing the territory's workforce (ODR, undated f). The USVI disaster-recovery action plan includes a $10 million investment in a workforce-development program to prepare workers for recovery efforts and to enhance skills needed in tourism, including customer service and digital literacy (VIHFA, 2019a). VIDOL and the USVI Economic Development Authority (VIEDA) are the administering entities for this program; other organizations involved in workforce-development efforts include the VIDE, the USVI Workforce Development Board, the Virgin Islands Career and Technical Education (CTE) Board, the Department of Tourism, and UVI.

In the remainder of this chapter, we document how the level and composition of employment in the USVI have changed since the hurricanes, examine workforce needs that might arise from the recovery efforts, and discuss how recovery needs might compete with the workforce needs of other major sectors. We then present some potential options for addressing those needs. Box 4.2 describes the methods used in this analysis and the limitations of those methods.

Setting the Stage

Before the Hurricanes

In August 2017, just prior to the hurricanes, VIDOL reported that about 43,000 workers were employed in the USVI; about 18,000 (about 40 percent) of these workers were on St. Croix, and about 25,000 (about 60 percent) were on St. Thomas and St. John.[1]

[1] Employment figures reported by VIDOL are not comparable to employment figures reported by BLS. The BLS Quarterly Census of Employment and Wages—which includes workers covered by state unemployment insurance or Unemployment Compensation for Federal Employees—reported approximately 38,000 employees in the USVI in August 2017, as did the Current Employment Statistics, which covers payroll workers in nonfarm industries. VIDOL notes that its estimates include "persons 16 and older who show up in our unemployment insurance wage data working full time or part time and actively seeking employment through VIDOL" and that, although it uses BLS methods, its estimates are not adjusted using the Current Population Survey. The specific reasons for the differences in the estimates are not clear but might include this adjustment. Nonetheless, the general patterns of employment—and the distributions by industry—are consistent across sources. Throughout this chapter, we use VIDOL estimates for overall USVI- and island-level employment and unemployment and BLS estimates for more-detailed breakdowns by industry and occupation. Our overall takeaways from the data are similar, regardless of the source.

Box 4.2
Methodology and Limitations on Workforce Capacity

Methods Used in This Analysis

- We conducted a descriptive analysis of labor market conditions in the USVI before and after the hurricanes using employment and wage data from VIDOL and BLS). We also held discussions with representatives from five hotels, five other tourism-related businesses, six retailers, and five business associations on St. Croix and St. Thomas to elicit their perspectives on the recovery to date and barriers to continued recovery.
- In addition, we drew on results from prior HSOAC analysis that develops potential recovery spending paths based on data from prior hurricanes to forecast the peak increase in employment, by industry and occupation, that could result from the recovery efforts (Strong, Wenger, Anderson, et al., unpublished research; Strong, Wenger, Opper, et al., unpublished research). The model takes into account direct effects from spending on construction projects and indirect effects as construction spending induces further demands in the economy.
- Using BLS data, we identified the education and on-the-job training that would be needed for those occupations that the model forecasted would require the greatest increases in employment. Drawing on this information, the most-recent information available on education levels in the USVI, and information from our discussions with stakeholders regarding vocational training, we identified the occupations that are most likely to be difficult to fill from the local workforce.
- Given the importance of leisure and hospitality in the USVI's economy, we also examined the education levels and wages for major occupations in this sector, and compared the knowledge, skills, and abilities (KSAs) for leisure and hospitality jobs with the KSAs for jobs likely to be required for the recovery efforts. Following Wenger et al., 2017, we constructed a "distance metric" that identifies which occupations in leisure and hospitality are most similar to recovery-related occupations in terms of KSAs, work activities, context, and styles. Using this analysis, we identified those occupations in leisure and hospitality from which workers might be more likely to switch into recovery-related jobs.

Limitations of This Analysis

- There was a lack of posthurricane population-level data, which increases the uncertainty about how many more individuals (who are not currently in the labor force) might be willing and qualified to take recovery jobs.
- There was also a lack of data on the number of workers who migrate to the USVI seasonally or have migrated specifically to take recovery-related jobs.
- The assumptions inherent in the model forecast—including the assumption that the structure of production remains the same and that the distribution of occupations within an industry in the USVI mirrors that in the United States as a whole—were limiting factors.
- There was potential selection bias in the discussions.

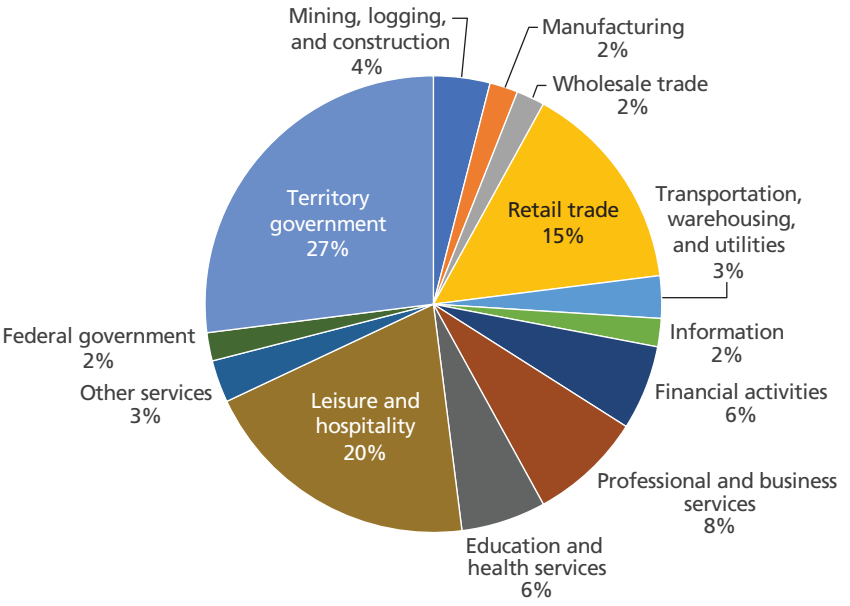
Prior to the 2017 hurricanes, the USVI workforce was concentrated in a few employment sectors. In August 2017, nearly 30 percent of employment was in government agencies, largely territory government (Figure 4.1). The leisure and hospitality sector accounted for 20 percent of overall employment and 28 percent of private-sector employment.[2] Retail trade—which is also dependent, in part, on tourism in the USVI—accounted for another 15 percent of total employment (20 percent of private-sector employment).

Impact of the Hurricanes

The 2017 hurricanes resulted in a sharp drop in employment starting in September 2017 (Figure 4.2). Between August and October 2017, VIDOL reported that the

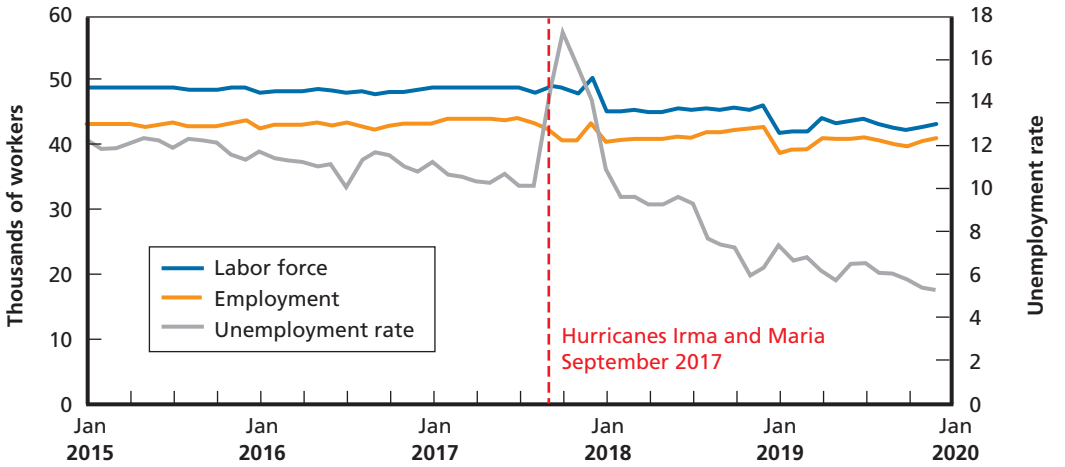
[2] The leisure and hospitality sector, which is the focus of Chapter Ten, includes the accommodation and food service sector, as well as the arts, entertainment, and recreation sector, and is often used to approximate tourism-related activity.

Figure 4.1
Industry Percentages of All USVI Employment, August 2017



SOURCE: BLS Current Employment Statistics for the USVI in August 2017, seasonally unadjusted, series SMU7800000XXXXXXXX01.

Figure 4.2
Labor Force, Employment, and Unemployment in the USVI, 2015–2019



SOURCE: VIDOL, 2020.

number of employed workers fell by about 3,000 (6 percent of total employment at the time) from about 43,000 to 40,000 employed people, and the unemployment rate rose from 10 percent to 17 percent.

Evidence suggests that many USVI inhabitants also began leaving for the continental United States shortly after the hurricanes. Although comprehensive posthurricane data on population and out-migration are not available, records show approximately 26,000 more air departures from than air arrivals to the USVI in 2017. Although the opposite pattern was observed in 2018, with more arrivals than departures, the net number of arrivals in 2018 (14,000) was substantially below the net number of departures in 2017 (Bureau of Transportation Statistics, undated). Likely as a result, in part, of this out-migration, the total number of workers in the labor force also fell in 2018. At the same time, the unemployment rate fell below 10 percent.

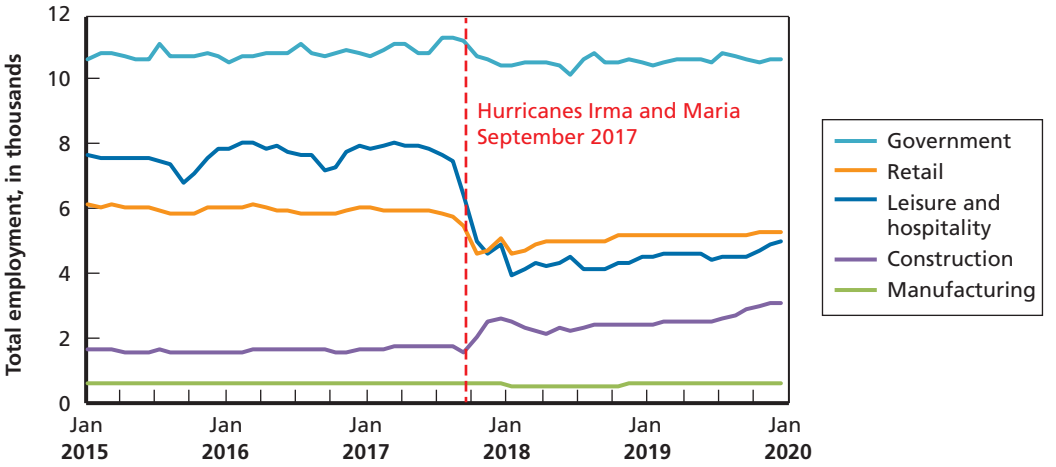
Recovery Progress Since the Hurricanes

The drop in employment following the hurricanes was driven largely by job losses in the leisure and hospitality sector, which had a loss of 3,500 jobs between August 2017 and January 2018, and the retail trade sector, which had a loss of 1,100 jobs during the same period. Since then, these two sectors have made progress toward returning to prehurricane levels. As we discuss in more detail in Chapter Ten, many hotels were closed during the 2017–2018 high season, and tourist arrivals remained low. Thus, employment in the leisure and hospitality and retail sectors rebounded only slightly from their low points in January 2018 during that period. However, starting with the 2018–2019 tourist season, hotel room availability and tourist arrivals rose (although, as we discuss in Chapter Ten, they are not yet back to their prehurricane levels); with this recovery, employment in leisure and hospitality rose further, and, by December 2019, about 30 percent of the jobs previously lost in this sector had returned, as had about 55 percent of jobs in retail.

The construction workforce has grown to support recovery efforts. Figure 4.3 shows that, as short-term recovery efforts were implemented in the wake of the hurricanes, the number of workers employed in the construction sector rose from 1,700 to 2,500 between August 2017 and January 2018 and has remained high since then. And, although total manufacturing employment also dropped by about 100 jobs (out of 600) after the hurricanes, it rose back to 600 by the end of 2018 and remained at that level through the end of 2019. The sustained recovery in manufacturing employment, and some part of the increase in construction employment, could reflect the restarting of the Limetree Bay refinery. Although the project team has not found an estimate of the total number of jobs associated with the restart, Limetree Bay's chief executive officer reported that the refinery and the terminal would eventually have a total of 450 employees and 230 contractors (Ellis, 2019).

The recovery direction for workforce capacity is shown in Box 4.3. We explain the key components of this direction in this section.

Figure 4.3
Employment, by Industry, 2015–2019



SOURCE: BLS Current Employment Statistics data, seasonally unadjusted series SMU78000007000000001 (leisure and hospitality), SMU78000004200000001 (retail trade), SMU78000003000000001 (manufacturing), SMU78000001500000001 (logging, mining, construction), SMU78000009000000001 (government); data pulled on February 23, 2020.

Box 4.3
Recovery Direction for Workforce Capacity

Ensuring that there are enough workers, with the appropriate skills, to meet recovery needs while still sustaining the other sectors of the USVI economy

As shown in Chapter One, modeling possible hurricane recovery spending paths based on expenditure patterns from prior hurricanes suggests potential spending of up to $800 million per year at the peak. Linking this level of spending to an input–output model of the USVI economy indicates that approximately 5,520 more workers would be required to support the recovery efforts at the peak (Table 4.1). Sixty percent of these new workers would be required in the construction sector, and another nearly 15 percent would be in the retail trade.

Table 4.2 translates these forecasted increases by industry into increases by occupation. The overall increase in demand translates into an increase in the workforce of 17 percent from the level in 2018. However, for construction occupations in particular, an increase of 120 percent will be required. Because the increased spending will induce demand in other sectors, the model also forecasts substantial increases in employment in a broad variety of sectors, including office support, sales, repair, and management.

Table 4.1
Change in Employment, by Industry, for Recovery Expenditures

Occupation	Forecasted Increase
Total	5,520
Construction	3,360
Retail trade	720
Health and social services	240
Accommodation and food services	240
Real estate and rental	160
Other services	160
Wholesale trade	80
Information	80
Finance and insurance	80
Professional, scientific, and technical services	80
Administrative and waste services	80
Educational services	80
Arts, entertainment, and recreation	80
Government	80

SOURCES: Forecasted increase indicates the peak number of additional workers forecasted to be needed for the recovery effort based on Strong, Wenger, Anderson, et al., unpublished research, and Strong, Wenger, Opper, et al., unpublished research.

NOTE: Only industries with forecasted increases are shown.

These increases are more moderate as a share of the 2018 workforce[3] but still suggest increases of 10 to 30 percent.

Key Barriers and Gaps

Where might the workers necessary to fill recovery needs come from? In this section, we examine four potential sources—currently unemployed workers in the USVI, local workers who are not currently in the labor force, workers who are currently employed in other sectors, and workers from outside the USVI. We discuss the potential chal-

[3] We used the 2018 data here because they are the most recent available from the BLS Occupational Employment Statistics.

Table 4.2
Change in Employment, by Occupation, for Recovery Expenditures

Occupation	Forecasted Increase	2018 Employment	Forecasted Percentage Increase over 2018 Employment
Total	5,520	32,290	17
Construction and extraction	2,120	1,780	119
Office and administrative support	680	5,460	12
Sales and related	560	3,030	18
Installation, maintenance, and repair	400	1,350	30
Management	280	3,080	9
Food preparation and serving related	240	3,040	8
Business and financial operations	200	1,360	15
Transportation and material moving	200	1,350	15
Health care practitioners and technical	120	1,260	10
Education, training, and library	80	2,000	4
Building and grounds cleaning and maintenance	80	1,510	5
Personal care and service	80	970	8
Production	80	730	11
Computer and mathematical	40	320	13
Architecture and engineering	40	210	19
Community and social service	40	420	10
Arts, design, entertainment, sports, and media	40	180	22
Health care support	40	380	11
Protective service	40	2,280	2

SOURCE: Forecasted increase indicates the peak number of additional workers forecasted to be needed for the recovery effort based on Strong, Wenger, Anderson, et al., unpublished research, and Strong, Wenger, Opper, et al., unpublished research.

NOTE: Only occupations with forecasted increases are shown. Some rounding causes totals to differ from the sum of the column data.

lenges associated with drawing workers from each of these sources. Because it will also be important for the USVI to continue to meet the workforce needs of its other sectors, we also compare the most-common jobs likely to be needed for the recovery with those

in the leisure and hospitality sector, to shed light on which occupations in the latter might be most likely to lose workers to the recovery efforts.

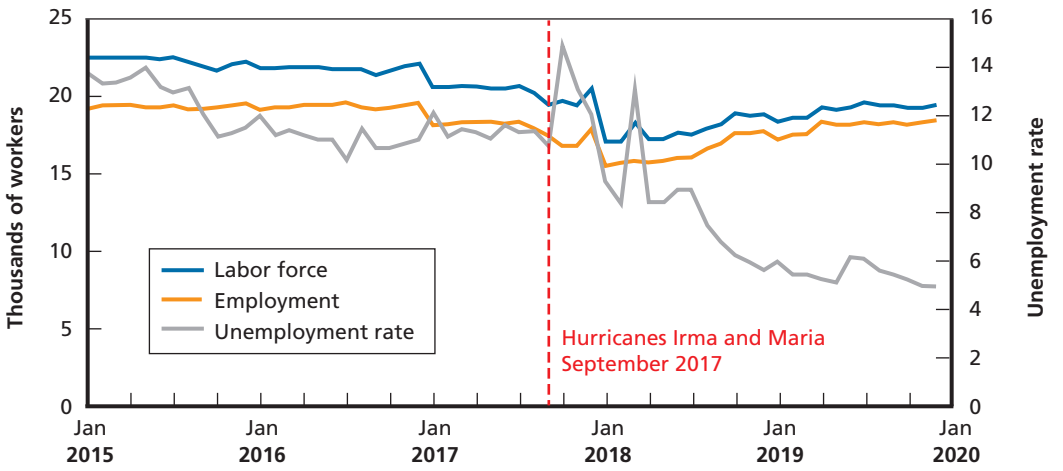
The Number of Currently Unemployed Workers Is Likely Too Low to Fill Demand

One potential source of recovery workers is those who are currently unemployed in the USVI. Just prior to the hurricanes, the unemployment rate was around 10 percent in St. Croix and the same in St. Thomas and St. John (Figures 4.4 and 4.5). Unemployment jumped to 14.9 percent in St. Croix and 18.6 percent in St. Thomas and St. John, by October 2017 but has subsequently fallen steadily, reaching about 5 percent in December 2019 in St. Croix and in St. Thomas and St. John.

However, the unemployment rate by itself does not tell the complete story, in that it masks some differences between islands. The total size of the labor force—including both employed and unemployed workers—fell from about 48,000 before the hurricanes to about 43,000 in 2019. The number of employed workers has also fallen, from about 43,000 prior to the hurricanes to about 40,000 in 2019. Because of the damage to the leisure and hospitality sector, the decline in the labor force and in the number of employed workers has been greater on St. Thomas and St. John than on St. Croix. Although the labor force fell by only about 1,000 workers on St. Croix, it fell by 4,000 on St. Thomas and St. John, between August 2017 and December 2019. In fact, the total number of employed workers on St. Croix was actually higher in December 2019 than it was in August 2017, while employment in St. Thomas and St. John remained below prehurricane levels.

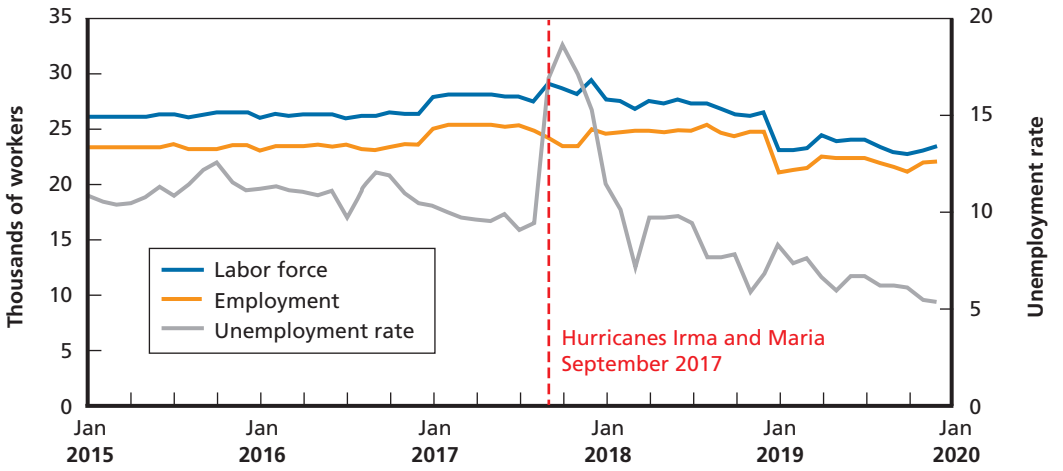
Taken together, these figures suggest that, as of December 2019, approximately 2,200 people were seeking work but were not employed. Some of these people might be

Figure 4.4
Labor Force, Employment, and Unemployment on St. Croix



SOURCE: VIDOL, 2020.

Figure 4.5
Labor Force, Employment, and Unemployment on St. Thomas and St. John



SOURCE: VIDOL, 2020.

able to fill workforce-capacity needs. However, some level of unemployment cannot be effectively reduced; this represents frictional unemployment as people move between jobs. In addition, as we discuss in the following sections, there could be mismatches between the education, training, and skills of unemployed people and recovery needs, in addition to health status, work limitations, or family responsibilities that limit people's ability to work in recovery-related jobs. Thus, it is unlikely that a large share of the increased demand for construction, retail, and other recovery jobs could easily be filled by currently unemployed workers.

Many New Labor-Force Participants Likely Lack Basic Skills and "Soft Skills" Needed for Recovery-Related Jobs

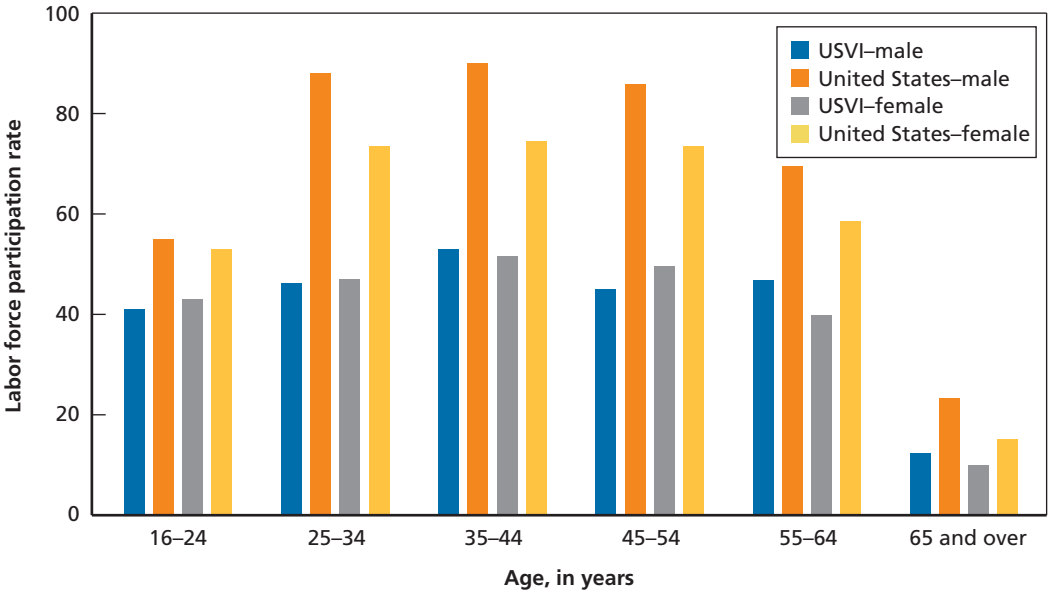
A second potential source of recovery workers is USVI residents who are not currently in the labor force but who might be brought into it. Given the lack of population-level data collection since the hurricanes, we do not have a clear idea of how large this potential source could be. However, the most–recently available data on the population—the 2015 Virgin Islands Community Survey (VICS) (Eastern Caribbean Center, 2018)—indicate that, among a population of about 100,000, 83,000 people age 16 and above could be in the labor force. Because that age group likely includes people still in high school and many retirees, a more realistic estimate of the potential labor force might be the 62,000 people between the ages of 20 and 64.

The labor force–participation rate (LFPR)—that is, the percentage of people working or actively looking for work—was about 40 percent among those age 16 and above and about 50 percent for those between the ages of 20 and 64. Earlier VICSs indicated that the LFPR had been between 55 and 65 percent—close to the LFPR

of about 63 to 64 percent for the United States overall—in 2000 and 2009.[4] However, following the shutdown of the Hovensa refinery in 2012, the LFPR dropped to about 50 percent; by 2015, it had fallen to less than 40 percent and was lower than the LFPR in the United States overall for every age bracket from 16 to 64 years of age (Figure 4.6). The LFPRs for both men and women in the USVI were substantially below the overall U.S. LFPRs, although the difference was greater for men (39 percent in the USVI versus 69 percent for the U.S. overall) than for women (39 percent in the USVI versus 57 percent in the United States overall).[5] The LFPR was lowest in St. Croix (36.9 percent), somewhat higher in St. Thomas (40.1 percent), and highest in St. John (57.1 percent) (Eastern Caribbean Center, 2011; Eastern Caribbean Center, 2014; Eastern Caribbean Center, 2016; Eastern Caribbean Center, 2018).

To what extent is it feasible to draw on additional USVI workers—those who could be in the labor force but are not—for the recovery efforts? To examine this issue, we considered the education levels in the USVI population and compared those with the education and training levels that would be needed for recovery jobs.

Figure 4.6
Labor-Force Participation in the USVI and the United States, Overall



SOURCE: For the USVI, authors' calculations are based on data from Eastern Caribbean Center, 2018. For the United States overall, data are from the BLS Current Population Survey using seasonally unadjusted rates for the fourth quarter of 2015.

[4] The same age range (16 and over) was used for these years.

[5] U.S. data are from the BLS Current Population Survey seasonally unadjusted LFPRs for the fourth quarter of 2015.

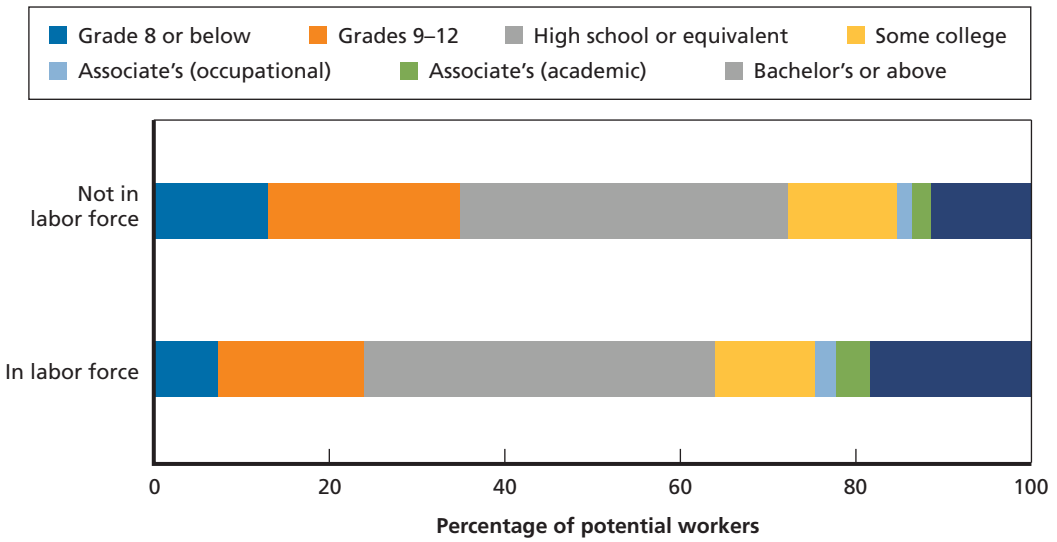
USVI residents not in the labor force are somewhat more likely than those in the labor force to have less than a high school education. Among the population not in the labor force in 2015, about 35 percent had less than a high school education, and another 40 percent had a high school diploma or equivalent (Figure 4.7).[6]

Would these levels of education be sufficient to fill recovery jobs? We identified 19 specific occupations, categorized using BLS's Standard Occupational Classification (SOC) system, forecasted to have an increase in 50 or more individual positions (Table 4.3). Together, these occupations account for about half of the total projected increase in jobs. For each of these occupations, we identified the most–commonly reported education level and type of on-the-job training reported by BLS, along with the average hourly wage.

Among these 19 occupations, Table 4.3 shows those that require at most a high school degree and relatively short-term on-the-job training (typically three months or less). These occupations include some specific to the construction sector (for example, construction laborers and cement masons) and several that also reflect induced demands in other sectors (for example, retail salespeople, office clerks, and cashiers). Table 4.3 also shows the average hourly wage in the USVI in 2018 for each occupation.

Table 4.3 shows employment in each occupation in both 2016 and 2018. The number of construction laborers had already doubled between 2016 and 2018, while

Figure 4.7
Educational Attainment Distribution, by Labor-Force Status



SOURCE: Eastern Caribbean Center, 2018.

[6] These figures include those age 16 and above and those above 65 years old, who may be retired and less likely to rejoin the labor force.

Table 4.3
Occupations with the Greatest Forecasted Increases in Demand Due to Recovery Efforts and with Minimal Education and Training Requirements

SOC	Occupation	Number of People Employed		Forecasted Increase	Location Quotient, 2018	Education	On-the-Job Training, in Months	Hourly Wage, in Dollars
		2016	2018					
47-2061	Construction laborers	190	380	400	1.69	High school	Up to 1	17.02
41-2031	Retail salespersons	1,860	1,240	200	1.25	High school	6–12	14.09
43-9061	Office clerks, general	740	620	160	0.94	High school	1–3	15.57
41-2011	Cashiers	1,080	820	160	1.01	High school	Up to 1	10.83
43-6014	Secretaries and administrative assistants, not legal, medical, or executive	980	740	120	1.53	High school	Up to 1	16.81
47-2051	Cement masons and concrete finishers	Not available	40	80	0.84	Less than high school	Up to 1	19.09
35-3021	Combined food preparation and serving workers, including fast food	200	Not available	80	Not available	Less than high school	Up to 1	10.66
43-5081	Stock clerks and order fillers	930	640	80	1.39	High school	Up to 1	11.16

SOURCE: Forecasted increase indicates the peak number of additional workers forecasted to be needed for the recovery effort based on Strong, Wenger, Anderson, et al., unpublished research; and Strong, Wenger, Opper, et al., unpublished research. Remaining data are from BLS, 2020a.

NOTE: N/A = not available. A location quotient compares the "concentration of an industry within a specific area to the concentration of that industry nationwide" (BLS, 2020b).

the numbers of workers in other jobs had typically fallen, which is consistent with the sectoral employment trends discussed previously. The location quotient in 2018—the number of workers in that occupation in the USVI as a share of the total workforce, compared with that in the United States as a whole—was nearly 1.7 for construction laborers, indicating that this occupation accounts for a substantially higher share of the USVI's employment than of that nationally.

Given the relatively low education and training requirements, the jobs shown in Table 4.3 are those that USVI residents not currently in the labor force could most easily fill. However, there might be other barriers that could prevent those not in the labor force from filling these jobs. Our discussions with educational training providers indicated that the standards for basic education in the USVI might not provide students with sufficient literacy or numeracy skills to take on certain jobs, such as cashier or administrative assistant, that require some minimal level of such skills. In addition, other jobs, such as retail salespeople, require strong "soft skills," which our discussions suggest might also be lacking for many. There could also be barriers unrelated to education and training, such as the need to provide child care or to care for family members, that prevent people from joining the labor force.

Table 4.4 presents the occupations that are likely to be needed during the recovery that require substantial education or training requirements. The majority of these jobs are in the construction trades (for example, electricians, carpenters, plumbers, and operating engineers), which often require apprenticeships or many years of on-the-job training. In keeping with the short-term recovery efforts, Table 4.4 shows that the numbers of workers in many of these occupations in the USVI more than doubled between 2016 and 2018. In fact, the location quotient was greater than 2 for carpenters, general and operations managers, and construction managers. In other words, the percentage of USVI employment in these occupations accounts for more than twice that nationally.

It is not clear whether the workers who filled the new construction-related jobs were USVI residents who were previously unemployed, out of the labor force, or in other sectors or whether these workers came from outside the islands. Our discussions suggest that a mix of these sources was most likely the case.

The long time required for training is a key barrier to preparing local workers for the occupations shown in Table 4.4. Even for those occupations that require a relatively short on-the-job training period, our discussions with education providers also indicated that there are very few teachers of CTE remaining in the USVI, who could provide some of the necessary skills (see Chapter Eleven). The relatively low levels of literacy and numeracy also remain barriers to USVI residents' successful completion of vocational training courses.

Table 4.4
Occupations with the Greatest Forecasted Increases in Demand Due to Recovery Efforts and with Moderate to High Education and Training Requirements

SOC	Occupation	Number of People Employed		Forecasted Increase	Location Quotient, 2018	Education	On-the-Job Training, in Months	Hourly Wage, in Dollars
		2016	2018					
47-2031	Carpenters	320	360	280	2.25	High school	6–12	23.35
47-2111	Electricians	100	170	240	1.14	Certificate	24–48	27.08
47-1011	First-line supervisors of construction trades and extraction workers	80	140	200	1.06	High school	48–120	29.76
47-2152	Plumbers, pipefitters, and steamfitters	Not available	60	160	0.6	Certificate	48–120	23.53
47-2073	Operating engineers and other construction equipment operators	Not available	120	120	1.35	High school	12–24	19.76
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	Not available	80	120	1.08	Certificate	6–12	20.78
11-1021	General and operations managers	1,790	1,170	120	2.3	Bachelor's	48–120	36.31
11-9021	Construction managers	Not available	180	120	2.88	Bachelor's	N/A	40.37
47-2141	Painters, construction and maintenance	50	60	80	1.15	High school	12–24	17.9
43-3031	Bookkeeping, accounting, and auditing clerks	380	310	80	0.89	High school	1–3	17.48
13-1051	Cost estimators	Not available	Not available	80	Not available	Bachelor's	6–12	Not available

SOURCE: Forecasted increase indicates the peak number of additional workers forecasted to be needed for the recovery effort based on Strong, Wenger, Anderson, et al., unpublished research, and Strong, Wenger, Opper, et al., unpublished research. Remaining data are from BLS, 2020a.

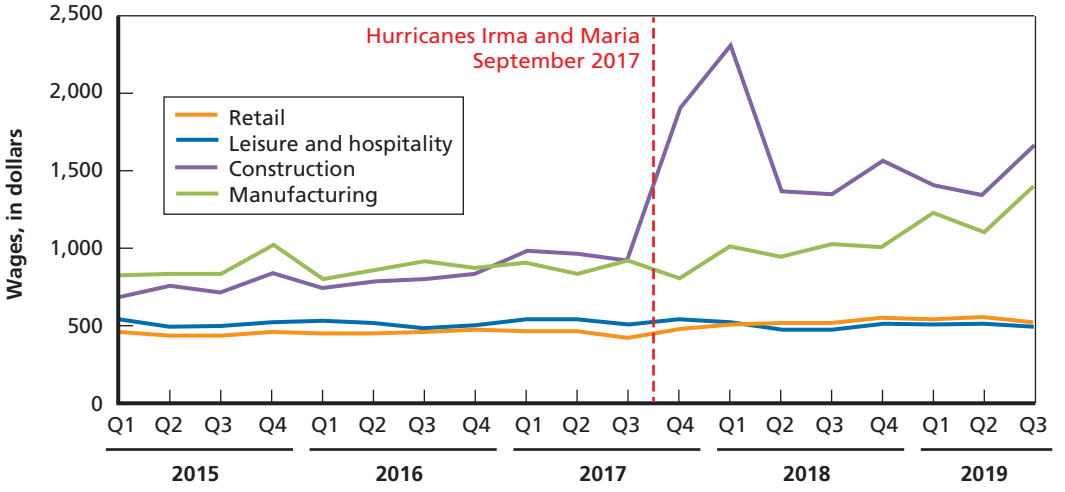
Recovery Efforts Have Increased Competition for Workers Currently Employed in Other Sectors

Another potential source of workers for the recovery efforts is people who are already working in other sectors. During our discussions with employers in the leisure and hospitality and retail sectors, several expressed concerns that some of their workers had left to take construction jobs at higher rates of pay. Indeed, the average weekly wages paid to construction workers rose from just under $1,000 prior to the hurricanes to about $2,200 in early 2018, then fell to around $1,500, with a recent uptick to more than $1,650 (Figure 4.8). In contrast, the average weekly wages in the leisure and hospitality and retail sectors remained around $500 per week throughout this period.

Employers with whom we spoke were also concerned about out-migration following the hurricanes, which reduced the overall size of the local workforce. Although some employers expressed concern about specific skills, the more general concern was that the overall labor force was small, that the recovery efforts had increased competition for workers, and that recovery jobs could pay more than leisure and hospitality jobs. In fact, many of these employers suggested that they view not being able to find enough workers to be a serious barrier to continued recovery of the leisure and hospitality sector.

Table 4.5 shows the 20 occupations with the highest U.S. employment in the accommodation and food service sector (the largest part of the leisure and hospitality sector in the USVI) in the United States overall, along with the employment associated with each occupation in the USVI in 2018. We also show the most–commonly reported education level and level of on-the-job training, along with the average hourly

Figure 4.8
Average Weekly Wages, by Industry, 2015 to 2019



SOURCE: Data downloaded from BLS Quarterly Census of Employment and Wages on February 21, 2020.

Table 4.5
Occupations with the Highest U.S. Employment in the Accommodation and Food Service Sector

SOC	Occupation	Number of Workers[a]	Location Quotient	Education Required	Months of On-the-Job Training	Hourly Wage, in Dollars
35-3021	Combined food preparation and serving workers, including fast food	Not available	Not available	Less than high school	<1	10.66
35-3031	Waiters and waitresses	730	1.27	High school	<1	11.79
35-2014	Cooks, restaurant	450	1.52	High school	<1	13.89
35-1012	First-line supervisors of food-preparation and serving workers	240	1.09	High school	<1	17.37
35-3011	Bartenders	220	1.56	High school	<1	12.87
35-2011	Cooks, fast food	Not available	Not available	High school	<1	11.09
35-2021	Food-preparation workers	370	2.02	High school	<1	10.74
37-2012	Maids and housekeeping cleaners	390	1.89	High school	<1	12.14
35-9021	Dishwashers	130	1.19	Less than high school	None	11.78
35-9031	Hosts and hostesses, restaurant, lounge, and coffee shop	Not available	Not available	Less than high school	<1	11.17
35-9011	Dining room and cafeteria attendants and bartender helpers	90	0.87	High school	None	Not available
41-2011	Cashiers	820	1.01	High school	<1	10.83
35-3022	Counter attendants, cafeteria, food concession, and coffee shop	120	1.1	Less than high school	<1	10.83
43-4081	Hotel, motel, and resort desk clerks	170	2.99	High school	<1	12.72
53-3031	Drivers and sales workers	60	0.67	High school	<1	12.60
11-9051	Food service managers	80	1.72	High school	12–24	22.06
35-2015	Cooks, short order	Not available	Not available	High school	<1	11.11
49-9071	Maintenance and repair workers, general	620	2.02	High school	6–12	15.35
11-1021	General and operations managers	1,170	2.3	Bachelor's	6–12	36.31

Table 4.5—Continued

SOC	Occupation	Number of Workers[a]	Location Quotient	Education Required	Months of On-the-Job Training	Hourly Wage, in Dollars
35-1011	Chefs and head cooks	90	2.98	Associate's	<3	23.04

SOURCE: BLS, 2020a.

NOTE: Data on the occupations with the highest employment are based on overall U.S. employment because employment data were not available for all occupations in the USVI.

[a] The number of employees in the USVI, when those data were available.

wage. The education and training requirements are minimal for these occupations—typically high school or less, with short on-the-job training.

To shed light on whether there are certain occupations in the accommodation and food service sector that are likely to lose workers to the recovery efforts, we examined the similarity of the KSAs and work environment in the occupations with the most employees in the accommodation and food service sector and the recovery-related occupations with the greatest forecasted increases in employment.[7] We focused on recovery occupations that do not require extensive education or training (Table 4.2) because, as discussed previously, the lengthy training pipelines for some construction trades are likely to make it difficult for workers who do not have those skills to move into those occupations. (One notable exception is general and operations managers, an occupation that is likely to face increased recovery-related demand and that is also a common job category in the accommodation and food service sector.)

In Table 4.6, we show the three large food and accommodation occupations that were most similar to each of the recovery-related occupations shown in Table 4.2. First, we considered the recovery-related occupation likely to face the highest increase in demand: construction laborers. The occupations in food and accommodation that are most similar to the construction laborer occupation are maintenance and repair workers; cooks (restaurant and short order); food-preparation workers (including combined food-preparation and serving workers; not shown in the table); drivers and sales workers; and dishwashers. Customer-facing occupations, including waiters and waitresses, counter attendants, bartenders, hosts and hostesses, and desk clerks, are less similar. Consistent with this were reports from employers in the leisure and hospitality sector that their employees in non–customer-facing jobs, such as food preparation, were more likely than customer-facing employees to have left to take construction jobs during the initial recovery efforts. They attributed this to the relatively difficult working condi-

[7] In particular, we examined the *knowledge* of principles and facts needed to do the job, the *skills* that workers in the job have developed that facilitate further learning, the individual *abilities* that help someone perform the job, the physical and social *context* in which that work is performed, the *work activities* that reflect general behaviors that would be performed in multiple jobs, and the worker's *work style* (personal characteristics) that affect job performance.

Table 4.6
Closest Matches Between Recovery-Related Occupations with Minimal Education and Training Requirements and Accommodation and Food Service Occupations

SOC	Occupation	Hourly Wage, in Dollars	Closest Three Matches in Food and Accommodations
47-2061	Construction laborers	17.02	• Maintenance and repair workers, general (49-9071) • Cooks, restaurant (35-2014) • Cooks, short-order (35-2015)
41-2031	Retail salespersons	14.09	• Cashiers (41-2011) • Hotel, motel, and resort desk clerks (43-4081) • Waiters and waitresses (35-3031)
43-9061	Office clerks, general	15.57	• Hotel, motel, and resort desk clerks (43-4081) • Cashiers (41-2011) • Hosts and hostesses, restaurant, lounge, and coffee shop (35-9031)
41-2011	Cashiers	10.83	• Cashiers (41-2011) • Waiters and waitresses (35-3031) • Combined food preparation and serving workers, including fast food (35-3021)
43-6014	Secretaries and administrative assistants, not legal, medical, or executive	16.81	• Hotel, motel, and resort desk clerks (43-4081) • Cashiers (41-2011) • Hosts and hostesses, restaurant, lounge, and coffee shop (35-9031)
47-2051	Cement masons and concrete finishers	19.09	• Maintenance and repair workers, general (49-9071) • Cooks, restaurant (35-2014) • Food preparation workers (35-2021)
35-3021	Combined food preparation and serving workers, including fast food	10.66	• Combined food preparation and serving workers, including fast food (35-3021) • Waiters and waitresses (35-3031) • Short-order cooks (35-2015)
43-3031	Bookkeeping, accounting, and auditing clerks	17.48	• Hotel, motel, and resort desk clerks (43-4081) • Cashiers (41-2011) • Bartenders (35-3011)
43-5081	Stock clerks and order fillers	11.16	• Combined food preparation and serving workers, including fast food (35-3021) • Dining room and cafeteria attendants and bartender helpers (35-9011) • Waiters and waitresses (35-3031)

SOURCE: Authors' calculations based on the similarity of KSAs across occupations, following Wenger et al., 2017.

tions in some occupations, such as food preparation, and the substantially higher pay for construction laborers ($17 per hour for construction laborers, versus $11 to $13 per hour for food-preparation workers). In contrast, although the hourly wages of waitstaff, bartenders, and hosts and hostesses are also in the $11- to $13-per-hour range,

employers reported that customer-facing employees, especially waiters and waitresses, are often hired from the continental United States for the tourist season, have the possibility of earning tips, and are therefore less likely to take construction jobs.

However, it is worth noting that many recovery-related occupations that do not require substantial education or training will likely be in nonconstruction occupations, necessitating more workers in retail sales and clerk and cashier jobs (Table 4.2). Customer-facing occupations in accommodation and food services are quite similar to these recovery-related occupations (and in some cases, such as cashiers, are identical). For example, Table 4.6 shows that the closest three matches for retail jobs in food and accommodation are cashiers, desk clerks, and wait staff. As the recovery effort ramps up, it is likely that there will be increased competition for these types of customer-facing workers as well.

It also is worth noting, however, that the total number of workers in the accommodation and food service sector was about 5,000 in 2018; therefore, even if some workers move from the tourism sector into recovery-related jobs, this influx is unlikely to meet the total demand.

The Most Significant Barrier to Using Workers from Outside the USVI Is Lack of Housing

Finally, given the small size of the USVI workforce, it is likely that a large share of the recovery workers will be from off-island. This is particularly likely for those construction trades that require long-term, on-the-job training. Although it could be optimal for the USVI to train some local workers for the construction trades, it is unlikely that it would be feasible to train enough local workers to meet peak demand; nor would it make sense to train locals to meet peak demand for these trades, in that this would leave many of these workers without sufficient local demand for their skills in the long term.

The most important barrier to bringing in additional workers from outside the territory is the availability of housing. In addition to the housing challenges discussed in Chapter Eight, it is worth noting two specific workforce-related challenges that arose during our discussions. First, several employers in the leisure and hospitality sector voiced a concern about their seasonal workers. Typically, these employers hire workers from the continental United States for the tourist season to accommodate the higher demand. However, several employers noted that they had not been able to hire enough workers from the continental United States for the 2019–2020 high tourist season because the increase in rental prices (see Chapter Eight) had made it infeasible for these workers to afford housing in the USVI given the wages that the employers in this sector could afford to pay.

Second, employers in the retail sector on St. Croix also noted challenges from an influx of workers, although, in this case, their concern was related to the restart of the Limetree Bay refinery. These employers noted that the biggest challenge they

perceived their employees to face was a sharp increase in rents driven by competition from workers hired by Limetree Bay. The employers and potential and actual workers with whom we spoke indicated that, although Limetree Bay had built a camp to house many of its workers, some chose to live off-site, renting apartments, homes, and Airbnb residences. The employers with whom we spoke also indicated that the wages paid by Limetree were higher than typical wages in the retail sector; this is consistent with Figure 4.8, which shows that the average weekly wage in manufacturing is twice the average weekly wage in retail and had risen as of the end of 2019. The employers with whom we spoke reported that, because the new employees hired by Limetree Bay could pay higher rents than the retail employees, the latter therefore faced difficulty remaining in their houses.

Box 4.4
COVID-19 and Workforce Capacity

The status of the USVI workforce and the workforce needs for the recovery as described in this chapter were developed based on discussions and analysis conducted between November 2019 and February 2020. COVID-19 will have profound impacts on the USVI workforce. Although many of those impacts cannot be anticipated, it is clear that there will be a major decline in employment in the short term, as tourism and retail—two of the sectors hardest hit by the physical-distancing measures—made up more than 25 percent of the workforce at the end of 2019. Moreover, the impacts on tourism, a major driver of the USVI's economy, are likely to be long lasting.

As we described in this chapter, the combination of USVI residents leaving after the hurricanes and the increase in demand for recovery workers has tightened the labor market substantially in the past two years. Therefore, much of our analysis focuses on how to ensure that there are enough workers to sustain the recovery effort, the tourism sector, and other parts of the USVI economy. If the tourism sector takes a long time to recover, there might be a surfeit of workers who might be able to contribute to the recovery efforts when those efforts can resume. However, COVID-19 might also cause more USVI residents to leave the territory, shrinking the workforce further.

The potential recommendations that we present in the next section focus on building up the skills of the local workforce. Regardless of what labor market conditions are like going forward, it is likely that this type of skill training will be important, although the mix of specific skills that are needed could change.

Recommendations

This section presents recommendations to fill the large increase in the number of workers who will be needed for the recovery efforts. Given the small size of the USVI population, it is likely that several thousand of these workers will need to come from off-island. The biggest barrier to bringing in off-island workers is the limited supply of housing; recommendations to address that challenge are discussed in Chapter Eight. In particular, the use of temporary prefabricated or modular housing would help to accommodate the short-term increase in housing demand associated with the recovery without creating a long-term oversupply of housing stock.

At the same time, LFPRs in the USVI are relatively low, so it might be possible to increase the local supply of labor by tailoring the planned workforce-development program to bring additional workers into the labor force and equip them with skills that will be needed for the recovery. The recommendations in this section focus on options for developing the local workforce.

Create Short-Term Training and Credentialing Programs for Key Tourism- and Recovery-Related Occupations, and Connect USVI Residents with Those Programs

Goal

Bring additional residents into the labor force and connect them with jobs in tourism- and recovery-related jobs that do not require long-term training.

Rationale

The recovery action plan calls for a workforce-development program administered by VIDOL, VIEDA, and other qualified agencies that would accept applications for workforce training from educational institutions, vocational training providers, businesses, and nonprofit providers approved for workforce training by the Virgin Islands Workforce Development Board. Several considerations could help maximize this program's effectiveness. First, encouraging the creation of programs that provide credentials that are portable across employers and stackable (i.e., able to be combined) with other credentials would help to increase future career prospects for workers who complete the programs (Center for Occupational Research and Development, 2017). Second, it will be important to help small and medium-sized businesses participate. Third, workers should be trained for both construction and nonconstruction recovery jobs. Fourth, focusing primarily on occupations that require short-term training would be optimal because of the lack of technical training providers in the USVI and because USVI residents not currently in the labor force would be most likely to be able to fill these jobs.
Finally, there might be factors that have prevented these people from joining the labor force; providing wraparound services, such as transportation, could enable them to participate (Daugherty, Johnston, and Berglund, 2020).

Implementation considerations

Implementing this recommendation could follow these steps:

1. Identify a list of potential education and training providers that could provide short-term training, such as UVI, the Raphael O. Wheatley Skill Center, My Brother's Workshop, and the World Ocean School (responsible parties: Virgin Islands CTE Board and the VIDE).

2a. Work with local and continental U.S. construction firms to identify the key skills that they seek when hiring for jobs that require short-term training, and share this information with the local education and training providers identified in step 1 (responsible parties: VIDOL, the Virgin Islands Workforce Development Board, and VIEDA).

2b. Work with industry associations in the tourism sector to identify their members' needs for skills that could be developed through short-term training, and help connect these associations with the local education and training providers identified in step 1 (responsible parties: VIDOL, the Virgin Islands Workforce Development Board, and VIEDA).

3. Work with chambers of commerce and other private-sector organizations, such as retailers' associations, to encourage the formation of consortia that are not specifically aimed at training a construction- or tourism-related workforce but that target the peripheral occupations that will be needed for the recovery efforts (responsible parties: VIDOL, the Virgin Islands Workforce Development Board, and VIEDA).

4. Develop short-term training courses that would provide the required skills (responsible parties: selected consortia with guidance from the Virgin Islands CTE Board and VIDE).

5a. Encourage consortia to offer portable and stackable "microcredentials" so that workers who complete them have proof that they can provide to any employer of their skills and can be combined with other credentials in the future (responsible parties: the Virgin Islands CTE Board and the VIDE).
5b. Encourage consortia to offer competency assessments for certain skills to provide formal credentials to individuals based on prior work experience. This could be particularly valuable for workers who have already participated in the recovery efforts in the immediate aftermath of the hurricanes (responsible parties: the Virgin Islands CTE Board and the VIDE).
5c. Make sure consortia are aware of, and can take advantage of, ongoing activities associated with the establishment of the proposed hospitality training school and maritime academy that were authorized under 17 V.I.C. Chs. 27 and 26, respectively (responsible parties: the VIDE, the Virgin Islands Department of Tourism, and UVI).
5d. Consider providing—or encouraging consortia to provide—wraparound services, such as transportation or child care, that could make it easier for those not currently in the labor force to participate (responsible parties: VIDOL and VIEDA).
5e. Coordinate efforts, where possible, with concurrent workforce training programs in Puerto Rico, which are likely to target similar skills (responsible parties: VIDOL and VIEDA).

Time frame Near term

Leading entities VIDOL and VIEDA are to provide overall administration of the workforce-development plan and would thus be the lead USVI entities, collaborating with the VIDE, the USVI Department of Tourism, the Virgin Islands CTE Board, the Virgin Islands Workforce Development Board, the Hospitality Training School, the Maritime Academy, UVI, employers, employers' organizations, and training providers.

Send Eligible Applicants to the Continental United States for Longer-Term Training

Goal	Help the USVI provide local residents with training for recovery-related jobs that require long-term training.
Rationale	Many recovery-related jobs, particularly the construction trades, require long-term training or apprenticeships. Because few training providers or vocational training teachers are currently available in the USVI, it will be challenging for additional local residents to gain these skills locally. Although the disaster action plan indicates that equipment, supplies, and technology for the workforce-development program must be used for providers in the USVI, there is no restriction on funds being used to send USVI workers to programs in the continental United States.
Implementation considerations	Implementing this recommendation could perform these steps, which could be taken in parallel: • Work with local and continental U.S. construction firms to identify the key skills that they seek when hiring for jobs that require medium- to long-term training (responsible parties: VIDOL and VIEDA). • Review and identify appropriate training programs in the continental United States that would provide the necessary skills (responsible parties: VIDOL and the Virgin Islands Workforce Development Board). • Identify people who would be interested in, and qualified to participate in, long-term training in the construction trades. High school CTE programs might be a promising source (responsible parties: VIDOL and Virgin Islands Workforce Development Board, working with the VIDE). • Develop conditions for program participation that increase the chance that program participants return to the USVI after training, including requiring a certain period of residency in the USVI following training, and providing incentives to retain those who complete the training in the longer term (responsible parties: VIDOL and VIEDA).
Time frame	Longer term
Leading entities	VIDOL and VIEDA are to provide overall administration of the workforce-development plan, and would thus be the lead USVI entities. The Virgin Islands Workforce Development Board could provide support in identifying required skills and program participants.

CHAPTER FIVE

The Supply Chain

Box 5.1
Key Findings About the Supply Chain

- The USVI recovery will likely lead to a substantial increase in demand for construction services. Two general areas of supply-chain management represent the greatest risk to USVI recovery efforts: (1) purchasing and acquisition (i.e., how organizations procure contracting services for recovery and contracting firms perform recovery work, including procuring necessary building materials and labor) and (2) distribution and logistics (i.e., how materials are brought into the USVI via the seaborne supply chain).
- To expand supply-chain capacity, the USVI must (1) enhance operations in purchasing and acquisition by ensuring that effective and efficient processes and tools are in place to procure contractor services and that accurate cost estimates are available to purchase contractor services, and (2) support efficient distribution and logistics by ensuring that processes and assets are available to transport construction and other materials and that adequate storage capacity is available to hold materials until they are needed.
- The USVI faces three key barriers to achieving sufficient supply-chain capacity:
  - The USVI's current approach to contracting for recovery work can lead to long timelines.
  - FEMA cost estimates are sometimes lower than bids submitted by contractors.
  - Having sufficient port capacity is the biggest constraint on the recovery supply chain.
- To address these barriers, we make the following recommendations:
  - Implement contracting reform by creating contract templates that can be rapidly modified or by establishing indefinite-delivery contracts that can expedite procurement of recovery project services.
  - Create guidelines to support grant applicants to revalidate FEMA cost estimates.
  - Increase berth capacity by extending operating hours, utilizing the additional piers on St. Croix and St. Thomas, or doing both.
  - Increase stackyard storage capacity at the Crown Bay port in St. Thomas by acquiring additional acreage, or increase stackyard velocity by acquiring additional material-handling equipment and increasing gate capacity.
  - Create a steady demand for recovery project materials, communicate that demand to shipping companies, and plan ahead for a months-long lead time.
  - Use information from the FEMA Grants Manager database and other federal agency sources to identify grant applicants with similar projects that are nearing their implementation timelines and reach out to these applicants to coordinate in contracting to reduce barriers, achieve economies of scale, and optimize outcomes.

In addition to the management, fiscal, and workforce capacity challenges, the USVI faces a great logistical challenge in the coming years: How can it procure the contracting services and procure and transport the unprecedented amounts of materials needed to rebuild its infrastructure across its constituent islands? The aim of this chapter is to identify key challenges in supply chains that could slow or otherwise disrupt recovery efforts and to offer recommendations to ease these constraints.

The research team identified the following two general areas of supply-chain management that represent the greatest risk to USVI recovery efforts:

- **Purchasing and acquisition:** how organizations procure contracting services for recovery and how contracting firms perform recovery work, including procuring necessary building materials and labor
- **Distribution and logistics:** how materials are brought into the USVI via the seaborne supply chain.[1]

For the USVI, these supply-chain areas can be considered to include all the activities that governmental or nongovernmental organizations must perform once they determine what projects they will undertake—that is, after they complete damage inspections, environmental impact assessments, and other administrative processes required to make projects feasible.

For the purposes of this report, we refer to the activities of the USVI and FEMA seeking recovery services to be *purchasing* and the activities of the firms performing the services to be *acquisition*. We make this distinction so that we can separate out the activities of these different entities involved in the USVI supply chain.

Box 5.2 explains the methods used in this analysis. In the remainder of this chapter, we first provide a brief overview of the USVI supply chain and define recovery directions in this area. We then discuss key barriers and gaps that are impeding or slowing the recovery process. The final section provides recommendations to address these barriers.

[1] We focus on seaborne logistics because the vast majority of building supplies are not economical to ship by air and no other surface options exist for the USVI. Additionally, it is worth noting that Cyril E. King Airport on St. Thomas and Henry E. Rohlsen Airport on St. Croix are not capacity constrained by operations. According to the Federal Aviation Administration's Air Traffic Activity Data System, there were approximately 95 and 140 daily operations at St. Croix and St. Thomas in 2019, respectively. For comparison, San Diego International Airport, also a single-runway airport, averaged 630 daily operations in 2019. So St. Thomas and St. Croix have capacity for significantly more flights, but that capacity is unlikely to be realized for heavy construction materials. Furthermore, "[v]irtually anything that cannot economically fit in the belly of an airplane must be moved via maritime conveyance to and from" the USVI, as is the case with all lands that are separated by the ocean from other areas where goods are made available (Resnick et al., 2020).

Box 5.2
Methodology and Limitations of the Analysis of the Supply Chain

Methods Used in This Analysis

- We used FEMA Grants Manager data to understand the scope of future recovery work and to assess how recovery efforts could be coordinated with respect to the supply chain for needed materials. We also reviewed FEMA data on projects being funded across U.S. federal agencies.
- To study how organizations purchase contracting services, we talked with representatives of organizations that had applied for FEMA grants for posthurricane recovery projects. We also talked with representatives from one USVI private nonprofit organization and one USVI government department. We also spoke with officials from a large contracting company in the USVI that is performing recovery work. We spoke with personnel from three organizations responsible for initiating recovery efforts following Hurricanes Maria (2017) and Michael (2018) in Florida coastal communities (with populations of 10,000 to 100,000 residents).
- The supply-chain team also drew on discussions with multiple territory agencies and findings from other teams working on this report.
- We studied the seaborne supply chain for the USVI and performed a capacity-utilization analysis of the main cargo ports. We assessed each port's capacity and utilization of the infrastructure (stackyards and berths) using supply-chain analytic models, data collected from empirical sources, and discussions with stakeholders. Data sources included discussions with the Virgin Islands Port Authority (VIPA), discussions with shipping companies and terminal operators, research literature, geographic information system and Google Maps, DOT, and various other public documents.

Limitations of This Analysis

- This research is limited by the number of organizations we were able to contact within the project timeline. Although the representatives with whom we met provided valuable information and insights, it is possible that we could have identified even more opportunities to improve supply-chain management for recovery had we been able to speak with more stakeholders.
- The research is also limited in scope by the time and resources available. In particular, we were not able to perform research about the roadways or the portion of the supply chain represented by truckers who carry materials from ports to distribution centers and customers. Other analysis has been performed on the road networks of the USVI. This research evaluated the damage from the hurricanes in 2017 in terms of their impacts on transportation networks. The researchers calculated travel times for residents to access grocery and fuel stores and made recommendations to decrease travel times in postdisaster conditions (Good, 2019). Additionally, previous HSOAC research into seaborne logistics for posthurricane recovery identified the importance of sufficient capacity in the trucking industry to pick up materials when they arrive in ports and move them onward to free up space in the stackyards (Resnick et al., 2020).

Setting the Stage

To establish the context for the discussion in this chapter, we begin by describing the major components of the USVI supply chain.

Using projections of scheduled recovery projects, as discussed in the introduction to this report, we estimated that USVI expenditures could be up to $600 million to $800 million each year from 2020 through 2022. This represents an approximate 30-percent increase per year in economic activity in the USVI and a corresponding increase in imports to the USVI.[2]

[2] Because recovery projects include more construction and consumption of construction materials on average than the overall economy of the USVI, we project that the economic activity related to the $1 billion in recovery projects will correspond to a greater-than-30-percent increase in imports to the USVI. To pose a conservative or

The recovery will likely lead to a substantial increase in demand for construction services. In Chapter Four, we identified the industry sector of construction and extraction as representing more than half of the direct increase needed for employment related to the recovery. This increase in construction services will also lead to an increase in the demand for building materials. These items must be imported, which will result in an increase in the goods being brought through the seaborne supply chain. Therefore, a successful recovery will place significant demands on the USVI's logistics capacity. We describe features of the USVI supply chain in more detail in the next two sections.

Purchasing and Acquisition

Chapters Two and Three described the process by which territory agencies use funding from FEMA's PA program. These agencies require a complex set of steps involving multiple territory agencies and FEMA before finishing project obligation and arriving at a point at which contracting is feasible. PA also requires an agency to have its own funding to start its assigned work while waiting for reimbursement from FEMA.

Organizations pursuing recovery projects in the USVI rely on both local and outside construction firms to perform the work. These firms employ workers directly and through subcontractors. To develop a contract for projects, the USVI government uses a design–bid–build process, which entails working from basic contracts and tailoring them to the purposes of the project. In performing large construction projects, firms in the USVI must also import a large share of their workers, as discussed in Chapter Four, because of the small labor force in the USVI and the relatively low number of USVI workers with specific skills in high demand for construction, such as carpenters and electricians.

According to our discussion with staff members from a USVI government department about the process used in the USVI to purchase services for recovery work (such as the process for contracting for a new building), after agreeing to the terms for a contract with a prospective contractor, a government organization must submit its custom-created contract for approval by approximately five organizations within the USVI government. This process includes multiple sign-off approvals from the Virgin Islands Department of Justice and governor's office. Staff told us that approximately ten people were required to sign off on all contracts. If further renegotiation of the contract—for either cost or terms of work—is required, the entire USVI government contracting process of ten individual sign-offs must occur again.

Illustrating an example of acquisition, a large construction contractor in the USVI reported that it uses approximately ten to 15 different suppliers that sell wholesale building supplies. These suppliers are located primarily in Florida, Georgia, South

"high" estimate of the impact of recovery projects, in our seaborne logistics analysis, we projected whether the USVI ports could accommodate a 50-percent increase in imports.

Carolina, and North Carolina. The materials are packaged in shipping containers for transport to distribution in the USVI.

Distribution and Logistics

Construction contractors typically need to transport the majority of their building materials from off-island. Seaborne logistics capacity is provided by a small number of ports on each of the main islands (St. Croix, St. Thomas, and St. John). St. Croix and St. Thomas have ports that serve large cargo ships and ports with cruise ship terminals (USVI Hurricane Recovery and Resilience Task Force, 2018; Virgin Islands Now, undated; Virgin Islands Now, 2020; VIPA, undated). Ferry terminals in St. Croix, St. Thomas, and St. John serve barges and smaller ships carrying passengers and cargo.

The operations at a port terminal can be divided into three phases: seaside operations, stackyard operations, and landside operations. Each phase is extensively engineered. During *seaside operations*, the vessel occupies a berth, and either vessel-equipped cranes or ship-to-shore cranes load and unload cargo. During *stackyard operations*, imported container cargo is transferred to the stackyard using specialized handling equipment, while container cargo that is ready for export is transferred to the stackyard to await loading onto a vessel. This work can be performed by private port terminal operators, which are distinct from VIPA and who may pay fees to VIPA for various services and who might lease space, equipment, and other goods from VIPA for these operations. *Landside operations* involve transportation of materials by truck from the stackyard to the site on the island where they will be used (and transport of materials or finished products from the island to the stackyard to await export).

The USVI's seaborne logistics infrastructure is particularly robust on St. Croix. For example, Wilfred "Bomba" Allick Port in St. Croix (also known as the St. Croix Containerport), one of the two principal cargo ports in the USVI, has berths for two cargo ships (each marked with an "S" in Figure 5.1) and 29 acres in the yard (outlined in the figure), including 18 acres that are used to store containers. Additional berths are available at the nearby Gordon A. Finch Molasses Pier. All yard space at these and other port facilities in St. Croix is managed by VIPA; shippers pay fees for containers stored more than five days.

Cargo infrastructure is heavily utilized in St. Thomas, and cargo ships must compete for space with tourism. For example, Crown Bay Cargo Port in St. Thomas has berths for two cargo ships (indicated by the "S" icons in Figure 5.2). The outlined area in the figure includes 12 acres, all of which are used to store containers. The stackyard appeared nearly full in satellite images and during an in-person visit in February. VIPA has leased yard space to Tropical, Crowley, and other smaller shippers, which manage its use.

As we discuss further in the "Key Barriers and Gaps" section, USVI government reports (USVI Hurricane Recovery and Resilience Task Force, 2018), discussions with VIPA officials and port terminal operators, and contemporary policy research (Good,

Figure 5.1
The St. Croix Containerport

SOURCE: Google Maps.
NOTE: The 29-acre outlined area includes 18 acres that are used to store containers. Each oval marked "S" is a berth for a cargo ship.

Figure 5.2
Crown Bay Cargo Port in St. Thomas

SOURCE: Google Maps.
NOTE: The 12-acre outlined area is used to store containers. Each oval marked "S" is a berth for a cargo ship.

2019) all indicate that port capacity—particularly container stackyard utilization and berthing utilization—might be insufficient to support posthurricane recovery and is therefore the binding constraint on getting building materials to the islands in a timely fashion for project completion. The USVI Hurricane Recovery and Resilience Task Force states that "current container port capacity on St. Thomas—which serves as the hub for the rest of the Territory—is insufficient to accommodate the Territory's needs in the hurricane recovery period" (USVI Hurricane Recovery and Resilience Task Force, 2018).

Recovery Directions

To support effective recovery in the USVI, particularly major construction projects, the USVI needs to develop the capacity of its supply chain, particularly in terms of improving contracting and expanding port capacity, but also in other areas. Box 5.3 describes the recovery directions necessary to expanding supply-chain capacity in the USVI.

Box 5.3
Recovery Directions for the Supply Chain

Expanding supply-chain capacity by enhancing operations in these areas:

- purchasing and acquisition
  - Effective and efficient processes and tools to procure contractor services
  - Accurate cost estimates to ensure adequate funding for contracted services
- distribution and logistics
  - Efficient distribution and logistics processes and assets to transport construction and other materials into the USVI
  - Adequate storage capacity to hold materials until they are needed

Key Barriers and Gaps

In this section, we describe key barriers to achieving the recovery directions shown previously. We first discuss barriers related to purchasing and acquisition and then to distribution and logistics.

The USVI Approach to Contracting for Recovery Work Can Lead to Long Timelines

As described in Chapters Two and Three, the contracting process used for recovery—which entails applying for funding, undertaking damage estimates, having those estimates validated, and ultimately having funds obligated—can take months to years to conclude.

The complexity of this process affects the purchasing and acquisition process because USVI staff do not have access to templates or other tools that would help streamline the process. Staff members related that, although some contract templates exist, these are basic and require thorough development. Staff also noted that they do not have the ability to use common continental United States–based contracting practices, such as design–build project delivery, which can shorten timelines (Hale et al., 2009),[3] but instead use a *design–bid–build* process, which requires them to reshape basic contracts for more-complex recovery processes.

[3] *Design–build* is a delivery system in which both design and construction are contracted to the same entity. In contrast, in a *design–bid–build system*, design and construction contracts are awarded sequentially (and possibly to different entities).

The extended sign-off process of obtaining contract approvals can take six months to a year, meaning that, when contracts are finally approved by the USVI government, changes in costs or other conditions might have occurred in the interim, which could make performance of the contract less desirable for either the government organization or the contractor. If further renegotiation of the contract for either cost or terms of work is required, we were advised, the entire USVI government contracting process of ten individual sign-offs must occur again, adding to the delays.

In other communities, templates for building construction are approved for use by government organizations. This allows contracts to be completed and approved in less time with moderate tailoring and with robust protections in place for the government entity entering the agreement. For example, arbitration clauses are routinely included in building construction contracts to ensure that, if differences relating to cost or scope of work arise during the work performance, the contract need not be fully renegotiated. Work can proceed while new contract terms are reached through a negotiation and arbitration process.

An encouraging strategy used in one community in the continental United States, which could represent a policy option to implement in the USVI, was that of "piggybacking" on other local or state contracts that had already been set for specific services. By piggybacking on existing contracts, a municipality or school district can use that contract immediately, which can save months in contracting processes and yield faster recovery.

Some Agencies Reported Some Discrepancies Between Cost Estimates and Bids Submitted by Contractors

In three discussions, staff members from USVI government organizations and continental U.S. government organizations noted examples in which cost estimates provided by FEMA were below contractor bids. They expressed concern that future estimates would not be enough to attract contractor bids. Moreover, these staff members were unaware of how to incorporate the bids they had received into the FEMA cost processes. FEMA has extensive efforts underway to adapt cost estimates to the higher costs of construction in the USVI. Although we do not have data available about the extent to which contractor bids to particular agencies related to cost estimates, these discussions indicated concern, uncertainty, and confusion on the part of applicants about how to engage with these processes. This implies usefulness of outreach and technical assistance for applicants to help them incorporate contractor bids into cost estimates or of modifying existing or creating new FEMA policies to aid grant applicants.

Having Sufficient Port Capacity Is the Major Constraint on the Recovery Supply Chain

As we noted in the "Setting the Stage" section, port capacity—particularly container stackyard utilization and berthing utilization—might be insufficient to support post-hurricane recovery and is a key constraint on the recovery supply chain.

Limited port capacity in combination with the volume of needed building supplies and materials has led to bottlenecks. For example, after Hurricane Maria, there were bottlenecks in the flow of building supplies because cargo ships bringing goods to the USVI were fully laden with emergency supplies. The main shippers to the USVI—Crowley Marine and Tropical Shipping—had allocated their shipping capacity to relief and other commercial supplies. Therefore, firms in the USVI that sought to purchase building materials from the continental United States resorted to chartering private boats and planes to deliver materials, at great expense and yielding smaller quantities. A USVI contracting company executive said,

> You must throw a lot of money at the problem to make progress in building and restoration after the hurricane; you know you are going to lose money, but nothing moves quickly without a lot of money being thrown at it. So, we chartered private boats and planes, we had to go outside our usual set of suppliers and in some cases those new suppliers failed, and we lost money. Puerto Rico charges a premium for anything we buy from them. But without putting a lot of money on the table nothing is going to move.

We can illustrate the challenge by focusing on the capacity at the two principal cargo ports in the USVI, Crown Bay in St. Thomas and the Containerport in St. Croix, which together handle the largest volume of materials brought into the USVI.

USVI Cargo Ports

St. Thomas

The Crown Bay Cargo Port (Figure 5.3) contains the only large terminal dedicated to cargo in St. Thomas with an adjacent stackyard and quay crane. The West Indian Company (WICO) pier at Crown Bay has sufficient length and water depth to accommodate large cargo vessels, and cargo ships were offloaded at the WICO pier in the aftermath of Hurricanes Irma and Maria in 2017.[4] However, the WICO pier is not generally used for cargo because it is heavily used as a cruise ship terminal and lacks adjacent infrastructure for cargo—most importantly, stackyard acreage. The marine terminal at Red Hook, Urman V. Fredericks Marine Terminal, accommodates smaller ships for cargo operations, such as carrying materials to and from St. John, but its draft limits its ability to receive large cargo ships (interviews with VIPA personnel in St. Croix and St. Thomas).

[4] WICO is a subsidiary of the PFA.

Figure 5.3
Map of Ports in St. Thomas

SOURCE: HSOAC analysis using R, OpenStreetMap, and Leaflet.

VIPA owns and manages the facilities at the ports in St. Thomas, except for the WICO pier (USVI Hurricane Recovery and Resilience Task Force, 2018). At the ports that it owns, VIPA provides essential services for maintaining marine facilities, such as scheduling vessel calls, and for providing harbor pilots. With respect to pierside stackyards, however, in St. Thomas, VIPA has leased the space to private companies to use for managing their terminal operations and storing cargo.

St. John

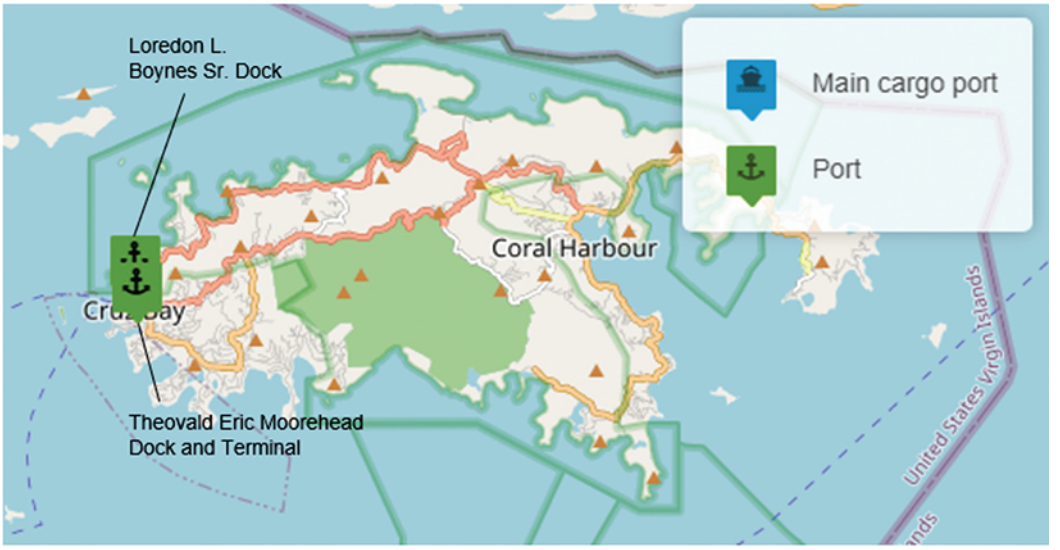
St. John (Figure 5.4) does not have a port that can receive large cargo ships, which means that cargo destined for St. John typically gets cross-shipped from Crown Bay in St. Thomas by truck and ferry (Tropical Shipping, undated). The smaller ships are served in St. John at the Theovald Eric Moorehead Dock and Terminal.

St. Croix

In St. Croix, container vessels are received primarily at the Containerport (Figure 5.5). The Gordon A. Finch Molasses Pier is nearby and is used for liquid bulk molasses imports for the USVI's rum industries but accommodates other liquid cargo, including liquid asphalt, and bulk dry cargo, including gravel, cement blocks, metals, and construction materials. When we visited the Molasses Pier in February 2020, a cargo ship was loading scrap metal from the USVI to transport for recycling elsewhere.

The Gallows Bay dock near Christiansted can accommodate smaller cargo vessels and barges but lacks the draft for admitting larger cargo vessels. The Ann E. Abramson Marine Facility on the west end of the island receives cruise ships.

Figure 5.4
Map of Ports in St. John



SOURCE: HSOAC analysis using R, OpenStreetMap, and Leaflet.

Figure 5.5
Map of Ports in St. Croix

SOURCE: HSOAC analysis using R, OpenStreetMap, and Leaflet.

These four facilities in St. Croix are owned and managed by VIPA. VIPA has not leased any of the stackyard acreage adjacent to the Containerport to tenants for their sole use. Shippers can store their containers in the stackyard while they await pickup; they pay additional fees to VIPA for containers that remain for long periods.

The Limetree Bay fuel port is also close to the Containerport. The Limetree Bay port handles tankers and vessels carrying crude oil, liquefied petroleum gas (LPG), and other refined-petroleum products. The facility is owned by Limetree Bay Ventures and includes more than 11 deepwater docks and pipeline infrastructure to adjacent refineries, with storage capacity for approximately 34 million barrels of crude oil, LPG, and other refined-petroleum products (Limetree Bay Ventures, undated).

The rest of this section assesses the ability of the main cargo ports in the USVI to support the supply chain if imports increase for recovery projects. Overall, we found that the ports of St. Croix and St. Thomas are capable of receiving more ships to accommodate increased imports of materials for recovery projects; however, stackyard practices used by terminal operators at St. Thomas might have to change to accommodate the increased volume.

Estimating Berth and Stackyard Utilization

We drew on accepted quantitative methods to analyze port capacity and throughput (Böse, 2011; Lagoudis and Rice, 2011; Park, Yoon, and Park, 2014). We analyzed stackyard utilization using the number of containers expected to arrive at each port per day, the average time containers sit in the yard before being serviced, service time per container, and the capacity of the stackyard. In practice, ports typically strive to keep the amount of material in the stackyard well below 100-percent capacity and thus typically use only about 70 to 75 percent of their capacity (Böse, 2011; Lagoudis and Rice, 2011).[5] We performed a similar analysis for berth utilization using the number of vessel calls per day, the average unloading and loading time for the vessel, and the available berth capacity, which is typically no more than 60 percent (Park, Yoon, and Park, 2014). Data used in the port utilization calculations are listed in Table 5.1.

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[5] We used established methods from queuing theory. We let $\lambda > 0$ denote the number of 20-foot-equivalent units (TEUs) per day that arrive at each port. We let W_s represent the average service time for a container, including the average time for unloading the container from or loading the container onto the vessel, transporting it to the stackyard, and unloading from or loading onto a truck. We denote the average container queueing or dwell time as W_q. Average container dwell time is the weighted average of the individual dwell times for containers that are awaiting transshipment and the dwell times for containers that will be delivered locally. A widely applicable mathematical model, known as Little's law (Little, 1961), allows one to estimate the average number of TEUs present at the port in the steady state, L, and the average number of TEUs in the stackyard, L_q:

$$L = \lambda\left(W_s + W_q\right)$$
$$L_q = L - \lambda W_s = \lambda W_q.$$

The assumed stackyard capacity (in TEUs) is denoted by K, and the stackyard utilization can be calculated as

$$\frac{L_q}{K}.$$

Table 5.1
Operational Measures for USVI Cargo Ports

Data Element	Crown Bay, St. Thomas	Containerport, St. Croix
Vessels: calls per week	15 [12–19]	18 [14–18]
Percentage of vessels requiring berths	75	75
Stackyard acreage	10 [8–12]	15 [15–20]
Berths (ships)	2	2
Operating days per week	6 [6–7]	6 [6–7]
Operating hours per day	13	13
Percentage of containers for transshipment	33.3	33.3
Transshipment container dwell time, in days	2.5 [2–3]	2.5 [2–3]
Nontransshipment container dwell time, in days	Varied with sensitivity analysis	Varied with sensitivity analysis
Vessel unloading time, in hours	6 [5–7]	6 [5–7]
Truck loading time, in hours	1	1
Stackyard capacity, in TEUs per acre	120 [80–200]	120 [80–200]

NOTE: Values in brackets denote observed ranges of the data value across different data sources.

Findings on Utilization

We used calculations from the capacity utilization model to assess whether the ports of the USVI would be able to support a very large increase in imports associated with projected recovery work.

The annual gross domestic product of the USVI was estimated at nearly $4 billion for 2018 (Bureau of Economic Analysis, 2019); an increase in economic activity of $600 million to $800 million related to recovery projects would be an increase equivalent to more than 20 percent of annual gross domestic product. Recovery projects—which include construction services—can be assumed to be proportionately greater consumers of imported materials than the average economic activity in the USVI, so

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Mathematically, the capacity in the stackyard is sufficient as long as

$$\frac{L_q}{K} < 1,$$

which means that the utilization of the stackyard is less than its assumed capacity. This condition is affected by the average number of TEUs arriving daily, the average container dwell times, container handling times, and the capacity of the stackyard.

we tested whether USVI ports could accommodate a 50-percent increase in imports (by volume) as a test case for the ports' robustness.

Stackyard Utilization

We found that, under current throughput levels, the stackyard capacity appears sufficient. However, the stackyard capacity would not be sufficient to accommodate a 50-percent increase in imports. We arrived at this conclusion by first considering the amount of time the average container spends in port ("dwell time"). The stakeholders with whom we met suggested that the average dwell time for cross-shipped cargo containers is approximately 2.5 days.[6] The dwell times for containers picked up by customers were less clear and appear to vary more. As an initial assessment of the ports' robustness, we assumed that containers for customers also dwelled 2.5 days on average.[7] Using these assumptions about dwell time at the Containerport in St. Croix and the Crown Bay port in St. Thomas, we observed from the model that, with the current levels of imports, the stackyards would be less than 70-percent utilized. As shown in Figure 5.6, the St. Croix stackyard would be 56-percent utilized, and St. Thomas stackyard would be 67-percent utilized, based on current levels. The red line denotes the targeted peak level of 70-percent utilization.

However, an increase in efficiency would be required to handle the projected increase in imports in St. Thomas. From the utilization model, we can project that, if the terminal operators move their containers through the stackyards quickly (ensuring that they are picked up by customers promptly and do not dwell long when they are empty and awaiting departure) and keep dwell times for customer containers close to one day, the stackyard could process the volume. We can use these results to estimate how quickly containers would need to move to maintain stable operations with a 50-percent increase in demand. If customer containers were to dwell in the stackyard for less than two days in St. Croix and less than 1.5 days in St. Thomas, both utilizations would remain below 70 percent. However, it may or may not be possible for terminal operators to achieve this level of efficiency. The port in St. Thomas faces the greater challenge, given its current operating conditions.

USVI ports might not be able to achieve sufficient throughput without an increase in container-handling capacity and gate moves. *Container-handling capacity* roughly refers to the number of containers that can be unstacked, unloaded, and moved per unit of time. This depends on the stacking equipment employed (e.g., straddle carriers, rubber-tired gantry cranes, and rail-mounted gantry cranes), the geometry and layout

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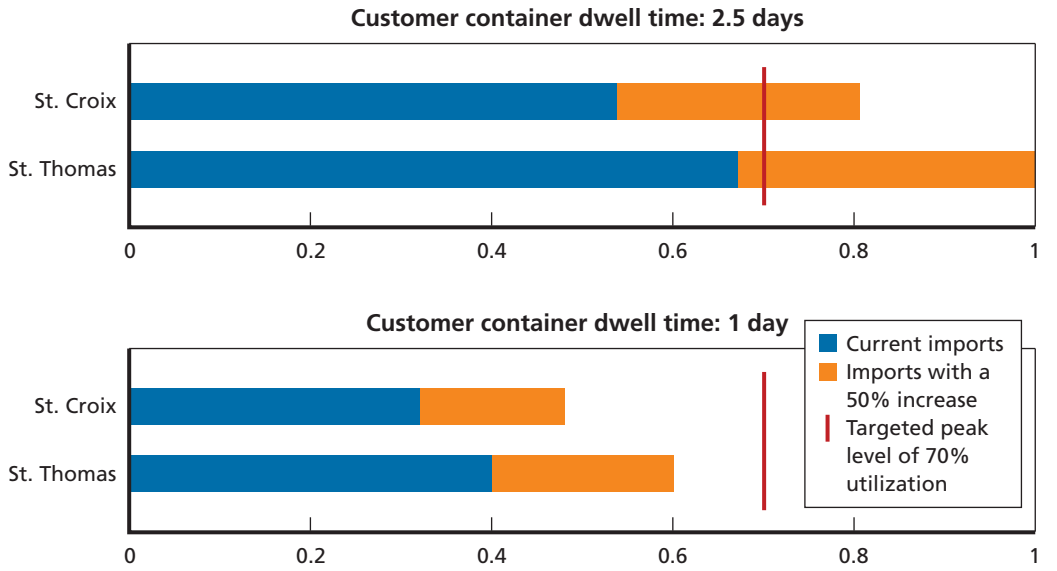
6 *Cross-shipped containers* are those that are taken off a cargo ship, stored in the stackyard, and then put back on a cargo ship. They are not picked up by a customer.

7 Dwell time is modeled as the sum of the periods spent by a container in the stackyard: on arrival in the USVI and then awaiting departure. Irrespective of our initial assumption for customer containers' dwell time, we could project how fast the containers would *need* to move through the ports to accommodate increased imports associated with recovery work by solving for W_s, W_q, or their sum in the model described in the footnote on page 101.

Figure 5.6
Stackyard Utilization in St. Croix and St. Thomas



SOURCE: Table 5.1.

of the port, and the configuration of the stackyard, among other factors. *Gate moves* refers to the number of loaded trucks exiting the port per unit of time. This is influenced by loading times, port infrastructure, road conditions, the availability of trucking services, and customer responsiveness. To increase efficiency, terminal operators might need to incentivize customers to pick up containers that arrive in the USVI and adjust their own practices for storing empty containers that are awaiting shipment back to continental United States.

We should note that, in the near term, there does not appear to be any acreage to expand the stackyard in Crown Bay. However, there is land adjacent to the Containerport where stackyard capacity could be increased for imports to St. Croix, which is another method of increasing imports in addition to speeding the movement of containers.

Berth Utilization

Although it is possible for terminal operators to increase the speed with which they move containers through the port, we understand the process of unloading a ship to be less variable. It is a function of the number of cranes used in offloading and the number of containers to offload and, to a lesser degree, can be influenced by the way containers are stacked on the ship. We understand from discussions with stakeholders that the terminal operators unload as quickly as they can, and complete unloading of a ship in the USVI ports can be completed in five to seven hours.

However, although terminal operators in the USVI cannot speed up their operations, they *can* increase the effective capacity of their berths to receive cargo ships by working more hours during the week—either by moving to a 24-hour workday or by expanding to a seven-day workweek. We understand that it is preferred by USVI terminal operators to work during daylight hours because of less-than-optimal lighting equipment at the piers. Nighttime operations are possible but can be less safe and efficient. If there were a business case to do so, VIPA could install better lighting. Also, ships arrive only six days per week. Work hours could be expanded by extending the schedule for ships to arrive to seven days per week.

Using the same mathematical model as with stackyard utilization, we can project that, if imports increase by 50 percent, berth utilization would increase above the preferred 60-percent level. Two policy options are projected: to move to a seven-day workweek or to keep a six-day workweek but move from a 13-hour workday to a 24-hour workday. We observed that increasing work to include a seventh day is nearly sufficient to bring berth utilization below 60 percent in both St. Croix and St. Thomas (Figure 5.7). Moving to a 24-hour workday produces more than enough berth capacity to receive cargo ships carrying 50-percent more imports. In practice, terminal operators could adopt a policy that both extends the workweek to seven days and increases work hours to a level between 13 and 24 hours.

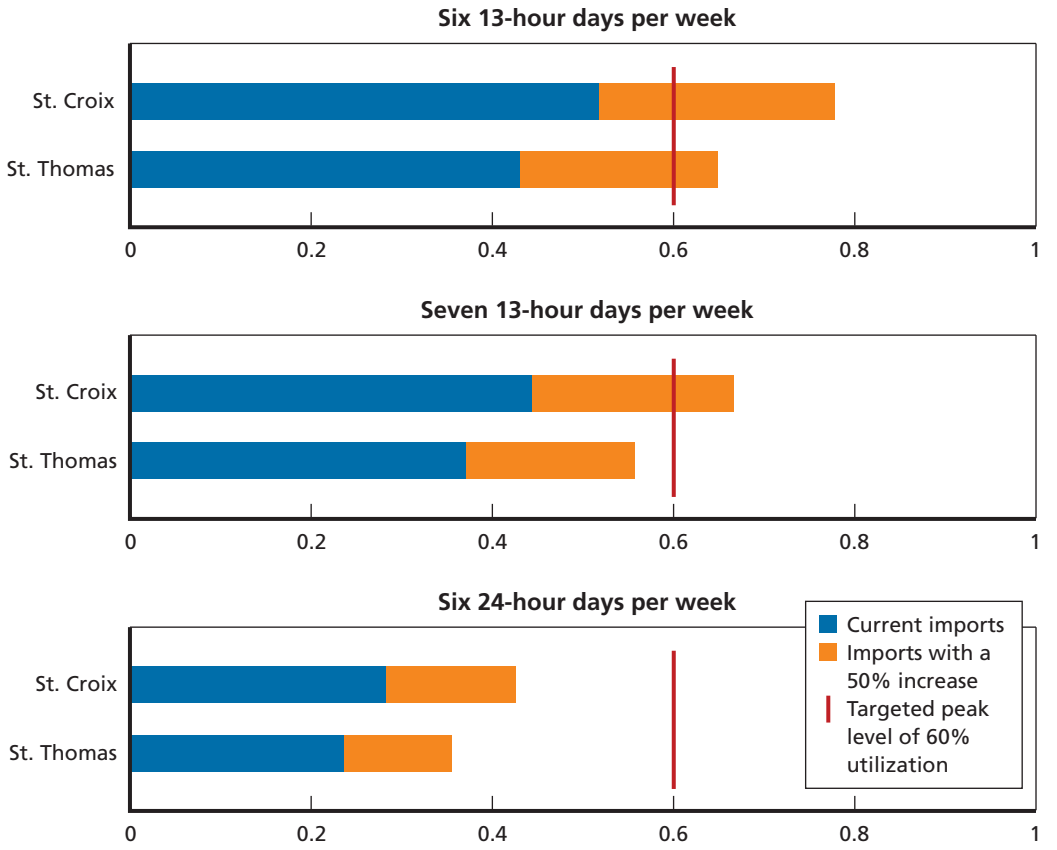
With respect to St. Croix, we should also note that additional berthing capacity is available at the Molasses Pier. Although this capacity is not adjacent to the Containerport stackyard, it could be used for container operations.

Thus, assuming significant increases to the number of workhours to include 24-hour operations, it appears that the main cargo ports in the USVI would have sufficient berth capacity to receive a large increase in cargo imports. The stackyard in St. Croix has available capacity for an increase in imports and has adjacent acreage in which to expand. Some infrastructure, such as the stackyard in St. Thomas, would require attention to its use to achieve maximum efficiency. The port in St. Thomas might require supplementary container storage areas to accommodate increased demand.

Management Capacity to Meet Recovery Needs

Organizations participating in recovery span a wide range in their makeup, mission, and management capacity. Government organizations in the USVI have varying independence in the way they contract for services. For example, semiautonomous authorities, such as WAPA and the VIHFA, are not bound by the same contract-approval processes as other USVI government departments. Nonprofit organizations vary greatly in their capacity to purchase and acquire goods and services; these organizations vary from the smallest nonprofits, staffed by volunteers, to hospitals and universities.

Figure 5.7
Berth Utilization in St. Croix and St. Thomas



All of these organizations would have differing management capacity to purchase recovery services. However, they can all be supported by assistance in tackling with the purchasing challenges identified in this report. They can benefit from guidance to participate in cost estimation and validation. They can all benefit from umbrella contracts, which they can leverage. And all USVI government organizations can benefit from expedited contract approvals.

With respect to coordination across recovery work for operational efficiencies, in time and space, and to permit more-responsive seaborne logistics, work is being done by FEMA. For big, complex, and priority projects, FEMA supports an effort for coordination, convening a series of meetings between partners to address project scope, funding, legal coordination, and other issues. This effort is necessary and important.

Box 5.4
COVID-19 and the Supply Chain

With the onset of COVID-19, the tourism industry in the USVI has experienced a severe decrease in activity and will continue to be negatively affected into the future. These events created a major loss to the economy and will continue to reduce demand for capacity in the main cargo ports. A decrease in imported materials will relieve congestion in the stackyards, and a reduction in cruise ship arrivals will yield expanded berthing capacity for cargo ships—although not adjacent to existing stackyards. VIPA and terminal operators working at the main cargo ports in St. Croix and St. Thomas should be less burdened to find additional throughput capacity to accommodate imports of materials for recovery projects.

Recommendations

In this section, we describe recommendations to address the supply-chain areas addressed in this chapter: purchasing and acquisition and distribution and logistics.

Recommendations Related to Purchasing and Acquisition

Implement Contracting Reform in the USVI Government by Creating Contract Templates That Organizations Can Rapidly Modify or by Establishing Indefinite-Delivery Contracts That Organizations Can Use to Expedite Procurement of Recovery Project Services

Goal	Help the organizations in the USVI contract for services to facilitate recovery more quickly and cost-effectively.
Rationale	Current practices by the USVI government can lead to yearlong timelines to execute contracts for recovery projects because of the large number of USVI government entities needed to approve each contract. Currently, no templates have been developed to provide easy adaptation for project use, so organizations need to create unique individual contracts and get each one approved. Although oversight is important, the inability to execute contracts within reasonable time limits has resulted in a limited supply of contractor bids, which manifests in increased costs and delayed recovery. The USVI government can expedite contracting for recovery projects by creating contract templates that can be modified and approved more quickly. Moreover, the USVI government could likely reduce costs by executing indefinite-delivery, indefinite-quantity contracts for services, which organizations can leverage. Through these mechanisms, USVI government organizations can contract for services more quickly with lower costs and with protections in the contracts to ensure that the interests of the government organizations and service providers are preserved. Collaboration in contracting can achieve economies of scale with large-scale procurement of supplies, labor, and capital equipment, which can reduce work performance timelines and enable projects to be performed that otherwise might not have been able to be successfully contracted.
Implementation considerations	Implementing this recommendation would require taking the following steps: • Document the current contracting process and the USVI governmental entities needed for each recovery or construction initiative, tiered by price category as needed. • Develop templates and approval mechanisms for procurement contracts that can be used by USVI government organizations. • Explore opportunities to create indefinite-delivery, indefinite-quantity contracts for recovery services.
Leading entities	The entities likely to lead the implementation of this recommendation would be VITEMA, WAPA, or the VIDE, or some combination thereof.

Provide Technical Outreach to Applicants While Continuing to Refine and Validate FEMA Cost Estimates

Goal	Help the USVI more quickly and successfully execute rebuilding contracts to facilitate overall infrastructure recovery.
Rationale	Incorporating contractor bids and recognized cost factors is important for being able to implement recovery projects. Although FEMA has efforts underway to adapt cost estimates to the higher cost of construction in the USVI, some agencies were apprehensive about how they could provide feedback into this process if they found discrepancies. FEMA and other government agencies can provide guidance to grant applicants on how to use existing FEMA policy options to incorporate contractor prices into requests for updated cost estimates. If current options present challenges to affecting FEMA cost estimates, new policy options can be incorporated. With these efforts, more recovery projects may successfully be contracted and performed.
Implementation considerations	Implementing this recommendation would require taking the following steps: • Provide technical assistance and outreach for grant applicants so they can, where practical, take advantage of existing or historical contractor bids into the cost decisionmaking process. • Continue to refine a robust, recognized set of inflation factors due to the expected timeline and renumeration periods for contractors, as well as market pricing factors due to limited available capacity of firms to provide services. • Codify USVI-specific burdens for recovery projects, such as costly supply chains, required building materials, and limited skilled labor that result in increased costs. • Develop an outreach plan to bring information and support to grant applicants, to enable them to fully utilize FEMA capabilities to fund recovery work.
Leading entities	FEMA would be the lead entity in DHS. All major USVI governmental entities with significant rebuilding and contracting would be involved, in conjunction with VITEMA.

Recommendations Related to Distribution and Logistics

Increase Berth Capacity by Extending Operating Hours, Using the Additional Piers on St. Croix and St. Thomas, or Doing Both

Goal	Increase throughput capacity at the main ports during surges in cargo operations.
Rationale	Our findings suggest that the seaborne logistics infrastructure is robust with additional stackyard and berthing capacity available in St. Croix. If there is a sizable increase of cargo traffic to St. Croix, berthing will be the first limiting factor. Increasing the ability to do nighttime operations would relieve berthing constraints, but this would require investments in lighting infrastructure and assessing the economic feasibility of nighttime operations for the shippers. Alternatively, using additional berths, such as the adjacent Gordon A. Finch Molasses Pier on St. Croix and the Austin "Babe" Monsanto Pier on St. Thomas, could provide surge capacity.
Implementation considerations	Implementing this recommendation would require taking the following steps: • If the ports operate during nighttime hours, install temporary lighting to support cargo movement. The lighting will likely need generators and fuel. • Make capacity available at either the Gordon A. Finch Molasses Pier or the Austin "Babe" Monsanto Pier during disaster-recovery surges by reconciling usage with cruise ships and other usages. Unloading operations at these piers would be less efficient because of indirect access to the adjacent stackyards.
Leading entity	VIPA would be the lead entity for this effort.

Increase Stackyard Storage Capacity at the Crown Bay Port in St. Thomas by Acquiring Additional Acreage or Increase Stackyard Velocity by Acquiring Additional Material-Handling Equipment and Increasing Gate Capacity

Goal	Increase the throughput of the Crown Bay port in St. Thomas so that cargo is not delayed and the port is not backlogged because of congestion.
Rationale	Should imports increase significantly with recovery work, the Crown Bay port in St. Thomas is most at risk for lacking available stackyard space. VIPA could acquire both additional stackyard acreage and harbor frontage to construct a new pier, but not in the near term.
Implementation considerations	Implementing this recommendation would require taking the following steps: • In the near term, ease stackyard crowding in Crown Bay by reducing dwell times. To reduce dwell times, the port will have to increase throughput rates in the stackyard by increasing container-handling capacity and reducing gate times to exit the port. • Limit the customer's ability to take receipt of cargo and request that it be held at the port. • Develop a conditional-use, inland stackyard to transfer excess cargo for longer-term handling or storage of empty containers.
Leading entities	VIPA and terminal operators would be the leading entities.

Create a Steady Demand for Recovery Project Materials and Communicate It to Shipping Companies; Plan Ahead for Months-Long Lead Times

Goal	By reliably, predictably, and deliberately scheduling recovery projects, allow resources to flow efficiently to minimize avoidable delays in the supply-chain system.
Rationale	Organizations planning recovery projects should plan for months-long lead times until materials purchased by contractors arrive. By creating a steady and long-term increase in demand for imports and communicating it to shipping companies and terminal operators, the USVI government and NGOs can support VIPA's, terminal operators', and shippers' efforts to increase capacity and provide them with the necessary market conditions. FEMA and the USVI government could coordinate the timing of recovery projects and create a forward-looking schedule for when projects will occur. This would yield valuable information that could be passed to shippers and terminal operators so that they could plan ahead to ensure that the seaborne logistics chain has sufficient capacity and is not an impediment to recovery.
Implementation considerations	Implementing this recommendation would require taking the following steps: • Ensure that organizations involved in major recovery efforts communicate future import demands to shipping companies, VIPA, and terminal operators so that they can plan capacity and schedule throughput accordingly. • Where possible, leverage information about related projects to streamline the shipment of large amounts of related recovery materials.
Leading entities	FEMA, major USVI governmental entities with significant rebuilding (e.g., the VIDE, WAPA), and VIPA would be the leading entities.

Use Information from FEMA's Grants Manager Database and Other Federal Agency Sources to Identify Grant Applicants with Similar Projects That Are Nearing Their Implementation Timelines, and Reach Out to These Applicants to Coordinate in Contracting to Reduce Barriers, Achieve Economies of Scale, and Optimize Outcomes

Goal	Help USVI organizations become more cost-effective in their recovery efforts through coordination of projects, thus reducing performance timelines and increasing the number of projects that can be completed.
Rationale	Currently, there are many recovery projects throughout the USVI that are of similar nature and could encounter challenges to generating contracts for services and executing them with firms to perform the work. Organizations with limited staff members might face daunting up-front costs or other challenges to drafting contracts for recovery projects to be performed. Organizations seeking performance of individual projects might garner little interest from contractors because of the challenge to perform them individually and earn sufficient profit. Contractors bidding on larger amounts of work could achieve operational efficiencies by creating a consistent level of work across a longer period, rather than needing to perform surges in workload with concurrent projects. This can reduce the overall amount of labor and capital equipment that must be acquired (and that potentially must be imported). Coordinating recovery projects so that they are staggered and not concurrent will decrease the amount of manpower and equipment that must be imported to the USVI for construction capacity. Greater future predictability for recovery project schedules will enable USVI contracting firms to operate more efficiently and get more work done. By identifying projects with similar recovery objectives (e.g., refurbishing government office buildings, street resurfacing, park or playground landscaping) and supporting organizations to coordinate in contracting, more projects could be successfully completed.
Implementation considerations	Implementing this recommendation would require taking the following steps: • Identify categories of projects that function in similar time frames, geographical locations, and recovery initiatives from the FEMA Grants Manager database. • Perform outreach to these organizations, which may collaborate, and find commonalities so that economies in contracting can be reached to expedite project performance. • Develop a process and set of agreements under which each of the common organizations would agree to the umbrella terms, including lead coordinator.
Leading entity	DPP would be the leading entity.

CHAPTER SIX

Infrastructure Services

Box 6.1
Key Findings About Infrastructure Services

- Physical infrastructure, such as water and wastewater assets, roads and bridges, telecommunications, and public buildings, is valued for its important role in providing basic services to people and society.
- Prior to the hurricanes, USVI infrastructure agencies faced significant challenges due to risk of operational failure by infrastructure approaching the end of its intended design life, a low level of "hardening," and staffing vacancies. The hurricanes caused catastrophic damage to infrastructure services, including damage to roads, ports and airports, communications, water and wastewater systems, and the public buildings that housed territory government agencies and public services.
- Since the hurricanes, a broad variety of infrastructure projects have been identified, funded, and implemented, including emergency works to restore drinking water, wastewater services, road networks, and communications, and to stabilize public buildings. However, as of March 2020, the majority (65 percent) of the Top 100 infrastructure service projects had not begun work. Twenty percent were in the design phase, and construction had commenced on only 4 percent.
- USVI recovery directions focus on (1) hardening and fortifying infrastructure; (2) reconfiguring utility, waste, technology, and transportation systems for resilience and redundancy; (3) strengthening governance and regulations so that vital public services have capacity and capability to operate better when storms occur; and (4) planning, preparing, and training for future storms.
- Key barriers include legacy challenges related to aged, interdependent infrastructure, complex federal disaster-assistance processes, infrastructure interdependencies, workforce vacancies and skill gaps, expensive and slow supply chains, and insufficient private-sector participation and community engagement.
- Management capacity in this sector is affected by the large volume of work, staffing vacancies, capacity constraints, and insufficient cross-agency coordination, which have led to delays for DPW and the Virgin Islands Waste Management Authority (VIWMA).
- Near-term recommendations include doing the following:
  - Address legacy infrastructure management challenges by prioritizing recovery projects that overlap with existing infrastructure vulnerabilities.
  - Enhance capacity for the prioritization and implementation of infrastructure recovery projects by identifying project performance criteria.
  - Enhance situational awareness and interagency coordination regarding recovery project implementation by establishing a transparent, real-time project information system.
  - Overcome financial roadblocks to infrastructure project implementation by developing a project seed fund that territory agencies could use to derisk recovery projects.
  - Streamline recovery funding for infrastructure projects by consolidating the administration of federal agency funding programs under a single lead agency.
  - Improve coordination of hurricane recovery projects and long-term disaster-mitigation planning by more closely integrating recovery efforts into the update to the USVI hazard-mitigation plan (ODR, 2019a).

Box 6.1—Continued

- Longer-term recommendations include the following:
  - Build the capacity of the territory's government and associated agencies to navigate the administrative demands of the recovery process by expanding predisaster training and preparedness.
  - Enhance information management, resilience, and security by developing and implementing a territorywide data strategy.

Like it does everywhere, physical infrastructure supports every aspect of life in the USVI, including the movement of people, the production and delivery of goods and services, emergency response and management, tourism, and education. Accordingly, infrastructure's value lies not only in its physical attributes but also in the services and benefits it generates for society. This emphasis on services recognizes the role of infrastructure in supporting and maintaining human well-being and conveying resilience to communities (S. Clark et al., 2019). Moreover, infrastructure represents large capital investments that persist for long periods of time; thus, the cost of repairing or replacing physical infrastructure is substantial, and its performance and resilience have long-term implications for the territory. The USVI's physical infrastructure consists of multiple, interdependent systems: Electricity is needed to pump water, and electricity is needed to power buildings. Therefore, some of these systems need to recover in parallel, not sequentially or in isolation.

This chapter documents the research, analysis, and stakeholder interactions associated with recovery planning and implementation for infrastructure and its services, defined here to include the provision of water and wastewater, transportation, communication, or selected public buildings. Moreover, in this chapter, we recognize that resilient recovery of the USVI's infrastructure requires consideration for not only the physical condition of infrastructure assets but also the quality and reliability of the services those assets provide. Ultimately, our objective was to identify near- and long-term opportunities for accelerating project implementation.

Working with FEMA, the USVI territory government, and a variety of other federal and nongovernmental agencies, we examined the prehurricane state of infrastructure in the territory, the impacts of the hurricanes, and the accomplishments to date in restoring, repairing, and replacing damage. We also considered the barriers to the timely implementation of recovery projects that might exist in the territory. Consistently with the overall project approach, we conducted our work through discussions with federal, territory, and nongovernmental stakeholders and through an analysis of the status of recovery projects in available databases. Box 6.2 summarizes the methods used in this analysis, along with limitations.

Box 6.2
Methodology and Limitations on the Analysis of Infrastructure Services

Methods Used in This Analysis

In addition to the methods described in Chapter One, this analysis relied on the following:

- We relied heavily on meetings and discussions with federal and territory agencies. On the federal side, we spoke with various sector leads; branch directors and supervisors within FEMA; and representatives from DOT, EPA, and the U.S. Department of Energy (DOE). Within territory agencies, we met with directors, engineers, and representatives of the VIHFA, the Virgin Islands Energy Office, UVI, the VIWMA, DPW, WAPA, and VIPA. We also spoke with representatives from private companies and NGOs affected by or involved with critical infrastructure.
- We downloaded and analyzed all FEMA PA project data for roads and bridges, utilities, and public buildings, as recorded in the Grants Manager database as of February 18, 2020. These data were cleaned, formatted, and filtered to remove all emergency-work projects and all projects related to education, health and human services, and natural and cultural resources, regardless of agency. We also removed category Z, management costs.
- We also analyzed project data from other federal agencies, as reported on ODR's recovery dashboard.

Limitations of This Analysis

Because of time constraints and availability, we were unable to speak with representatives from all territory agencies involved in critical infrastructure. We were also constrained in our ability to comprehensively access recovery data from other federal agencies, apart from what were available through ODR.

Setting the Stage

USVI Infrastructure Services Before the Hurricanes

Prior to Hurricanes Irma and Maria, USVI infrastructure agencies faced significant challenges in operating, maintaining, and investing in their infrastructure systems. The territory's infrastructure—including roadways, ports, and water and wastewater systems—was designed and built decades ago. Much of this infrastructure is now past its engineered design life and its functionality degraded over time because of deferred maintenance and continuous exposure to rain, wind, and severe storms. The level of hardening was also low prior to the hurricanes, meaning that not all physical infrastructure systems were built to withstand significant rainfall events and major hurricanes (this depends on their year of construction). This lack of hardening exacerbated the effects of repeated hurricane damage, such as from category 3 Hurricane Marilyn in 1995 and category 4 Hurricane Hugo in 1989. The consequence was recurring damage to infrastructure, such as washed-out roads, flooded pump stations, clogged intakes, culverts, other stormwater infrastructure, and sewage overflows into surface streets and natural waterways.

In addition, USVI agencies that manage public infrastructure have long dealt with vacancies at upper- and middle-management positions (see Chapter Two) as costs of living in the territory and lower salaries than in continental U.S. jobs have pushed many highly qualified engineers, managers, and infrastructure professionals out of the USVI. The VIWMA, for example, has had chronic shortages of experienced workers that have constrained its ability to carry out normal and emergency operations.

Impact of the Hurricanes

Hurricanes Irma and Maria caused catastrophic damage to the USVI's physical infrastructure systems. This included not only complete loss of electrical power (see Chapter Seven) but also damage to roads, ports and airports, communications, water and wastewater systems, and the public buildings that housed territory government agencies and public services.

The hurricanes damaged sea, air, and land transportation infrastructure across the territory (USVI Hurricane Recovery and Resilience Task Force, 2018). The airports on both St. Thomas and St. Croix ceased services before Hurricane Maria made landfall in September 2017, and the towers and terminals sustained significant damage, with the tower in St. Thomas being completely destroyed. Ports and marinas were closed because of catastrophic damage to marine vessels—particularly small craft, which had to be removed. Meanwhile, the territory's road systems were damaged by flooding and erosion, mudslides and extensive debris, and widespread loss of traffic signals and signage.

The loss of electrical power, combined with high winds and flooding, damaged water storage cisterns and water treatment facilities and disrupted water and wastewater services throughout the territory. In addition, debris flows into sanitary sewer systems and damage to pump stations caused raw sewage to be discharged into communities and surface water (USVI Hurricane Recovery and Resilience Task Force, 2018).

The hurricanes caused cellular phone and territorywide government wire-line telephone services to fail, damaged fiber-optic cables and cut off internet service, and disrupted public radio and television broadcasting. In addition, the damage to the communication infrastructure impaired efforts to coordinate disaster relief efforts and transport people and resources to where they were needed.

Hundreds of public buildings experienced wind and flood damage across the territory (USVI Hurricane Recovery and Resilience Task Force, 2018). This included both culturally significant buildings, such as the government house buildings on St. Thomas, St. Croix, and St. John, and the offices of public agencies responsible for the day-to-day delivery of services to territory residents.

Recovery Progress Since the Hurricanes

Since the 2017 hurricane season, a broad range of emergency and permanent infrastructure projects have been identified, planned, funded, and implemented across the territory. Emergency work is work that must be performed to reduce or eliminate an immediate threat to life, protect public health and safety, or protect improved property that is significantly threatened because of disasters or emergencies declared by the President of the United States. Permanent work is work that is required to restore a damaged facility, through repair or restoration, to its predisaster design, function, and capacity, in accordance with applicable codes and standards.

Several territory agencies have lead responsibility for managing recovery efforts for infrastructure systems (Table 6.1). Although each system is generally the responsibility of a single agency, coordination among agencies is often necessary because some infrastructure (e.g., above-ground electricity and fiber-optic cables or below-ground water and wastewater pipes) is colocated.

Figure 6.1 shows the number of obligated and nonobligated FEMA PA permanent-work projects by island and infrastructure type. Obligated projects are those that have received approval from FEMA to proceed and for which financial resources have been committed but not necessarily expended. Unobligated projects are those projects that have been entered into FEMA's Grants Manager database but are at varying procedural stages that precede obligation (e.g., agreement between applicant and FEMA on infrastructure damage). Public buildings represent the most-numerous projects; however, the average value of those projects tends to be relatively small.

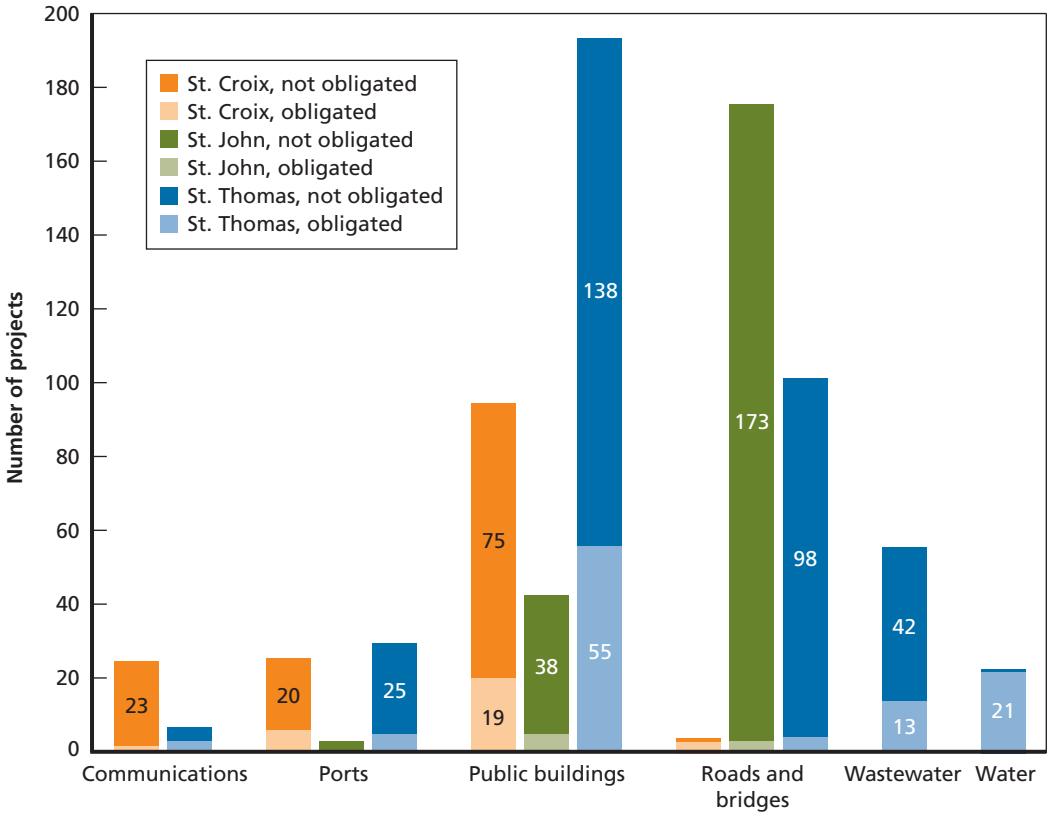
Recovery projects have also been funded by other federal agencies. For example, as of January 31, 2020, the ODR dashboard reported that HUD had approved $120.5 million in grants for infrastructure projects in the territory. FHWA had expended $16.7 million of $38.7 million in obligated funds for repairs to federal highways and roads. Funding for a total of 111 infrastructure projects has been obligated by the U.S. Department of Commerce, DOI, the U.S. Department of Labor, USDA, EPA, and others. To date, a total of $351.9 million has been obligated for these projects, of which $56.1 million (16 percent) has been expended (ODR, undated g).

Table 6.1
USVI Agencies with Responsibility for Infrastructure Recovery Projects

Territory Agency	Infrastructure Assets and Functions
BIT	• IT infrastructure • 911 emergency communication infrastructure
DPW	• Roads • Bridges • Public buildings • Sport and community centers • Guts (stormwater channels)
Virgin Islands Next Generation Network	• Wholesale broadband products and services
VIPA	• Airports • Marine ports
VIWMA	• Landfills • Wastewater
WAPA	• Electricity • Water

NOTE: IT = information technology.

Figure 6.1
Permanent-Work Projects Across the Territory Islands



SOURCE: Data collected from the FEMA Grants Manager database, as of February 2020.

Within the total portfolio of infrastructure projects, ODR has also prioritized a subset of the Top 100, which are posted on ODR's recovery dashboard (ODR, undated i). Of these, 15 are related to transportation, including projects to improve major traffic corridors, improve drainage, and make repairs to Bureau of Motor Vehicles facilities. In addition, 11 projects involve public buildings, including repairs to the government houses on St. John and St. Thomas, repairs to Bureau of Corrections facilities, repairs to police buildings and fire stations, and repairs to the St. Thomas Raceway/Dragway. As of March 2020, however, the majority (65 percent) of these transportation and public buildings projects had not begun work. Twenty percent were in the design phase, and construction had commenced on only 4 percent. This is either because the projects had not yet been approved or because the funding had been obligated but the territory had not yet contracted the project so that construction could proceed.

In the rest of this section, we provide additional information about subsectors within infrastructure services.

Transportation

Immediately following the hurricanes, emergency work commenced quickly throughout the territory to clear debris from roads and highways to allow the passage of relief workers and materials. Temporary repaving was conducted where necessary to enable safe traffic flow. In addition, the Cyril E. King International Airport on St. Thomas reopened approximately a week after Hurricane Maria, while the Henry E. Rohlsen Airport on St. Croix reopened the following week. The marine port reopened to commercial ship traffic and cruise ships in November 2017, two months after Hurricane Maria. Analysis of project data in FEMA's Grants Manager database in November 2019 suggested that total costs for emergency transportation infrastructure projects were on the order of $10.2 million.

As efforts transitioned from response to recovery, the territory moved forward with plans for permanent improvements to federal highways and received approval to restore highways in a manner compliant with current FHWA standards—which are substantially more robust than the standards to which the highways had originally been built (Federal Lands Highway, 2014). The territory's roads became the focal point for the concept of a "dig-once" approach to infrastructure recovery and resilience (Government of the USVI, 2018). The vision of *dig once* is to coordinate excavation for transportation, water and wastewater, communication, and electricity projects so that trenches are dug only once when placing underground utilities, rather than multiple times in the same location. Projects are also planned to modernize, expand capacity, or do both for Rohlsen Airport and for various commercial marine ports. The territory is working with Eastern Federal Lands Highway Division (EFL) of FHWA to explore a streamlined approach for channeling funds from federal agencies into recovery projects.

Water and Wastewater

Drinking water services were restored to residents and businesses within one month of Hurricane Maria. This necessitated emergency work to repair damaged pumping stations and water storage tanks in WAPA's water distribution system. Restoration of water and wastewater services was delayed because of the need to restore electricity services (see Chapter Seven). Similarly, damaged wastewater pump stations were repaired, and emergency works were completed to address blocked sewer lines. Nevertheless, some parts of the territory's sanitary sewer systems are more than 50 years old, and their state of disrepair contributes to ongoing leaks of untreated sewage into surface streets and waterways and necessitates continual maintenance.

Inspection of project data in FEMA's Grants Manager database for water and wastewater emergency-work projects revealed project costs of $11 million. However, interviews with territory agency staff suggested that this project represents only a small

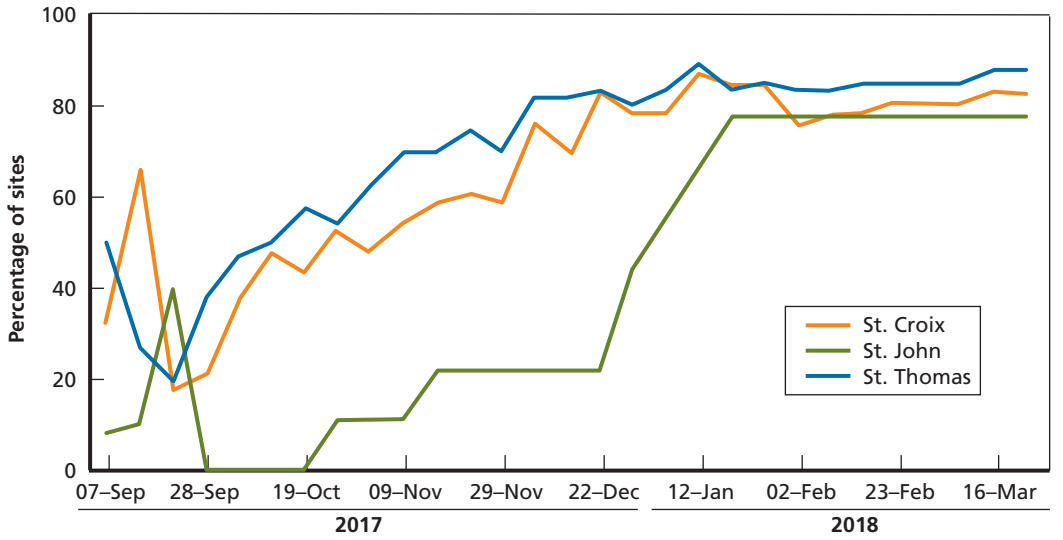
fraction of the work, and funding, needed for water and wastewater infrastructure. For example, WAPA estimates that approximately $300 million is needed to extend drinking water lines in the territory and addresses high (40-percent) leakage rates. As of February 2020, the VIWMA had still not yet completed a full inspection and damage assessment of its sanitary sewer pipes. This has slowed the VIWMA's ability to apply for FEMA PA funding for sewer projects. The VIWMA has estimated the cost of such an assessment at approximately $200 million. However, VIWMA staff believe that the majority of the territory's sewer lines need to be replaced at a cost that could be in the hundreds of millions of dollars.

For long-term recovery, WAPA continues to pursue long-standing plans to extend drinking water lines into new areas. At present, drinking water for approximately half the households in the territory is provided by WAPA. In addition, recovery funds are being allocated to replace leaking drinking water pipes, to address high (approximately 50-percent) leakage rates from the system, and to replace and repair sanitary sewer lines that are prone to clogging and leaks.

Communications

Through the efforts of both territory agencies and private telecommunication firms, communications across the territory were mostly restored by January 2018—four months after the storm. This included repairing both copper and fiber-optic communication cables. However, full recovery would take longer. For example, as of March 2018, only 86 percent of cellular towers were again operational (Figure 6.2).

Figure 6.2
Recovery Times for Operational Cell Sites, by Island, September 2017–March 2018



SOURCE: USVIBER, undated a.

Recovery projects have focused on hardening of the telecommunication infrastructure, such as taking advantage of the composite poles being installed to harden transmission and distribution power lines by using them to also secure above-ground fiber-optic cables. In addition, plans exist to place communication infrastructure and electrical lines underground in more–densely populated areas to shield these lines from future storms.

Public Buildings

As of April 1, 2020, the FEMA PA program was processing 555 projects for public buildings alone, and, according to FEMA's Grants Manager via our communication with FEMA PA staff, an estimated $16.2 million in emergency projects was needed following the storms. Damage was more severe for buildings constructed prior to 1996 because building codes were improved after Hurricane Marilyn struck the territory in 1995 (USVI Hurricane Recovery and Resilience Task Force, 2018).

Following Hurricane Maria, territory agencies took steps to stabilize public buildings and community and recreational facilities to prevent further damage until permanent-restoration efforts could be completed. For example, tarps were used to cover damage on the government houses to prevent further water penetration and damage. Recovery funds have already been obligated for the repair and restoration of the government houses. Meanwhile, DSPR is working to facilitate recovery of recreational facilities and public parks. For example, DSPR has been working to secure FEMA PA funds to repair Emile Griffith Park's baseball field and other amenities (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019).

Recovery Directions

Although a formal vision statement for recovery efforts specific to infrastructure has not been publicly articulated, the general direction for recovery can be inferred from statements made by the Office of the Governor. These strategies, summarized in Box 6.3, emphasize the importance of infrastructure hardening and resilience to main-

Box 6.3
Recovery Directions for Infrastructure Services

- Hardening and fortifying infrastructure by strengthening buildings, roads, communication towers, power lines, and other facilities
- Reconfiguring the utility, waste, technology, and transportation systems for resilience and redundancy
- Strengthening governance and regulation so that vital public services have capacity and capability to operate better when storms occur
- Planning, preparing, and training for future storms, including having systems in place for planning and managing emergency response and critical resources, such as power and communications

tain "vital public services," such as power and water recovery (USVI Hurricane Recovery and Resilience Task Force, 2018).

This emphasis on resilience has continued through the first two years of recovery and thus appears to be a dominant theme guiding infrastructure recovery. In the USVI's second-year progress report, for example, the governor noted that federal funding could be used to "provide a foundation for the territory to not just build back, but to build back more resilient than ever before" (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). This approach is also recognized at the federal level, reflected in Section 20601 of the Bipartisan Budget Act of 2018 (Pub. L. 115-123), which allows FEMA to provide PA for critical services (e.g., power, water, sewer, wastewater treatment, communications) without regard for "pre-storm condition" (FEMA, 2018e).

In addition, individual vision statements for community recovery were published in 2018 for St. Croix (CPCB RSF, 2018a), St. Thomas (CPCB RSF, 2018b), and St. John (CPCB RSF, 2018c). Some objectives in these plans explicitly refer to enhancing resilience, the built environment, and community assets.

Key Barriers and Gaps

Since Hurricanes Irma and Maria, USVI agencies and U.S. federal government entities have moved from the short-term emergency-response phase and into the longer-term permanent-work recovery effort. In this process, federal and territory partners collectively must address some key financial, institutional, technical, and cultural barriers to achieve the territory's infrastructure recovery vision and goals described previously, as well as gaps in the recovery effort to date. This section details the primary barriers and gaps affecting the pace and efficacy of infrastructure recovery efforts in the USVI.

Infrastructure Systems Are Design Constrained and Interdependent

The USVI faces challenges related to its aged, interdependent infrastructure systems. The wastewater system provides a case study of the challenges posed by infrastructure deterioration and the lack of prestorm maintenance, although the issues described are not unique to this one area of infrastructure. The VIWMA provides wastewater services to approximately 40 percent of the territory's population. The remaining 60 percent rely on on-site sewage systems, such as septic tanks. Much of the VIWMA sewer system was built between 50 and 60 years ago and relies on an annual wastewater user fee of $110.77 per equivalent residential unit[1] to support the operations, maintenance, and capital investment plan of the VIWMA (VIWMA, undated). The sewer system consists of eight wastewater treatment plants, 30 pump stations, and 402 miles of

[1] The equivalent residential unit is a common unit of measurement for water and wastewater fees and is generally based on a given user's equivalence in terms of wastewater generation to a single-family home.

buried wastewater lines, many of which are unmapped (EPA, undated). To manage this extensive system, the VIWMA has staff on both St. Thomas and St. Croix, but staff vacancies across units on both islands limit the agency's management capacity. Furthermore, this user fee is not enough to support the VIWMA's growing infrastructural, operational, and human capacity needs. The VIWMA's budget is insufficient to front the costs of hurricane damage assessments, has constrained the agency's ability to hire contractors for recovery projects, and has limited the hiring of additional staff needed for recovery efforts. For example, the FY 2020 budget proposed by Governor Bryan totaled $31.4 million. This was a 17-percent reduction from the FY 2019 budget, and reportedly half of the funding needed was obligated for the authority to make capital investments to comply with consent decrees negotiated prior to the 2017 hurricane season (VIWMA, 2019). As of FY 2019, the authority was reportedly $24 million in debt, much of that owed to contractors and vendors that provide services to the authority.

The VIWMA also faces frequent sanitary-sewer overflows (SSOs), which result in the backup of raw sewage into the environment. These SSOs have resulted from (1) years of neglect and deferred investment; (2) the prevalence of illegal connections; (3) improper use of the system by businesses and residents, such as the disposal of fats, oils, and grease into the system; (4) degradation of various pipe materials; and (5) inflow of stormwater through cracks in the system during heavy precipitation events (EPA, undated). Colocation of many wastewater lines along the territory's natural intermittent waterways (often called "guts") has meant that frequent SSOs affect the sustainability of the territory's ecosystems and environment and violate federal Clean Water Act standards (see EPA, 2019a). Wastewater lines also back up into surface streets, where they can threaten public health. These challenges mean that the SSO problem needs to be addressed quickly. The need to respond to frequent SSOs, compounded by a lack of staff and constrained financial resources, have left the VIWMA in a vicious cycle of emergency maintenance in which regular operations and maintenance (O&M) are further neglected and wastewater assets continue to depreciate.

Further challenges facing the VIWMA include meeting the requirements of a series of consent decrees from EPA, which require upgrading wastewater treatment plants to meet Clean Water Act standards for treatment and effluent (EPA, undated). In addition to mandated upgrades, the VIWMA also will need to harden its pump stations and treatment plants to withstand storm surges, hurricanes, and intense precipitation events. During Hurricane Maria, many of the authority's pump stations failed because of rainwater and storm surge flooding, loss of electric power, or a combination of these factors, and treatment plants experienced damage from wind, rain, and flood that required repair or replacement of facilities.

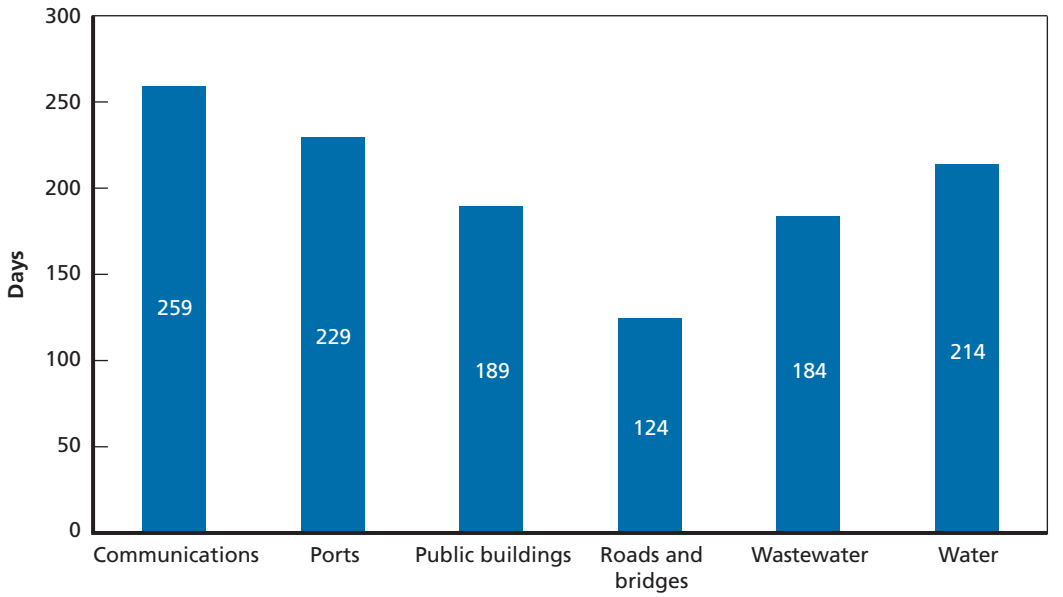
Federal Disaster-Assistance Processes Are Complex

As discussed in Chapter Two, territory and federal agencies have encountered significant barriers in coordinating, supporting, and navigating the federal disaster-assistance process. Although these barriers are not unique to infrastructure, the complexity of the federal disaster-assistance process does pose some specific barriers to the provision of infrastructure services. In this section, we categorize those barriers into three groups: institutional processes, funding and finance, and interagency coordination.

Institutional Barriers at the Federal and Territory Levels

For the federal level, territory agencies cited the constant rotation of FEMA staff, PA sector divisions, and FEMA decisionmaking processes as a complicating factor. Turnover of FEMA staff limits institutional memory and requires the forging of new relationships between partners at regular intervals. Territory agency applicants often need to work with multiple FEMA officials; for example, DPW manages public buildings and transportation and must work with FEMA officials from different PA sectors. Finally, territory agencies reported a lack of transparency into how FEMA makes decisions on when and how to fund damage assessments, what constitutes reimbursable projects, and how costs are determined. This complexity ultimately slows the recovery process. Figure 6.3 shows the length of time FEMA PA projects have taken, from proj-

Figure 6.3
Average Number of Days from Project Creation to Signing, by Infrastructure Category



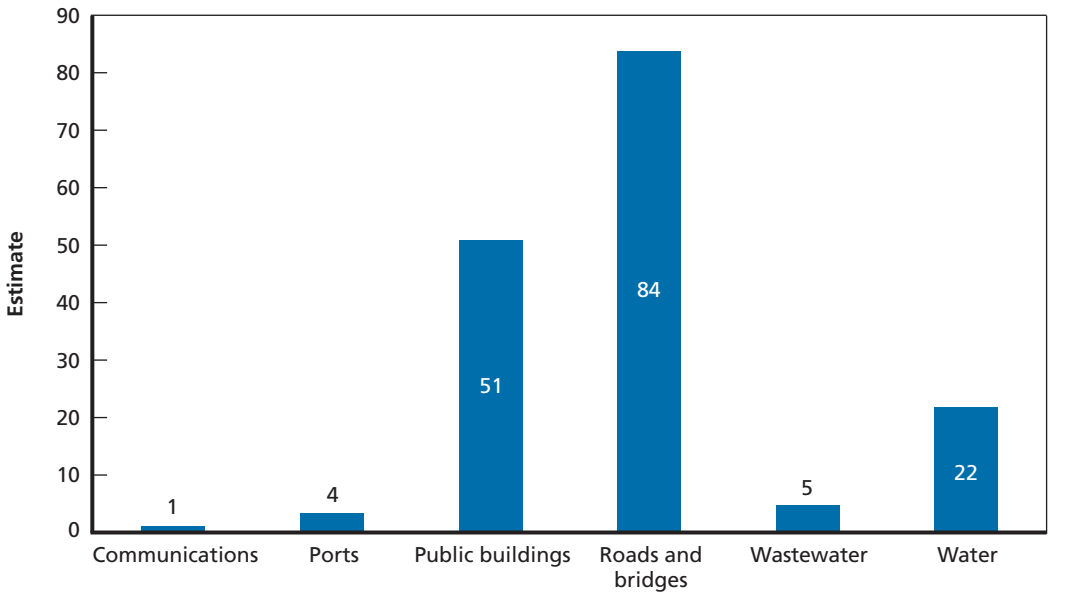
SOURCE: FEMA Grants Manager database, as of February 2020.
NOTE: *Project creation* refers to when a project was entered into FEMA's Grants Manager database. *Project signing* refers to when a project was approved by FEMA staff.

ect creation in FEMA's Grants Manager database to approval by FEMA staff. In some sectors, the process took nearly eight months.

Need to Manage Funding from Many Federal Agencies with Differing Requirements

As discussed in Chapter Two, on the territory side, agencies lack depth of training, funding, and experience in federal disaster processes, and they face a shortage of staff for recovery, which leaves them highly dependent on outside contractors rather than building their own long-term disaster-recovery capacity. These agencies must also deal with the complexity of aligning funding sources (including requirements for cost-sharing) to implement recovery portfolios. Figure 6.4 illustrates the amount of total anticipated funding, by infrastructure type, for FEMA PA alone, based on those projects entered into FEMA's Grants Manager database by February 2020. However, a single territory agency in the infrastructure sector alone, such as WAPA, could be eligible for federal funding from FEMA's PA funding (including the "standard procedures" for reimbursement under the Stafford Act and the Section 428 alternative procedures under the Bipartisan Budget Act), FEMA's HMGP, HUD's CDBG-DR

Figure 6.4
The Best Total Cost Estimates for FEMA Public Assistance Projects, in Millions of 2020 U.S. Dollars



SOURCE: FEMA Grants Manager database, as of February 2020.
NOTE: This figure includes the total of FEMA's best-available cost estimates in millions of 2020 dollars for PA projects entered into FEMA's Grants Manager database. Not all projects in Grants Manager had available cost estimates, nor were all PA projects entered into the database as of February 2020. Water cost totals include some projects that could overlap with electrical projects, such as advanced metering, for which WAPA applied for funds jointly across its systems.

program, USACE, DOI, USDA, the National Oceanic and Atmospheric Administration (NOAA), and EPA. Other infrastructure owners, such as DPW, are also eligible for funding from DOT. Not only does the sheer breadth of funding sources pose strategic and administrative burdens, but the different application processes and postaward monitoring and reporting requirements in all these federal programs can create an insurmountable challenge for small territory agencies.

Interagency Coordination

Interagency cooperation and coordination are important elements of efficient and effective recovery efforts. However, the federal approach to supporting recovery efforts places a significant responsibility on the territory as applicant to successfully navigate the recovery process (see Figure 2.5 in Chapter Two, which portrays the complexity of the engagements needed by the territory in the FEMA PA process, for example). This makes it difficult for territory agencies to leverage funds strategically, for example, to use as a cost share or to pay administrative costs that another federal funder is not able to cover. Further, for most of the recovery so far, there has been no centralized database or tracking mechanism for project planning and implementation across federal agencies in the United States in general and in the USVI in particular, although the territory's OMB is beginning the roll-out of the eCivis database to address some of this challenge.

Decisionmakers Need to Understand Infrastructure Interdependencies

The specific needs and priorities of colocated and interdependent infrastructure are not yet fully considered in recovery phasing and implementation. In the short term, this could mean higher costs and longer recovery times as trenches for buried infrastructure are dug, uncovered, or both, multiple times. In the long term, strategic decisions about infrastructure hardening, upgrades, and decisions on relocation (e.g., moving assets out of floodplains) should be coordinated so investment returns can be fully realized. For example, if a roadway is built to withstand a 100-year flood event without erosion or damage, but a nearby pump station is not hardened and fails under a small flood event, damage to both assets could still be significant. Furthermore, as with the federal government, there is no centralized database or tracking mechanism for mapping interdependencies, project planning, and implementation across territory agencies.

Workforce Vacancies and Skill Gaps in Infrastructure Have Worsened

Workforce vacancies in infrastructure-related positions is a long-standing problem in the USVI, which has worsened, given the extensive demands of the recovery (see the discussion of vacancies in public agencies in Chapter Two). In the months following the hurricanes, FEMA hired consultants to support the VIWMA's ability to respond and recover. However, many territory agencies have not been able to hire enough workers to manage reconstruction and repair projects. As discussed in Chapter Seven, during

emergency response, WAPA struggled to find enough electric utility workers at the appropriate skill levels to help reposition poles and power lines.

In addition to workforce vacancies, there is the problem of USVI contractors having limited availability and ability to take on the breadth and duration of recovery work. Instead, many infrastructure agencies are looking outside the USVI to hire contractors from the continental United States to complete recovery infrastructure projects. For example, DPW is looking to bundle projects to attract larger contractors that might not be interested in smaller, one-off projects. However, even if this approach is successful, attracting outside contractors might mean higher costs for the implementation of recovery projects. Chapter Four discusses workforce capacity and Chapter Five discusses contractor dynamics in more detail.

Supply Chains Are Expensive and Slow

Supply-chain concerns pose an important technical and economic challenge for territory infrastructure agencies, particularly given the relatively high demand for construction materials, equipment, and specialized parts. As addressed in Chapter Five, high material costs, particularly for cement and asphalt, drive up recovery costs and could slow projects as competition increases for scarce imported materials. In addition to the high costs of basic construction materials, specialized parts, such as monitoring systems or specific pumps, motors, and accessories, might require long lead times and would not benefit from economies of scale.

Private-Sector Participation and Community Engagement Are Insufficient

Private-sector and community engagement in the recovery effort can help ensure buy-in on projects, communicate changes in road closures, and garner trust between territory and federal agencies and the larger USVI public. To date, NGOs, private-sector companies, and communities have largely been left out of the formal federal disaster-recovery process in the infrastructure sector. This has resulted in lost capacity because communities, businesses, and NGOs familiar with legacy challenges, infrastructure usage, and USVI needs did not contribute. Those NGOs that received PA funds cited a lack of communication and lack of transparency from both federal and USVI agencies and the need to dedicate significant staff resources to navigate PA processes as the primary and burdensome challenges.

Management Capacity to Meet Recovery Needs

Because of the sheer magnitude of hurricane damage and legacy infrastructure needs, the pace of recovery efforts will ultimately be determined by the capacity of USVI agencies to manage disaster-assistance applications, funds, and reporting requirements; work with federal disaster-recovery partners; and oversee construction projects.

The challenges encountered by the territory government and its agencies in managing recovery efforts were discussed in Chapter Two. To place the challenges in the context of infrastructure systems, this section describes the special human, institutional, and financial capacities within two key USVI infrastructure agencies—DPW and the VIWMA—that serve as examples of strengths and challenges within USVI infrastructure agencies more broadly.

Volume of Work and Lack of Construction Firm Capacity Have Led to Delays for the U.S. Virgin Islands Department of Public Works

Among the territory agencies affected by the hurricanes, the USVI DPW is uniquely positioned to manage the recovery process. The normal day-to-day role of DPW is, at least in part, to plan, design, and build (via contractors) large public-works projects and to manage the repairs and maintenance of a large portfolio of public roads and buildings. This role requires DPW to have the institutional protocols and knowledge for permitting, project design, and construction bid processes. Nonetheless, the sheer volume of new recovery projects has meant slower design and implementation timelines for the department. Although DPW was able to expedite some emergency-response projects, such as the repair of critical sections of roadways and traffic signals, many permanent-work projects still experience long delays.

DPW also faces challenges in managing the numerous public-works projects because of both the lack of construction engineering firm capacity and the need to learn new federal funding sources and protocols—namely, those for FEMA and DOT recovery funds. DPW has been able to overcome some of the latter challenges with support from outside contractors. In particular, the EFL is coordinating the delivery of funds and managing the construction projects funded under the FHWA Emergency Relief program on behalf of DPW. These enhancements to its human capacity have made it possible for DPW to restart many of the prestorm projects that were underway and keep its pipeline of recovery projects flowing.

Challenges for the Virgin Islands Waste Management Authority Include Aged Systems and Staffing Vacancies

The VIWMA faces a challenging situation due to the need to address problems with infrastructure systems approaching the end of their intended design lives and hurricane damage while dealing with staffing vacancies throughout the agency. To fill this gap, the VIWMA has relied on outside contractors, funded by FEMA, to manage the FEMA PA process and interact with FEMA on the VIWMA's behalf. From an institutional perspective, the VIWMA engineers who plan and design recovery projects are siloed from the departments that manage project finance and other grants, such as EPA funding. Financial capacity to meet cost-sharing requirements or pay contractors prior to reimbursement further limits the VIWMA's ability to fully take on the demands of hurricane recovery.

Box 6.4
COVID-19 and Infrastructure Services

- Although COVID-19 does not pose a direct threat to infrastructure systems themselves, the indirect effects on recovery and provision of infrastructure services could still be significant. Three primary vulnerabilities merit consideration for infrastructure recovery efforts.
- First, COVID-19 is poised to disrupt global trade and transportation, which could disrupt the supply chains that bring equipment and materials to the territory. This disruption could manifest as delays in the procurement of goods and a potential increase in their cost.
- Second, the availability of workers to administer and undertake recovery-project work is likely to be significantly constrained. Governor Bryan's March 23 stay-at-home order will reduce the near-term availability and productivity of staff needed to implement recovery projects. Some will be able to work from home, and the implementation of some infrastructure projects will be considered essential activity. However, recovery projects will still be affected by the broader slowdown in economic and administrative activity. Moreover, not only are territory agency workers affected, but those workers in federal agencies who are supporting recovery efforts will be as well, particularly if FEMA's presence in the territory is reduced.
- Third, some recovery projects will require contractors from Puerto Rico or the continental United States. Although it will be possible to receive project bids and even sign contracts in the middle of the pandemic, getting contractors to the territory and commencing work will be more challenging. With disaster declarations issued for all 50 U.S. states and multiple territories, even those continental U.S. contractors with an interest in bidding on USVI infrastructure projects might choose to delay the pursuit of contracts until the threat from COVID-19 has subsided.

Insufficiency of Interagency Coordination Remains an Issue

Given the capacity constraints that many of the territory agencies face within their own organizations, many have not had the ability to effectively coordinate or collaborate with one another on recovery projects. Some water and wastewater pipe replacement projects, such as one that broke ground in Christiansted in February 2020, have been coordinated between WAPA and the VIWMA, but the majority of projects have not taken this path. As stated in the previous section, the territory lacks a centralized project-tracking system that could enable more-effective coordination between agencies and identification of colocated projects.

Recommendations

Near-Term Recommendations

Prioritize Recovery Projects That Overlap with Existing Infrastructure Vulnerabilities

Goal	Focus the attention of local, state, territory, and federal agencies involved in recovery on those projects that would address hurricane damage and legacy management challenges associated with territory infrastructure.
Rationale	In addition to the extensive infrastructure damage caused by Hurricanes Irma and Maria, various infrastructure systems in the territory were subject to a variety of legacy challenges including systems that were under- or overcapacity, had inadequate maintenance, or were supported by out-of-date technology. Recognizing these issues, territory infrastructure agencies have had capital improvements plans to modernize infrastructure in place for multiple years. However, financial constraints have limited their ability to implement those plans. The availability of federal recovery and mitigation funds offers an opportunity and partial remedy for funding gaps, providing that existing capital projects match recovery funding program eligibility criteria. Priority therefore should be given to infrastructure recovery projects that repair, restore, or replace infrastructure associated with assets that both experienced significant storm-related damage and were targets of capital improvement plans prior to the 2017 hurricane season. This includes, for example, replacement of water and sewer lines or upgrading federal roads.
Implementation considerations	In order to prioritize projects that address immediate damage associated with the disaster, as well as those that address legacy issues that may have preceded the disaster, the following points should be considered: • The Bipartisan Budget Act of 2018 has created additional flexibility, particularly for infrastructure projects, so applicants are not limited to simply building back to the predisaster standard. • Territory agencies should prioritize projects that enable the overhaul of basic infrastructure systems. For example, several of ODR's Top 100 projects are associated with upgrading energy infrastructure to modernize generation and harden transmission and distribution. In contrast, no water distribution or wastewater projects are included, despite plans to extend or upgrade these systems. • Territory agencies should revisit the priority projects with respect to infrastructure. This could be followed by more-detailed cost–benefit analyses of specific projects to identify those that maximize return on investment over both the short and long terms. • Reprioritization of infrastructure projects could also necessitate evaluation of the funding mechanisms associated with projects and the timing associated with their obligation and implementation.
Time frame	Near term
Leading entities	The primary entities for this recommendation include the governor's office and ODR, with additional cooperation across territory agencies, particularly those with responsibility for infrastructure systems and services (e.g., WAPA, the VIWMA, DPW).

Identify Infrastructure Recovery Project Performance Criteria

Goal	Take steps toward the development of a framework that clearly identifies the criteria for success with respect to the implementation of infrastructure recovery projects and the mechanisms by which success will be judged. Examples of relevant criteria include service delivery, service utilization, access to services, regulatory compliance, and customer satisfaction (National Research Council, 1996).
Rationale	Funding for a broad variety of emergency- and permanent-work projects has already been obligated across the territory. Once funding is made available, territory agencies assume responsibility for project implementation. Available evidence suggests that the pace at which projects move forward is highly variable and related to the capacity of the responsible agency, the complexity of the project, the availability of suitable contractors, and the ability of the implementing agency to overcome administrative hurdles. ODR already tracks which projects have had their funding obligated, on its publicly available recovery dashboard. However, little information is available about the implementation process. Developing a set of common criteria for project implementation that can be incorporated into the existing dashboard would help communicate recovery progress to USVI residents, businesses, and other stakeholders. It would also increase accountability and enhance incentives to accelerate project implementation.
Implementation considerations	Implementing a more comprehensive project performance framework dashboard would require • identification of relevant performance criteria relevant to USVI projects and stakeholders • greater situational awareness about project status vis-a-vis those criteria • additional ODR staff time to facilitate routine updates of information on project performance on the ODR project dashboard.
Time frame	Near term
Leading entities	ODR could develop performance criteria in collaboration with FEMA and other federal funding agencies, and then implement those criteria in an updated ODR project dashboard.

Establish a Transparent, Real-Time Project Information System

Goal	Develop the operational capability that enables territory agencies and federal funders to view the entire portfolio of recovery projects, status of those projects, and potential interdependencies.
Rationale	Multiple federal and territory agencies are actively working to plan, fund, and implement recovery projects across the territory. However, the large portfolio of infrastructure projects and the diversity of federal funders supporting recovery efforts create complexity around the governance of recovery projects. For example, although some federal agencies maintain project databases (e.g., FEMA's Grants Manager), others do not. This limits awareness of what projects are currently being planned and when work is likely to commence. Such complexity can pose a barrier to a timely and efficient recovery. By creating a one-stop shop for visualizing information for recovery projects that have been proposed, obligated, and completed, agencies would have greater insights into opportunities for project coordination and sequencing.
Implementation considerations	• Implementing such an information system would necessitate cooperation and data-sharing among both territory and federal agencies. Not all federal or territory agencies would necessarily have the current capability to readily provide that information. • Collecting the necessary information would require dedicated personnel, which could increase the burden on both federal and territory agencies. • Some form of digital platform would be needed to facilitate the storage, management, and visualization of the information. This would likely require an external contractor to design and build. • Given such a capability is likely of value not just to the USVI but to disaster recovery generally, having the federal government invest in its development might be a better approach for maximizing the return on investment. However, such an approach would likely mean that the information system would be developed too late in the recovery process to maximize benefits.
Time frame	Near term
Leading entities	Enhancing situational awareness cuts across sectors and agencies. For this reason, the leading entity would likely be an agency with a reach across all the agencies, such as ODR, VITEMA, the PFA, or some combination thereof.

Develop a Project Seed Fund That Territory Agencies Could Use to Derisk Recovery Projects

Goal	Provide infrastructure project applicants with additional, short-term access to financial capital to allow obligated projects to move forward.
Rationale	Multiple territory agencies report challenges in raising sufficient financial capital to, for example, undertake initial "make-ready" work for larger recovery projects (see also Chapter Three).[2] Moreover, contractors report delays in reimbursement following project completion, thus increasing project risk. This, in turn, increases project costs as contractors charge more to offset that risk. Given other financial challenges for the territory, resorting to conventional financing options, such as the municipal bond market, has not been feasible. Development of a novel seed fund that could be used to accelerate the implementation of projects that lack sufficient capital or to reduce project risks for contractors concerned about reimbursement times could accelerate project implementation. Such a fund could be generated by the provision of low- or no-interest bridge loans to the territory government to partially offset the costs of project implementation, with the loan repaid once the project is reimbursed. (In Chapter Eleven, we include a similar option for education.)
Implementation considerations	Development of such a recovery seed fund would involve the following considerations: • An appropriate investor (or investors) would be needed to underwrite such a fund. Potential investors include philanthropic organizations, private investors, and federal agencies (Pub. L. 113-2, 2013). • At least one investor would have to be willing to take on additional risk while receiving a lower rate of return than a traditional investment opportunity. This would limit the pool of investors to angel or affect investors that are not necessarily seeking to maximize the return on their financial investments. • Fund managers or territory agencies would need to identify which projects would benefit from flexible funding and the magnitude of capital needed. • Decisions would have to be made about how such a fund would be administered, including oversight and auditing functions. This would likely necessitate involvement of a third-party administrator to ensure transparency and minimize potential conflicts of interest.
Time frame	Near term
Leading entities	Implementing a recovery seed fund would likely be led through a collaboration between the USVI government (for example, through VITEMA) and an independent administrator.

[2] In this context, *make-ready* work includes preparatory actions that must be completed in advance of implementing a recovery project. This could include damage assessments needed to justify project costs, site preparation work, or relocation of existing essential services to a new location to minimize disruption.

Consolidate the Administration of Federal Agency Funding Programs Under a Single Lead Federal Agency

Goal	Enhance the federal agencies' flexibility to coordinate the delivery of recovery funds for projects, particularly those associated with a common infrastructure type.
Rationale	Multiple territory agencies reported challenges associated with navigating multiple recovery funding programs across different agencies. Each agency program involves separate eligibility criteria and necessitates independent applications. This places a significant administrative burden on applicants and reduces opportunities for efficiently coordinating funding sources and projects. Consolidating the administration of federal funding programs and routing them through a single agency would reduce the burden on both applicants and funding agencies (Leicht, 2017). It would also increase the likelihood that awareness of projects becoming trapped could spread across agencies, allowing greater master planning among multiple infrastructure projects.
Implementation considerations	• Constraints on the pooling of funds across different recovery programs both within and among federal agencies pose significant barriers to implementing this recommendation. • Although precedents exist, significant coordination is necessary within and among agencies to maintain compliance with funding program requirements.[3] • Administrative challenges from past precedents could be overcome in future efforts, particularly with broader federal buy-in on the benefits of this approach for the administration of recovery efforts.
Time frame	Near term
Leading entities	Territory infrastructure agencies, such as WAPA, the VIWMA, and DPW, can advocate for streamlining recovery funds, but federal agencies would have to take the lead in developing the administrative framework for funding consolidation.

[3] For example, following Hurricane Sandy, EFL, which typically delivers projects funded by DOT only, delivered a roadway repair project funded by HUD's CDBG-DR program for New York's Housing Trust Fund Corporation (EFL and New York State Housing Trust Fund Corporation, 2018). This pilot, which focused on a single project on Fire Island, New York, expedited the completion of this recovery project by centralizing the project and funding management within EFL. Although this project can serve as a model for consolidating recovery efforts, HUD reporting requirements and the transfer of funding from HUD to EFL posed administrative challenges.

Integrate Recovery Efforts into the Update to the USVI Hazard Mitigation Plan

Goal	Place the territory's mandated hazard-mitigation planning process at the center of disaster-recovery efforts to facilitate the enhancement of long-term resilience.
Rationale	FEMA requires that, to be eligible to receive a grant to mitigate the adverse consequences of future natural and anthropogenic hazards, a state or territory undertake hazard-mitigation planning. Given the social, economic, and infrastructure vulnerabilities revealed by Hurricanes Irma and Maria, the current process to update the USVI hazard-mitigation plan (ODR, 2019a) provides a timely opportunity to integrate disaster-recovery and disaster-mitigation efforts and investments. Capitalizing on this opportunity, however, will require hazard-mitigation planning to incorporate lessons learned from Hurricanes Irma and Maria and will require that recovery projects be aligned with the plan objectives.
Implementation considerations	• Coordination between recovery efforts and hazard-mitigation planning can be improved at relatively low cost. • A committee or task force could be implemented to bring together territory agencies involved in the management of recovery projects with those at UVI who are leading the hazard-mitigation plan update. • A key challenge will be aligning the timing of mitigation planning and recovery planning such that one can effectively inform the other. • Some of the other recommendations outlined previously (e.g., project performance criteria and project information systems) could also be used to facilitate such alignment.
Time frame	Near term
Leading entities	Such coordination could be facilitated by VITEMA working in partnership with ODR and by UVI. Additional participants from individual agencies could also be included as needed to facilitate coordination on specific topics.

Longer-Term Recommendations

Expand Predisaster Training and Preparedness

Goal	Address the common concern raised by USVI agencies about the challenges they experience in navigating the complex administrative processes associated with applying for and receiving federal recovery funds.
Rationale	Multiple territory agencies and federal agencies working with the territory have reported a variety of constraints on their capacity to manage the administrative burden of recovery efforts. Part of this is a function of the inherent challenges posed by the scale of the disaster, relative to the size of the USVI government and its economy. However, part of this is also because of territory agency staff having limited prior experience with the disaster-recovery process. Although contractors, such as Witt O'Brien's, have played a key role in filling gaps in the capacity of territory agencies, the greater familiarity agency staff have with the process, the more effective their ability to work with contractors like Witt O'Brien's will be. Hence, programs that can train state, territory, and tribal staff in disaster recovery as a core component of disaster preparedness would enable more-efficient progress through disaster recovery. Although this is unlikely to benefit the USVI in terms of current recovery efforts, it could significantly enhance recovery processes in future disasters, particularly those in rural and remote communities.
Implementation considerations	A federally managed expansion of predisaster training and preparedness would require the following considerations prior to implementation: • At the federal level, given the number of states, territories, and tribes eligible for federal disaster assistance, maintaining an ongoing training and capacity-building program would necessitate significant federal investment, or at least augmentation of existing programs. • For local entities, if the costs of such capacity building were shared between local and federal agencies, those entities would also be responsible for nontrivial investments of resources. • Such a training program would need to reach sufficient staff across relevant state, territory, and tribal agencies, and be responsive to staff turnover and changes in federal policies and practices associated with disaster recovery. • Decisions would need to be made about whether such training should focus solely on FEMA, as the lead emergency management agency, or include other federal agencies. • Additional analyses examining the potential costs and benefits of such capacity building are needed, particularly given the relative infrequency with which major disasters strike some states and territories.
Time frame	Long term
Leading entities	Implementation of a capacity-building program would be led by federal agencies that administer grant programs in cooperation with the states, territories, and tribes that are eligible to apply for federal funding.

Develop and Implement a Territorywide Data Strategy

Goal	Harden the territory's data and information to reduce the likelihood of data loss in the event of future disasters and facilitate speedy data recovery to quicken future recovery efforts.
Rationale	Hurricanes Irma and Maria damaged or destroyed a wide variety of paper and digital data, including public and administrative records. This data damage and loss have slowed the recovery process and disrupted other administrative processes. Moreover, various types of data that could have been used to facilitate recovery (e.g., geographic information system maps of territory sewer systems) did not exist or were incomplete. Shifting a larger fraction of the territory's administrative processes to digital formats (see also Chapter Two) and implementing appropriate off-site backup for critical data would help streamline administrative tasks and also facilitate faster recovery in the wake of future disasters.
Implementation considerations	The pursuit of a territorywide data strategy represents a long-term effort that would likely affect every territory agency and its operations and includes the following considerations: • Such an effort would necessitate digitizing hard-copy records but also require more-deliberate collection of new data on territory assets and operations. • The territory would need to first take stock of existing data resources and existing asset-management systems. • The territory would likely need support from one or more consulting firms to address technology requirements, metadata standards, business practices, and change-management efforts. • This stock-taking could be implemented first in high-priority agencies, such as those that manage public records (e.g., Office of Vital Records and Statistics), permitting (DPNR), and emergency management (police, fire, and VITEMA), and then extended throughout the territory. • Priority could also be given to those infrastructure systems that are experiencing large-scale improvements, such as the electricity grid or the replacement of water or sewer lines.
Time frame	Long term
Leading entities	A territorywide data strategy would likely be led out of the governor's office, with support from BIT and VITEMA.

CHAPTER SEVEN

Energy

Box 7.1
Key Findings About Energy

- Strategic planning efforts before and since Hurricanes Irma and Maria in 2017 have promoted increased energy system resilience, expansion of renewable energy, improved energy system design, and additional capital investment.
- Several high-priority energy projects have been identified, funded, and implemented, including emergency projects to restore power to the territory and efforts to harden energy infrastructure, upgrade electricity generation units, and increase integration of renewable energy. Nevertheless, some projects have not been approved for funding yet; in other cases, funds have been obligated, but the work has not commenced yet.
- Key barriers to the timely and successful implementation of recovery projects for the energy sector include legacy challenges related to power system reliability, financial health of WAPA causing high electricity costs because of old and inefficient infrastructure, volatile fuel prices, and regulatory compliance issues. Moving forward, additional challenges include coordinating energy infrastructure projects with other recovery efforts.
- Management capacity in this sector is affected by the large volume of work, sustaining the skilled workforce needed to support energy system O&M, and a low level of WAPA investment in community engagement and stakeholder outreach.
- Near-term recommendations include the following:
  - Enhance WAPA's fiscal sustainability by restructuring debt and improving the collection of fees to boost the authority's revenue.
  - Enhance WAPA's capacity to implement disaster-recovery efforts and manage future capital investments in the USVI energy system by developing, promoting, and maintaining a skilled energy workforce.
  - Enhance mechanisms for coordinating among USVI agencies responsible for infrastructure for energy-sector recovery projects.
- Longer-term recommendations include the following:
  - Enhance the reliability and long-term performance of energy infrastructure by implementing improvements to WAPA's asset-management systems and operations and maintenance protocols.
  - Improve power delivery in the USVI electricity grid by hardening its infrastructure to meet resilience needs.
  - Increase power supply reliability and reduce system costs by upgrading the electric system infrastructure.

The USVI's electrical power infrastructure experienced catastrophic damage in September 2017, when Hurricanes Irma and Maria, both category 5 storms, made landfall. According to WAPA, 80 to 90 percent of the transmission and distribution (T&D) infrastructure that conveys power from the point of generation to the point of use was damaged (USVI Hurricane Recovery and Resilience Task Force, 2018). The damage was particularly extensive on St. Thomas and St. John. The reliability, security, and resilience of the territory's power system is critical not only to support disaster-

recovery efforts but also for the operation and performance of every sector of the territory's economy. Accordingly, recovery of the territory's electricity grid and enhancing its resilience to future disasters has been a high priority for the territory government.

Box 7.2
Methodology and Limitations on the Analysis of Energy

Methods Used in This Analysis

- The analyses and recommendations in this chapter are based on a mix of methods, including the review of planning and performance evaluation documents, expert discussions with federal and territory agencies, and analysis of recovery project data.
- The team reviewed existing planning documents from territory agencies and technical guideline documents relevant to recovery work, such as the WAPA Integrated Resource Planning Report (Black and Veatch Management Consulting, 2019), the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan (USVI Hurricane Recovery and Resilience Task Force, 2018), the FEMA Threat and Hazard Identification and Risk Assessment and Stakeholder Preparedness Review Guide (DHS, 2018), the WAPA 2021 Strategic Plan (WAPA, 2021), the Hazard Response and Power Restoration Planning Handbook by the Electrical Infrastructure Security Council (Electric Infrastructure Security Council, 2014), the Hawaii integrated grid planning report (Hawaiian Electric, 2018), Congressional Research Service reports on the USVI energy sector (C. Clark, 2020; C. Clark, Campbell, and Austin, 2018), and the USVI Hurricane Irma and Maria recovery progress reports (Government of the Virgin Islands, 2018; Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019).
- We also relied heavily on interviews and discussions with people from a variety of federal and territory agencies. These interviews focused on understanding recovery accomplishments to date and barriers to recovery experienced by territory agencies and stakeholders. On the federal side, we spoke with various sector leads, branch directors, and supervisors within FEMA and conducted interviews with representatives from DOE, the National Renewable Energy Laboratory, and the Naval Postgraduate School. In the territory, we spoke with people from WAPA, the Virgin Islands Energy Office, and other agencies and private businesses that interact with WAPA.
- We downloaded and analyzed all FEMA PA project data as recorded in the Grants Manager database as of February 18, 2020. These data were cleaned, formatted, and filtered to remove all emergency-work projects, all projects from agencies related to education, health and human services, and natural and cultural resources. This left the majority of PA projects for energy utilities. We also removed category Z, management costs. The remaining data are summarized in charts and figures in this chapter. We also analyzed project data from other federal agencies, as reported on ODR's recovery dashboard.

Limitations of This Analysis

- Because of time constraints and staff availability, we were unable to conduct follow-up interviews with WAPA to undertake case studies on specific aspects of energy-sector recovery. We were also constrained in our ability to comprehensively access recovery data from other federal agencies, apart from what is available through ODR. This chapter therefore reflects the best available information from the sources and materials described above.

Although the damage from the hurricanes created an immediate need for investment to repair and restore electrical services, this process of recovery is part of a larger, long-term effort to modernize the territory's energy system. Electricity rates in the territory are among the highest in the United States, even when compared with neighboring territories, such as Puerto Rico. Yet WAPA has a history of problems with power reliability (C. Clark, 2020; C. Clark, Campbell, and Austin, 2018). Prior to the 2017 hurricanes, focal points for capital investment have therefore targeted hardening of the electrical grid against storms and other forms of disruption, upgrading and rightsizing generation to enhance efficiency and reduce operating costs, and enhancing the use of renewable energy and microgrids. These long-standing goals for the energy

sector therefore should be considered in the evaluation of more-recent disaster-recovery efforts.

This chapter documents the research, analysis, and stakeholder interactions associated with recovery planning for energy infrastructure. We examined the prehurricane state of the territory's electrical power infrastructure; the hurricanes' effects; and the accomplishments to date in restoring, repairing, and improving the system. We also considered the barriers associated with the design and implementation of recovery projects and developed recommendations to accelerate the delivery of a robust recovery process for the sector that enhances future resilience.

Setting the Stage

Before the Hurricanes

The USVI power system is composed of two interdependent networks. The USVI energy sector provides electricity to 45,000 residential and 9,000 commercial customers throughout the territory. The territory's electricity generation and T&D infrastructure are operated and controlled by WAPA. WAPA is a government-owned and -operated public utility regulated by the USVI Public Services Commission to provide both water (see Chapter Six) and electricity (WAPA, 2019).

WAPA's electricity generation is largely associated with fossil-fueled power plants, which provided between 259 and 282 megawatts (MW) of generation capacity across two separate networks (see Table 7.1 and Figure 7.1). Historically, most electricity generation on the islands was fueled with imported petroleum. In 2018, about 20-percent generation capacity came from renewable energy, particularly from large-dollar energy facilities and customer-installed rooftop solar panels. Network 1 is composed of the generation and T&D assets of St. Croix. The main source of generation is provided by the Estate Richmond Power Plant consisting of six generation units. Five units have been converted to LPG-powered units to lower costs but have dual-fuel capabilities enabling them to switch to fuel oil; when needed, one unit continues to run on fuel oil.

Network 2 connects the remainder of the islands, including St. Thomas, St. John, and Water Island, the latter of which is connected to St. Thomas by an underwater cable. The primary source of generation in network 2 is provided by Randolph Harley Power Plant (RHPP), which is connected to a 138-kilovolt (kV) transmission line. The plant consists of six generation units, all of which still run on fuel oil, except one that was converted to LPG in 2016 to lower costs. There are also three emergency units in RHPP for backup generation. Approximately 24 MW of capacity comes from distributed, renewable generation resources, including wind generation, large utility-scale solar energy facilities, and customer-installed and small rooftop solar panels (U.S. Energy Information Administration, 2019). Collectively, these resources represent about 20 percent of USVI's generation capacity.

Table 7.1
USVI Electricity Generation Assets and Capacity

Island	Plant	Fuel Type	Capacity, in Megawatts
St. Croix: Network 1	Estate Richmond Power Plant	Oil and LPG	117–140[a]
	Toshiba Estate Donoe Solar Array: utility scale	Solar	4.2
	Solar PV[b]		4.47
	Solar net metering[c]		5–6
St. Thomas: Network 2	Randolph Harley Power Plant	Oil and LPG	~142[d]
	Solar net metering	Solar	6.9
	Tutu substation: VIPA	Solar	0.45

SOURCE: Alderson et al., 2018.

NOTE: PV = photovoltaic.

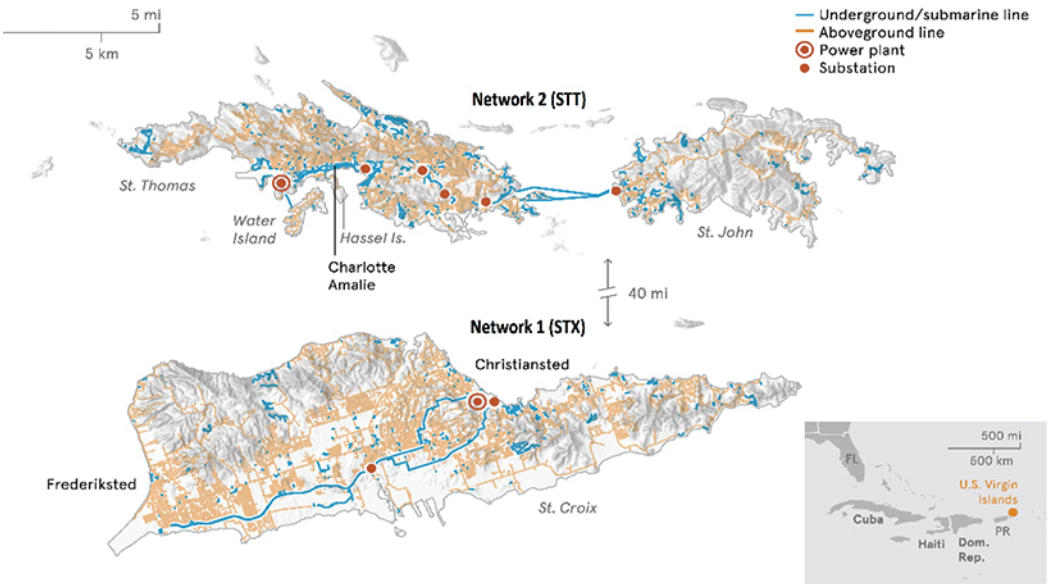
[a] Capacity depends on generation daily or dispatch.

[b] There is a 4-MW solar PV generation capacity at Estate Spanish Town of St. Croix, one near Midland substation, and one at the Almeric L. Christian Federal Building (with 0.47-MW capacity) north of the Estate Richmond generation station.

[c] PV generation units are in multiple locations across St. Croix.

[d] Rated megawatt capacity depends on average dispatch, schedule maintained, and forced outage rates.

Figure 7.1
The Geographic Distribution of USVI Electricity Infrastructure



SOURCE: C. Clark, Campbell, and Austin, 2018.

The electricity generated by WAPA is transmitted at high voltage levels via transmission lines to stepdown substations that lower the voltage and send power to residential and commercial customers. There are eight substations in the USVI's two networks: two on St. Croix, five on St. Thomas, and one on St. John. St. Croix utilizes 24.9-kV subtransmission lines and 13.8-kV distribution lines. The T&D systems on St. Thomas and St. John are composed of 34.5-kV primary lines and 13.8-kV distribution lines. Each system has more than 1,000 miles of power lines, and most of them are overhead. Only about 10 percent of these lines are underground cable. This low percentage of undergrounding of T&D systems—although not unusual in sparsely populated regions—creates a significant source of vulnerability in the event of extreme weather events, such as hurricanes.

Impact of the Hurricanes

Hurricanes Irma and Maria caused extensive damage to USVI's energy infrastructure (see also Chapter Six), particularly electricity T&D systems. Ninety percent or more of overhead power lines were damaged during the storms, along with an estimated 13,478 utility poles. T&D infrastructure damage on each island is shown in Table 7.2. St. Croix bore the brunt of the damage, losing more poles, miles of power lines, and transformers than the other islands. Although the fossil generation units were largely undamaged by the storms, damage to the 4.2-MW utility-scale Donoe solar PV system on St. Thomas was devastating (Hotchkiss, 2018). Similarly, the 4-MW Spanish Town solar farm on St. Croix sustained significant damage and remained offline for five months (BMR Energy, undated; Hotchkiss, 2018).

The damage associated with Hurricanes Irma and Maria resulted in an essentially complete blackout across the territory for up to about three months. It took four days for the first customers to be reconnected and four months to restore power to 90 percent of customers (Bloomberg Philanthropies, 2019). In the initial months after the hurricanes, WAPA carried out projects focused on emergency response and repair, including hurricane debris removal and power restoration activities across St. Croix, St. Thomas, and St. John. These efforts focused initially on restoring electricity to pri-

Table 7.2
Transmission and Distribution Infrastructure Damage per Island

Island	Poles	Line Span, in Miles	Transformers
St. Croix	7,534	15,026	2,945
St. Thomas	4,408	7,968	1,900
St. John	1,536	2,313	491
Total	13,478	25,307	5,336

SOURCE: VIHFA, 2019a.

ority critical loads, such as hospitals, ports, and airports, the emergency service sector, and water treatment plants.

Recovery Progress Since the Hurricanes

Strategic emergency energy infrastructure projects were instrumental in restoring power across the territory. In the wake of the hurricanes, emergency projects funded under FEMA's PA grant program were used to address immediate needs. Based on obligated funds reported within USVI's ODR project dashboard (ODR, undated c), the actual expended costs of emergency work totaled $270.1 million in St. Croix and $257.3 million in St. Thomas, St. John, and Water Island combined (Table 7.3). These costs were associated with debris removal, mutual-aid agreements, and emergency power restoration (Figure 7.2).

A Broad Portfolio of Permanent Energy Recovery Projects Has Been Identified, and Projects Are at Various Stages of Planning and Implementation

Over time, WAPA transitioned from emergency work to a focus on permanent recovery work. (See Table 7.4 for a summary of accomplishments.) FEMA's Grants Manager database identifies 21 power system projects for which WAPA is the applicant at various stages in FEMA's PA approval and obligation process (Figure 7.3). According to ODR's recovery dashboard, the total value of permanent projects is approximately $500.3 million, and the territory has already expended nearly half (47.6 percent) of this amount. One of the major projects for which funding has been obligated is approximately $286 million in permanent repairs to St. Croix's electrical distribution system. Similar repairs to the St. Thomas and St. John distribution systems ($143 million and $50 million, respectively) were pending approvals as of February 2020. These three projects represent the largest projects by cost in both ODR's dashboard and FEMA's Grants Manager database. Permanent repairs to WAPA substations, estimated at approximately $35 million, are also awaiting interim review or approval. Time from project creation in FEMA's Grants Manager database to final FEMA signing averages around 249 days for permanent-work projects in WAPA's electric power system.

In addition, where funding conditions permit, the intent is to repair or replace infrastructure to a higher standard than existed before the storms. For example, in 2009, the USVI enacted a net metering safety standard that follows the interconnection standard in the Federal Energy Policy Act of 2005 (Pub. L. 109-58, 2005; USVI Office of the Governor, 2009; USVI Senate, 2009), and Institute of Electrical and Electronics Engineers Standard 1547 (Institute of Electrical and Electronics Engineers, 2018), a standard for interconnecting distributed resources with electric power systems that establishes criteria and requirements for interconnection of distributed

Table 7.3
FEMA Public Assistance Recovery Projects

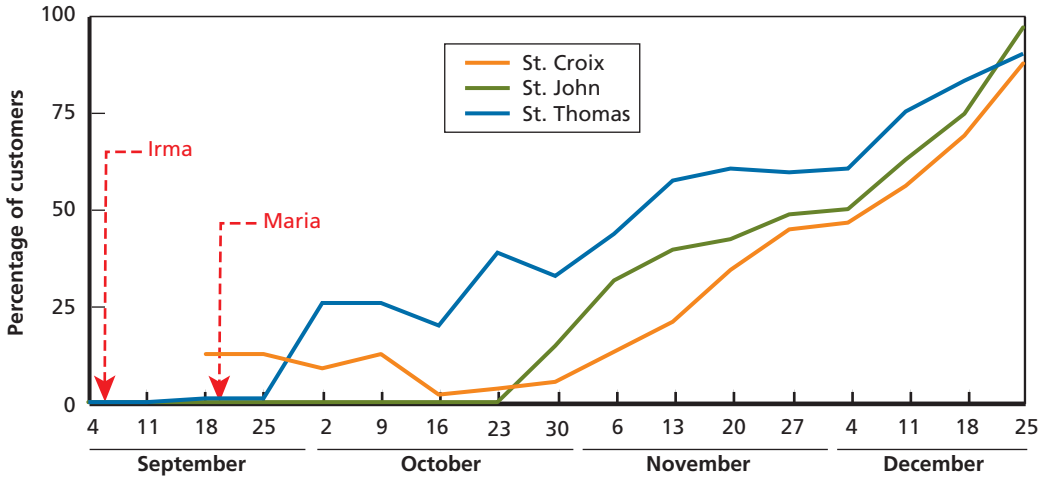
Project	Funds, in Dollars		Percentage Expended
	Obligated	Expended	
Emergency			
Debris removal (WAPA, St. Croix)	39,089,828	17,218,285	91
Emergency protective measures (power restoration, St. Croix)	231,656,644	231,656,644	44
Emergency protective measures (power restoration, St. Thomas)	2,000,000	1,700,726	33
Emergency protective measures (power restoration, St. Thomas)	33,446,989	30,485,171	33
Mutual-aid agreements for power restoration	12,953,100	9,805,404	33
Power debris removal (St. Thomas, St. John, Water Island)	42,667,576	14,114,113	33
Emergency protective measures (power restoration, St. Thomas)	166,208,400	158,187,317	33
Subtotal	528,022,537	463,167,660	88
Permanent			
St. Croix electrical distribution permanent repairs	286,095,249	117,628,918	64
St. John electrical distribution permanent repairs	50,184,307	30,172,143	68
WAPA advanced metering infrastructure system	18,566,507	5,832,038	96
St. Thomas electrical distribution permanent repairs	143,096,693	82,262,562	100
Water Island electricity distribution system permanent repairs	2,392,832	2,392,832	44
Subtotal	500,335,588	238,288,493	48
Total	1,028,358,125	701,456,153	68

SOURCE: ODR, undated b.

resources with electric power systems.[1] Such energy system code improvements are eligible for reimbursement through FEMA PA, provided that these improvements meet predetermined criteria (C. Clark, Campbell, and Austin, 2018). Moreover, under the Bipartisan Budget Act (Pub. L. 115-123, 2018), applicants for FEMA PA have greater

[1] The Institute of Electrical and Electronics Engineers is an international organization that develops standards for a variety of technologies, focusing on the electrical distribution systems.

Figure 7.2
Percentage of Eligible Customers Restored, by Island, 2017



SOURCE: Bloomberg Philanthropies, 2019, using data from WAPA.

flexibility to include improvements in their project designs. Such efforts to "build back better" will enable the USVI's power systems to emerge from the recovery phase with greater resilience than they had before the 2017 hurricane season.

Recovery Projects Have Focused on Enhancing the Resilience of the Electricity Grid

Recovery efforts are being pursued in conjunction with long-standing plans to enhance the energy sector's resilience to shocks and stresses. The WAPA power-grid resilience plan (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019), for example, includes mitigation projects of $742 million funded by FEMA and HUD and is a combination of increased undergrounding of power lines, installation of composite poles, hardening of infrastructure, and installation of emergency backup generators for critical loads.

Although the composite poles are being used to harden WAPA's aboveground infrastructure, WAPA is also pursuing plans to transform the territory's overhead power lines into underground cables. WAPA plans to connect 50 percent of its customers through underground power cables for each of the three islands. Underground circuit designs for St. Croix, St. John, and St. Thomas are still a work in progress. Currently, an underground circuit has been designed for Christiansted, with an RFP issued. Similar RFPs for St. John (Cruz Bay) have been issued and advertised.

In addition, WAPA is hardening the electricity infrastructure by constructing new substations and emergency backup generation units across the territory. A new substation is being added on the east end of St. Thomas. The project is funded by FEMA for $12 million. For system restoration, WAPA is adding new emergency backup gen-

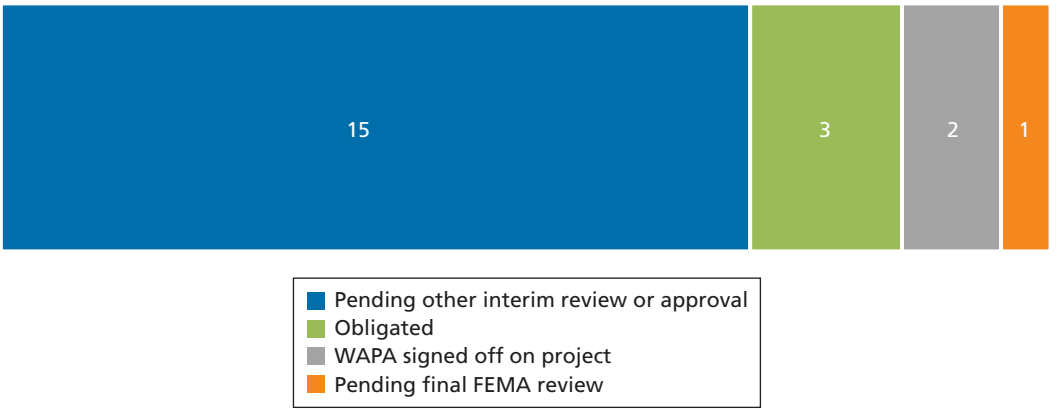
Table 7.4
Summary of Recovery Accomplishments

Strategic Plan Element	Project
Emergency work	**Goal:** Restore power supply and repair damage to T&D infrastructure. **Projects:** Emergency-response projects funded by various federal and government agencies **Accomplishments:** WAPA's emergency work is largely complete, with 88 percent of the FEMA funds having been expended. Some emergency-response PA projects had not been obligated as of February 2020. For example, substation repairs in St. Thomas and repairs to the Richmond power plant in St. Croix are still pending review and final approvals.
Generation capacity	**Goal:** Evaluate reliable and environmentally acceptable power supply options for the separate electric power systems in the USVI, including adding renewable wind and solar PV units across the territory (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). **Project:** Integrated resource planning **Accomplishments:** • WAPA initiated a revision to its IRP to enable the utility's strategic planning to reflect the opportunities and constraints created by the 2017 storms. • A stakeholder engagement period with public meetings was launched in December 2019, and WAPA is working toward finalizing the IRP based on stakeholder feedback. • The IRP study recommendations for WAPA were to evaluate options for retiring old, less efficient generation units, expand the use of renewable generation and battery storage, and perform transmission studies to confirm that system stability and load flows remain reliable given the transforming power grid.
Infrastructure upgrades	**Goal:** The plan is to connect 50 percent of the USVI's customers through underground power cables for the territory. **Projects:** Mitigation projects include $742 million funded by FEMA and HUD (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019) and $780 million for installation of 7,000 poles territorywide. **Accomplishments:** More than 1,670 new composite poles that can withstand 200-mph winds have been installed across the territory.
Renewable energy	**Goal:** Increase renewable generation across the territory. **Project:** Restoration of utility-scale solar farms, installation of microgrids based on solar PV and battery storage (ODR, undated b) **Accomplishments:** • The first set of these projects includes utility-scale solar generation with battery storage capability of 28 MW on St. Croix. • There are also several RFPs prepared and in final VIHFA process approval. • WAPA has additional renewable-energy projects on its priority list, including rooftop solar with net energy billing. • Recently, WAPA, the Virgin Islands Energy Office, and USVI Public Services Commission unveiled a new net energy billing proposal that would allow all customers with rooftop solar panels to sell excess power to WAPA during sunny periods in exchange for credits of WAPA-generated power to be used whenever sunshine is not available.

NOTE: IRP = integrated resource plan.

eration units on St. John. This restoration work falls under FEMA's HMGP project, funded through FEMA with a 90/10 cost-share mechanism in which FEMA pays 90 percent of the cost while WAPA pays the remaining 10 percent. WAPA's 10-percent match will be satisfied using federal grant money provided by HUD (FEMA, 2015).

Figure 7.3
Number of Permanent-Work Projects, by Public Assistance Process Step



SOURCE: FEMA Grants Manager database.
NOTE: These projects do not include FEMA's category Z, which covers management costs; some projects fund joint improvements to WAPA's power and water systems, such as advanced metering

The availability of federal recovery funds is creating opportunities for WAPA to pursue the expansion of distributed energy resources in the territory. WAPA is transforming the territory's grid into new, upgraded, smaller and more-efficient generation units, mostly from renewable generation (particularly solar). Other smaller units are being added, using propane as the primary fuel; propane has lower carbon content than other fossil fuels but still produces other pollutants.[2] Utilities are considering adopting advanced technologies in a more distributed resource approach. Moreover, WAPA will add new generators with battery storage at RHPP; these are set for activation in December 2020. The project has a total cost of $95 million and is funded by the CDBG-DR program.

The USVI government's goal is to not only transition the territory's power to a more resilient state but also reduce energy production from fossil fuel across the territory. In 2009, the USVI legislature passed Act 7075 (USVI Office of the Governor, 2009) to create a renewable-energy portfolio target of 25 percent of WAPA's peak demand being met by renewable energy by 2020 and 30 percent by 2025. With expanding renewable generation being a long-standing objective for the territory, WAPA views the recovery as an opportunity to further its vision for greater use of distributed generation.

Independently, the Virgin Islands Energy Office runs a variety of energy programs. The office also works closely with DOE on a variety of energy projects: DOE provides technical assistance to several programs that are underway, including those

[2] Propane has a smaller carbon footprint, producing 38-percent lower emissions than oil (EPA, 2019b).

involving energy efficiency and solar energy. The energy office communicates with DOE staff across these different areas. The office also has a residential weatherization program that provides free energy-efficiency retrofits. The program is funded through DOE. Currently, the office has a $300,000 grant from DOI for an energy-efficiency benchmarking program and a program for solar water heaters because residents are looking for more-efficient water-heating options. There is also a partnership effort to install solar PV and net metering projects in the territory. This partnership includes WAPA, the Virgin Islands Energy Office, and federal agencies, such as DOE. In addition, WAPA continues to develop advanced resilience data for its power grid's operational performance. Specific directions regarding recovery and associated investments are articulated in the WAPA 2021 strategic plan report and the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan visions and goals.

Recovery Directions

We examined strategies and plans from WAPA, the HSOAC recovery-planning project for Puerto Rico, and other stakeholders that could be used to identify recovery directions for the energy sector. Such directions are outlined in the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan (USVI Hurricane Recovery and Resilience Task Force, 2018), WAPA's IRP draft report (Black and Veatch Management Consulting, 2019), with emphasis on the continued resilience objectives outlined in the Congressional Research Service report on resilience in the USVI power sector (C. Clark, Campbell, and Austin, 2018). WAPA recognizes the approach to recovery as having started the transformation of the USVI energy system, including increases in system reliability and a significant reduction in grid disruptions. Such a transformation has been enabled by FEMA's flexibility under the Bipartisan Budget Act (Pub. L. 115-123, 2018) to provide PA for critical infrastructure services, including power, without regard for prestorm conditions (FEMA, 2018e). Accordingly, the territory government, via WAPA, has taken advantage of this once-in-a-generation opportunity. Box 7.3 summarizes the key recovery directions identified for the energy sector.

Box 7.3
Recovery Directions for Energy

- **Conducting regulatory planning and implementing reforms:** Maintaining the utility's financial stability and regulatory compliance while providing new generation capacity, reducing ongoing operational costs, and identifying opportunities to restructure and reduce WAPA's debt burden
- **Ensuring grid reliability and resilience:** Strengthening infrastructure standards and construction, identifying and evaluating potential threats and vulnerabilities, assessing potential investments to protect the grid during extreme weather events, assessing the mix and location of generation resources, and strengthening grid capabilities in physical and cyber security
- **Improving emergency management readiness:** Achieving a state of emergency readiness and improving information and data-sharing capabilities with other sectors
- **Upgrading infrastructure:** Reinforcing underground transmission and distribution lines in critical locations and installing submarine cable from St. Thomas to St. John for additional redundancy
- **Transforming the grid:** Replacing outdated generation units with new, more-efficient and -reliable generators and expanding the use of smaller, renewable-compatible propane units; wind and utility-scale solar with battery storage; and rooftop solar program

Key Barriers and Gaps

The USVI's recovery has positioned it to accelerate emergency response and support for a longer-term vision for rebuilding the energy sector's infrastructure. As outlined in the previous section, a variety of federal and territory strategies are being pursued both in the context of, and independent from, disaster-recovery efforts to improve resilience and reduce costs of future disasters. Nevertheless, interviews with subject-matter experts in territory and federal agencies suggested the existence of several financial, institutional, and technical barriers to achieving the territory's energy infrastructure recovery goals. This section summarizes these barriers, which should be viewed as primary targets for interventions to accelerate recovery efforts.

The Virgin Islands Water and Power Authority's Financial Challenges Have Limited Capital Investments and Infrastructure Investments

The USVI energy system was already facing high electricity rates before the 2017 storms. Residential energy rates were $0.32 per kilowatt-hour—among the highest in the Caribbean and three times the U.S. average. These high rates were driven, in large part, by the territory's significant reliance on imported fossil fuels because the majority of WAPA's generation units are dependent on oil. The high cost of electricity creates a strong incentive for residential and commercial customers to go off-grid through local distributed generation (e.g., rooftop solar). However, this further affects WAPA's revenue because O&M costs have to be recovered from a shrinking customer base. The USVI has established a goal to reduce oil consumption by 60 percent by 2025, and WAPA has initiated renewable portfolio targets to integrate wind and solar generation units. The territory is also actively improving energy-efficiency programs to diversify the power generation mix and lower electricity rates for residential and commercial

sectors. However, energy rates remain high as a result of WAPA's enduring fiscal problems, in addition to an outsized infrastructure operating beyond its designed service life that poses barriers to electricity reliability.

As recently as September 2019, Moody's downgraded WAPA's $178 million in bonds to Caa2 and Caa3 ratings, noting the existence of "unsustainable capital structure with very tight liquidity, high debt load including a substantial unfunded pension liability, the increased frequency of power outages, reducing the reliability of the electric system, high electric rates, and chronic challenges facing the economy" (Moody's Investors Service, 2019a). These issues have been exacerbated by high nonpayment rates among WAPA customers. For example, WAPA was carrying millions in debt due to nonpayment by government customers until August 2019, when the USVI government finally paid off its delinquent power bills. These fiscal challenges have made recovery implementation efforts that support resilience and modernization of the electric power grid even more challenging than they otherwise would have been.

Fuel Security Is a Key Element of the Virgin Islands Water and Power Authority's Contingency Planning

Planning for power system contingencies during extreme weather conditions—such as hurricanes, during which power outages can last from days to several weeks—is no easy matter. In the wake of Hurricanes Maria and Irma, the ability to access, transport, and store adequate supplies of fuel was difficult on all islands. In the event of an extended power outage, all sectors are heavily dependent on fuel resupply and delivery capabilities. This is not only because of the USVI's dependence on fuel for primary generation but also because of the USVI's need for fuel to power emergency generators. In St. Thomas, for example, the shortage of fuel shut down critical facilities that supported emergency and response operations. In addition, because of inadequate fuel supply and limited storage capacity, the islandwide WAPA power outage lasted more than three months. To address these challenges, federal and territory agencies, such as WAPA and VITEMA, started to identify critical facilities in need of backup generators. This necessitated the development of a procurement process and installation plans for those emergency generators and ongoing maintenance programs.

Interdependencies Among Energy and Other Infrastructure Systems Introduce Potential Vulnerabilities to USVI Energy Systems

Interdependencies among infrastructure sectors are critical to enabling the territory to provide a broad variety of essential services (DOE and DHS, 2010). Figure 7.4 illustrates critical-infrastructure interdependencies as defined by DHS (Cybersecurity and Infrastructure Security Agency, 2020). Interviews with various territory agencies suggested that such interdependencies are not yet fully integrated into recovery phasing and implementation. The loss of power in critical customer and infrastructure sectors has implications for the health and well-being of the public, causes damage to infra-

Figure 7.4
Critical-Sector Interdependencies on the Energy Sector

Communications	Sectors that need emergency internet, cellular power, and data communication services
Energy	Sectors that need to restore power supply, run cellular towers, monitor and control facilities, and support other communications
Emergency services, healthcare, and hospitality	Sectors that need immediate emergency response communications, public operating and warning systems, and, for emergency 911 calls, immediate housing facilities and health care
Transportation	Sectors that need immediate services to control the flow of dispatching public vehicles, railroad systems, and marine and air traffic
Water and wastewater	Sectors that need immediate water and wastewater services
Financial services	Sectors that need to run currency transactions and operate financial institutions and financial markets

structure and property, has environmental impacts, and inflicts significant economic costs.

In the event that a primary power system fails, backup generation is often employed as a standard contingency. As noted above, however, backup generation was not widely implemented across the territory prior to the 2017 hurricanes, and problems with the fuel supply chain impeded the reliability of available generators. Therefore, although various infrastructure services are contingent on power, the provision of electricity dependent on other infrastructure is as well. For example, ports and roads are needed to deliver fuel to WAPA power plants and backup generators. Infrastructure owners and operators work together in close partnership to coordinate disaster planning and recovery.

In addition, energy infrastructure is often colocated with other infrastructure systems (see Chapter Six). For example, underground conduits for distribution lines might

lie alongside water distribution or sanitary sewer pipes and telecommunication cables. Moreover, all of these systems might be placed underneath roadways. Hence, WAPA is a key actor in the territory's dig-once approach to infrastructure recovery and resilience (Government of the USVI, 2018). Given the management-capacity constraints that many of the territory agencies face within their own organizations, our interviews suggested, infrastructure agencies have had limited opportunity to effectively coordinate or collaborate with WAPA on recovery projects. As we noted in Chapter Six, the territory lacks a centralized project-tracking system that could enable more-effective coordination among agencies and identification of colocated projects. Although the need for coordination among territory agencies in itself could slow the implementation of undergrounding projects of high priority to WAPA, failure to coordinate could ultimately increase overall recovery costs for the territory if, for example, roads have to be excavated multiple times to access individual infrastructure systems. Similarly, the composite poles being installed throughout the territory to harden the T&D system will also support fiber-optic cables. This creates another need for coordination between infrastructure owners and operators to facilitate the efficient installation of poles and the services they support.

Navigating the Complexities of Federal Disaster Recovery Programs Slows the Implementation of Recovery Projects

As discussed previously, emergency recovery work focused on restoring electricity to critical infrastructure has largely been accomplished. Longer-term efforts for permanent recovery work are still underway. Recovery funding for permanent projects comes from both federal and nonfederal government sources. The cost share for permanent work is 90-percent federal and 10-percent nonfederal. However, complexities associated with the funding landscape and the need for local cost sharing have led to longer recovery times for the planning and implementation of permanent-work projects. For WAPA specifically, internal restructuring issues facing the utility led to additional lag times in making technical and financial decisions.

Some of the funding environment complexities stem from the fact that WAPA is eligible for multiple sources of federal funding, although the relevant funder for any given project is contingent on the characteristics and objective of the project. Under FEMA's PA program alone, project funding could fall under several assistance options, including 406 standard procedures, 428 alternative procedures under the Bipartisan Budget Act (Pub. L. 115-123, 2018), and the HMGP. Additionally, WAPA can receive recovery funding from HUD's CDBG-DR, USACE, USDA's Rural Development programs, NOAA, EPA, and DOI. For example, DOI has already funded a fundamental project from WAPA's strategic plan: upgrades to automated meter-reading technology, which replaces manual reading (Government of the USVI, 2019; WAPA, undated). Although this highlights the fact that multiple federal agencies can contribute to supporting recovery efforts—potentially expanding the pool of available resources—

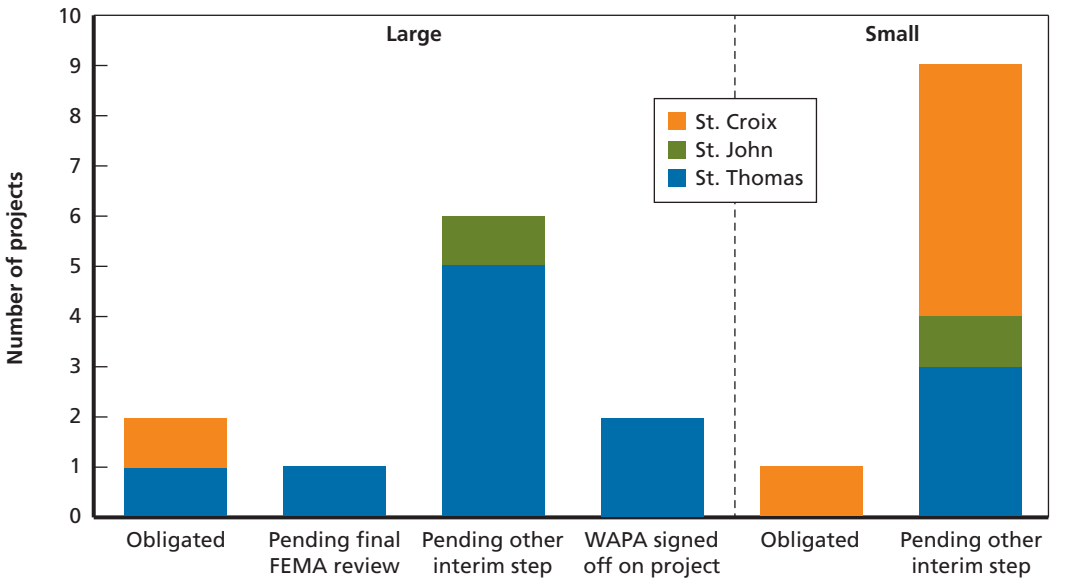
matching different federal agencies with projects can nevertheless lead to greater transaction costs than would be the case with a single funder.

Figure 7.5 shows the number of permanent-work PA projects included in FEMA's Grants Manager database as of February 18, 2020. Only three energy projects have been obligated, and, of the 18 nonobligated projects, only two have received applicant signatures, which is the final process step before FEMA approval and project obligation. Most WAPA permanent-work projects in the FEMA Grants Manager database are in St. Thomas. The majority of permanent repair work is for the St. Thomas electrical distribution substation feeders at various substation sites, including RHPP, Donald C. Francois, Tutu substation, and East End. For the energy infrastructure projects that have made it to the applicant signature stage, it has taken 249 days, on average, from project creation to project applicant signature.

Old Energy Infrastructure and Constraints on Operations and Maintenance Have Created Challenges for Energy Reliability and Efficiency

Prior to the 2017 hurricanes, the USVI was already challenged with old electrical infrastructure significantly past its engineered design life. This outdated infrastructure also resulted in significant WAPA debt of about $22 million in unfunded pension liabilities, long-term debt commitments of $265 million, and high energy prices. The territory is heavily dependent on inefficient, unreliable, and costly thermal generating

Figure 7.5
Virgin Islands Water and Power Authority Public Assistance Energy Projects, by Project Size, Island, and Public Assistance Funding Process Step



SOURCE: FEMA Grants Manager database, February 18, 2020.

units installed more than 35 years ago. The outdated units are located at RHPP on St. Thomas, and the emergency diesel-generating unit is on St. John. Old generation facilities on St. Croix are located at the Estate Richmond site on the north shore of the island, near Christiansted. The IRP report conducted an expansion assessment to diversify the territory's generation portfolio mix and has recommended that WAPA make policy decisions to develop a retirement schedule for its old and unreliable units. Old T&D infrastructure plays a major role in pre- and posthurricane challenges. The territory was experiencing power losses because of old and poorly designed overhead T&D lines. There are ongoing efforts to upgrade T&D facilities that take advantage of funding opportunities from FEMA and HUD.

Opportunities to Use Stakeholder Outreach to Communicate Virgin Islands Water and Power Authority Strategy and Build Community Support Have Been Missed

Because electricity is critical to the whole of the USVI, government agencies, residents, and private businesses are all stakeholders of WAPA, its operations, and its performance. All those stakeholders noted the history of reliability challenges at WAPA and the high cost of electricity. A subset of those stakeholders also pointed out that limited public engagement and communication by WAPA has left stakeholders with limited understandings of the source of WAPA's reliability and fiscal challenges and the actions required to transition USVI to a more modern and integrated electrical system. Greater investment in public engagement could assist in identifying common interests among WAPA and its stakeholders and build a more collaborative approach to developing a more reliable and resilient energy system.

Box 7.4
COVID-19 and Energy

- The COVID-19 pandemic poses a new challenge to the implementation of recovery projects in the energy sector. These challenges generally mirror those for infrastructure more broadly (e.g., see Box 6.3 in Chapter Six). This includes disruption of supply chains that bring both equipment and materials to the territory. Of particular importance is the disruption of fuel deliveries to the territory for both primary and backup generation. Delays in the procurement of fuel or other equipment could enhance short-term vulnerability of the energy system, particularly given the pending onset of the 2020 hurricane season.
- The availability of workers to administer and undertake recovery project work is likely to be significantly constrained. Although WAPA's operations are considered essential services, the administration of recovery projects by WAPA, FEMA, and other contractors will still be affected by the pandemic through, for example, stay-at-home orders. In addition, should the rate of COVID-19 infections in the territory accelerate and start to affect WAPA's workforce, this could pose more-significant challenges to energy security.
- Third, although WAPA has a skilled workforce, the scale of the projects identified for the energy sector will invariably require contractors from Puerto Rico or the continental United States. However, getting contractors to the territory and commencing work on new projects—or continuing work on existing projects—will be more challenging in the event that COVID-19 becomes a significant threat.

Management Capacity to Meet Recovery Needs

Given the variety of barriers to WAPA implementing its vision for recovery, success will be contingent on WAPA bolstering its management capacity to meet recovery needs, including workforce- and stakeholder-management issues similar to those faced by other USVI agencies and sectors. Chapter Two provides additional details on the agency's budget and management-capacity burden.

The Ability to Sustain a Skilled Energy Workforce Might Encounter Headwinds

WAPA, across its water and utility services, is facing significant workforce challenges. These challenges are a microcosm of those experienced by the territory more broadly and discussed in detail in Chapter Two. To place the challenges in the context of infrastructure systems, this includes developing and maintaining a skilled workforce in renewable energy, as well as technological advancement in metering and control monitoring systems. We heard from various meetings with government and territory officials that experienced WAPA managers and engineers—along with skilled electric and water utility workers—are departing the territory. Recruiting, hiring, developing, and retaining a professional workforce with sufficient skills and knowledge require significant effort and attractive employment packages. Moreover, WAPA faces the retirement of highly skilled engineers and professionals: According to the WAPA *2021 Strategic Plan* (WAPA, undated), in the next three to five years, a significant percentage of WAPA employees will be eligible to retire.

Recommendations

Although barriers exist to the USVI successfully implementing its vision for a more resilient and sustainable energy system, these barriers are not insurmountable. The majority of barriers, although linked to a long legacy of challenges, are potentially short term in nature. For example, there are interventions that can address challenges associated with WAPA's finances, the available workforce, or the capacity of the agency. This section therefore identifies recommendations of actions that could assist in overcoming barriers, thereby enabling a more rapid and efficient recovery.

Upgrade the Electric System Infrastructure

Goal	Provide proactive forward planning in upgrading the energy infrastructure and modernizing the way it operates and performs for a better quality of service to USVI customers.
Rationale	Extreme weather events, such as hurricanes, pose significant risks to the territory's energy infrastructure, the loss of which contributes directly to power outages (DOE, 2017).[3] The structure of the USVI's grid, composed of two separate networks (one each in St. Thomas and St. Croix), poses challenges and costs with respect to maintaining an adequate level of generation and demand balance. Multiple priority infrastructure projects are in various stages of design, approval, or implementation. However, ongoing monitoring of the status of those projects is needed to align capital investments and recovery projects with desired levels of system performance. A few transmission and distribution lines have been buried underground.[4] Prior to the 2017 hurricanes, WAPA started to harden the electricity infrastructure and completed several programs, such as diversifying its energy portfolio by increasing the share from renewable energy, installing microgrids and distributed energy resources of smaller generation units, and improving energy efficiency for its customers. In 2010, WAPA completed hazard-mitigation projects for its electric systems, which were funded through FEMA (Hawkins Delafield and Wood, 2010). Within the $850 million request to upgrade the energy sector in 2017, WAPA estimated and requested about $300 million to meet its mitigation, reliability, and resilience needs (Hawkins Delafield and Wood, 2010).
Implementation considerations	WAPA is undertaking efforts to harden the territory's electric systems to withstand severe weather events. Such efforts include replacing wooden poles with composite poles on various T&D overhead lines. In this regard, we recommend that the territory do the following: • Continue considering alternative technologies, such as renewable energy with energy-storage capabilities, to substitute old fossil fuel and units and increase system flexibility. • Enable regulations for distributed generation, such as rooftop solar, that provide financial platforms and incentive programs to allow residents to sell power back to the grid. • Continue replacing traditional wooden poles with composite poles on various key T&D feeders on all islands. • Support microgrid investment projects that serve as small generation facilities. • Apply additional energy-efficiency and reliability standards to reduce energy demand and keep power outages at the lowest possible level of frequency and duration. • Perform routine and necessary maintenance of T&D systems and their components to mitigate risks involving forced outages. • Upgrade T&D lines by investing in underground cables to key feeders serving numerous critical customers and facilities. • Develop power purchase agreements with suppliers of fuel oil and tourism industry customers, such as hotels and resorts, to increase the system's efficiency and enable cogeneration opportunities.
Time frame	Longer term, 2–5 years
Leading entities	WAPA, FEMA, DOI, DOE, the National Renewable Energy Laboratory, and other nonprofit organizations and local territory agencies would be the leading entities.

[3] DOE defines *reliability* as "the ability of the system or its components to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components" (name redacted, 2018, p. 1).

[4] The team was unable to get more information from WAPA about grid mapping, locational, or scheduling priorities of the underground project.

Enhance Mechanisms for Project Coordination Among USVI Agencies

Goal	Improve cooperation and coordination among USVI government agencies, particularly with respect to how energy project implementation interacts with other infrastructure projects.
Rationale	Given that the provision of electricity services is fundamental to recovery efforts across multiple agencies and federal assistance applicants, aligning planning and investment in the energy sector to the needs of energy stakeholders is an important mechanism for maximizing the benefits of those investments in the territory. Improving coordination among agencies and stakeholders is a low-cost endeavor, relative to the size of capital investments being made in the USVI electricity system. However, various barriers exist, not the least of which is a culture of governance in the USVI in which agencies, such as WAPA, operate autonomously rather than in close coordination with other agencies.
Implementation considerations	Implementing this goal could therefore begin by doing the following: • Map critical connections between WAPA recovery projects and those of other infrastructure agencies or stakeholders. This could be done through a series of breakout discussions with local agencies to ensure that their priority list is consistent with emergency management restoration and permanent plans. Such mapping should consider all critical facilities, such as hospitals, airports, schools, and water and wastewater systems. • Develop a cross-agency task force to specifically facilitate coordination on energy recovery projects to address interdependencies with respect to co-location of energy and other infrastructure and the management of trade-offs in project design features. The task force should assess gaps in existing emergency management, security, and hazard-mitigation projects and provide a resilient cross-agency framework of recovery initiatives. • Enhance WAPA outreach to its customers and stakeholders using greater communication platforms to enable understanding of the territory's future energy system and billing rates. • Share recovery and risk-mitigation responsibilities among WAPA, critical customers, and the government during severe events. There should be close partnerships to coordinate and prioritized disaster planning and recovery efforts.
Time frame	Near term, 1–2 years
Leading entities	Such coordination could be facilitated through a whole-of-government initiative led by the governor's office. VITEMA or ODR could be recruited to lead coordination on behalf of the government. However, significant buy-in would be needed from WAPA and other infrastructure agencies, as well as private businesses and civic organizations.

Implement Improvements to the Virgin Islands Water and Power Authority's Asset Management Systems and Operations and Maintenance Protocols

Goal	Implement an enhanced asset-management system for WAPA to improve the efficiency of O&M for energy assets; this would enable early detection of faults and enhance energy assets' longevity.
Rationale	Asset-management systems are now widespread in infrastructure-intensive industries and operations as a means of tracking assets, their depreciation, and needed maintenance, recapitalization, or retirement. Increasingly, asset-management systems are technology-dependent, creating both new opportunities and new challenges for their effective deployment. Improvements to WAPA's asset management could support day-to-day operational decisionmaking, strategic planning and investment, and emergency management efforts. Understanding assets, their characteristics, and their performance is therefore essential for enhancing system optimization and efficiency to reduce operating costs.
Implementation considerations	Costs associated with implementing an enhanced asset-management system are potentially significant. Steps include the following: • Update existing inventories of WAPA assets and the acquisition of new software systems for asset management. • Train staff in asset-management best practices. • Train staff in exercises that address performing emergency and contingency operations with loss of power. • Identify needs and requirements to effectively and efficiently perform procurement actions. Some of these activities could be supported with disaster-recovery or mitigation funds (e.g., FEMA or CDBG-DR funds), but sustaining an asset-management program over the long term would likely have to come out of WAPA's operating budget, which is already significantly strained.
Time frame	Near term, 1–2 years
Leading entities	Implementing an asset-management system should be led by WAPA in conjunction with DPP, which is tasked with managing all government property.

Restructure Debt and Improve Fee Collection to Boost the Authority's Revenue While Providing Better Service

Goal	Improve WAPA's financial performance; improve the consistency of its payments to creditors and contractors; and enhance revenue flows to support capital investment, operations, and maintenance.
Rationale	The USVI faces challenges of high purchasing and shipping costs for materials, fuel, and equipment; this challenge is combined with infrastructure operating past the end of its intended design life. These factors contributed to a relatively high cost of energy for its residents.
Implementation considerations	WAPA should proceed with enhanced reconciliation of debt and restructuring of energy bills and explore options and scenarios to balance fair electricity rates for customers with the need to enhance revenue. Moving toward an approach of rigorous financial reform might include establishing • financial policies and best practices for accountability measures • forecasting tools to meet customer needs and expectations • other essential market obligations, such as increased transparency, efficiency, and productivity • redesigned power purchase agreement process to attract capital investment for the utility to add more cost-effective renewable capacity and qualifying facilities.
Time frame	Near term, 1–2 years
Leading entities	WAPA, the USVI government, USVI Public Services Commission, and WAPA bondholders would be the leading entities.

Develop, Promote, and Maintain a Skilled Energy Workforce

Goal	Develop a sustainable, skilled workforce to implement ongoing structural improvements, keep up with necessary O&M, and expedite disaster-recovery and implementation efforts.
Rationale	WAPA is regarded as having a competent, professional workforce. However, the scale of recovery in the energy sector has placed new demands on WAPA for labor. Moreover, with new fossil and renewable-energy generation units being installed and new microgrids and battery storage being planned, the technical skills needed by WAPA are likely to change with changing infrastructure. Over time, retirements and the potential for out-migration of trained staff could introduce shortages of skills that might require interventions to adequately ensure succession planning.
Implementation considerations	Developing a sustainable skilled workforce will necessitate the development of various programs including those that do the following: • Create and maintain effective and efficient project and asset management, and O&M processes. • Hire and keep skilled workers with incentive packages. • Implement organizational management-capacity approaches to retain and manage contractors involved in the implementation of various recovery investments, capital investments, or both. • Provide effective training and leverage lessons learned to support continuous improvement.
Time frame	Near term, 1–2 years
Leading entities	Implementing such programs is recommended for WAPA and the Virgin Islands Energy Office with technical support from DOE.

Update the Assessment of Grid Resilience Needs and Improve Capacity to Respond to Those Needs

Goal	Enhance the capacity of WAPA and other territory agencies to assess the resilience of the USVI's energy infrastructure and operations and the opportunities and constraints associated with different resilience investments.
Rationale	Resilience addresses the performance of the power system under severe conditions, such as extreme natural disasters (e.g., hurricanes). It entails a certain amount of redundant capability in the power generation, transmission, and distribution functions. Given the dependence that emergency response, basic health and safety infrastructure, and economic activities have on power being provided, additional resilience measures will be required to ensure that the grid can both withstand future hazards and recover quickly from failure. However, developing effective resilience strategies and targeting investments necessitate the undertaking of assessments and analyses that build understanding of potential vulnerability and opportunities for enhancing resilience.
Implementation considerations	A rigorous resilience assessment would include consideration of • reinforcing fuel supply alternatives by increasing distributed energy resources and distributed storage resources for severe natural emergencies • developing a partnership emergency-response platform with critical customers, the federal government, and interdependent sectors to expedite power outage emergency recovery times • expanding opportunities for workforce training during emergencies to provide more-robust assessment to emergency situations • using helicopters on islands to provide emergency support to remote areas with difficult access sites • evaluating options for hardening and upgrading critical T&D systems, including composite poles, advanced metering technologies, and distributed generation and renewable-energy integration • continuing planning for expanding underground cables • evaluating options for digital meters to provide real-time information on critical loads during extreme events. In addition, resilience assessments need to consider options for funding capital infrastructure. This could include a combination of efforts to enhance the financial stability of WAPA, new investments by the federal government, various incentive programs, and public–private partnerships.
Time frame	Longer term, 2–5 years
Leading entities	Implementation of these studies would be led by WAPA with technical support from DOE and financial support from FEMA PA and mitigation programs.

CHAPTER EIGHT

Housing

Box 8.1
Key Findings About Housing

- The hurricanes damaged homes and displaced residents, exacerbating existing issues, such as a lack of sufficient public housing and high demand for existing housing stock.
- The USVI's housing needs so far have been addressed through a combination of services offered through nonprofits, planning for the restoration of public housing through the FEMA PA program, and payouts from FEMA Individual Assistance (IA) and private insurers.
- The territory leadership's vision for recovery in the housing sector has the following parts:
  - repairing damaged private homes
  - replacing damaged public housing
  - ending homelessness and providing housing
  - building new housing in accordance with resilience standards and enhancing community resilience
  - employing housing recovery workers.
- Three key barriers stand in the way of implementing the vision for housing recovery:
  - Housing repairs (for both private and public housing) are delayed and impeded for several reasons.
  - The contractor and builder workforce being limited results in higher wages and construction prices.
  - A lack of property records leads to delays and impedes assistance.
- The territory also faces management-capacity challenges:
  - The VIHFA will have to manage the flow of nearly $2 billion in funds to address disaster-related impacts.
  - VIHA faces the challenges of absorbing recovery funds and aligning funding from different sources for particular projects.
- To address these challenges, we recommend the following:
  - Speed up delayed repairs and repair all eligible homes by augmenting government capacity through
    - additional training on criteria for EnVIsion Tomorrow
    - technical assistance beyond just compliance and support to community-based groups
    - creation of a territorywide builders' association
    - access to capital before full action-plan approval
    - updates to the contracting process
    - clarification of property ownership and location needs.
- Increase the supply of affordable housing by
  - implementing tenant protections and supply-side incentives
  - increasing the use of temporary housing for recovery workers
  - leveraging federal and private funds for homelessness reduction, following best practices
  - rehabilitating vacant government-owned properties.

The USVI housing sector faced challenges of affordability and availability even before Hurricanes Irma and Maria damaged housing in 2017. The vast majority of homes suffered damage from the hurricanes, which created challenges for USVI resi-

dents and recovery workers alike. Housing is not just about four walls and a roof—its sustained existence supports individual and overall community health. Housing stability, quality, safety, and affordability are associated with positive health and educational outcomes (Mueller and Tighe, 2007; Taylor, 2018; Wan and Su, 2016).

Housing recovery involves rebuilding housing units, creating new infrastructure, and maintaining and improving the safety and health of homes (e.g., ensuring that homes are free from mold). Rebuilding housing units, especially if carried out sustainably and equitably, lays the foundation for other positive social outcomes. If new and rebuilt housing is vulnerable to the next disaster or leaves out particular social groups (e.g., the elderly), then housing recovery might not have the promised social benefits of better health, education, and opportunity. After a disaster, jobs and housing are often the leading indicators of recovery, but the recovery of these sectors depends considerably on power, transportation, and, ultimately, schools and health care (Comerio, 1998; Comerio, 2014).

In U.S. disaster recovery, the private market is expected to provide most of the financing and tools for recovery, with supplemental assistance from states, territories, and localities and targeted assistance from FEMA, congressional appropriations administered by HUD through the CDBG-DR process, and loans administered by SBA. Property owners are responsible for using their own funds, insurance, and limited federal aid to rebuild. A balance of government assistance and individual responsibility is intended to foster a full recovery without long-term dependence on government assistance. The system works well for those who are insured, and insurance usually delivers money more quickly than government aid does (Mukherji, 2011). The system works less well for people in rental units or who lack land titles or personal savings. Homeowners with flood insurance, including National Flood Insurance Program policies, can receive more money than those who seek help only through FEMA's IA program (Montano and Savitt, 2018).

Government assistance and insurance compensation are often *loss-based*, with the amount of compensation varying according to the value of what was lost (Tafti and Tomlinson, 2019). For homeowners, this is not always sufficient to cover the cost of replacement. The assistance typically does not address renters. Therefore, some scholars argue for *need-based* assistance in addition to loss-based assistance (Mukherji, 2011; Mukherji, 2017).

In this chapter, we describe the current situation of the USVI housing sector. We first set the stage by discussing damage to the built environment, implications for related social changes, and recovery accomplishments to date. We then describe the territory's vision for housing moving forward and identify barriers and gaps to implementing the vision. Last, we present some potential recommendations for addressing those needs. Box 8.2 describes the methods used in this analysis and the limitations of those methods.

Box 8.2
Methodology and Limitations on the Analysis of Housing

Methods Used in This Analysis

- HSOAC researchers used a mixed-method approach to determine the vision, status, barriers, and gaps for hurricane recovery in the housing sector.
- The project team reviewed prestorm policy documents, agency action plans, recovery plans, and public officials' statements. Supplemental published information was gathered from media and commercial reports. Additional administrative data from FEMA were analyzed, including IA and PA aggregated data and project-tracking metrics from FEMA's Grants Manager database.
- Data and document review were supplemented by in-person and teleconference discussions with key housing stakeholders. The HSOAC research team reached out to as many stakeholders in the territory as could be identified and conducted discussions with 26 public officials and nonprofit-sector leaders and observed one nonprofit organization's meeting related to housing repair. Notes were taken without attributing the comments to specific individuals.

Limitations of This Analysis

- Data availability limits our understanding of the USVI housing market. Several standard housing research tools are not available or not published for the territory. Omissions include the annual American Community Survey for demographic and household data and Zillow's Home Value Index for housing market data.
- The HSOAC team used the most recent version of VICS—which is similar to the American Community Survey but administered by UVI—and published with a significant temporal lag.

Setting the Stage

Before the Hurricanes

Overall Housing Stock

Like many disasters, the hurricanes accentuated issues that predated the disaster. The territory's hilly islands offer limited terrain suitable for building, and modest incomes and high housing costs resulted in housing affordability stress. Many of the territory's residents depended on subsidized or public housing before the storm, and there were waiting lists for existing public housing slots. The territory had a greater proportion of renters than the U.S. average, and these residents depended on property owners to initiate repair of rental properties. The characteristics of the USVI housing stock are presented in Table 8.1.

Building Codes

The territory's building codes were upgraded in 1996, within a year of Hurricane Marilyn. Evaluation by a FEMA Mitigation Assessment team found that buildings that were repaired or constructed under the post-Marilyn building code showed far less roof damage in general and that no structural roof damage was found in roofs installed through a post-Marilyn HMGP-funded program (FEMA, 2018b). However, these strong codes would have covered only a minority of homes; 31.9 percent of units were built in or after 2000, the year of the first post-Marilyn survey.

Rental Housing Stock

The territory's renters faced affordability problems even before the 2017 hurricanes. The median (nonzero) rent paid in renter-occupied units was $949 per month in 2015, which was 33.1 percent of median gross income. Alternatively, 44.9 percent of the territory's rent-paying households were cost-burdened, according to federal definitions (i.e., gross rent exceeding 30 percent of income). The territory's housing stock reflected racial disparities (see Table 8.1), with higher median home values and homeowner's insurance take-up rates among white homeowners. These predisaster financial disparities affect recovery because of the lack of liquidity or insurance payouts to fund repairs.

Public Housing

In addition to affordability stress, there was a shortage of available public housing units. In 2015, the most-recent data available, there were 845 households on the waiting list for existing units and more than 400 households on the waiting list for future units—specifically, the Louis E. Brown community on St. Croix (pictured in Figure 8.1). Overall, public housing supply was 3,900 units (VIHA, 2015).

Building Materials Used

The building materials that are available on the island also shape the path for recovery. A large majority of housing structures use concrete-wall and metal-roof construction, making the territory's housing stock more similar to that of Puerto Rico than to that of the continental United States. The mix of building materials sought after a hurricane therefore is likely to differ from the mix in the continental United States. Additionally, the small market for homes in a territory of approximately 100,000 people (Eastern Caribbean Center, 2018), widespread lack of insurance coverage, and ongoing affordability pressures present financial challenges that affect the pace of recovery and cost of housing.

Impact of the Hurricanes

The hurricanes damaged homes and displaced residents, leading to possible secondary effects in health, education, and employment. Storm damage led residents to move in with family, friends, and neighbors or simply live in damaged housing. In addition, housing damage had secondary effects on livelihoods, education, and health. Other chapters of this report (see Chapters Eleven and Twelve) explore how secure housing is an important ingredient for educational achievement and well-being.

Structural Damage

High winds damaged housing structures across the territory, while storm surge and rain caused less damage (FEMA, 2018g), as shown in Table 8.2. St. John and St. Thomas bore the brunt of Hurricane Irma, which was powerful enough to tear off roofs and bring down walls. Days later, Hurricane Maria caused similar structural

Table 8.1
Prestorm Characteristics of the USVI Housing Stock

Category	Housing Characteristic	Number	Percentage of Total
Overview	Total units	58,329	100
	Number of occupied units	42,992	73.7
	Owner-occupied	20,107	46.7
	Renter-occupied	22,885	53.3
	Vacant	15,337	26.3
Tenure	Number of mortgaged units	6,607	15.4
	Number of units owned free and clear	13,500	31.4
	Number of units rented with cash payment	18,575	43.2
	Number of units rented with no payment	4,310	10.0
Age	Number of units constructed 2000 or later	13,718	31.9
	Number of units constructed 1999 or earlier	17,253	40.1
	Number of units with unknown construction date	12,022	28.0
Finance and insurance	Number of cost-burdened households	10,281	44.9
	Median gross monthly rent, in dollars	949	Not applicable
	Number of owners with mortgaged homes	6,607	40.3
	Median value of home, in dollars	199,849	Not applicable
	Black household median value, in dollars	197,265	Not applicable
	White household median value, in dollars	442,201	Not applicable
	Other-race household median value, in dollars	150,568	Not applicable
	Number of homeowners with homeowner's insurance	6,531	39.8
	Black owners with homeowner's insurance	4,926	37.1
	White owners with homeowner's insurance	1,261	66.7
	Other-race owners with homeowner's Insurance	344	27.8

SOURCE: Eastern Caribbean Center, 2018.

NOTE: Percentages are of total occupied units for the tenure and age categories, and second-level percentages are of the parent-level total. Mortgaged and homeowner's insurance percentages are of VICS-specified owner-occupied housing units by race (owner-occupied one-family houses on less than ten acres and without a business or medical office on the property). Cost-burdened percentage is of all renter-occupied units by race, using federal definition of cost burden (gross rent exceeding 30 percent of income).

Figure 8.1
Examples of Subsidized Housing in St. Croix, Virgin Islands

Photos by the authors, 2020.
NOTE: On the left is Sunny Isle Housing, St. Croix, Virgin Islands; on the right are the Louis E. Brown Senior Villas, Fredricksted, St. Croix, Virgin Islands.

damage on St. Croix, and its outer rain bands caused further water damage to structures on St. John and St. Thomas.

In all, at least 23,890 households sustained damage to a primary residence. Overall, registrations for FEMA IA included 12.4 percent of the territory's housing stock in the major or severe damage categories—representing more than 5,000 housing units—and 41.8 percent of the territory's housing units in the minor damage category. This is a lower bound on the number of households suffering damage, because households that did not formally register with FEMA are not included (VIHFA, 2018). Many residents might not have applied for FEMA assistance because they lacked title and ownership records, the assessed damage was too severe to qualify, or they might have been displaced.

The most recent known translation of this physical damage to financial need was compiled by VIHFA in its CDBG-DR action plan, which was last updated in the spring of 2019. Using counts of damaged homes by category and damage category multipliers as defined by HUD,[1] VIHFA estimated that the recovery funding need for the territory's housing sector was approximately $2.504 billion. Funding from FEMA, SBA loans, National Flood Insurance Program, and private insurance met approximately $1.357 billion of the need. Additionally, $72 million in unmet need is set to be addressed by tranche 1 of CDBG-DR funds and $225 million through tranche 2. Thus, this accounting method estimates remaining unmet need for housing damage at approximately $850 million (VIHFA, 2019a). Additional federal funding,

[1] The HUD damage category multipliers are (rounded to the nearest thousand): $13,000 for minor-low, $50,000 for minor-high, $104,000 for major-low, $127,000 for major-high, and $151,000 for severe.

Table 8.2
Damage to Homes Qualifying for FEMA Individual Assistance

Damage	Number of Units	Percentage
By tenure and severity		
Total occupied	23,890	55.6
Owner-occupied	14,904	74.1
Minor damage	12,394	83.2
Major damage	1,955	13.1
Severe damage	555	3.7
Renter-occupied	8,397	36.7
Minor damage	5,567	66.3
Major damage	2,703	32.2
Severe damage	126	1.5
Public housing	589	14.8
Major and severe, by island[a]		
St. Croix	1,779	6.7
St. John	2,802	9.9
St. Thomas	568	15.8

SOURCE: VIHFA, 2019a; USVI Hurricane Recovery and Resilience Task Force, 2018.

NOTE: First-level percentages are of the territory total units for the category. Second-level percentages are of the first-level total.

[a] Imputed by the authors. Lack of precision in territory reporting might lead to minor inconsistencies comparing one section of the table with another.

in the form of CDBG mitigation funding, will contribute $774 million to disaster-mitigation activities across many sectors. The fraction of that money contributed to housing investments is not yet publicly available (HUD, 2019a). Overall, the public and private funding picture suggests that most of the needed recovery funds have been or will be distributed to the territory. But from an implementation point of view, managing those resources and directing them to medium- and long-term housing and housing-related social issues are challenging.

Homelessness

The hurricanes initially increased the number of people in the USVI without homes and created an additional strain on the USVI housing stock due to increased demand from the recovery workforce. The annual point-in-time count census of people experiencing homelessness showed a spike from 381 in January 2017 to 486 after the hurricanes in January 2018, largely as a result of an increase in the emergency shelter population following the 2017 hurricanes (HUD, 2017; HUD, 2018). From January 2018 to January 2019, the emergency-shelter population decreased, as did the population of people who were without both shelter and home. Nevertheless, many territory residents were still without homes: The unsheltered population remained at 232 people, while 26 used emergency-shelter beds and 56 were in transitional housing spaces (VIHFA, 2019b). HSOAC discussion participants from the nonprofit sector observed that unsheltered homelessness has become more visible since the hurricanes and that the point-in-time count might have understated the number of homeless because of the difficulty in accurately counting people lacking shelter on a single day.

Homelessness is associated with increased mortality and illness (Montgomery et al., 2016; Roncarati et al., 2018), causing spillover concerns for the physical and mental health care systems. Housing challenges also stress the territory's educational and economic systems. School principals and counselors described how some teachers' living conditions deteriorated; teachers reported having their homes damaged and destroyed, seeing mold in their homes, living in groups with relatives because their homes were damaged, and facing a difficult and costly process to repair their homes. These poststorm housing conditions placed mental strain on teachers and contributed to shortages of qualified educators in the territory. The VIDE has lost around one-fifth of its teacher workforce since 2017 (see Chapter Eleven), with school principals reporting that living conditions—including the loss of housing—were the reason for teachers leaving the islands. Without an adequate pool of educators, the workforce-development pipeline in the territory is stunted.

Impact on the Tourism Economy

The lack of affordable housing has also affected the economy. Tourism is the territory's economic engine, and tourism operations are predicated on seasonal workers' ability to find affordable accommodations. In HSOAC discussions, tourism service providers indicated that they often hire workers from the continental United States to come to the territory for the winter season. As rental costs have risen, tourism providers report that fewer people are willing to come to the territory, and, as a result, providers have cut back on services, such as restaurant shifts.

Competition with Other Land-Use Priorities

Finally, the siting of housing units competes with other land-use planning priorities, and a comprehensive land-use planning process will need to account for the need for affordable and resilient housing and the needs of other sectors. Land-use planning has

the potential to inform choices about the territory's development of its natural and built environment and, ultimately, build resilience (Burby et al., 2000). The territory participates in the federal Coastal Zone Management (CZM) program designed to preserve coastal resources (Office for Coastal Management, 2018). DPNR is the lead agency for the program, and it is supported by NOAA.

Recovery Progress Since the Hurricanes

USVI housing recovery has made use of multiple services. So far, the USVI's needs have been addressed through a combination of services offered through nonprofits, planning for the restoration of public housing through the FEMA PA program, and payouts from the FEMA IA program and private insurers. In the first quarter of 2020, the territory transitioned from the FEMA STEP program to a HUD-funded EnVIsion Tomorrow housing recovery program. Although STEP was intended to support limited repairs, EnVIsion Tomorrow is a more comprehensive housing recovery program funded by the CDBG-DR appropriation and administered by the VIHFA.

Since Hurricane Irma and Hurricane Maria in 2017, the FEMA IA program processed applications from 23,301 households, representing 54 percent of all permanently occupied residential structures in the territory (VIHFA, 2019a). This is a lower bound on damage because some homes had damage too severe to qualify and, in other cases, owners were unable to prove ownership or provide clear title. USVI officials estimate that 85 percent of homes suffered damage (VIHFA, 2018).

Although disaster recovery presents challenges, the storm damage and associated recovery also create an opportunity to remake the territory's housing in a more resilient, sustainable, and equitable fashion (Comerio, 2014). After Hurricane Marilyn in 1996, the territory designed and adopted newer and much stronger building codes (Davidson, Picciano, and Lehman, 1996). At the time, some residents replaced damaged wooden roofs with concrete ones using SBA loans (Morrow and Ragsdale, 1996). Today, the territory has building codes comparable to continental U.S. standards, but it faces the competing demands of financing and implementing repairs at the same time that it is trying to house recovery workers across the island.

Much private housing has been repaired through insurance and public support. After the 2017 hurricanes, federal government funding mechanisms supported the repair of private homes. Specific programs included FEMA IA awards, SBA loans, and National Flood Insurance Program payouts. Private insurance also funded repairs to an as-yet-undocumented number of homes. Funding obligated or disbursed by government programs amounted to $1.121 billion as of August 2018 (VIHFA, 2019a). However, HSOAC discussions revealed that some people were confused about eligibility and sought clarity on requirements.

Aside from the usual response and recovery actions, FEMA's STEP program was authorized to support permanent (rather than strictly temporary) improvements. In total, STEP had funded at least $235 million in repairs as of August 2018 (VIHFA,

2019a). The FEMA PA-funded STEP program officially ended on April 15, 2019, although the closeout process continues. In the end, 7,381 homes received repairs (FEMA, 2013; FEMA, 2017; U.S. Government Accountability Office, 2019b). The program repaired walls and roofs and rebuilt electricity and plumbing while people remained in their homes. HSOAC discussions with residents, contractors, NGO representatives, and territory officials suggested that some repairs were of low construction quality and might not be durable for the long term.

The territory has also made progress in processing HUD funds. Specifically, it has submitted and amended an action plan for two tranches of congressionally appropriated CDBG-DR funds. A primary aim is implementing homeowner and renter rehabilitation and reconstruction programs. As of 2019, $85 million has been allocated to these programs—with $15 million in tranche 1 and $70 million in tranche 2. Using planned per-household rates (HUD, 2019b), we estimate that the program will repair at least 634 units, for an average investment of approximately $134,000 per unit.[2] Besides rehabilitation and reconstruction, CDBG-DR tranche 1 and 2 funds will also be invested in subsidized new construction units for sale to low- and moderate-income first-time buyers, at a cost of $50 million for 140 projected units, or $357,000 per unit, in projected cost.

Disaster-recovery funds will support public and affordable-housing repair. The FEMA PA program will fund $96 million in repairs to public housing. The majority of the funding, $73 million, will go toward replacing the Estate Tutu Apartments community on St. Thomas. In addition, CDBG-DR investments will fund public and affordable-housing developments, investing $72 million for 720 projected units, or $100,000 per unit. Additionally $90 million is planned for supportive housing and sheltering, resulting in 258 projected units at $349,000 per unit (HUD, 2019b).

Table 8.3 summarizes planned CDBG-DR investments for housing recovery in both private and public units. Overall, the HSOAC team estimates that CDBG-DR investment will result in the reconstruction, rehabilitation, or new construction of 1,747 units. This equates to an average cost of approximately $170,000 per unit across the five categories of CDBG-DR programs. The number of households and housing units with remaining unmet needs is unknown, but it is likely quite large. Accordingly, the CDBG-DR program could likely serve more households if the per-unit cost were kept lower, such as by allocating resources to rental rehabilitation rather than new-home construction.

[2] The per-unit planned investment in owner-occupied homes is approximately $285,000 to $296,000, while the per-unit planned investment in renter-occupied units is approximately $58,000.

Table 8.3
Planned Community Development Block Grant Disaster Recovery Investments for Housing Recovery

Program	Tranche 1 and 2 Funding, in Millions of Dollars	Projected Number of Households Served	Projected Per-Unit or Per-Household Cost, in Dollars
Homeowner Reconstruction and Rehabilitation	60	204	294,000
Rental Reconstruction and Rehabilitation	25	425	59,000
New Construction Homeownership Opportunity	50	140	357,000
Public and Affordable Housing	72	720	100,000
Supportive Housing and Emergency Shelters	90	258	349,000
Total	297	1,747	170,000 (average)

SOURCES: VIHFA, 2019a; VIHFA, 2019b.

NOTE: The projected number of households served is computed by assuming that tranche 2 funds will serve proportionally the same number of units as tranche 1 funds. Projected investment is computed by dividing projected households served in tranche 1 by funding in tranche 1. Cost projections are rounded to the nearest $1,000. The average projected per-unit or per-household cost, in dollars, represents the sum of tranche 1 and 2 funding divided over the projected number of households served.

Recovery Directions

The territory's government and nonprofit sector have offered plans and aspirations that add up to a vision for housing recovery in the next decade, addressing storm damage and long-term challenges. This vision, which is based on existing documentation and discussion with stakeholders, is shown in Box 8.3. We discuss each of these components in this section.

Box 8.3
Recovery Directions for Housing

- Repairing damaged homes
- Replacing damaged public housing
- Ending homelessness and providing housing
- Building more-resilient new housing
- Housing recovery workers

Repairing Damaged Private Homes

In 2020, the territory will begin to see repair construction from the CDBG-DR–funded EnVIsion Tomorrow housing recovery program, which is intended to meet the needs of some residents whose homes were not completely repaired or who did not qualify or register for STEP (Government of the USVI, 2019). As of January 2020, approximately 1,500 homeowners had registered for EnVIsion Tomorrow, and the territory prequalified 42 contractors to perform repairs (Bryan, 2020b). The territory's authorities hope additional homeowners will sign up for the program in the coming months. EnVIsion Tomorrow will restore hurricane-damaged homes of U.S. citizens and residents who meet HUD requirements of low to moderate income or urgent need who can prove ownership of a primary residence as of September 2017 (EnVIsion Tomorrow, undated). The program also offers repair assistance to landlords who rent to low- and moderate-income tenants. However, despite its many parallel efforts, this program alone is not likely to reach all of the remaining damaged units because of the funding limitations described above.

NGOs, including the LTRGs on each island, have prioritized rebuilding homes that do not qualify for STEP or EnVIsion Tomorrow or that are in immediate need. Some residents might not be able to show a clear title, might live in structures with absent landlords, or might have difficulty proving that the damage sustained was caused by one of the 2017 storms. A successful EnVIsion Tomorrow that meets most needs will make the NGOs' remaining workload more manageable. (See the management-capacity section of this chapter for more on NGOs.)

Replacing Damaged Public Housing

The average age of public housing in the territory is 50 to 60 years, and deferred maintenance and older building standards on these properties make them more vulnerable to future storms than newer construction is (Michael et al., 2019). The recovery provides an opportunity for the territory to remake public housing in a more resilient and dispersed way, in line with contemporary housing practices (VIHFA, 2019a). Bryan has proposed "the rehabilitation and development of affordable and mixed-use rental housing and with the development of new subsidized, project-based affordable housing units for low to moderate-income individuals" (Bryan, 2020b). The territory will move some housing to higher, less flood-prone ground, and create less concentrated housing arrangements. VIHA executive director Robert Graham has said that, in the next eight to ten years, he would like the agency to build as many as 1,000 new affordable housing apartments, replacing older ones ("The Virgin Islands Housing Authority," 2017).

Ending Homelessness and Providing Housing

The VIHFA has set out a goal of ending homelessness (Bryan, 2020b; Ellis, 2019; VIHFA, 2019a). The territory's housing agencies and nonprofit organizations are investing in permanent supportive housing facilities and adopting the best evidence-

based practices, such as Housing First, which prioritizes providing permanent housing as the first step toward exiting homelessness for people with serious mental illness. This model encourages people to use housing as a springboard to secure a job, treatment for addiction, and health care (Padgett et al., 2011). The territory will prioritize permanent supportive housing for vulnerable populations, including people without homes, people with disabilities, people with mental illness, and people of advanced age (VIHFA, 2019a).

Building More-Resilient New Housing

The territory aims to reconstruct public and affordable housing to meet HUD resilience standards and for all new housing construction to meet territory building codes (VIHFA, 2019a). Furthermore, the territory's CZM program continues to support resilience planning in coastal areas through the DPNR zoning and permitting processes. (See Chapter Nine for more detail on DPNR and planning.) The territory's nonprofit organizations envision building community resilience by training local workers in housing and roof repair and mold remediation. The territory's leaders also encourage the purchase of insurance: In February 2018, the territory government issued an emergency order mandating that insurance companies explain the consequences of underinsurance to their policyholders (Lieutenant Governor of the USVI, undated).

One obstacle to efficient recovery is the territory's nonstandard street address system, a legacy of colonial Danish property law. Address eccentricities can hamper economic activity, such as making delivery stops. Additionally, emergency responders can become delayed or lost, negatively affecting a key component of overall community resilience. In 2013, the territory began an initiative to standardize street addresses under the direction of the Office of the Lieutenant Governor (Lieutenant Governor of the USVI, undated). HSOAC discussions indicated that there has been additional effort toward this initiative since the 2017 hurricanes, but the specific plan and details remain unclear. A push to complete this initiative could improve the territory's resilience.

Housing Recovery Workers

The territory's leaders do not include the goal of housing recovery workers in formal strategies, but our discussions with leadership and residents identified it as a widely recognized goal. Recovery in other sectors, such as rebuilding damaged infrastructure, health care facilities, and education facilities, depends on the ability to house recovery workers. The lack of housing for recovery workers makes it more difficult to attract new off-island workers to the islands, which impedes recovery across all sectors, including housing. However, no single organization has clear responsibility for housing recovery workers.

Key Barriers and Gaps

The achievement of the housing vision faces several challenges, which we describe in this section.

Housing Repairs Are Delayed and Impeded for Several Reasons

The Limitations on the Contractor and Builder Workforce Result in Higher Wages and Construction Prices

The sheer magnitude of the reconstruction has increased labor demand in construction trades dramatically. The increase in demand for labor has led to higher wages while unemployment has decreased substantially. As a result, some construction jobs are hard to fill, and others command higher wages that raise the price of rebuilding. The lack of recovery workers leads to delays in completing projects. Training local workers is a long-term solution but does not address the existing demand for immediate work on recovery projects. See Chapter Four for a discussion of workforce issues and related recommendations.

With labor and technical needs not met by local hires, recovery workers have been imported from outside the USVI. Off-site construction of prefabricated and modular-housing units could shift the need for construction labor away from the territory toward a site in the continental United States or even in another country. See the "Recommendations" section of this chapter for a recommendation to consider prefabricated units for housing and other buildings.

A Lack of Property Records Leads to Delays and Impedes Assistance

Property ownership and location records are often inaccurate or imprecise. One cause of this problem is lack of property title registration after generational changes in ownership and intrafamily subdivision of property. Additionally, cadastral markers used in formal property records have known errors and inconsistencies that can make the exact boundaries of land parcels unclear. This point was made by multiple stakeholders in HSOAC discussions. If disaster aid applicants lack formal, consistent legal documents proving property ownership, the government might withhold assistance. Lengthy delays can ensue, involving property lawyers and probate courts. We are not aware of coordinated efforts to stimulate or incentivize property title clearance and registration. Adding some would help progress recovery efforts from the 2017 hurricanes; it would also improve the territory's resilience against future storms because future aid applicants would not be subject to the same delays and legal challenges.

Inconsistent Federal Funding for Nonprofit Work Limits Those Organizations' Participation

Nonprofit organizations on all three main islands filled gaps in housing repair. On St. Croix, Lutheran Social Services of the Virgin Islands (LSS) used volunteers from the island, along with off-island volunteer groups, to repair 65 homes as of the end

of January 2020, with 60 houses remaining in its repair queue. On St. Thomas and St. John, the LTRGs organized social services. On St. John, Love City Strong, a nonprofit organization, began offering mold remediation for 131 homes in 2018 and then moved to other housing needs. In the summer of 2018, some residents reported that the STEP payments were not sufficient to repair their roofs, and other residents did not qualify. Love City Strong organized donors and local contractors to repair 30 homes on the island in 2019. Twelve homes remained after those 30, to be completed in 2020. The nonprofits also conducted a field assessment to compile a database of residential structures. Nonprofits reported that, despite the length of time to complete repairs, "clients are less worried about waiting because they can see that we are active."

The amount of funding and the availability of labor limited the nonprofit organizations' housing-repair work. In some cases, inconsistent federal funding hampered planning. Some nonprofits relied on FEMA payments for travel for volunteers from off the island, but, in 2020, travel reimbursements ceased. The groups responded by lengthening their timelines for completing all projects in the queue, totaling less than 300. These groups will eventually complete these projects, but additional federal support could speed up the timeline.

Progress in Repairing Public Housing Is Slow

Progress in repairing government-funded housing—including project-based public housing and permanent supportive housing for people experiencing homelessness—is constrained by crosscutting issues—in particular, management capacity and fiscal capacity (see Chapters Two and Three for further exploration of these issues). FEMA PA funding requests for the repair of public housing units are in progress. Multiple public housing properties are in the repair queue, in addition to properties from other government agencies. Without a standardized timeline or phasing plan for the PA projects, there is risk that multiple simultaneous approvals would overwhelm local construction labor capacity or increase material costs.

CDBG-DR funds have also been allocated to the public housing and supportive housing categories writ large. In our discussions, we identified people who hoped that the block grant funding could be used to address homelessness by implementing known best practices and to transform the built and social environment of public housing communities to achieve contemporary medium-density, mixed-income community standards. However, the territory has not published a list of proposed CDBG-DR allocations for particular property reconstruction, rehabilitation, and development projects. Specific plans detailing the ways in which public housing might move toward officials' vision—becoming less dense, more mixed income, newer, and more resilient—have not been published.

Housing Is Lacking for Workers Supporting Recovery Across Sectors

The storm recovery brought an influx of workers from outside the territory, and these workers require housing for periods of months to years. Some are federal government employees, but more are contractors employed by the private sector for reconstruction and other technical expertise. Workers brought in to repair and operate the Limetree Bay refinery and terminal also fall into this group. In this report, we use the blanket term "recovery workers" to refer to all of these categories of off-island workers.

One crosscutting characteristic of recovery workers is their relative price insensitivity. This means that federal employees, contractors, and technical specialists will pay high rents because they are reimbursed for such expenses by the government or their employer.

When off-island recovery workers look for long-term housing, they compete with territory residents, who are less willing and able to pay high prices. In our discussions, we found that the competition for housing drives property owners to increase rental prices and, sometimes, to evict current tenants and then rent their property for a higher price. The process of raising rents affects local residents by displacing them in favor of off-island recovery workers or by making housing take up a greater share of residents' incomes, which economists describe as a cost burden. Anecdotally, several people in government, the private sector, and nonprofits said that rental prices had approximately doubled. We attempted to track these changes over time but found a lack of reliable data. Our back-of-the-envelope analysis of real estate listings from the *Virgin Islands Daily News* during a three-week period in February and March 2020 shows that 19 of 21 listings were more expensive than $949, the territory's reported median monthly rent in 2015.

Box 8.4
COVID-19 and Housing

COVID-19 will affect the housing market by heightening some factors that are associated with increased housing demand while weakening others, leading to mixed effects on the market. For the short to medium term, increased demand might come from people seeking more space to accommodate physical distancing. Decreased demand will almost certainly come from a slowdown in construction and recovery projects and from a decrease in the number of off-island workers supporting those projects and from a decline in tourism. In the long term, the disease could delay housing recovery by slowing construction and investment, making this report's recommendations and analysis even more urgent.

At present, some recovery projects appear to be slowing. Work projects that are still operating are implementing physical-distancing measures, and experts estimate that construction workplaces are vulnerable to the illness, which could add to delays ("COVID-19 Pandemic," 2020). Some workers from the continental United States are returning home during the crisis.

The territory's primary housing recovery program, EnVIsion Tomorrow, is moving forward while taking new precautions ("HFA Home Recovery Programs Continue amid Pandemic," 2020). Home LLP, a contractor that operates the application and case-management center, and the Armand Corporation, a construction-management firm, have asked staff to follow Virgin Islands Health Department and CDC guidelines. Home has closed in-person office locations and is operating remotely. Armand is continuing its field inspection program while using personal protective equipment and offering homeowners the option to reschedule appointments.

The population of people without homes or in supportive housing is particularly vulnerable to the spread of COVID-19, and many jurisdictions in the United States are prioritizing finding housing for people who are medically fragile or elderly and homeless. For example, Los Angeles is housing people without homes in hotels, which are largely vacant during the crisis (Smith, 2020). Other jurisdictions are providing temporary space for housing with appropriate distancing and installing handwashing stations. HUD provides an updated set of resources for assisting people without homes or living in supportive housing (HUD, 2020b). Public housing facilities should consult these guidelines.

In the long term, the slowdown in construction because of the crisis could exacerbate the need for affordable housing, especially when reconstruction activity returns to normal. The recommendations for expanding supply will likely apply to the post–COVID-19 environment, although financing the most-expensive options will remain a challenge without federal help. In March, Governor Bryan issued an order temporarily suspending eviction provisions in USVI law (USVI Office of the Governor, 2020; Rao, 2020). At the federal level, the government has issued protections for mortgage owners who agree to protect tenants during the crisis. The USVI could consider extending a halt on evictions, depending on local conditions. In preparing for a post–COVID-19 environment, the USVI could identify and rehabilitate vacant properties if the housing crunch is severe. While people are working remotely, it could consider updating addressing and permitting systems, and contractors could use the slower period to lay the groundwork for a builders' association. The territory could also revisit regulations and plans for modular and prefabricated housing, both to address medium-term demand for more living space and to prepare for future hurricanes.

Management Capacity to Meet Recovery Needs

The territory's government addresses housing recovery needs through a combination of territory agencies, including the VIHFA, VIHA, and DPNR. The nonprofit community on each island also plays a role in addressing housing needs through repair, reconstruction, and sheltering programs. The action plan for the USVI CDBG-DR frames the approach to housing recovery as focusing on low- and moderate-income households, shelters, and mitigation efforts to reduce the impact of future storms (Michael et al., 2019; VIHFA, 2019a; VIHFA, 2019b).

The primary sources of federal government funds for housing recovery are the CDBG-DR funds and FEMA PA funds. A host of other agencies offer specialized programs, and private insurance provides compensation to property owners who qualify.

The Virgin Islands Housing Finance Authority

The VIHFA funds affordable-housing development for low- and moderate-income residents. In normal times, the housing units are financed through municipal bonds and annual appropriations from HUD federal housing programs, totaling $46 million in the most recent fiscal year (Graham, 2019). Post–2017 storms, the VIHFA is the territory's grantee for $1.86 billion in CDBG-DR funds, which were provided by supplemental appropriation (VIHFA, 2019a). The funds are to be used for "necessary expenses related to disaster relief, long-term recovery, restoration of infrastructure and housing, and economic revitalization" (VIHFA, 2019a) and target low- to moderate-income individuals and urgent needs. These funds can fill gaps, but they cannot supplant other federal funding.

The VIHFA will have to manage the flow of $1.86 billion in funds to address disaster-related impacts. It has designed the EnVIsion Tomorrow program to address unmet needs, and it will establish internal controls for the program, provide technical assistance to subgrantees and subrecipients, and preview applications for eligibility, including inspection and assessment (Graham, 2019). To manage federal government compliance and accountability processes, identify residents in need, help those residents apply, and manage the flow of funds, the agency will have to hire and train more staff, work with nonprofit partners that have connections with community members seeking funds, and develop clear instructions for applicants. It will also have to develop a communication strategy to update partners and the public on progress.

Virgin Islands Housing Authority

VIHA plans, constructs, operates, and maintains public housing for low- and moderate-income residents and vulnerable populations, including people of advanced age. It also assists people eligible for vouchers under relevant federal programs, including the Section 8 voucher program, covering approximately 1,275 units at eight complexes (VIHFA, 2019b). The normal annual budget for VIHA is $42 million per year (USVI Hurricane Recovery and Resilience Task Force, 2018). The storms caused significant damage to public housing; the largest loss was the Estate Tutu public housing complex, which is being rebuilt (Michael et al., 2019). Nearly all of VIHA's 3,014 rental units were occupied as of 2019.

Affordable-housing construction, operated by VIHA, makes up a substantial portion of the territory's total new rental housing. For the 12 months ending July 2019, 90 new rental units were permitted, an increase from the 80 units permitted in the previous 12 months. In August 2019, 90 new units were under construction, including the 68-unit second phase of Magen's Junction, which is open to residents earning

below 60 percent of the area's median income (Michael et al., 2019). HUD analysts projected demand for 940 units from August 2019 to August 2022; currently, however, only 90 units are under construction.

VIHA faces the management challenge of absorbing recovery funds and aligning funding from different sources for particular projects. In particular, discussions with territory officials identified the timing of FEMA fund availability and approvals as a particular challenge, which is exacerbated by turnover in federal government and territory officials.

At the same time, VIHA officials say they will use the recovery as an opportunity for "portfolio repositioning" to move communities vulnerable to storm surge and floods out of harm's way and to rebuild properties in line with contemporary housing practices, such as more-dispersed and mixed-income communities. Currently, five public housing communities are within 250 feet of the coastline and are at risk of erosion and sea-level rise (USVI Hurricane Recovery and Resilience Task Force, 2018). Some public housing units will be moved to higher ground, and others will be converted to Section 8 voucher assistance units.

The Department of Planning and Natural Resources

DPNR released new building codes and *Construction Information for a Stronger Home* in April 2018 (DPNR, 2018). A FEMA grant funded code enforcement personnel for a six-year term because inadequate enforcement was found to be responsible for a large degree of damage during Hurricane Marilyn, and better enforcement could help build resilience after the more-recent storms (FEMA, 2018b). DPNR's top priorities are to roll out an electronic permitting system, put more technology in the hands of inspectors, and train its inspector workforce, most of whom are local hires. Currently, permitting is a manual process with little electronic visibility for prospective builders. DPNR is also developing a voluntary retrofit program for homeowners.

Nonprofits

The nonprofit community supplements government action through additional expertise, resources, and local ties. Nonprofits offered home-repair programs on all three islands, organized through the LTRGs on each island, with much of the work carried out by LSS on St. Croix and Love City Strong on St. John. Nonprofits on St. Croix and St. Thomas have made progress in repairing their own buildings to house their volunteers and serve as a shelter in future storms (St. Thomas Recovery Team, 2018). Some rebuilding programs use local contractors. Others rely on volunteers with building skills from the continental United States, and some of these programs relied on FEMA-funded travel assistance for volunteers. The nonprofit community on all three islands has substantial expertise and local connections that could be used to support applications for housing repair and care for the people with no or inadequate housing.

The territory's nonprofit sector is fragmented because of the islands' distance from one another and because the islands have distinct needs.

The Private Market

Even though income-restricted and subsidized housing accounts for approximately 25 percent of the housing market in the USVI (compared with 14 percent in the continental United States), most people are housed in the private market. The territory has relatively few apartment complexes, and most rental activity is in homes. The private market is not poised to build new apartment complexes because it does not have a long tradition of doing so, and the viability of the market is unclear because, builders reported, residents prefer single-family homes or duplexes.

The private market will be aided by improving the street-addressing system, which will speed deliveries and logistics planning. DPNR's planned electronic permitting and inspection portal should also help private builders. The VIHFA commissioned a housing demand study in 2015, and commissioning a similar study in the poststorm environment could shed light on the state of the affordable-housing market, including both the private and public sectors (Community Research Services, 2015).

Recommendations

In the spirit of adaptive management (Wise, 2006), we propose recommendations that can be developed with further analysis or, in some cases, tried on an experimental basis and revisited as needed throughout the recovery. Housing recovery is linked with recovery in other sectors and with the private market. Interventions in the housing market can serve the public interest, but, when undertaken without care, they can also produce unintended consequences, such as increasing the cost of housing or promoting development in locations inconsistently with comprehensive planning goals and disaster resilience (discussed in Chapter Nine) (Glaeser and Gyourko, 2018).

The territory has made substantial progress in achieving its vision for recovery, including repairs to private homes and public housing, expanding care for people without homes and those in supportive housing, and upgrading new construction. Implementing this vision will require a combination of speeding up the present recovery path and developing management capacity to spend federal recovery dollars efficiently and effectively in accordance with the vision.

The territory also faces a problem unacknowledged by formal plans and strategies but recognized by most residents: *The influx of recovery workers has distorted the housing market for residents and off-island workers*. Accelerating the recovery across sectors will require providing more affordable housing for residents and temporary to medium-term housing for recovery workers who might otherwise occupy existing homes or

tourist accommodations. The workforce chapter (Chapter Four) provides recommendations for expanding the construction workforce.

Our recommendations fall into two categories: (1) Develop tools and strategies to make repairs more quickly by incorporating the nonprofit and private sectors, and (2) increase the supply of affordable housing and temporary housing for recovery workers. The recovery vision for the territory is one of a resilient and fully housed population. Achieving that vision requires supplementing the territory's capacity to manage recovery funds and expanding the supply of housing for workers who will help implement that vision.

Speed Up Delayed Repairs, Repair All Eligible Homes by Augmenting Management Capacity and Reforming Processes, and Include Nonprofits

Provide Additional Training and Planning to Develop Clear Criteria to Qualify for EnVIsion Tomorrow Aid

Goal	Reduce confusion, inaccuracy, and registration delays among EnVIsion Tomorrow registrants, and reach the maximum number of potential EnVIsion Tomorrow registrants.
Rationale	Beyond its usual programs, the VIHFA is expected to receive more than $1 billion in CDBG-DR recovery funds, which will be directed to several programs. The amount of money and new processes the agency will absorb exceed its typical capacity. Furthermore, in HSOAC discussions, residents reported confusion with requirements for previous recovery programs. Additional training could enhance VIHFA staff's financial control expertise and responsiveness to public inquiries, and other organizations in the territory could provide additional capacity.
Implementation considerations	• Hire and train VIHFA staff to provide assistance to applicants. – Have outside technical assistance provide additional training and remote backup (e.g., hotlines off-island). • Assist recipients and individual homeowners in understanding the ways in which the funds can be combined with money from other sources for repairs (e.g., avoiding duplication of benefits). • Nonprofits can conduct outreach about EnVIsion Tomorrow to residents. • Manage accountability processes with metrics, oversight, and transparency, so that the funds are used for their intended purposes.
Time frame	Near term
Leading entities	The VIHFA would lead, with support from nonprofits and HUD.

Use Community Development Block Grant Disaster Recovery Funds for Technical Assistance Beyond Just Compliance, and Support Community-Based Nonprofit Groups

Goal	Provide administrative assistance to the VIHFA and the USVI so recovery funds are spent efficiently and effectively for housing repair.
Rationale	Technical assistance provided by CDBG-DR funds helps grantees navigate the requirements of different funding streams. However, territory agencies need ongoing help with more-strategic decisions, including workforce development, phasing and prioritization of work projects, outreach to vulnerable populations, and harmonization of different funding sources. The assistance will require frequent consultation beyond the development of a single plan. Assistance could also provide training for enhanced data quality in reports essential to housing recovery, such as USVI Bureau of Economic Research (USVIBER) reports on housing.
Implementation considerations	• Seek legal and regulatory advice on what activities CDBG-DR technical assistance could fund beyond clarifying definitions and procedures. – Seek expert advice on how EnVIsion Tomorrow projects and tasks are interrelated (e.g., if there is temporary relocation of residents, deciding what policies and procedures should be in place first). • Seek assistance for community planning efforts so neighborhood priorities are reflected in the EnVIsion Tomorrow process, and nonprofits and citizens' groups can fill gaps. • Provide consistent funding for efforts led by nonprofits. • Assess training needs for EnVIsion Tomorrow staff and develop guidance on training procedures. • Consider subgrantees and assign a grant manager to be a single point of contact for CDBG-DR–funded projects, and provide assistance. – Provide trainings throughout the recovery process on procurement, the CDBG-DR program, need assessment, and application and closeout. • Develop tool kits for specific kinds of EnVIsion Tomorrow projects. – Include lessons from past disaster-recovery efforts and from earlier phases of this effort, including guidance for procurement and construction oversight (Pereira et al., 2019; Urban Land Institute Advisory Services, 2019).
Time frame	Near term
Leading entities	HUD would be the primary leading entity, with support from the USVI, the VIHFA, and nonprofits.

Create a Territorywide Builders' Association

Goal	Improve the efficiency and effectiveness of construction projects.
Rationale	The territory lacks a builders' association. In many states, such associations educate workers, screen contractors, and create standards. The territory has historically relied on Puerto Rico to supplement its capacity, but, after Hurricane Maria, Puerto Rico attended to its own recovery effort. A builders' association could enhance USVI capacity and identify networks and mutual-aid arrangements for supplemental capacity.
Implementation considerations	• Convene construction firms to determine the association's mission and structure. • Forge working relationships with nearby and related U.S. industry networks, including those in Puerto Rico and Florida. • Forge partnerships with relevant government agencies (e.g., the VIHFA) to improve efficient delivery of private- and public-sector construction projects. • Partner with UVI to offer training short courses for high-demand topics. • Prioritize transparency in interactions with governments to avoid the appearance of corruption or conflict of interest.
Time frame	Near term
Leading entities	Private-sector construction firms, UVI, and the VIHFA would be the leading entities.

Access Capital Before Full Action-Plan Approval

Goal	Access CDBG-DR capital in a timely manner to begin projects as quickly as possible.
Rationale	The territory lacks access to sufficient capital in a timely manner to begin some projects. It is considering seeking loans from the private market, but CDBG-DR rules might allow access to funds before full action-plan approval.
Implementation considerations	• Seek clarity from HUD and legal advisers on the territory's ability to access capital before formal action-plan approval. • Consider whether the action plan could be presented in steps that could trigger the release of some funds.
Time frame	Near term
Leading entities	HUD would be the primary leading entity, in discussion with the USVI.

Update the Contracting Process

Goal	Use modern contracting processes that result in cost- and time-efficient recovery projects.
Rationale	In our discussions, participants suggested that current USVI contracting processes are a one-size-fits-all solution to a multifaceted recovery rebuilding problem. DPP might not be utilizing all of the potential contracting processes that are available. It could consider adding new evaluation metrics—in particular, best value as opposed to lowest price. The government's procurement manual allows for this possibility but does not provide specific guidelines as to when or how it should be used (DPP, 2018). Best-value contracts might be advisable for the high-cost projects that will be typical in recovery work in the next several years.
Implementation considerations	• Initiate retrospective contract performance review and legal analysis to determine whether cost and time outcomes could be improved and whether legislative changes are required to enact such measures. • Consider adding only a small number of new options because the territory likely does not have the capacity or volume to initiate as many different contracting process options as a larger entity, such as a state or federal government, might. • Seek advice from a builders' association (if created) or leading builders on evaluation metrics. • Train DPP staff on new contract types. • Communicate changes of process and bid requirements to the public. • Partner with other communities affected by disaster to share best practices in updating contracting processes.
Time frame	Medium term
Leading entities	DPP would be the leading entity, with support from the USVI legislature.

Clarify Property Ownership and Location Records

Goal	Minimize property disputes and prevent delays in obtaining relief in future disasters by providing clear and accurate legal records.
Rationale	USVI property ownership and location records are often inaccurate or imprecise. As property passes down through generations, records might be lost, or the property might be divided among family members living in different locations. Furthermore, the boundaries of land parcels are often unclear. Without formal, consistent legal documents proving property ownership, aid applicants risk having assistance withheld. Clarifying property ownership would speed up recovery and ensure that future aid applications would not be subject to the same burdens.
Implementation considerations	• Build on success and lessons learned from the lieutenant governor's street-addressing program. • Provide a portal for residents to get help clarifying property registration and title. • Partner with nonprofit organizations to provide assistance with applications for titles and registration. This will expand the reach of the program to the hardest-to-serve parts of the community. • Provide subsidies for low-income households that would overcome the cost barriers to completing the title and registration process. • Conduct a retrospective analysis to determine whether financial incentives for residents at moderate income levels would result in net savings compared with administrative burden and delayed relief in future disasters.
Time frame	Medium term
Leading entities	The USVI lieutenant governor's office, nonprofits, and island LTRGs would be the leading entities.

Increase the Amount of Affordable Housing

Implement Tenant Protections and Supply-Side Incentives

Goal	Prevent displacement of existing residents while encouraging the creation of new housing units for recovery workers.
Rationale	Added demand for recovery-worker housing puts upward price pressure on the existing supply of rental housing. Strong tenant protections, such as rent controls or "just-cause" eviction requirements, can prevent longtime residents from being priced out of their rental homes. However, overly rigorous tenant protections can restrict the supply of rental housing by discouraging investment in rental housing and encouraging conversion to for-sale units. In this scenario, long-term rental prices can rise even more (Diamond, McQuade, and Qian, 2019). An approach that balances supply incentives with tenant protections could allow the housing market to respond to demand pressures without causing resident displacement.
Implementation considerations	• Evaluate the budgetary and legislative implications of supply incentives, including zoning and regulatory waivers, fee exemptions, and incentives for recovery workers to live in spare bedrooms rather than renting whole units. • DPNR evaluates environmental and land-use implications of zoning waivers. • Evaluate the budgetary and legislative implications of tenant protections, including just-cause eviction restrictions, tenant legal aid, temporary rent controls, and increasing the number of housing-subsidy vouchers. • Establish statutory authority and funding for these incentives and restrictions. • Create an information portal to connect tenants to legal resources if rent control, eviction restriction, or legal aid is implemented.
Time frame	Near term
Leading entities	Coordinated efforts among OMB, the Office of Governor or Lieutenant Governor, DPNR, and the USVI legislature would provide leadership.

Increase the Use of Temporary Housing for Recovery Workers

Goal	Install temporary units for recovery workers engaged in ongoing hurricane recovery projects, and improve territory resilience by identifying and preparing additional sites for rapid temporary unit installation after future disasters.
Rationale	Temporary housing is already one part of the government tool kit for assisting disaster victims. Its key strength is the ability to be removed when no longer needed. This strength suggests its applicability in the USVI in the medium term as a way to meet demand for recovery-worker housing from contractors. Long-term overall housing demand might not increase if recovery workers leave the territory after completing their projects. Instead of new permanent units being built, the installation of temporary housing could meet this surge in demand. Under a relatively rigid regulatory and permitting environment, installing such housing is time-consuming. Furthermore, options available after the fact might not adapt well to local cultural or infrastructure context. Both of these forces can negate the benefits of temporary prefabricated or modular housing in disasters (Félix, Branco, and Feio, 2013; C. Johnson, 2007). One interview subject in the territory stated, "The supply chain [for prefabricated and modular units] is relatively easy. Getting the okay to [construct them] is very hard." The International Building Code limits the permitted use of temporary buildings to 180 days. Both of these forces can negate the benefits of temporary prefabricated or modular housing in disasters (Félix, Branco, and Feio, 2013; C. Johnson, 2007). However, in cases in which the buildings were expected to be used for a longer period of time (e.g., classroom buildings), DPNR required that they be constructed or installed to code (FEMA, 2018g). Done quickly enough, the same procedure that supported modular classroom buildings could support the installation of housing units to meet the tail-end demand for recovery-worker housing from the 2017 hurricanes. In the long run, this would allow for a quicker, more elastic housing-market response after future disasters. Modular or prefabricated homes have the potential to reduce supply-chain costs, withstand future disasters, and be adapted for long-term use (Windle, Quraishi, and Goentzel, 2019).
Implementation considerations	• DPNR staff review existing relevant regulations and potential land parcels. • DPNR staff recommend changes to regulations, such as land-use planning or CZM, to expand or clarify the set of parcels eligible for temporary housing. • The USVI legislature makes any necessary changes to land-use law. • Community outreach identifies property owners willing to install temporary units in the short term for recovery-worker housing. Because of the territory's hilly terrain, large, flat parcels of land capable of supporting many temporary units are rare. Thus, a decentralized implementation, with many individual property owners installing one or two units per parcel, might be necessary. • Use HMGP or other resilience and mitigation funding to identify and prepare sites for placement of temporary housing units after future disasters. • Consider partnering with other states, territories, or jurisdictions to enter into contracts for temporary housing materials in advance in order to reduce prices. Multiple jurisdictions in different locations are less likely to need prefabricated materials at the same time.
Time frame	Medium term
Leading entities	DPNR would lead regulatory and permitting analysis, the USVI legislature would analyze laws, and the VIHFA would identify potential efficiency gains for projects.

Leverage Federal and Private Funds for Homelessness Reduction, Following Best Practices

Goal	Initiate evidence-based intervention and services to achieve lasting homelessness reduction.
Rationale	Planned CDBG-DR action-plan investments would fund supportive housing and emergency shelters. Future public or private recovery funds or competitive grants may augment these efforts for new facilities and services. Following evidence-based practices for interventions, such as Housing First, is the best way to achieve sustained positive outcomes for people experiencing homelessness. This will improve resilience among vulnerable populations under blue-sky conditions and in the face of future disasters.
Implementation considerations	• Review federal funding options and requirements for homeless services. • Identify private funding sources for evidence-based practices if federal funding does not apply, such as for interventions that do not have sobriety requirements. • Assess need and potential funding sources for additional capital projects. • Forge strong partnerships between funders, constructors, operators, and wraparound service providers in order to maximize impact and minimize friction in delivering supportive housing units and shelter facilities.
Time frame	Near term
Leading entities	VIHA would serve as lead, supported by the VIHFA and nonprofit groups.

Rehabilitate Vacant Government-Owned Properties

Goal	Adapt the use of government property in response to unmet social needs.
Rationale	Underutilized or vacant government property can be repurposed to address pressing social issues. To the extent that affordable housing is one of the government's top priorities, the government could retrofit existing property to provide affordable or homeless housing. These moves would be warranted in the current supply-constrained market.
Implementation considerations	• Conduct analysis to compare needs in affordable housing with needs in other areas, such as education and health care services, incorporating public input. • Weigh pressing social needs against the potential for each vacant property to fulfill them. For example, some properties could be better retrofitted as clinics than as apartments, but decisionmakers would still need to consider whether the demand for housing outpaces the demand for health care services. Some properties might have fallen into such disrepair that rehabilitation is not cost-effective. • Identify funding sources and contracting mechanisms for rehabilitation projects. This could include CDBG-DR funding, HMGP funding, or public–private and public–NGO partnerships.
Time frame	Near term
Leading entities	USVI agencies could identify needs and suitable properties and seek out NGO or private-sector partners.

CHAPTER NINE

Natural and Cultural Resources

Box 9.1
Key Findings About Natural and Cultural Resources

- The 2017 hurricanes caused significant damage to natural and cultural resources, including damage to historic buildings and their collections, archival and library materials, museums, and natural resources, such as corals, beaches, and mangrove ecosystems. Damage from the hurricanes resulted in a significant amount of solid waste and mixed debris.
- Since the hurricanes, NCR recovery has made progress in key areas. Nearly 900,000 cubic yards of debris were removed. EPA has been working with the VIWMA on a work plan for a grant to address capacity and compliance issues at landfills. The National Park Service (NPS) has rehabilitated trails, cleared debris, assessed reefs, provided archival preservation training, and documented traditional homes and construction methods for preservation.
- FEMA has provided support to the NCR sector through grant funding that totals an estimated $47 million across 197 active projects.
- Moving forward, the NCR sector seeks to follow these broad recovery directions:
  - **Protecting and restoring natural resources:** Restoring key ecosystems, strengthening their protections, and improving the management of these resources for greater resilience
  - **Stabilizing, restoring, and fortifying cultural resources:** Fortifying key historic properties and districts, securing archival records, improving archiving, better maintaining historic properties and their collections, and leveraging historic properties and districts for the community, artisans, performers, education, and tourism
  - **Establishing and maintaining sustainable solid-waste management practices:** Establishing sustainable solid-waste management practices, investing in new landfill capacity and waste reduction, and planning for future debris management.
- Several challenges need to be overcome in order to meet these objectives:
  - **Natural and cultural resources:**
    - limited awareness of the importance of NCR recovery needs
    - time-sensitive nature of many natural and cultural resources' recovery activities
    - lack of up-to-date and comprehensive information on the location and condition of assets and limited monitoring capability
  - **Solid-waste management:** deficient solid-waste management funding, investments, practices, and disaster preparedness
  - **Crosscutting:**
    - limited federal agency presence
    - siloed recovery planning and execution among NCR stakeholders.
- The sector also faces several challenges related to its management capacity: lack of interdivisional coordination and collaboration at DPNR, staffing challenges at both DPNR and the VIWMA, low priority for DPNR requests, and organizational turmoil at the VIWMA.

Box 9.1—Continued

- To address the barriers and gaps, we make the following recommendations:
  - **Natural and cultural resources:**
    - Identify champions for NCR recovery to lead and facilitate recovery.
    - Develop a consolidated, comprehensive, and accessible data repository of NCR assets.
    - Ensure that the NCR field coordinator has the resources to effectively monitor NCR projects and provide needed outreach, coordination, and expertise.
    - Develop and implement a framework and process for coordinating funds and identifying priorities and goals among NCR projects and programs.
    - Make greater use of comprehensive land- and water-use planning to execute more-resilient recovery by considering interactions and synergies with other recovery sectors.
    - Improve strategic planning and implementation of recovery funding for historic properties and cultural resources.
  - **Solid-waste management:**
    - Establish a high-level task force to develop more-detailed implementation plans for sustainable solid-waste recovery and management.
  - **Crosscutting:**
    - Increase collaboration, strengthen management processes, and enhance coordination within DPNR divisions and with DPP.
    - Develop clear educational materials on permitting to streamline the process and continue implementing the electronic tracking system.

Recovery for natural and cultural resources in the USVI includes recovery planning and implementation for natural resources (such as land, fish, other biota, and water) and cultural resources (including sites, objects and collections, archives, structures, landscapes, artisans or performers, performing arts centers, and organizations that define a community and convey significant information about its culture [e.g., archeological sites, historic properties, collections, landscapes, artists and art organizations, and local practices]) (DOI et al., 2015; FEMA, undated d; Morgan, Morgan, and Barrett, 2006). *NCR*, as defined in this analysis, also includes solid-waste management (including storm-debris management and landfill operations) and sports and recreation facilities and parks. DPNR is the primary agency responsible for natural and cultural resources, and the VIWMA is responsible for solid waste (and wastewater, which is not addressed in this chapter). VIDA and DSPR also manage aspects of natural and cultural resources, although we focused our analysis in the chapter mainly on DPNR and the VIWMA.

DPNR has broad responsibility to administer and enforce all laws pertaining to the preservation of fish and wildlife, trees and vegetation, and water resources. It also houses the territory government's offices for historic preservation, libraries, and museum services. Within DPNR, the CZM Division and the Division of Archaeology and Historic Preservation each work with commissions composed of residents nominated by the governor to oversee coastal permitting and architectural historic control districts, respectively.

Several NGOs, such as the Nature Conservancy, the St. Croix Environmental Association, the Virgin Islands Conservation Society, and the Coral Bay Community Council, are active participants in natural resource conservation and management. Similarly, the St. John Historical Society and the St. Croix Landmarks Society are

active in cultural preservation and education (although the hurricanes have affected their ability to operate and have led to the closure of the St. Thomas Historical Trust).

In this chapter, we describe the current status of NCR recovery in the USVI. We first briefly describe natural and cultural resources in the USVI prior to the 2017 hurricanes, summarize the effects of the hurricanes, and describe the recovery accomplishments of the past two years. Then we discuss the recovery directions in this sector and identify some key barriers to accomplishing those goals. We also describe challenges related to the management capacity available for natural and cultural resources. The chapter ends with recommendations to address barriers and gaps. Box 9.2 describes the methods used in this analysis.

Setting the Stage

Before the Hurricanes

Natural and cultural resources contribute broadly to well-being in the USVI. The different geographies of the islands and corresponding differences in land-use practices have shaped and affected the habitats on each island in different ways. St. Thomas, with a deep natural harbor, is the most developed of the three major islands that make up the USVI. St. Croix has more agricultural activities, and St. John is made up largely of the Virgin Islands National Park. Historic properties and archeological sites are also located on the three main islands.

Box 9.2
Methodology and Limitations on the Analysis of Natural and Cultural Resources

Methods Used in this Analysis

Our review of NCR recovery implementation is framed within complex-adaptive socioecological system theory—which recognizes that human and ecological systems influence each other and evolve over time in complex and uncertain ways—adaptive management principles, legal and regulatory frameworks, and best management practices. We reviewed FEMA documents, performed literature reviews, and engaged federal partners and stakeholders in discussions, as follows:

- We reviewed the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan, status update, and the recovery plans for each island to determine recovery priorities. We also reviewed the literature describing the damage to natural and cultural resources in the USVI and the status of recovery efforts. Previous planning documents for historic preservation, state wildlife planning, heritage trees, recycling, and CZM provided useful contextual information for understanding overall management priorities and issues.
- We held discussions with DPNR, the VIWMA, and federal partners, such as FEMA, DOI, NOAA, and EPA. We also consulted subject-matter experts and stakeholders within government and UVI, NGOs, and other stakeholders on each island.
- Last, we performed an analysis of projects and grants within FEMA's Grants Manager database and reviewed available workplans for disaster supplemental funds.

Limitations of This Analysis

We were not able to speak in depth with many divisions within DPNR, nor the VIWMA, despite our follow-up requests. For example, we were not able to fully address the recovery needs for parks because of our inability to reach DSPR; nor were we able to reach out to VIDA because of constraints on project resources. Additionally, the list of people with whom we spoke, while extensive, was not exhaustive, and we might have missed some important insights and perspectives.

The USVI's natural and cultural resources contribute to the health and well-being of its residents, support tourism and the economy, help create a sense of place, and form a key part of the territory's infrastructure and community resilience. For example, in the five years prior to the hurricanes, the national parks in the USVI generated more than $70 million in visitor spending and nearly 923 jobs annually (NPS and U.S. Geological Survey, 2018).[1] The territory's ocean economy is estimated to support between 6,700 and 10,700 jobs for USVI residents; these jobs are concentrated in tourism and recreation and also involve marine transportation and commercial and recreational fishing (DPNR, 2018b). Natural resources also provide valuable ecosystem services (see Figure 9.1 for an example), such as water and air filtration, provisioning of food and fishery habitat stormwater control, and coastal protection from erosion, flooding, and storm surge, which were collectively valued at an average of more than $200 million per year (van Beukering et al., 2011). Cultural resources of all types are integral to social-capital networks—the connections among people and communities that reinforce cultural and social norms and provide a shared identity and sense of place. Strong social-capital networks help reinforce the very sense of what it means to be a community (Parks et al., 2018).

Figure 9.1
Corals in Mangroves in the USVI

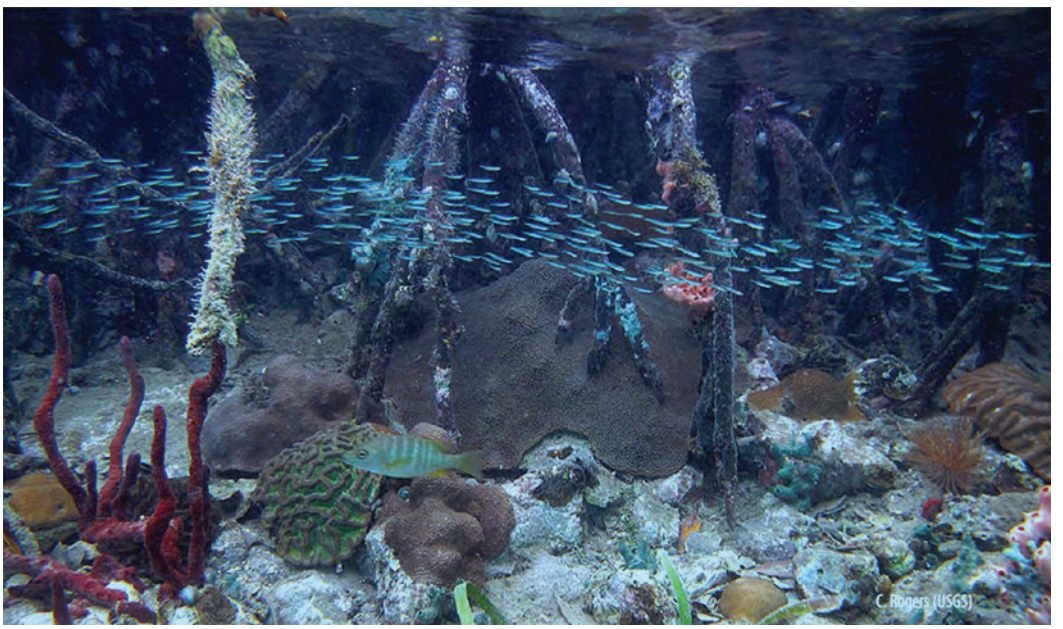


Photo courtesy of Caroline Rogers, U.S. Geological Survey, USVI, 2014. Used with permission.

[1] Parks included in these values are the Virgin Islands National Park, Christiansted National Historic Site, Salt River Ecological and Historic Preserve, and Buck Island Reef National Monument.

The USVI has two landfills that accept residential, commercial, and industrial waste: Bovoni on St. Thomas and Anguilla on St. Croix. St. John's waste is sent from its Susannaberg transfer station to the Bovoni dump. DPNR's Environmental Protection Division performs regulatory oversight of VIWMA operations. Some residents have trash pickup services, while others must dispose of their waste at one of several bin sites located throughout the islands (approximately three per island) (see Figure 9.2 for a photo of a residential drop-off site). Residents in apartment buildings and businesses can use private haulers, who must be licensed, inspected, and permitted annually by the VIWMA. Otherwise, commercial entities must go directly to the landfill to dispose of their waste. Improper waste management has negative consequences to human health, the environment, and the economy (USVI Hurricane Recovery and Resilience Task Force, 2018; UVI, 2009).

Impact of the Hurricanes

The hurricanes caused extensive damage to physical structures owned by public and nonprofit entities, including many that fall into the NCR category. FEMA's Grants

Figure 9.2
A Household Waste Drop-Off Site for St. Amalie Residents

Photo by the authors, 2020.

Manager database indicates that 3,890 hurricane-related damage claims were reported on the USVI that could *potentially* relate to NCR management. The FEMA Grants Manager database did not include a category in the "Sector" field to select projects that are related to natural and cultural resources. Some of the NCR-related projects identified in Grants Manager were categorized under the public building sector or the utility sector. Filtering the list of damage occurrences in the database by NCR-specific applicants, such as the ones listed in Table 9.1, we found a total of 312 active damage claims. We also were able to use the Grants Manager database to approximate damage to historic buildings. Table 9.2 provides a summary of damage sustained by buildings that are more than 50 years old, which is one criterion for inclusion on the National Register of Historic Places.[2] Examples of some of these properties with damage listed as urgent priority include the Montessori school and Abattoir Slaughterhouse building

Table 9.1
Summary of Damage Claims, by Applicant, in the Natural and Cultural Resources Sector

Applicant	Number of Claims	Priority			
		Urgent	High	Medium	Low
VIDA	53	1	6	46	0
DSPR	83	0	4	78	1
DPNR	55	0	2	49	4
VIWMA	121	0	14	107	0

SOURCE: Grants Manager, queried in February 2020.

Table 9.2
Summary of Damage for Properties More Than 50 Years Old

Priority	Total
Number of claims	1,131
Urgent	13
High	207
Medium	873
Low	38

SOURCE: Grants Manager, queried in February 2020.

[2] Other criteria are that the property have its defining features intact and has had either an event or a person of historical significance connected to the site, or the building itself must have important architectural or interior features.

on St. Thomas, as well as the Bureau of Motor Vehicle office building on St. Croix. In addition to the applicants listed in Table 9.2, other damage has been reported to historic buildings owned by other applicants, such as the governor house located on St. Thomas (built in 1867), the Whim Museum on St. Croix (built in 1790), and the Sts. Peter and Paul Cathedral on St. Thomas (built in 1848).

Natural resources also suffered damage from the hurricanes, including sometimes-severe damage to corals from sedimentation and physical breakage (FEMA, 2018a). The beaches and soil on St. Thomas were eroded to the point of reaching inland limits; trees and other types of vegetation were uprooted on St. John, which resulted in debris along the shore; and erosion of the beaches on St. Croix resulted in saltwater intrusion into inland water bodies (Cox et al., 2019). St. John, home to the Virgin Islands National Park and the Virgin Islands Coral Reef National Monument, also experienced damage to its mangrove ecosystem. Surveys five months after Hurricane Irma indicated that biodiversity was significantly reduced (Rogers, 2019). The coral reef systems also experienced damage but not to the same extent as the mangroves. Changes in migratory patterns for certain species were also observed. The longer-term effects of the damage to water filtration, erosion control, wildlife, and fisheries are uncertain.

Damage from the hurricanes resulted in a significant amount of waste and mixed debris (Government of the USVI, 2018). USACE estimated that 80 percent of the debris generated in the USVI was vegetative and that the remainder consisted primarily of construction and demolition debris, vehicles, vessels, and medical waste (Palin et al., 2018).

Recovery Progress Since the Hurricanes

In the two years since the hurricanes, USVI residents, territory organizations, and federal agencies have made strides toward recovering and rebuilding the territory's natural and cultural resources. The Department of Commerce also funded postdisaster shoreline mapping (ODR, undated g).

The NPS has rehabilitated trails, cleared debris, assessed reefs, and documented traditional homes and construction methods for preservation. Additionally, it reestablished relationships with the Division of Libraries, Archives, and Museums, creating an LTRG focused on cultural heritage, art, music, dance, and cultural initiatives. A variety of investments and grants from different government agencies have been made to support cultural recovery and preservation of archival materials (FEMA, 2018c). For example, DOI and the National Endowment for the Humanities provided grants for the storage and preservation of archival materials and critical technical training for archive management and preservation, crucial for maintaining invaluable historical documents, artifacts, and archival materials. Although DPNR's state historic preservation officer (SHPO) has completed the need assessment and is dividing a $10 million NPS grant from disaster relief supplemental appropriations among administrative costs, the Charlotte Amalie Government House, the former WAPA building, and

remaining eligible historic sites on a first-come basis. During our discussion with this SHPO, we learned that grant spending would focus on repairs and investments in mitigating damage from flooding and other hazards.

Through a coordinated effort, federal, territory, and private partners removed nearly 900,000 cubic yards of debris of all types—vegetative, marine, power systems, construction, and demolition—from the territory. The VIWMA increased bin-site disposal collections by 1,200 percent to keep up with the need (Government of the USVI, 2018). At the federal level, NOAA provided $4.2 million for marine debris removal in Crown Bay, St. Thomas, while EPA supported USACE in removing vegetative debris and managing oil, household, medical, and hazmat cleanup and removal. The U.S. Coast Guard removed roughly 300 vessels in the USVI (Palin et al., 2018). EPA has also been working with the VIWMA on a work plan for a $10 million disaster supplemental grant to address capacity and compliance issues at its existing landfills. The VIWMA has worked with EPA to receive authorization of its USVI Municipal Solid Waste Landfill permit, required before landfill capacity can be expanded (EPA, 2019). The VIWMA has also identified options for expanding landfill capacity on St. Croix and St. Thomas and is developing a waste diversion program with DPNR (VIWMA, 2019). EPA notes that authorization of the landfill permit program is a significant accomplishment and provides options for operational and financial assurance mechanisms while complying with the Resource Conservation and Recovery Act (EPA, 2019; Pub. L. 94-580, 1976).

FEMA has provided significant support to NCR recovery through grant funding, totaling $47 million across 197 active projects for VIDA, DPNR, the VIWMA, and DSPR. As of January 2020, just over half of the identified funds, or $22 million, were in the postaward phase. The biggest recipient by far is the VIWMA, which received $21 million for work on St. Thomas; 56 percent of its projects (40 total) are in the postaward phase. DSPR received almost $18 million, distributed across St. Croix and St. Thomas. FEMA also funded the development of eight additional watershed management plans (five on St. Croix, three on St. Thomas), representing a 50-percent increase within the territory.

Civil society organizations have also played a key role in NCR recovery within their communities. Involved organizations include the St. Croix Environmental Association, the Community Council of the Virgin Islands, Coral Bay Community Councils, Craft Emergency Relief Fund (CERF+), and All Hands and Hearts. According to a UVI professor with whom we spoke in 2019, UVI and the Nature Conservancy are doing innovative work with coral protection and replanting and are working with NOAA on coral and marine-debris monitoring.

Recovery Directions

The recovery directions and guiding principles, presented in Box 9.3 and in the rest of this section, were synthesized from the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan; the specific community recovery plans for St. Croix, St. John, and St. Thomas (CPCB RSF, 2018a; CPCB RSF, 2018b; CPCB RSF, 2018c); previous planning documents for natural and cultural resources (Chakroff, 2010; DPNR, 2018b; Platenberg and Valiulis, 2018a; Platenberg and Valiulis, 2018b; Virgin Islands State Historic Preservation Office and University of Alabama Museums Office of Archaeological Research, 2016); and subject-matter expert and stakeholder discussions.

In addition to the specific recovery directions, the sources cited above emphasized some underlying principles that should guide NCR recovery:

- Short- and longer-term recovery goals and objectives are driven by community priorities and are financially, managerially, and ecologically sustainable. Recovery goals and objectives recognize that each island will differ in resource mix and recovery needs.
- Communities are empowered to self-determine recovery goals and objectives.
- Recovery implementation is equitable and culturally suitable.
- Strategies are adapted as implementation progresses and more information becomes available.

Box 9.3
Recovery Directions for Natural and Cultural Resources

- **Protecting and restoring natural resources:** In the near term, strengthening the processes that protect these resources; in the medium to longer term, restoring key ecosystems and improving the management of these resources to increase resilience to future disturbance
- **Stabilizing, restoring, and fortifying cultural resources:** In the near term, stabilizing, restoring, and fortifying key historic properties, their collections, and districts; improving record management and preservation; cleaning archival records and artifacts and storing them in safe, climate-controlled areas to prevent additional degradation; and improving outreach and support to the arts community. In the longer term, better leveraging these assets for community, educational, and tourism opportunities (DPNR, 2018b; Legislature of the Virgin Islands, 2019a; Virgin Islands State Historic Preservation Office and University of Alabama Museums Office of Archaeological Research, 2016)
- **Establishing and maintaining sustainable solid-waste management practices:** Establishing sustainable solid-waste management practices; investing in new landfill capacity, improved processing, diversion and recycling infrastructure, and upgraded equipment; and planning and preparing for future debris removal, reuse, or disposal, including community education on debris sorting and management

SOURCES: Culture in City Reconstruction and Recovery, 2020; Williams and Brown, 2012; CPCB RSF, 2018a; CPCB RSF, 2018c; CPCB RSF, 2018b; DPNR, 2018b; Virgin Islands State Historic Preservation Office and University of Alabama Museums Office of Archaeological Research, 2016; Platenberg and Valiulis, 2018a; FEMA, undated d.

- Recovery activities leverage opportunities to build local capacity in the long term.
- Overarching recovery objectives are community well-being, resilience, and economic vitality.

Key Barriers and Gaps

The people with whom we met in the course of this research are dedicated to recovery and working hard to achieve progress, but they face many challenges that need to be overcome for recovery to progress successfully. In this section, we discuss our observations on the key factors hampering NCR recovery. These barriers span the three areas included in natural and cultural resources: natural resources, cultural resources, and solid-waste management. However, because some of the barriers are common to both natural and cultural resources, we address those two areas in one section and solid-waste management in a separate section. We also include two barriers that cut across all the categories of natural and cultural resources. Many of these challenges existed prior to the storms and have been documented in various planning documents.

The Complexity of Recovery Processes and Organizational Stovepipes Present Barriers to Recovery for Natural and Cultural Resources

Awareness of Recovery Needs for Natural and Cultural Resources Is Limited

NCR's effects on daily life are typically less noticeable than more-immediate recovery needs, such as damaged housing or a lack of electricity or water, and, as a result, NCR recovery tends to be less of a priority (Schwab, 2014). Although this is understandable, the result can be that the recovery of NCR assets is overlooked for years, at which point some damage might be irreversible or extremely costly to overcome. Also, as we learned in a discussion with NGO personnel, fewer NGOs and civil society groups can conduct NCR recovery activities. Many NGOs and community organizations were devastated by the hurricanes, significantly limiting these organizations' abilities to absorb additional recovery activities.

Although the task force recovery plan acknowledges the importance of the natural environment to the well-being of USVI residents and island-specific recovery plans contain many initiatives for beautification efforts and NCR recovery, an overall vision and more-specific recovery objectives and goals for natural and cultural resources have not been articulated. As a result, there is no obvious mechanism for identifying project priorities or for coordinating among projects when there are limited funding sources or other capacity constraints, especially when multiple grant programs are in play. In addition, there is no clear champion who can communicate community priorities and needs, create broader awareness in other recovery sectors, share information, and celebrate success or drive accountability for progress and work.

Many Natural and Cultural Resource Recovery Activities Are Time-Sensitive

Opportunities to assist NCR recovery are often time-dependent and, for natural resources, can vary by the species or the ecosystems of the natural resource involved. For example, damaged corals have a limited time window immediately after a storm during which they can be reattached and likely survive. We learned during discussions with NGO and NOAA personnel in 2019 that this restabilization effort did not happen in the USVI, resulting in additional damage to reefs—most notably, the Elkhorn coral on which many reef species rely for habitat. In addition, some damage might not be readily apparent until months or years after the hurricanes as a result of longer reproduction rates, changes in shoreline geography and hydrology, or shifts in species diversity. Planning and recovery implementation processes are ill-equipped to identify and manage the cumulative effects of multiple stressors to natural and cultural resources resulting from such threats as pollution and land uses. The combined effects of differing timescales for damage and recovery of natural resources, some of which can take years or even decades, can introduce challenges for finding enduring funding; sustained, long-term program management; and maintaining the interest necessary for successful recovery. Similarly, many cultural objects and archival materials must be cleaned and stored properly as soon as possible; otherwise, they will continue to degrade from exposure to heat, humidity, mold, and pests and, left untreated, historic properties could lose their historical or structural integrity.

There Is No Up-to-Date and Comprehensive Information and Limited Monitoring Capability for Natural and Cultural Resources

Much of the available information on natural and cultural assets is incomplete or outdated. Information is lacking on privately owned historic properties and on the condition of eligible sites (or the integrity of contributing sites) in historic districts.[3] There are no registries of artisans and performers. Nor is there readily accessible and up-to-date information on the location and condition of sensitive and essential habitats, such as wetlands or coral reefs. The recovery process would benefit from a full list of historic properties in the territory (including location, condition, and ownership), archives, and collections that are being maintained in a central source and publicly available and from having a comprehensive map of wetlands and corals and their associated conditions, hurricane damage, and other stressors. Although DPNR has expertise and knowledge in these areas, having more-complete information would provide better visibility throughout the government and the private sector into conditions, locations, operations, and other factors relevant to recovery and could facilitate the identification

[3] Eligible sites are those that could be listed on the National Register because they are more than 50 years old, have some historic significance, and maintain many original aspects but have not been formally listed. Contributing properties are those that add to the historic significance of a district, for instance, either because of their architectural features or because of an association with a historic event as distinguished from noncontributing properties, which simply happen to be located in the district but do not have any significant features.

of priority assets, sites, and projects. On a related note, DPNR does not have electronic tracking capabilities to facilitate recovery projects—most notably, for permitting, which is performed by multiple divisions in DPNR (although these capabilities are being developed).

These barriers were compounded by the loss of research and laboratory facilities on St. Thomas and St. John because of the hurricanes. Monitoring and communication equipment used in research was also lost or damaged during the storms (Virgin Islands Experimental Program to Stimulate Competitive Research, 2017).

Barriers to Recovery for Solid-Waste Management

Solid-Waste Management Investments, Practices, and Disaster Preparedness Are Deficient

The USVI generates nearly three times the U.S. daily average of solid waste per capita but has little recycling capacity and no long-term method of disposing of certain categories of waste (e.g., used tires, medical waste). Standard operational practices followed in other parts of the United States are not practiced in the USVI; for example, waste collection bins are not monitored by VIWMA personnel, residents do not have to pay for trash collection, and operators do not track the amount or type of waste going into the territory's landfills (Buchanan, 2019; discussions with UVI and EPA officials, 2019).

Both of the territory's landfills are near capacity and have been operating under EPA consent decrees since 2012 and 2013, respectively, for violations, such as inadequate controls over physical access to the site, insufficient landfill cover (which is needed to prevent transport of dust and debris), unstable slopes, and leaching of toxic waste into the nearby mangrove. Periodic fires at the landfills have led to temporary closures and additional pollution. For example, there were seven fires at the Anguilla landfill in 2019 that suspended landfill operations, destroyed necessary equipment, damaged the transfer station and baler, consumed scrap tires, and emitted toxics into the air and the environment. The landfill also presents a safety concern for the Henry E. Rohlsen Airport because it attracts large numbers of birds and the smoke from these fires has affected airport operations (EPA, 2019b; "Update," 2020). Attention that could have been focused on proactively expanding capacity and better preparedness for debris removal has had to be redirected to these more-urgent issues.

At present, the VIWMA does not have the financial resources to develop new landfill capacity and purchase equipment required by the consent decrees. Testimony by the interim executive director of the VIWMA before the Virgin Islands legislature indicated that the VIWMA's revenues are insufficient for making the necessary capital improvements, while other testimony noted that general funds provide approximately half of the monies needed to operate and that the appropriation of funding has delayed closure of the landfills (Buchanan, 2019; Ellis, 2020; "Update," 2020; VIWMA, 2019).

The director of the VIWMA needs political support to implement user fees and for residents to adhere to disposal regulations and requirements (VIWMA, 2019).

Failure to resolve these issues compounds the USVI's financial problems. Our conversations with stakeholders indicated that the USVI's economic situation, recovery costs, and higher-than-average poverty rates mean that charging for solid-waste removal is not seen as a solution that would be acceptable to the general population. Additionally, a secondary market of private waste haulers has grown up around the existing structure and might be resistant to change.

Crosscutting Natural and Cultural Resource Barriers

Federal Agency Presence in Natural and Cultural Resources Is Limited

The role of the NCR field coordinator is to integrate the federal government's capabilities to assist recovery. This multifaceted role includes facilitating information sharing about damage and recovery needs, leveraging and coordinating funding, providing technical assistance, coordinating environmental and historic preservation issues, and incorporating long-term sustainability and resilience into recovery planning (FEMA, undated d).

NCR staffing levels within the joint recovery office[4] appear to be insufficient to provide essential expertise, coordination, outreach, and information-gathering, which could help to mitigate the constrained capacity of the territory government agencies. The combination of staff turnover with minimal bench depth creates gaps in the joint recovery office's presence, resulting in loss of momentum and continuity. This creates additional risks for follow-through on projects and initiatives; the ability to access needed information and expertise; and conducting outreach for effective coordination with other sectors, funders, and stakeholders. The situation is exacerbated by the lapse in FEMA's interagency agreement with DOI that provides staff for the joint recovery office and long delays in executing federal interagency agreements or interagency reimbursable-work agreements with other federal agencies, such as NOAA, the NPS, or EPA, that could provide additional support, expertise, and, perhaps, continuity.

Moreover, the inability to readily identify NCR projects in the Grants Manager database—especially historic properties—limits the ability of FEMA, the NCR recovery coordinators, and FEMA's partners to troubleshoot problems with projects as they arise, monitor projects to ensure they are executed in a timely and appropriate manner, communicate status and progress with applicants and other stakeholders, and identify opportunities to leverage other funding sources to fill gaps. Failure to identify NCR projects in progress reports and other documents reinforces the sense that recovery of these resources is inconsequential.

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[4] The joint recovery office is where multiple agencies involved in the disaster-recovery process, including FEMA and the territory government, are colocated into a single working space.

Recovery Planning and Execution Among Natural and Cultural Resource Stakeholders Are Siloed

NCR stakeholders (federal agencies with authorities in this area, territory government agencies, and civil society organizations on each island) are working independently—each within its own area of focus—with little apparent coordination. Despite working in similar topic areas, NGOs, academic institutions, and civil society groups admitted that they do not work together closely. Similarly, FEMA and territory agencies did not know the status of activities being managed by the others. We also heard frustration from applicants, NGO officials, and personnel from other federal agencies about changing FEMA guidelines that led to additional data collection or revisions to scopes of work, which ultimately stymied progress.

Stakeholder discussions revealed a lack of communication among FEMA, ODR, and VITEMA, specifically regarding information on understanding projects and monitoring individual project status. Long lags in progress on projects resulted in applicants needing to submit the same information multiple times (as noted by several NGOs), while multiple site visits were needed to collect the same information. Changing guidance from FEMA (as noted by other federal agencies) and staff turnover exacerbated these delays and applicant confusion. Applicants are not fully aware of the different roles and responsibilities FEMA and its entities (including Witt O'Brien's, the FEMA contractor supporting territory recovery projects), ODR, VITEMA, and supporting federal agencies play in response and recovery. As such, they do not know the appropriate points of contract for follow-up or what may be needed to push the project along. Nor did they know who to approach when additional recovery needs were identified.

Management Capacity to Meet Recovery Needs

In addition to the barriers described in the previous section, the USVI faces several challenges related to the management capacity of its lead NCR agencies, DPNR and the VIWMA.

Interdivisional Coordination and Collaboration at the Department of Planning and Natural Resources Are Lacking

Although individual divisions within DPNR have their own priorities, there does not appear to be a widespread understanding of DPNR's or the territory's overarching goals and priorities for hurricane recovery, nor substantial coordination among divisions.[5] One area that could significantly benefit from better coordination is the per-

[5] Our observations were also noted by Page et al., 2012, who observed that achieving conservation goals is stymied by lack of coordination and sharing of scientific data among natural resource management entities, and that working with federal partners who are mostly based in Puerto Rico is challenging, in part because of physical distances and the expense.

mitting process (see also Chapter Ten), given that projects often require permits from multiple DPNR offices. In addition, as we learned in discussions with DPNR officials in 2019, divisional leadership does not appear to meet regularly to discuss programs, projects, and priorities; identify challenges; and pursue common objectives. Therefore, they are not always aware of the activities and priorities of their counterparts and are unable to share lessons learned and leverage efficiencies.

Both the Department of Planning and Natural Resources and the Virgin Islands Waste Management Authority Have Staffing Challenges

It has been reported that the VIWMA has nearly 50 vacancies despite interest in working for the agency (Buchanan, 2019), while 24 percent (approximately 50 positions) of the available positions within DPNR remain unstaffed, in part because of lack of funding (see Chapter Two). As a result, staff often cover the workload of several positions, which finds them working outside their areas of expertise more frequently (Page, Nemerson, and Olsen, 2012; discussion with environmental NGO personnel, 2019). Similarly, staffing limitations are causing some elements within DPNR to prioritize certain responsibilities over others; as an example, CZM meets its zoning requirements but does not conduct comprehensive land-use planning activities. Reliance on federal funds for hiring staff for recovery operations contributes to delays and management uncertainties. In discussion with staff of DPNR's building permit division and others in the USVI this year, it was noted that, because DPNR could not compete with salaries in the continental United States or in private industry, many of the incoming staff lack permitting experience and are not familiar with DPNR policies and procedures. According to NGO staff with whom we spoke in 2019, DPNR needs additional training and oversight capacity both within and among divisions, and it needs support for front-line inspectors who are tasked with upholding DPNR regulations in the field.

Staffing vacancies also contribute to problems in providing oversight. Two divisions within DPNR are plagued by vacancies and difficulty in attracting qualified people, according to our discussions and other documentation (Legislature of the Virgin Islands, 2019b). The VIWMA's oversight board currently has three vacancies on its seven-member governing board, which is composed of representatives from the public and private sectors (Legislature of the Virgin Islands, 2019a). And overall, the VIWMA has nearly 50 vacancies, the most critical of which employ engineers, environmental enforcement officers, and diesel mechanics (Buchanan, 2019; VIWMA, 2019).

Department of Planning and Natural Resources Requests Take Low Priority

DPNR division directors told us in 2019 that the department's ability to acquire recovery funding has been limited by delays in DPP, which has prioritized recovery initiatives related to housing, energy, and other basic needs. In addition, they told us, DPNR leaders are not always aware of processes, templates, and the other requirements that

divisions, such as DPP, require to process funding requests, which can also introduce schedule delays.

Organizational Turnover at the Virgin Islands Waste Management Authority

The VIWMA has experienced rapid leadership changes, most recently following the contentious debates over the disposal of storm-generated debris, after which the chair of the board of the VIWMA was fired and the recently hired executive director of the VIWMA resigned. In March 2018, an interim executive director was appointed (Roberts, 2019). The chief operating officer was also working in an acting capacity (Legislature of the Virgin Islands, 2019a).

For more than a decade prior to the hurricanes, the VIWMA and DPNR had not made demonstrable progress toward developing safe and legally compliant landfill capacity, and failure to do so has exacerbated hurricane recovery and preparedness for future storms (EPA, 2019b). Additionally, it has been years since the USVI has had a current waste characterization study to inform the development of waste-reduction alternatives (although an update has been drafted). The USVI had not developed plans for debris disposal to handle debris before the 2017 hurricanes (Palin et al., 2018). Although the VIWMA has known for years that a new landfill site would be required, concerns remain about the viability of the potential site it has identified, which lies within a flood zone. No schedule for developing the site has been provided, nor have alternative sites been identified. This lack of preparedness and consensus has occupied limited management resources and amounts to a lost opportunity to build resilience to future storms (Roberts, 2019; discussions with UVI personnel, 2019).

Box 9.4
COVID-19 and Natural and Cultural Resources

- The COVID-19 pandemic's effects on natural and cultural resources in the USVI overall are likely to be modest and will not affect our recommendations. COVID-19 will create concerns about transmission risk to sanitation workers from handling potentially contaminated waste—such as gloves, paper towels, or wipes—that is not securely bagged at drop-off sites. Medical waste, such as personal protection equipment, will likely increase, although there might be some offset if elective medical procedures are rescheduled. Should the USVI not be able to control the spread of the virus, there will also be an increased demand for mortuary services.
- Suspended community activities, such as plantings or monitoring, invasive-species removals, and cleanups that benefit such sites will reduce the progress of habitat restoration. Natural and cultural sites could suffer from more vandalism or illegal dumping if they are unattended because of the territory's stay-at-home order. The pandemic's effects on enforcement, personnel availability, contracts, or laboratory testing capabilities could create disruptions to compliance with environmental laws, regulations, and permits that could lead to a temporary increase in pollution and an elevated risk to human health and the environment.
- Ultimately, the pandemic's effects on natural and cultural resources might be second-order as the USVI responds and adapts. For example, greater pressure on single-family homes in the future could reduce open spaces that provide recreational opportunities or habitat for flora and fauna. The pandemic experience could increase support for preserving natural areas and public access to beaches. Contraction of cruise ship markets could spur the pursuit of alternative tourism, which could potentially provide greater incentives to sustain and protect natural and cultural resources.

Recommendations

Our recommendations are directed to federal and territory partners responsible for NCR recovery. Recall that recovery of natural and cultural resources is interdependent with other sectors and proceeds in unpredictable ways, increasing the importance of having up-to-date information and active organizational collaboration. Comprehensive recovery requires the collaboration of all property owners, federal and territory agencies, NGOs, academia, and the community at large. Thus, these recommendations are aimed at increasing awareness of NCR recovery needs to prevent further damage during reconstruction and facilitate long-term recovery; providing needed expertise and management capacity for recovery implementation; improving the coordination, prioritization, and ultimate effectiveness of actions; strengthening the overall protection of these resources; and seeking longer-term sustainability and resilience. These themes align with DOI guidance for NCR recovery support. This guidance states that recovery is facilitated by identifying needs; sharing information among stakeholders; providing funding and technical assistance as needed; developing organizational networks to enhance overall recovery capability and capacity; providing expertise to the Unified Federal Review and environmental and historic preservation processes; coordinating across sectors and government agencies; and addressing long-term environmental effects on natural resources, integration of open space and sensitive resources, and community well-being (FEMA, undated d).

The recommendations listed in this section are for the USVI as a whole; however, it is important to note that each island in the territory might face its own unique challenges and develop its own strategies. Each island's community might have to make an adjustment to how they contribute to these recommendations.

Nearer-term actions that can fairly quickly increase awareness of the recovery needs for ecosystems, cultural assets, and solid waste that may also protect them from further harm and improve recovery coordination for more-effective investments are described in the rest of this section.

Nearer-Term Recommendations to Address Natural and Cultural Resources

Identify a Champion for Natural and Cultural Resource Recovery to Lead and Facilitate Recovery

Goal	Ensure that NCR recovery activities have an advocate or advocates—ideally, led by someone in the territorial government who has authority—to increase awareness of NCR needs, address barriers, and drive progress. Additionally, champions will develop the necessary organizational linkages required for recovery that ensure that NCR recovery goals are derived from stakeholder input; communicated to all actors responsible for implementation, including those in other sectors; and are pursued despite changes in personnel, resources, and operating conditions.
Rationale	Implementation of NCR recovery is complex and, in the long term, relies on many actors, requires specialized expertise, often overlooked, and reliant on limited financial support for recovery. Moreover, FEMA programs do not fund habitat or artifact restoration and therefore only partially address the recovery needs. A strong champion (or champions) is needed to work with stakeholders to develop comprehensive recovery objectives and goals, guide the actors in recovery, obtain funds and resources, look for opportunities to enable action, orchestrate coordination and decisionmaking, and, most importantly, communicate recovery needs to ODR, VITEMA, and other parts of FEMA. Effective leadership has been identified as a key contributing factor to attracting financial and personnel resources to disaster recovery (Schwab, 2014). Although this champion does not necessarily need to have formal decisionmaking authority, bandwidth, capacity, and access to decisionmakers would be ideal in this role (Resetar et al., 2020). Champions ideally have a strong understanding of the issues at hand and can hold response elements accountable, resolve issues, and connect individuals and organizations.
Implementation considerations	• The governor or ODR should identify key stakeholders for each NCR element (natural resources, historical and cultural resources, solid waste). This includes federal, territory, and civil society groups working in this area. • The governor or ODR should host a workshop for each element to socialize the concept of champions and establish a baseline for what capacity exists for individuals or organizations to champion NCR goals. • Identify champions from this stakeholder group—ideally, led by someone from the territory government or a leader in civil society—with some level of influence and authority. Their specific roles and responsibilities should be established. • These champions should work within the existing baseline capacity as determined in the workshop to identify NCR recovery priority areas and identify leaders for those areas who can spearhead recovery activities. • The identified champions should maintain awareness of recovery activities within their assigned areas, communicating priorities, connecting projects and action officers, and networking with actors. They should also sound the alarm on delays, emergent challenges, and other issues affecting recovery. • Should a lead recovery coordinator for the overall recovery be established these champions should have a formal role in that coordination body. • This recommendation must be tempered to some extent because many of the individuals and organizations that would ideally fill this role are themselves recovering or do not currently have much capacity or bandwidth to fulfill this duty. However, if organizational capacity is assessed as part of the process, and expectations managed to reflect reasonable operational conditions, the identification of champions can prevent recovery activities from languishing and ensure progress on NCR recovery.
Time frame	Near term
Leading entities	The governor's office, ODR, FEMA, DPNR, the VIWMA, and VITEMA would be leading entities.

Develop a Consolidated Data Repository of Natural and Cultural Resource Assets to Inform Ongoing Recovery Initiatives and Improve Preparedness for Future Storms

Goal	Inform steady-state and recovery activities to protect natural and cultural resources from further harm, and provide the basis for strategic recovery and management of these resources.
Rationale	The lack of a consolidated data repository has prevented a broader understanding of the extent to which federal, territory, and nongovernmental organizations working to recover NCR assets were affected by the storms and limited a coordinated recovery effort. Individual organizations had pockets of visibility within their priority areas, but this information was siloed and not always shared efficiently. A repository would provide agencies and civil society organizations with a comprehensive view of assets, facilitate prioritization, and inform grant and funding requests. It would also allow decisionmakers to consider the secondary and cumulative effects of recovery activities and land and water use in general on these resources. For historical assets, it would also enable DPNR to quickly assess damage and benchmark repair and stabilization costs, creating an overlay of flood risk, providing prestorm condition data, and supplying action officers with contact information to enable rapid coordination. This resource would have applications wider than NCR recovery: It could be used to support tourism and economic development by incorporating the data into tourism marketing materials, tours, and other visitor resources. This information will be necessary for improved hazard-mitigation planning, land- and water-use planning, evaluating permits, enforcement, and other actions.
Implementation considerations	• Identify existing data sets held by the federal and territory governments, NGOs, academia, and other civil society groups. Process and consolidate these data sets to identify what information is available to prevent duplication of effort. • Share information with other reconstruction planners and enforcement personnel. • Establish a long-term plan for data standards, data storage, and data maintenance so that potential future needs are considered from the outset. This should include determining access criteria and establishing a data-access process. • Coordinate with subject-matter experts to identify gaps in existing data sets and establish a plan to collect, standardize, and analyze missing data. • Institutionalize data collection, input, reporting, and validation. This requires inserting data maintenance into the everyday processes and procedures of DPNR's and other agencies' personnel.
Time frame	Near to medium term; long-term maintenance
Leading entities	DPNR, NGOs, the NPS, the Virgin Islands Department of Tourism, and FEMA would be the leading entities.

Nearer-term actions that FEMA and the federal government can take, with participation of DPNR and the VIWMA, to address management-capacity challenges, improve communication and outreach to stakeholders, and improve planning processes are as described in the next two recommendation narratives.

Ensure That the Natural and Cultural Resource Field Coordinator Has the Resources to Effectively Monitor Natural and Cultural Resource Projects, and Provide Needed Outreach, Coordination, and Expertise to Support the Territory Government

Goal	Leverage the NCR field coordinator position to provide a single source of information for all recovery efforts related to NCR for FEMA programs and to help coordinate other federal agency grants and activities; this will help the USVI pursue a comprehensive recovery.
Rationale	The NCR standard operation procedure identifies key roles for the field coordinator. However, to effectively execute these roles, the field coordinator must have the proper resources to access the expertise needed and to assist territory agencies that might be strapped for management capacity. Furthermore, NCR projects are often funded by other federal agencies in addition to FEMA grant programs. However, NCR projects are not easily identified in FEMA's Grants Manager database, which makes it challenging to monitor NCR projects, provide assistance to applicants, and coordinate activities with other projects when necessary. Finally, ensuring that information is communicated and institutional memory is sustained across all actors in recovery implementation is crucially important given the level of turnover among federal and contractor staff and the weakness of existing permitting and enforcement processes for protecting natural and cultural resources. Given the siloed nature of NCR recovery and the management-capacity limitations, it is important to institutionalize information sharing and coordination, especially among DPNR, the VIWMA, ODR, and civil society organizations (Pendall et al., 2013; Resetar et al., 2020).
Implementation considerations	• Consider increasing the number of field coordinator positions so that someone with expertise in cultural recovery and someone with expertise in natural resource recovery can always be present in the territory. • Add an identifier for NCR projects so the field coordinator can more easily identify and track projects to proactively address issues and needs for support (responsible party: FEMA). • Bring in experts from other federal programs to coordinate recovery activities and to provide expertise, innovative ideas, and support to territory agencies. These experts could also act as mentors to territory personnel where the expertise is limited because of capacity constraints (responsible parties: FEMA, DOI, EPA, NOAA, USDA, and USACE with DPNR, the VIWMA, and ODR). • Establish a manageable process, given the capacity constraints of territory agencies, to engage in routine communication, learning, and reporting to more efficiently and effectively implement projects and to ensure accountability to the public. Engage in collaborative planning for projects determined to have potentially severe ecological effects (perhaps using area of land disturbance, proximity to guts, and other factors) prior to environmental and historic preservation review. • In addition to improved project implementation, the coordinator could codevelop fact sheets and awareness training on unique USVI heritage trees, protected species, archaeological artifacts, and other sensitive assets to increase awareness among planners and reconstruction personnel.
Time frame	Near term
Leading entities	FEMA, federal partners with DPNR (the U.S. Fish and Wildlife Service, the State Historic Preservation Office, and CZM), the VIWMA, and select NGOs would serve as leading entities.

Develop and Implement a Framework and Process for Coordinating Funds and Identifying Priorities and Goals Among Natural and Cultural Resource Projects and Programs

Goal	Have an improved project management plan that provides a holistic view of and encompasses all projects and grant programs for NCR recovery.
Rationale	Several federal programs provide funding sources; however, it is not clear that federal programs are effectively coordinating their activities and how other potential funding sources are being accessed to fill needs. DOI, USDA, and the U.S. Department of Commerce, the National Endowment for the Humanities, HUD, and EPA are some of the federal entities active in NCR recovery. Without coordination, local capacities can easily be overburdened and opportunities for recovery could be lost.
Implementation considerations	• ODR, with support from other entities that are actively involved with managing grants, should further develop the current database of projects and funds by including more-detailed information for effective project management, such as project time frames, milestones, and deliverables, to facilitate better project coordination, troubleshooting emerging issues, and progress tracking and reporting. Studies from past disasters indicate that alignment of execution strategies and coordination among agencies can help to mitigate capacity constraints and improve program performance (Cheatham, Healy, and Kuusinen, 2015). • Entities and individuals actively involved with managing grants can benefit from using tools, such as logic models, to identify the contribution between NCR projects and their intended outputs and outcomes to specific overarching recovery goals (McLaughlin and Jordan, 1999). Stakeholder participation is recommended. • To be most effective, a formal coordination body should have representatives from key agencies and stakeholders, and it should be chaired by someone empowered to lead (such as a recovery leader within ODR or, depending on how it is implemented, an overall NCR champion established as suggested in our first recommendation) to ensure coordination among the programs and grant activities.
Time frame	Near term
Leading entities	DPNR and the VIWMA with ODR, EPA, U.S. Department of Commerce, DOI, and the NCR RSF at FEMA

Longer-Term Recommendations to Address Natural and Cultural Resources

Comprehensive recovery that builds back in a sustainable and more resilient manner requires executing an interdependent portfolio of projects in a proper sequence. Pursuing a strategy for recovery and managing a comprehensive portfolio of projects and related activities will require interagency and stakeholder coordination. Without a strategy and a plan, it will be impossible to effectively perform project management, measure progress, or sustain accountability. The following recommendations address the need to develop more-detailed implementation strategies and plans for recovery and to prioritize activities that advance recovery within funding and management-capacity limits. They are longer-term recommendations but, for maximum effect, should be phased, to the extent practicable beginning immediately and could be developed as more management capacity is established.

Make Greater Use of Comprehensive Land- and Water-Use Planning to Execute More-Resilient Recovery by Considering Interactions and Synergies with Other Recovery Sectors

Goal	Provide the Virgin Islands government and residents with a planning approach and tools to more strategically and transparently balance social, economic, and ecological objectives.
Rationale	The USVI has high population density on a constrained land mass, triggering an intense competition for land. Comprehensive land- and water-use planning, although challenging, can increase the likelihood that communities are able to meet the needs of their constituents, protect their heritage, and sustain their economies. Comprehensive planning will also help rationalize public investments on infrastructure, schools, housing, conservation, hazard mitigation, and other items (Diamond and Noonan, 1996). NCR recovery is interdependent with the recovery activities of other sectors, such as housing and infrastructure, and strategic investments in NCR recovery can reduce flooding or coastal erosion if investments are made strategically rather than haphazardly. Greater utilization of land-use planning tools to coordinate recovery among sectors can lead to more efficiency in the recovery process, improve hazard mitigation, and avoid potential problems later on (Cutter et al., 2008; Schwab, 2011). Natural infrastructure offers many hazard-mitigation opportunities, and there might be strategies or opportunities to include natural infrastructure into HUD CDBG-DR tranche 3 projects, but, without preplanning, these opportunities could be lost. Effective land-use planning is also important for lessening environmental justice concerns, adaptation to climate change, mitigating future natural hazards, and reducing the negative effects of inland activity on the coastal zone (Bridges et al., 2015).
Implementation considerations	• Establish a task force within the governor's office and the legislature to spearhead land-use planning and perform an analysis of the management-capacity implications of pursuing this initiative (responsible parties: Office of the Governor, DPNR, CZM, and the Virgin Islands Historic Preservation Commission). Postrecovery land-use policy involves key considerations regarding the timing and quality of reconstruction and redevelopment patterns (Schwab, 2014). • Work with DPNR to assess current practices in comprehensive and coastal zone planning for formulating long-range plans, zoning maps, and subdivision processes to determine where better land-use strategies and implementation between the public and private sectors could be incorporated. Draw from the experiences of the Ridge-to-Reef initiative and CZM's water-use pilots as a first step. • Perform more-detailed analyses to determine where to invest in natural infrastructure for coastal protection. Investments in natural infrastructure can have high up-front costs and require routine maintenance. Additionally, direct benefits to coastal environments are dependent on a variety of site- and context-specific factors (Ruckelshaus et al., 2016) (responsible parties: UVI, DPNR, and NGOs). • Evaluate the existing planning process for the presence of guiding principles, existence of planning gaps, data availability and quality, public participation processes, monitoring outcomes, and evaluating implementation (Godschalk and Rouse, 2015). Develop a proposal to improve land- and water-use planning based on the evaluation of current practice and engage stakeholders, such as the housing authority, NGOs, and developers, to discuss and finalize the proposal.
Time frame	Initial phase near term with long-term continuing phasing in
Leading entities	The governor's office, DPNR, UVI, NOAA, VIHA, and NGOs would be the leading entities.

Improve Strategic Planning and Implementation of Recovery Funding for Historic Properties and Cultural Resources

Goal

Improve strategic planning of recovery funding sources. Although this recommendation builds on existing planning for historic-property recovery, a more comprehensive plan for identifying and managing supplemental funding from federal sources for all cultural resources is needed.

Rationale

Some NPS and other funds are available to fill gaps in FEMA funding. Although some initial planning has occurred, implementation could potentially proceed faster with more-detailed planning. Furthermore, historic properties and archeological sites are owned by private or not-for-profit entities in addition to the territory and federal governments. Irreplaceable records and archival material are maintained by private, religious, and nongovernmental agencies. More-refined planning will help ensure that investments are properly recovered, maintained, and linked to community needs and economic development opportunities. There needs to be better planning and coordination to identify ways in which these investments can be maintained and better prepared for future storms in the longer term. Finally, information on the needs of artisans, performing artists, and arts centers is sparse, despite their contributions to sustaining traditions and to tourism.

Implementation considerations

- This plan should be comprehensive and include historic sites, archeological sites, archival materials, collections, artifacts, and other culturally significant assets and build on the planning already being done for NPS funds by the SHPO. Outreach to artisans, performers, and performing arts centers is needed to improve recovery planning and implementation, including to ensure preparedness of the arts industry in USVI for future storms.
- Short-term needs are to fortify key historic properties and districts and to provide additional training on record management and preservation; clean archival records and artifacts; and store them in safe, climate-controlled areas to prevent additional degradation. Longer-term directions are to find permanent, safe archival storage facilities and gather more-complete and updated information on properties eligible for the National Register, including those at risk from additional damage.
- The SHPO, together with Department of Libraries, Archives, and Museums, should develop a more detailed plan, including a schedule and milestones, for funding from DOI, the National Endowment for the Humanities, and other potential sources. The detailed plan can help to alleviate challenges, such as delays in hiring, property, and procurement, which could put the plans for acquired NPS funds in jeopardy should they expire before the plan is fully executed.
- The plan should include clearer criteria for investing in projects, which could improve synergies with economic development activities or education, or ensure that critical cultural resources are not overlooked. One suggested strategy for developing clearer criteria for investing in projects is to create an inventory of historic properties and their historical significance.
- The SHPO should clearly delineate schedules and goals to help improve coordination with supporting FEMA activities in natural and cultural resources and environmental and historic preservation. This proactive approach also could be used as a framework for other NCR-related recovery efforts beyond historic properties and provide added benefits.
- Additionally, the SHPO should educate owners of historic properties about the various funding sources available and methods in applying for funding.
- Finally, the plan should include options for sustainable funding sources to support site maintenance, program management, archival preservation, and training opportunities.

Time frame

Near term

Leading entities

SHPO and Virgin Islands Historic Preservation Commission committees; the NPS; DPNR; the National Council of the Arts; the Department of Libraries, Archives, and Museums; and FEMA would be the leading entities.

Recommendation to Address Solid-Waste Management

Establish a High-Level Task Force to Develop More-Detailed Implementation Plans for Sustainable Solid-Waste Recovery and Management

Goal

Help the government of the Virgin Islands and the VIWMA overcome barriers to recovery and create a realistic and actionable implementation plan with solutions for improving solid-waste management and public accountability. At a minimum, this plan should include a list of specific activities to complete, priorities for and sequencing of these activities, milestones, and schedules.

Rationale

Solid-waste management has been a long-standing problem in the USVI, and there is strong stakeholder interest in addressing this issue. The territory's solid-waste management program has been financially unsustainable for years; both landfills have been operating under federal consent decrees because of noncompliance issues and are planned for closure in the very near future (between 2020 and 2021). Despite these pressures, the VIWMA and DPNR have made only modest progress. Many initiatives that will cost hundreds of millions of dollars have been identified in the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan. However, given the lack of progress in solving these issues in the past and the substantial investments that are required, full recovery and preparedness for future storms are high risk. Moreover, although some relatively modest funds are available from EPA to assist with recovery, they have not been obligated to date, nor is there a detailed sustainable program plan that could guide accessing other grants and identify solutions to long-term issues, such as sustainable financing and waste reduction.

Implementation considerations

- The VIWMA should develop a high-level task force that is dedicated to solid-waste management on the USVI. The task force, composed of members from the governor's office, the legislature, the VIWMA, DPNR, UVI, and EPA, should focus on developing an implementation plan as a collaborative effort building off the initiatives identified in the USVI Hurricane Recovery and Resilience Task Force's Recovery Plan. Although EPA is working with the VIWMA and DPNR to develop a sustainable solid-waste management program and, as described earlier, has made progress, developing a realistic implementation plan will require key stakeholders and subject-matter experts to work together. It is important to note, however, that any proposed organizational structure needs to be authorized at the level of the governor's office, with support from the legislature to ensure that the plan's implementers are empowered and funded to develop solutions to barriers that might arise.
- The detailed implementation plan mentioned previously should include a schedule, timetable, detailed steps and their sequencing, budgets, alternatives for addressing financial issues, and other management needs. VIWMA officials have testified on the status and challenges in meeting the requirements of the consent decrees; however, financing options (such as appropriate tipping fees), other barriers to implementation, and options for overcoming them require support from the entire territory government.
- Another recommendation for the solid-waste management task force is to incorporate community outreach and education in planning efforts. Specifically, the task force in its entirety should communicate the social benefits of proper solid-waste management practices and educate the community on the potential environmental hazards that can result from a lack of proper waste management.
- The VIWMA and other stakeholders involved with solid-waste management on the USVI should coordinate with entities from other sectors. For example, the procurement and installation of backup generators at landfills intersect with the goal of developing reliable energy sources for essential services on the islands.

- Elements of sustainable solid-waste management also will involve substantial investments and significant management, procedural, and cultural change that will likely take several years to attain, such as territorywide waste-reduction or recycling programs, material reuse programs, or both.
- Coordination among local organizations can also prove to be effective. The Coral Bay Community Council, for example, is interested in reducing the waste stream to prevent issues with runoff for the protection of ecosystems. It is recommended that the VIWMA pilot waste reduction on each island building on existing NGO activities and in coordination with the stakeholders scale up these pilots for the three islands.
- To maintain momentum and public accountability, it will be important to identify short-, intermediate-, and long-term goals for solid-waste management practices and set realistic expectations for meeting those goals.

Time frame Short to long term

Leading entities The governor's office, legislature, the VIWMA, DPNR, EPA, USACE, the U.S. Forest Service, UVI, and waste-reduction NGOs would be the leading entities.

Recommendations to Address Crosscutting Areas of Natural and Cultural Resource Management

In this section, we provide recommendations for improving recovery management within the territory government and should be relatively easy to implement. If implemented, these recommendations could increase information sharing and therefore contribute to a greater understanding of the processes needed to execute recovery projects, leveraging cross-divisional synergies, and pursuing priorities for DPNR.

Increase Collaboration, Strengthen Management Processes, and Enhance Coordination Within Department of Planning and Natural Resources Divisions and with Property and Procurement

Goal	Foster greater interdivisional coordination to eliminate barriers, share information on best practices, and identify project synergies.
Rationale	Many divisions of DPNR have responsibilities for NCR assets; however, DPNR leadership does not appear to meet regularly to discuss activities, priorities, and challenges. The sharing of information and strategies to overcome barriers could help to streamline processes, improve enforcement, and support more-effective decisionmaking. Additionally, DPNR projects have not been prioritized by DPP, which has led to delays that could slow recovery overall and paradoxically could increase the workload on DPNR when projects have to be modified or information has to be updated. Better coordination within DPNR could alleviate the delays with DPP. In addition, several divisions have responsibilities for permitting decisions and enforcement, which are important for preventing additional harm to natural and cultural resources during reconstruction.
Implementation considerations	• Develop a process for greater interdivisional coordination, through either simple meetings or topical working groups (responsible party: DPNR). • Share information on how to manage FEMA projects and other common processes, such as hiring and contracts. • Develop a simple scorecard to track progress and to provide supervisory oversight, sharing of lessons learned, and accountability for meeting divisional goals. • Encourage opportunities to participate in online training or subject-matter forums.
Time frame	Short term
Leading entities	DPNR divisions would be the leading entities.

Develop Clear Educational Materials on Permitting to Streamline the Process and Continue Implementing the Electronic Tracking System

Goal

Develop a more streamlined and transparent permitting process that also improves the protection of natural and cultural resources through greater awareness and enforcement. This implementation of this recommendation would provide permit applicants with all the information needed to efficiently apply for permits while enabling DPNR to schedule and streamline the permitting process, facilitating information flow across the department.

Rationale

NCR recovery is threatened by additional stressors from pollution and development. Permitting is the first line of defense to protect natural and cultural resources from further harm, followed by enforcement of laws and regulations. Efficient and effective permitting is also essential to smooth business operations and economic opportunity. However, recent assessments and plans have indicated that permitting and enforcement gaps exist, often because of lack of awareness, technical expertise, or understanding of regulations (Office for Coastal Management, 2018; Platenberg and Valiulis, 2018a; Platenberg and Valiulis, 2018b). Providing applicants with resources and guidance prior to application not only facilitates more-complete application packages but also gives inspectors clear guidelines by which to evaluate applications. Permitting processes are also largely paper-based and lack public transparency. Because many projects require different types of permits, processed by different divisions of DPNR, increased coordination among divisions would enable schedule alignment and would result in permits being issued more efficiently. It is also difficult to track lead times across the department because this information is not tracked electronically. Incorporating greater use of IT that can be used to generate information on process and permit status could facilitate economic opportunity and protect valuable resources simultaneously (National Institute of Building Sciences, 2002). Implementing an electronic permitting system could also result in cost savings for applicants; CZM deployed a permitting electronic data-entry solution that is estimated to save applicants between $3,000 and $4,000 for large construction projects (DPNR, 2018b). Increasing regulatory and technical awareness and training could improve the enforcement process. Greater public transparency in enforcement actions can improve enforcement and accountability (DPNR, 2018b; Goldren, 2019; Platenberg and Valiulis, 2018a).

Implementation considerations

- Establish a working group of DPNR subject-matter experts to develop a process map of each permitting process to guide applicants and permitting authorities. The maps should include information on the point of contact, information needed, steps in the permitting process, and a typical time frame for each permit type (responsible parties: CZM, SHPO, and Permitting).
- Validate the permitting process, including individual steps, required documentation, and evaluation criteria for each permit type.
- Compile and distribute permitting information in a user-friendly format and distribute it broadly to residents, federal agencies, and response organizations.
- Update resources on an annual basis or whenever a significant change is made to the process. Establish an engagement mechanism so that stakeholders are able to ask questions, request clarifications, and provide feedback to the process.
- Continue implementation of the electronic permitting system, ensuring that all applicants and inspectors understand the system's function and operation. A training curriculum and schedule should be established.
- DPNR leadership should identify ways in which the permitting system's additional capabilities can be used to improve permit enforcement, inspection scheduling, and other permitting elements. This includes larger permit displays at sites, regularly publishing violations and fines, and supporting enforcement officials. Electronic permitting enables violations to easily be released into the public domain, providing an additional compliance incentive (Goldren, 2019).

	• An electronic system maintenance and quality-control process should be scheduled and funded to ensure the system remains operational following the initial deployment.
Time frame	Education materials near term; tracking system long term
Leading entities	DPNR divisions, IT department, and business licensing office would be the leading entities.

CHAPTER TEN

The Tourism Economy

Box 10.1
Key Findings About the Tourism Economy

- Tourism is the most-important revenue stream in the USVI and depends critically on the USVI's natural and cultural resources. Recovery in this sector has been slow, although the level of impact has varied across businesses.
- Medium-term recovery goals include ensuring
  - sufficient workforce with appropriate training and skills to support tourism-related businesses
  - sufficient housing for high-season tourism-sector workers
  - reduction in obstacles for business owners who want to start or continue tourism-related businesses
  - sufficient infrastructure to support tourist arrivals and experiences
  - that the changing nature of tourism and potential options for diversifying the economy are considered.
- Key barriers to recovery include difficulty in finding workers, housing-related challenges, lack of access to capital and financial services, constraints on doing business, insufficient infrastructure, and increased competition for tourists.
- Recommendations include the following:
  - Establish a one-stop shop for business approvals and approvals of new construction projects.
  - Relax the regulations on the number of local workers a firm must employ to benefit from VIEDA programs when the unemployment rate is low.
  - Schedule construction work to cause as little disruption as possible during the tourist season.
  - Leverage tourism service providers to help promote the territory, including identifying opportunities to expand tourism by leveraging the USVI's natural and cultural resources (see Chapter Nine).

In this chapter, we discuss the USVI's tourism economy. Although tourism is often referred to as a sector in itself, it involves "goods and services associated with the activity of visitors," which are found in a variety of economic sectors (United Nations, 2010). Tourism-related activities are typically not included in standard data sources; in many cases, the leisure and hospitality supersector—which includes accommodation and food services, the arts, entertainment, and recreation—is used to approximate tourist activity. In this chapter, and in the report overall, we present information related to tourist activity where possible, and otherwise use leisure and hospitality as an approximation.

Box 10.2 highlights the methods used in this analysis, as well as its limitations.

Box 10.2
Methodology for the Analysis of the Tourism Economy

- The information in this chapter uses analysis of official data and a thematic analysis of discussions with tourism service providers in the USVI in November 2019 and January 2020. More information on sample selection and qualitative analysis can be found in Chapter One; those used for the tourism economy are consistent with methods applied in other sectors.
- Our discussions included members of several tourism-focused associations, owners of hotels, representatives of excursion and adventure companies, personnel from retail stores, property managers, and people involved in the marine industry. Overall, we held discussions with representatives from five hotels, five other tourism-related businesses, six retailers, and five business associations on St. Croix and St. Thomas. We also use information from discussions with banks and government officials that we conducted for other chapters in this report.
- Quantitative data were downloaded primarily from USVIBER and BLS. The percentage declines noted in the text use a model, described in Appendix B, to estimate the difference in outcomes after the hurricanes in order to account for time trends and seasonality.
- Our estimated effects of the hurricanes are the average monthly differences for the period of interest (September to December 2017 for immediate impacts, and January 2018 to December 2019 for longer-term impacts). For example, an estimated decline of 50 percent in cruise ship passengers immediately following the hurricanes means that the outcome was approximately 50-percent lower in the period between September and December 2017 than we would have expected it to be had the hurricanes not occurred. This does not mean, however, that the actual differences in the poststorm period are constant; in many cases, peak impacts occurred in October or November.
- Key limitations included the following:
  - lack of data on the short-term rental market; planned reopening of restaurants, retail stores, or other tourist-focused businesses; and information on sectoral value added since the hurricanes
  - estimates of declines being descriptive and not causal because we do not have a set of islands similar to the USVI with which we could compare them in order to estimate what the likely counterfactual trends would have been in the absence of the hurricanes
  - potential selection bias in the discussants; most of the discussants for this analysis were owners of tourism-related business and are not necessarily representative of the tourism sector as a whole.

Setting the Stage

Before the Hurricanes

Tourism is "the single most important stream of revenue" for the USVI and is of vital importance to the territory's economy (VIHFA, 2019a, p. 9) and depends critically on the USVI's natural resources (see Chapter Nine). In 2016, the World Travel and Tourism Council estimated that the direct contribution of travel and tourism to the USVI economy was 13.3 percent of gross territory product, and, including spillover effects of the industry on the broader economy, the sector made up 31.8 percent of gross territory product (World Travel and Tourism Council, 2017).[1] In 2016, just under 8,500 people were employed in tourism-related activities, accounting for about 20 percent of civil-

[1] The *direct* contribution is calculated using such sectors as hotel, airline, airport, travel agent, and leisure and recreation services. *Total* contribution includes indirect impacts—such as investment spending, government spending, and businesses that provide goods or services to hotels, airlines, and other tourism-related sectors—and *induced* contributions, which are economic activities supported by industries that are directly or indirectly employed by the tourism sector.

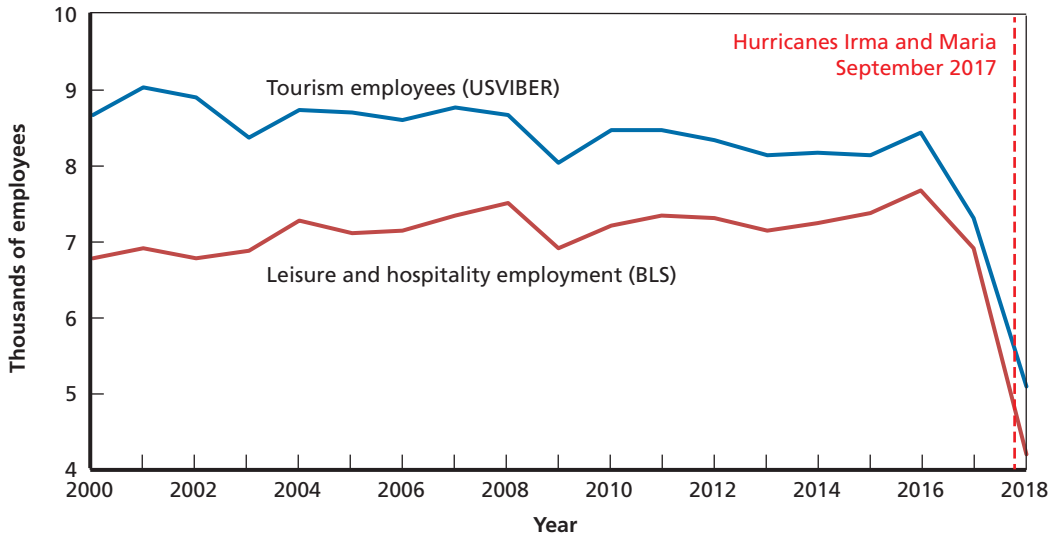
ian employment; tourism had accounted for around one-fifth of civilian employment since at least 2000 (Figure 10.1) (USVIBER, undated b; USVIBER, 2018a). Estimates from the Federal Reserve Bank of St. Louis and BLS, also shown in Figure 10.1, of the number of people employed in the leisure and hospitality supersector are nearly 8,000 for 2016.

Impact of the Hurricanes

The tourism industry in USVI was particularly hard hit immediately after the hurricanes in September 2017, and recovery in the sector has been slow. By the end of 2018, tourism-related employment had dropped to around 5,100, a decline of 40 percent from 2016 (12 percent of civilian employment [see Figure 10.1]). As discussed more in Chapter Four, this decline in tourism employment is likely driven by both (1) damage to tourism infrastructure and a decline in the number of tourists and (2) an increase in demand for higher-paying, less seasonal jobs associated with the recovery, such as construction.

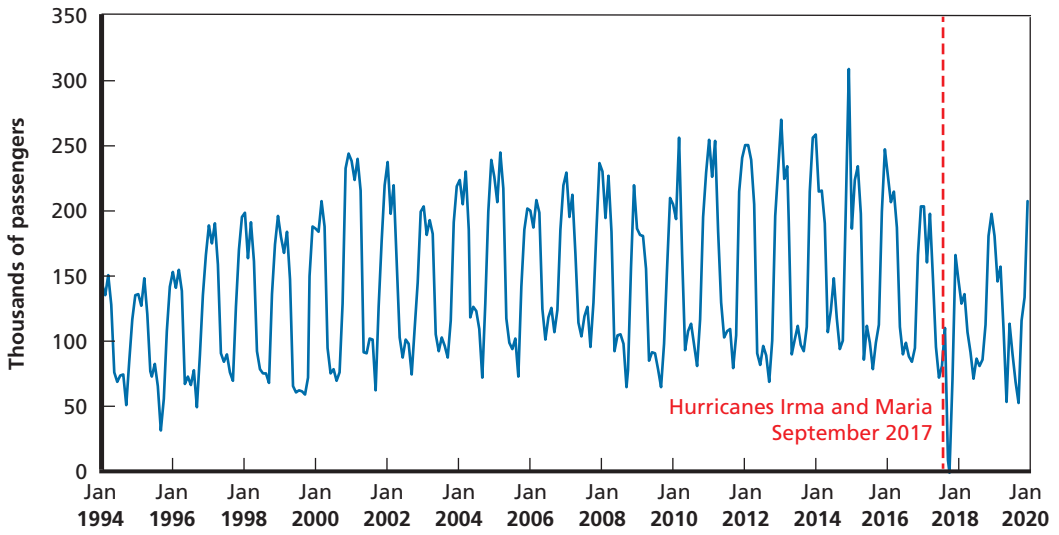
As can be seen in Figure 10.2, the tourism industry in the USVI is highly seasonal, with most guests arriving between November and April. Controlling for normal yearly and monthly changes using the regression framework described in Appendix B, the last four months of 2017 saw steep declines in many tourism-related indicators. Arrivals by air into the USVI were down 75 percent between September and December 2017, compared with previous years. The number of cruise ship passengers dropped

Figure 10.1
Tourism-Related Employment, 2000–2018



SOURCES: Federal Reserve Bank of St. Louis, 2017, including BLS data; USVIBER, 2018a; USVIBER, undated b.

Figure 10.2
Cruise Ship Passengers, 1994–2019



SOURCE: USVIBER, undated a.

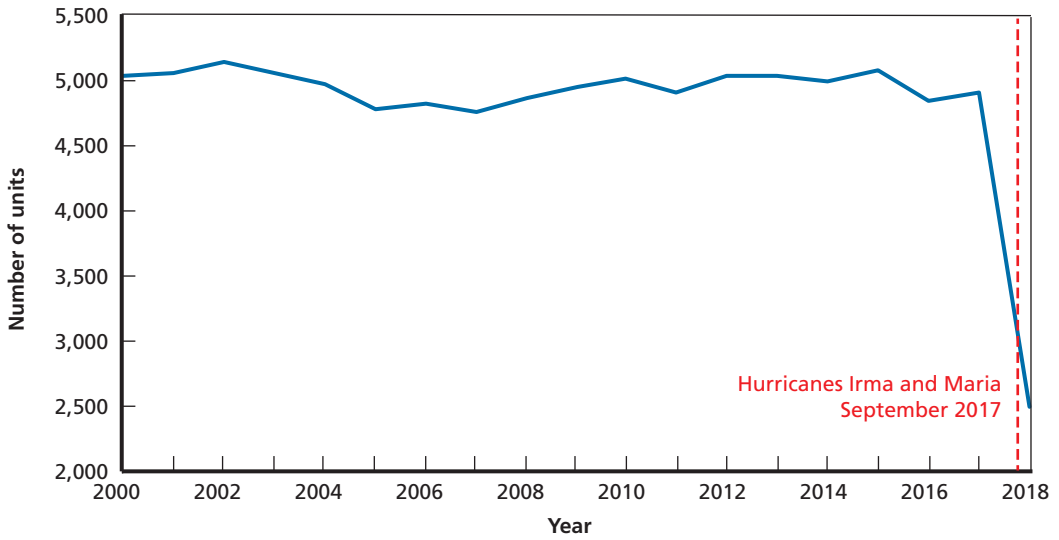
to zero in October 2017 and was down more than 50 percent for the four months following the hurricanes from that in previous years. Lost spending from cruise ship passengers and other tourists was estimated at $71.1 million for October 2017 alone (VIHFA, 2019a).

Because of damage to private homes and other residential housing caused by the storms, many residents from the USVI and Puerto Rico stayed in hotels following the hurricanes. The number of hotel guests from the continental United States dropped by 74 percent from the same period in 2017, with even-larger decreases in hotel guests from Canada, Europe, and South America. Despite the increase in locals staying in USVI hotels in October, the number of hotel nights occupied dropped by about 40 percent from the same period in 2017. At the same time, the total number of rooms available for tourists (including hotel rooms and condos) dropped from 4,842 in 2016 to 2,483 in 2018 (see Figure 10.3) (USVIBER, undated a).[2]

Although airlines take many factors into account when deciding how many flights to allocate to the USVI, there is some evidence that the number of hotel rooms available is a key factor in these calculations. Lisa Hamilton, president of the U.S.

[2] The estimates in this paragraph are based on regressions as described in Appendix B with month and year fixed effects and robust standard errors. Time periods vary by outcome, with air arrivals, cruise ship arrivals, hotel nights occupied, and hotel occupancy including data from January 1994 through December 2017; hotel guests including data from December 2004 through December 2017; and hotel rooms available including data from January 2006 through December 2017. Note that, for numbers of hotel guests and hotel nights, available data are missing from January through November 2016.

Figure 10.3
Total Tourist Accommodation Units (Hotel and Condo), 2000–2018



SOURCE: USVIBER, undated a.

Virgin Islands Hotel and Tourism Association, told a local paper in 2019 that "airlines are directly tied to the number of rooms in your destination" and USVI commissioner of tourism Joe Boschulte said, "The relationship between airlift and hotel is symbiotic. The airlines ask, are the hotels reopened yet? And the hoteliers ask, when are we going to get our airlift?" (Akin, 2019; Karantzavelou, 2019; "New Resorts Coming to USVI," 2019; "USVI Looking to Boost Airlift to St Croix," undated). Thus, fewer available hotel rooms might also have led to fewer flights.

Although exact figures are not available, the number of short-term rentals has increased substantially since the hurricanes. Prior to the hurricanes, in May 2017, Airbnb reported that it had around 2,000 active listings across the USVI (McCarthy, 2017). The Department of Tourism reported that it had partnered with Airbnb to increase the availability of short-term housing, although our discussions with tourism service providers suggested that it is not clear whether and how airlines factor the availability of such short-term rentals into their determinations about how much airlift to offer.

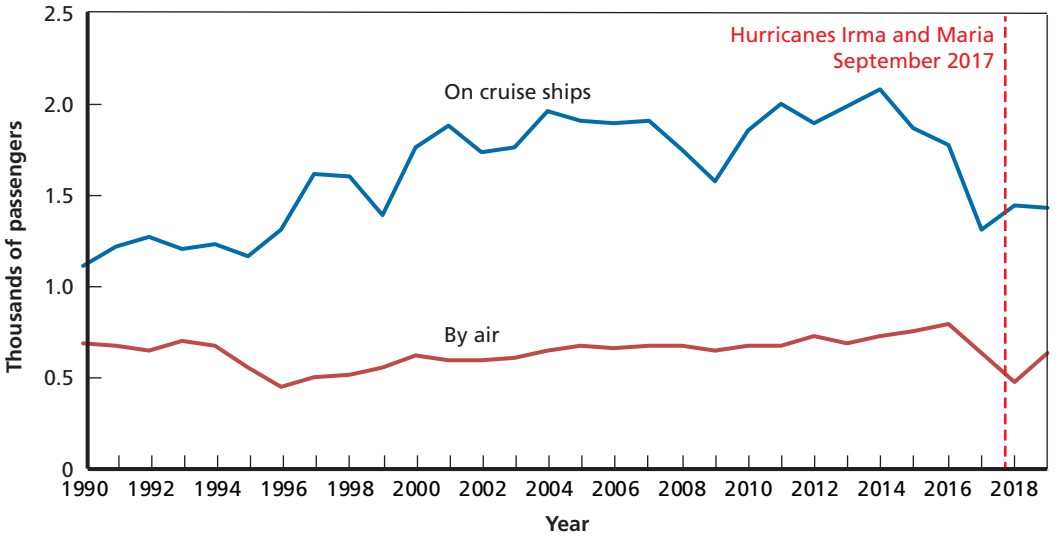
Recovery Progress Since the Hurricanes

As shown above, a destruction of capacity and lower demand immediately after the 2017 storms caused the entire sector to shrink; recovery in 2018 and 2019 were slow. Total flight seats were down 28 percent in 2018 and 2019 from pre-2017 levels (note

that data are missing for this variable for prestorm 2017 months).[3] Air arrivals in 2018 and 2019 were still 30 -percent below prehurricane levels (see Figure 10.4). The decline was driven by fewer air arrivals to St. Thomas; air arrivals to St. Croix actually increased in 2018 and 2019 from their prestorm levels, likely because of an influx of recovery and aid workers and the restart of the Limetree Bay oil refinery. Cruise passenger arrivals in 2018 and 2019 were 31-percent below historical levels, although cruise ship calls were down only about 8.5 percent.

The number of hotel guests from the continental United States was down 80 percent in 2018 from prestorm levels, with guests from Canada, Europe, and South America all down 75 percent or more. The number of hotel nights occupied fell 63 percent and the number of hotel room nights available fell almost 60 percent; because the numbers both of available rooms and of guests were lower, hotel occupancy rates did not change much from previous periods (USVIBER, undated a).[4]

Figure 10.4
Air and Cruise Ship Passenger Arrivals, 1990–2019



SOURCE: USVIBER, undated a.

[3] Calculations of the number of USVI direct-flight seats per week include information on daily scheduled flights arriving from outside the Caribbean during the first week of a given month.

[4] The estimates in this paragraph and the previous one are based on regressions described in Appendix B with month fixed effects, a linear time trend, and robust standard errors. Time periods vary by outcome, with air arrivals, cruise ship arrivals, hotel nights occupied, and hotel occupancy including data from January 1994 through December 2019 (excluding September through December 2017); hotel guests including data from December 2004 through December 2018 (excluding September through December 2017); and hotel rooms available including data from January 2006 through December 2018 (excluding September through December 2017). Note that,

Hotels, retail shops, and other tourism-focused businesses varied in the extent of damage sustained and the speed with which they were able to reopen. Some hotels sustained only minor damage and were able to reopen almost immediately after electricity was restored to their area. Other hotels are still not open more than 2.5 years after the hurricanes (see Table 10.1 for the number of hotel beds available).

During our discussions with hotel managers on St. Croix and St. Thomas, several reported that their businesses had benefited from an initial inflow of cash from recovery workers from FEMA and elsewhere staying at their properties in the months immediately following the hurricanes, when few tourists were coming to the territory. When tourists started coming back, many hotels started serving them. Other hotels, however, remained officially closed but were open for recovery workers, thus bringing in revenue. Our discussions with other tourism-focused businesses, such as retail shops, excursion providers, and charter boat companies, indicated that these businesses did not benefit substantially from the surge in recovery workers. On the contrary, as we discuss in more detail below, they might have been hurt by recovery workers competing with tourists for hotel rooms and raising rates for local accommodations and services.

Recovery Directions

Tourism has historically been one of the most important components in the USVI economy. Although one of the stated goals of the USVI's disaster-recovery action plan is to diversify the economy away from its dependence on tourism, such diversification will take time, and tourism will continue to play a critical role in the USVI's economy

Table 10.1
Number of Hotel Rooms Available, Fall 2019

Room Category	Territorywide	St. Thomas and St. John	St. Croix
Open end of the third quarter of 2019	2,352	1,931	421
Open to relief workers only	150	150	0
Scheduled to open the fourth quarter of 2019	409	217	192
Scheduled to open first half of 2020	773	622	151
Unknown reopening date	466	466	0

SOURCE: Individual hotel opening information provided by the U.S. Virgin Islands Hotel and Tourism Association, November 2019.

for the numbers of hotel guests and hotel nights, available data are missing from January through November 2016.

for many years to come. Thus, the disaster-recovery plan notes that "reinvigorating tourism is an urgent need" (VIHFA, 2019a, p. 164).[5]

Although many tourism service providers are once again operating their businesses and activity and employment in tourism as a whole are doing much better than in the immediate aftermath of the storms, tourism in the USVI faces many challenges moving forward. Key recovery directions for this sector are shown in Box 10.3.

Box 10.3
Recovery Directions for the Tourism Economy

- Accessing a sufficient workforce with appropriate training and skills to support tourism-related businesses
- Accessing sufficient housing for high-season tourism-sector workers
- Reducing obstacles in the way of business owners who want to start or continue tourism-related businesses
- Developing sufficient infrastructure to support tourist arrivals and experiences
- Monitoring the changing nature of tourism and diversification of the economy

Key Barriers and Gaps

Many of the most salient concerns relayed by those with whom we spoke were not specifically related to the hurricanes but were longer-term structural challenges, such as finding enough skilled workers (see Chapter Four), the rapidly increasing price of housing (see Chapter Eight), impediments to entrepreneurship and business growth, the degradation of important infrastructure (see Chapters Six and Seven), the availability of natural and cultural resources (see Chapter Nine), and the changing tastes and demographics of tourists. To create a thriving, sustainable tourist sector, the USVI must confront these issues. Given the financial and technical expertise provided by FEMA and other government organizations, now is the ideal time for the USVI to take advantage of this assistance to address these issues and improve the long-term performance of one of its most important industries.

Difficulty in Finding Workers

Several of the people with whom we spoke mentioned the difficulty of finding qualified workers to fill necessary positions in their organizations. Many noted that they had to look off-island to the continental United States or to other Caribbean islands to fill technical or management positions because they did not feel they could find the number or type of skilled workers that they needed for their businesses. This option

[5] Although the plan notes the importance of tourism and the need to diversify away from being too reliant on tourism, it does not suggest areas in which the USVI could diversify besides recovery-related sectors, such as construction. Some diversification away from tourism has happened with the opening of the Limetree Bay refinery on St. Croix; although exact long-term employment numbers are unknown, it is anticipated that the endeavor will employ 1,300 construction workers and create 700 long-term positions.

was not always available; several hotels that received tax benefits from VIEDA noted that they were required to fill a certain percentage of their positions with local workers (typically, 80 percent of operation, maintenance, and management employees must be legal residents of the USVI, and, after three years of operation, a business must fill at least 20 percent of management, supervisory, or technical positions [in any combination] with residents of the USVI) to qualify for those benefits (Sea Glass, undated; VIEDA, undated a; VIEDA, 2019a; VIEDA, 2019b).[6] VIEDA also runs the Virgin Islands Economic Development Commission, which offers a tax incentive program to encourage businesses to relocate to the USVI. Tourism-related businesses are included in category III of the program and can be eligible for tax reductions and below-market rental space if they meet certain conditions, including providing full-time employment for at least ten USVI residents (VIEDA, 2019a).

Although many of the business leaders we interviewed participated in these government tax incentive programs, some found the requirements too restrictive and could not make the programs work for their businesses. Some positions (housekeeping, for example) were reported to be much easier to fill than others (maintenance or engineers).[7] One operator noted that, at a job fair that his organization held, two-thirds of the applicants were applying for the two open housekeeping positions; meanwhile, the organization struggled to find enough qualified people to fill the other positions. Finding enough qualified labor with the right skill sets in the USVI was a pervasive concern across discussions with tourism service providers and is one of the most important challenges facing the tourism sector. Most providers indicated that finding enough qualified workers had always been somewhat challenging and that the storms had exacerbated the challenge. In particular, many providers reported that some of their employees had either left the USVI soon after the storms or had taken higher-paying jobs with the recovery efforts. Because many tourism-related jobs are seasonal, workers might have been enticed to construction and other jobs that offered more-stable employment. Chapter Four provides a more detailed discussion of the workforce capacity of the USVI, the need for workers in construction-related jobs, and recommendations for improving the skill match between workers and firms.

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[6] VIEDA's Hotel Development and Finance Program provides incentives for the development and construction of hotels and resorts in the USVI. Adopted in 2011 and amended in 2019, the program allows hotel and casino tax revenues to be used to repay loans incurred for construction of new hotels or expansions of existing properties. Each beneficiary must contribute $500,000 each year to the Tourism Revolving Fund ($20,000 of which goes toward a scholarship program in hotel management). In addition, each participant must contribute $2,500 each year for the creation and management of a database designed to recruit Virgin Islanders living abroad.

[7] Note that this might be because of strong demand in the construction sector. See Chapter Four for more details.

Housing-Related Challenges: Decreased Supply, Increased Demand

Housing for workers is a second challenge that was widely mentioned among those with whom we spoke. As detailed in Chapter Eight, rental prices increased substantially after the hurricanes because of several factors, including a reduction in supply of housing from storm damage and a surge in demand as emergency workers came from off-island. Our discussions suggested that higher rents have affected the tourism sector in several ways. First, some employers were concerned about the effects that inadequate or substandard housing and the inability to afford higher rents would have on the availability and productivity of their local staff. Because many properties were severely damaged by the hurricanes, the supply of housing in the market was significantly reduced. Long delays in processing claims and receiving funds to rebuild prolonged the supply shortage. The owners and operators with whom we spoke noted that some local employees had had to move in with relatives; some spent significant time searching for housing; some had been forced to move several times since the storms; some were living in housing that had only partial roofs; and others relocated to live with relatives in the continental United States. A few of the owners with whom we spoke had started helping employees find housing or were directly providing housing for their workers.

In addition to the reduction in housing supply, the demand for housing rose after the storms as recovery workers came to the islands. As detailed in Chapter Eight on housing, several people with whom we spoke noted that recovery-worker per diems had affected both supply and demand in the housing market, leaving rental prices much higher than before the hurricanes. Our discussions suggested that it was especially difficult for workers at the lower end of the income distribution to find housing.

Several tourism-related business leaders with whom we spoke indicated that the higher housing prices made it more difficult for them to hire workers from off-island for the tourist season, thus limiting the services they could offer. They noted that, traditionally, young people from the continental United States, Europe, South America, and Australia would come to the USVI for a period of several months during tourist season (some ended up staying for several years) to seek diverse life experiences. One hotel proprietor called these people "seekers." They often took jobs in the tourism sector, working as bartenders, waiters, and hosts. Some came just for the tourist season and would leave for cooler climates in the summer, thus providing the industry with a source of flexible labor during high-demand periods. Several employers with whom we spoke reported that, in their experience, the rise in rental prices had deterred many of these people from coming to the USVI in the years after the hurricanes because those potential workers felt that they could no longer live comfortably given typical salaries and the cost of housing.

The housing situation in St. Croix was further exacerbated by the reopening of the oil refinery at Limetree Bay (see Chapter Eight). Stakeholders with whom we spoke from St. Croix were more likely than those from St. Thomas to mention the difficulty of finding housing and the high housing costs. Although Limetree Bay has established

a camp to house the workers involved in reopening the facility, several interviewees reported that those who can afford it often find housing elsewhere. We were also told that, although petroleum-refinery company Hovensa had four camps for housing its workers, Limetree Bay—its successor—has only one.[8] As we discussed in more detail in Chapter Four, several employers on St. Croix also reported that Limetree Bay is now competing for workers with tourism and retail. These proprietors felt that they could not match the high wages being offered by the refinery, and many reported feeling the competitive pressure on wages of the refinery scaling up for production.

Lack of Access to Capital and Financial Services to Start and Expand Businesses

Along with the difficulty in getting enough of the right types of workers, obtaining capital and other financial services necessary to set up or expand a tourism-related business was also noted by private-sector employers as difficult. Although difficulty in accessing capital is a common concern of small businesses everywhere, many of the people with whom we spoke—including those who had run businesses in the continental United States—felt that banks in the USVI were particularly conservative. One told us that the only way to get a loan was to put up collateral equal to the amount of the loan. Consequently, almost all business owners with whom we spoke had self-financed their businesses or received money from family and friends rather than taken out bank loans.

The reasons for this reported lack of finance in the USVI are unclear and deserve further investigation. Some banking professionals with whom we spoke explained that the foreclosure process in the USVI is especially difficult and that it can take ten years for a commercial foreclosure and between three and five years for a residential foreclosure. Only 13 U.S. states, along with Puerto Rico and the USVI, require foreclosures to go through a judicial process and also have judicial foreclosure systems that require court approval of sales and distribution of surplus proceeds (Rao and Walsh, 2009). The banking professionals noted that banks in the USVI must ask for higher down payments and interest rates to mitigate the higher costs of foreclosure and that this made it harder for borrowers to qualify for loans. Limited geographic scope and less competition could also contribute to the difficulty of obtaining financing.

The lack of start-up capital (along with several other conditions discussed below) limits the number and type of new entrants into the industry. As consumer tastes change, the industry is also less flexible and adaptive because it takes additional capital to revamp offerings. In addition, our discussions suggested that financial services, such as insurance, are also expensive on the islands because of a lack of competition among providers.

[8] It is also unclear what will happen to Limetree Bay's camp once the retrofitting of the facility is complete.

Constraints on Doing Business: Regulatory Processes, Permits, and Office Space

Another common theme that emerged from our discussions was the concern that some of the territory's regulatory processes limit innovation and expansion in the tourism industry. In general, business owners reported that they were able to successfully renew their business licenses every year; however, many reported that it was difficult to understand and complete the necessary paperwork and obtain approval for new construction. They reported that many applications had to be completed in hard copy and delivered to a government agency where they would be assigned to an individual employee; if the employee was not available, if the paperwork was passed to another employee, or if the paperwork was lost, the process would be delayed or would have to be restarted.

The complexity of the permitting process (discussed as well in Chapter Nine) was also noted in interviews with government officials conducted for other parts in this analysis. For example, all building permits and other permits from DPNR are paper-based, and the only way to track the progress of a permit through the system is through direct communication with staff. Although the department is currently trying, with FEMA assistance, to set up an electronic system, it is at least six months to a year away from being operational. Building permit inspectors also face office-space constraints. The St. John office was completely destroyed by the hurricanes, and its employees now are in the basement of a library, with the inspectors working primarily out of their vehicles. Inspectors get one hour of office time in the morning and one hour of office time in the evening to file their reports and interact with the public. The lack of office space exacerbates problems caused by the lack of online systems, vehicles, laptops, and other resources.

Although some permit applications can be submitted simultaneously, a delay on one permit can hold up the entire project. For example, the building permit office reports that it can clear permits in an average of two to three weeks, based on its current staffing and workload. However, projects are often held up waiting for clearance from offices dealing with zoning, earth change, or coastal zoning. This can be problematic because St. Thomas and St. John have only one zoning technician for both islands to clear zoning permits.

The CZM program was also a source of frustration among tourism business leaders. In 2012, the program moved from paper applications to electronic applications for submitting permits. Although permits are submitted to CZM within DPNR, a separate committee, the CZM Commission is responsible for issuing, denying, or modifying all major coastal zone permits. The commission is made up of three committees, one for each island, consisting of up to five citizen members who must be residents of the islands. Each citizen member is appointed by the governor and then voted in by the legislature to serve a two-year term. However, decisions on permits are often delayed because a quorum is necessary to approve major permits, and the CZM committees are filled with the bare minimum of only three members per island, with each of these

members having exceeded their original two-year terms. Permits are often delayed repeatedly because reaching a quorum necessary for decisions is difficult: All three members must be present. Although the governor's office has called for nominations to fill vacancies on the committees, the "adversarial and invasive nature of the process of going before the legislature" has resulted in no new member being appointed to the committees. Current members who would like to retire feel "compelled to remain active until new members are appointed" but are not always available to attend the necessary meetings. The full commission, which includes the commissioner of DPNR and the director of planning, as well as the committee members from each of the three islands, has not met since February 2011 and is currently out of compliance with the Virgin Islands Code (12 V.I.C. § 904[f]), which requires them to present an annual progress report to the governor and legislature (Office for Coastal Management, 2018).

Although most tourism service providers with whom we spoke felt that there were not enough hotel rooms on the islands and that the industry as a whole would benefit from more accommodation units, very few new hotels have been built on any of the islands in the past 30 years. In a 2019 news article, George Dudley of the St. Thomas–St. John Chamber of Commerce "cited many Caribbean islands, such as Saint Kitts and Nevis, that have added more hotel rooms in the last five years than the Virgin Islands has added in the last 25 years, noting that 188 new hotels were under construction in the Caribbean Basin" (Lee, 2019). Further investigation is necessary to determine the reasons for the lack of new construction in the sector. The lack of new tourism development could be because of, among other things, a lack of demand, difficulties in obtaining financing, or intense competition among existing providers. However, those involved in the tourism sector in the USVI felt that government regulations and bureaucracy played a large part in the lack of construction. A few business owners also indicated that some tourism-related development had been blocked by local community opposition rather than by regulatory processes.

Lack of Necessary Infrastructure

Almost every business owner and manager with whom we spoke noted the high price of electricity and the substantial costs that this imposed on their businesses. Some had moved their businesses—or, more commonly, their personal residences—entirely off the grid. Although this is discussed in more detail in Chapter Seven, those with whom we spoke indicated that electrical interruptions were particularly challenging for tourism-related businesses that cater to vacationers, who often desire late-night entertainment options.

More generally, several firms felt that they had been negatively affected by a lack of necessary public infrastructure. Several hotel managers noted that they were responsible for cleaning up trash and algal blooms on the public beaches near their properties, even though they had no ownership rights over those beaches. Other proprietors mentioned streetlights, tsunami warning systems, and road signs that had not been

repaired after the storms, all of which made it more difficult to provide a high-quality experience for tourists.

Increased Competition from Other Islands and Changing Tourist Preferences

The tourist industry in the USVI is also facing challenges from outside competition and the changing preferences of its customers. Several of the tourism service providers with whom we spoke perceived that, although tourism in the USVI has been largely stagnant for the past few decades, other Caribbean islands have been growing and expanding their offerings (see also VIHFA, 2019a).[9] Competition from traditional players—such as Grand Cayman in the Cayman Islands, Cozumel in Mexico, Barbados, the Bahamas, Jamaica, the British Virgin Islands, and Puerto Rico—remains intense. In addition, relatively new areas are also increasingly competing for tourist dollars. Excursion providers with whom we spoke noted that aggressive marketing has attracted divers to Bonaire, Curaçao, and Aruba, all Dutch islands in the Caribbean. Adventure seekers can also visit Ocean World Adventure Park in the Dominican Republic, go ziplining in Haiti, enjoy the nightlife in Panama, or visit the second-largest coral reef in the world in Honduras.

The evidence of the competitiveness of the USVI tourism sector compared with that of its Caribbean peers is mixed. As Table 10.2 indicates, tourists who spend

Table 10.2
Tourist Stopover Arrivals in Select Caribbean Locations, 2004, 2009, and 2014

				Percentage Change	
Destination	2004	2009	2014	2004 to 2014	2009 to 2014
Anguilla	53,987	57,891	70,927	31.38	22.52
Antigua and Barbuda[a]	245,797	234,410	249,316	1.43	6.36
Aruba	728,157	812,623	1,072,082	47.23	31.93
Bahamas	—	1,327,005	1,421,860	—	7.15
Barbados	551,502	518,564	519,598	–5.78	0.20
Belize	230,831	232,247	321,217	39.16	38.31
British Virgin Islands	304,518	308,793	386,049	26.77	25.02
Cayman Islands	259,929	271,958	382,816	47.28	40.76
Cuba	2,048,572	2,429,809	3,001,958	46.54	23.55

[9] The VIHFA report (pp. 87–88) notes that the decline in tourism after 2014 "is largely driven by the emerging competition from newer, 'shinier' destinations and the size of new cruise ships being too large to enter most of the Territory's ports."

Table 10.2—Continued

Destination	2004	2009	2014	Percentage Change 2004 to 2014	Percentage Change 2009 to 2014
Curaçao	223,439	366,703	450,953	101.82	22.97
Dominica	80,087	74,923	81,472	1.73	8.74
Dominican Republic[a]	3,443,205	3,992,303	5,141,377	49.32	28.78
Grenada	133,865	113,370	133,521	–0.26	17.77
Guyana	121,989	141,053	205,824	68.72	45.92
Haiti	96,439	—	465,174	382.35	—
Jamaica	1,414,786	1,831,097	2,080,181	47.03	13.60
Martinique	470,891	443,202	489,561	3.96	10.46
Montserrat	10,138	6,311	8,804	–13.16	39.50
Puerto Rico[b]	1,411,910	1,300,783	1,688,472	19.59	29.80
St. Lucia	298,431	278,491	338,158	13.31	21.43
St. Maarten[a]	475,031	440,185	499,920	5.24	13.57
St. Vincent and the Grenadines	86,727	75,446	70,713	–18.46	–6.27
Suriname	137,808	150,396	251,611	82.58	67.30
Turks and Caicos Islands	173,027	—	368,164	112.78	—
USVI	658,638	666,051	730,367	10.89	9.66
Average				45.89	22.57

SOURCES: Caribbean Tourism Organization, 2013; Caribbean Tourism Organization, 2014; Caribbean Tourism Organization, 2015.

[a] Nonresident air arrivals.

[b] Nonresident hotel registrations only.

24 hours or more in the USVI (these are called "stopover" arrivals) increased by about 10 percent from 2004 to 2014, which is less than the average increase for other Caribbean locations. Table 10.3 reports similar numbers for cruise passengers and shows that, although USVI tourism grew more slowly between 2004 and 2014, it grew more quickly than that of many other Caribbean destinations in the latter half of the period (from 2009 to 2014). Note, however, that in all cases, growth remained substantially below that in similarly sized Caribbean markets, such as the Bahamas, Cozumel, Jamaica, and St. Maarten (Netherlands).

In addition to dealing with competition from other Caribbean destinations, the USVI will need to adapt to changing customer preferences. Some of our discussions

Table 10.3
Cruise Passenger Arrivals in Select Caribbean Locations, 2004, 2009, and 2014

				Percentage Change	
Destination	2004	2009	2014	2004 to 2014	2009 to 2014
Antigua and Barbuda	522,753	712,792	522,342	−0.08	−26.72
Aruba	576,320	606,768	667,095	15.75	9.94
Bahamas	3,360,012	3,255,780	4,804,701	43.00	47.57
Barbados	721,270	635,212	557,898	−22.65	−12.17
Belize	851,436	705,219	968,131	13.71	37.28
Bermuda	206,133	318,528	356,093	72.75	11.79
British Virgin Islands	466,601	530,327	378,083	−18.97	−28.71
Cayman Islands	1,693,293	1,520,372	1,609,555	−4.95	5.87
Cozumel	2,862,039	2,221,729	3,404,858	18.97	53.25
Curaçao	219,385	423,088	629,145	186.78	48.70
Dominica	383,614	532,352	286,573	−25.30	−46.17
Dominican Republic	456,321	496,728	435,494	−4.56	−12.33
Grenada	229,800	342,852	235,140	2.32	−31.42
Haiti	289,208	439,055	662,403	129.04	50.87
Jamaica	1,099,773	922,349	1,423,797	29.46	54.37
Martinique	159,416	69,749	177,786	11.52	154.89
Puerto Rico	1,390,343	1,179,022	1,356,822	−2.41	15.08
St. Lucia	481,279	699,306	641,452	33.28	−8.27
St. Maarten	1,348,450	1,215,146	2,001,996	48.47	64.75
St. Vincent and the Grenadines	74,657	149,464	85,170	14.08	−43.02
Trinidad and Tobago	54,254	119,600	42,820	−21.07	−64.20
USVI	1,964,689	1,582,264	2,083,890	6.07	31.70
Average				23.87	14.23

SOURCES: Caribbean Tourism Organization, 2013; Caribbean Tourism Organization, 2014; Caribbean Tourism Organization, 2015.

suggested that, although older tourists are often interested in shopping, eating, and enjoying the beaches in the USVI, younger tourists are more interested in experiences and adventure. As populations age in most developed countries and younger travelers

make up a larger part of the tourism market, businesses will need to change how they cater to customers (Condor Ferries, undated; Expedia and Center for Generational Kinetics, 2018; Expedia Group Media Solutions and Skift, 2019; Mudallal, 2015; Spinks, 2018). Although the USVI might be well-positioned for adventure tourism and ecotourism, relatively little territory investment has been directed toward developing these activities or natural and cultural resources (see Chapter Nine) on the islands.

The concerns noted in Chapter Twelve, about the USVI's health care sector, also affect the tourism industry. Cruise ship passengers account for more than 70 percent of visitors to the USVI, and they tend to skew older, with an average age of about 46 (Mudallal, 2015; Spinks, 2018). Some tourism service providers with whom we spoke mentioned the lack of adequate hospital services as one reason that older people might be less willing to stay on-island. Insurance that includes medical evacuation is relatively expensive, and the lack of advanced medical care options might lead tourists and potential workers to avoid the islands or limit their stays. There is also no functioning and staffed decompression chamber on the islands for treatment of decompression sickness brought on by diving accidents, which could hinder further development of the scuba diving industry.

Box 10.4
COVID-19 and the Tourism Economy

The list of prospects and challenges of the tourism sector, as described in this chapter, was developed using interviews and analysis conducted between November 2019 and February 2020; therefore, they do not reflect the extensive ways in which COVID-19 has already changed, and will continue to change, future prospects for tourism in the USVI. The tourism sector is one of those hardest hit by the physical-distancing measures that have been enacted in response to the virus. On March 27, 2020, the Department of Tourism announced that leisure visitors were encouraged to remain at home and that all arriving air passengers would be screened (USVI Department of Tourism, 2020). Royal Caribbean International suspended all sailing operations on March 14, 2020 (Royal Caribbean International, 2020). The retail industry, which caters to both tourists and locals, has also been negatively affected by the halt in tourism and the stay-at-home order. The immediate impact on employment in the USVI will be large because tourism and retail together made up more than 25 percent of the workforce at the end of 2019, and tourism accounted for nearly 13 percent of gross territory product prior to the hurricanes.

Even after the initial strict clamp-down on tourism, it is likely to be a long time before tourists are willing to resume leisure travel. This is particularly the case for one of the USVI's major tourist demographics: older Americans who arrive in cruise ships. High-profile outbreaks of COVID-19 on several cruise ships, with passengers being quarantined on the ships much longer than they originally planned to be aboard, could further dissuade even younger individuals from traveling on cruise ships in the next several years (Allen, 2020; Rodriguez, 2020). This will hit the USVI especially hard because, according to USVIBER data, about 70 percent of the total visitor arrivals coming to the islands come by cruise ship.

The lack of adequate hospital services in the USVI, which might already deter some people with health problems from traveling or living there, is likely to further deter tourists going forward. Therefore, it will be even more important to consider how the USVI could diversify its tourism sector toward a broader demographic and how it could diversify its economy, more generally, to reduce its dependence on tourism. The potential recommendations that we present here, which focus on making it easier for businesses to set up and operate in the USVI, and enhancing promotion of the USVI as a destination, could be useful as part of this longer-term strategy and further diversification efforts.

Management Capacity to Meet Recovery Needs

Tourism Advertising Revolving Fund Dependence on Hotel and Rental Fees

A key constraint on governmental management capacity in the tourism sector involves funding for the USVI Department of Tourism. The department administers the Tourism Advertising Revolving Fund, which coordinates activities to promote the islands as vacation destinations and also helps to subsidize the Virgin Islands Carnival, the Crucian Christmas Festival, and the St. John Fourth of July Festival (USVIBER, 2018b). Revenue for the fund comes from a 12.5-percent tax applied to any stay in a hotel or renting or leasing an apartment, condominium, timeshare, villa, or residence for less than 90 days (Legislature of the Virgin Islands, 2019a). Although the tax was formerly applied only to hotels, in May 2017, the government and Airbnb signed an agreement to allow Airbnb to collect the hotel room occupancy tax on behalf of hosts and send the funds to the government (McCarthy, 2017).[10]

Although this funding structure ensures that budget money spent on tourism advertising is tied to the amount of tourism in the economy, it is not resilient to sharp, temporary drops in tourism. Because revenues are directly tied to the number of guests, and revenues fell sharply because of the decline in tourism in the aftermath of the hurricanes, the budget for the Department of Tourism was decimated at a time when tourism promotion was most critical. For example, hotel tax revenue was 51-percent lower in FY 2018 than in FY 2017, dropping from $29.5 million to $14.6 million (Virgin Islands Bureau of Internal Revenue, 2017). Because of the drop in funds, promotion efforts had to be scaled back to advertising on inexpensive social media platforms (VIHFA, 2019a).

As detailed in the disaster-recovery plan, $10 million was allocated to the USVI Department of Tourism in CDBG-DR funding for tourism industry support. This was to include $4 million for a tourism marketing campaign to bring visitors back to the islands and $1 million for support of businesses and entrepreneurs in tourism-related activities (VIHFA, 2019a).

High Vacancy Rate in the Department of Tourism

In the 2017 budget, the Department of Tourism had 32 full-time equivalents allocated to its operation. In the 2018 budget, submitted before the hurricanes on June 20, 2017, the Department of Tourism had an allocation of 27 full-time equivalents. By the 2020 budget, released in May 2019, the allocation of personnel to the Department of Tourism had increased by 37 percent to 43 full-time equivalents. However, at that time, only 24 of the 43 (56 percent) positions were filled (Government of the USVI, 2017; Government of the USVI, 2019). It is unclear why the vacancy rate is so high and which positions are currently vacant. However, such a high vacancy rate could lead to

[10] See Appendix B for more details on the Tourism Advertising Revolving Fund.

constraints on management capacity in the department and make it more difficult for the department to support the tourism sector.

Lack of a Coordinated Marketing Strategy

Several business owners with whom we spoke expressed concerns about the lack of coordination between the Department of Tourism and the various tourism service providers on a marketing strategy. Some were concerned that they had not been adequately consulted in the development of the Department of Tourism's advertising campaigns to promote the territory. Some people with whom we spoke also suggested that a stronger branding campaign might be necessary and that separate branding for each island—rather than for the territory as a whole—might help to attract more visitors and allow each locality to specialize and distinguish itself from competitor islands in the Caribbean.

Recommendations

In this section, we provide recommendations, listed in rough order of importance, to help address some of the barriers and gaps described in the previous section. Note, however, that housing, infrastructure services, and larger workforce issues are covered in other chapters and that the recommendations provided in those chapters are also important to improve the tourism sector in the USVI.

Clarify and Streamline Business Approvals and Approvals of New Construction Projects

Goal

Make it easier to start and expand businesses in the USVI.

Rationale

Approval processes that require hard-copy applications and coordination among multiple government agencies make it difficult for new businesses to open in the USVI. A one-stop shop, or streamlined and transparent process for new construction projects and new business ventures, could help to encourage business growth and entrepreneurship. Many studies show that difficult-to-navigate bureaucracies harm business growth (Ciccone and Papaioannou, 2007; Djankov et al., 2002; Klapper, Laeven, and Rajan, 2006; World Bank, 2019).

Implementation considerations

Implementing this recommendation would require the following steps:

- Map out the processes someone must complete to start a business, renew a business license, build a new structure, expand or remodel an existing structure, or merge with another business. It should be clear which approvals are needed for each step and which steps can be done simultaneously versus which must be done sequentially.
- Conduct a workshop with major permitting entities and chamber of commerce representatives to discuss where the business community perceives the major obstacles to be and which steps might be eliminated, combined, or modified to make each process more efficient and quicker.
- Post clear information on each process on one easily accessible webpage, building on information already available online (for example, obtaining a business license [USVI Department of Licensing and Consumer Affairs, undated] and starting a business [VIEDA, undated b]). This can be integrated with the recommendation in Chapter Nine that DPNR develop clear, divisionwide educational materials to clarify and streamline the permitting process within that department.
- Provide transparent information on all taxes that a business is required to pay each year, including employment taxes, income taxes, property taxes, and import and export duties.
- Help each agency involved in an approval process set up an online portal for submitting paperwork, communicating with applicants, and approving projects.
- Create a one-stop shop webpage that links to each agency approval system and helps applicants track a project from initial application to final approval. The applicant should be able to see where their application is in the approval process, what agencies have not yet granted approval, what steps need to be taken to obtain approval, and whom the applicant can call within an agency if they have questions about their application.
- Designate a member of the governor's staff to track statistics on business approvals and reporting to the governor and Virgin Islands Senate on a regular basis about the number of approvals, necessary resources to speed up approval processing, and any major bottlenecks in the approval process. This staffer could help coordinate among government agencies, apply outside pressure when necessary, and help address interagency resource needs.

Time frame

Near term, 1–2 years

Leading entities

The Office of the Governor should assign one lead agency, such as the Department of Licensing and Consumer Affairs, to manage this process. The lead agency would coordinate with all major permitting agencies determined in the mapping process to be integral to the success of recommended actions, as well as with private-sector representatives, such as chambers of commerce. BIT could play a key role in helping agencies move permitting online and simplify paperwork.

Adjust the U.S. Virgin Islands Economic Development Authority's Local Worker Requirements Based on the Unemployment Rate

Goal

Allow the tourism sector to bring in additional workers from outside the USVI when local workers are more scarce.

Rationale

VIEDA should relax the regulations on the number of local workers that a firm must employ to benefit from VIEDA programs when the unemployment rate is low. It has been difficult for many tourism-related businesses to find enough qualified workers during the recovery period as demand for construction workers and other recovery-related workers has increased. The reopening of Limetree Bay refinery on St. Croix has also affected businesses' ability to recruit locally. This problem will likely intensify as recovery-related construction efforts ramp up. Tourism-related employment fell by 40 percent between 2016 and the end of 2018 (USVIBER, undated b; USVIBER, 2018b). Although some of this decline is driven by the lack of demand and the continuing closure of hotels and other tourism-related businesses, competition for workers has also increased substantially, and tourism-related businesses have reported difficulties in finding qualified workers. Relaxing regulations on the number of local workers would enable more businesses to benefit from VIEDA programs and establish a more favorable business environment.

Implementation considerations

Implementing this recommendation would require the following steps:

- Using data on job applications, the unemployment rate, and survey data from local firms, determine what level of unemployment should "trigger" the relaxation in local worker requirements.
- Determine how long the relaxation would last. For example, a specific rule could be that, if the unemployment rate were below 7.5 percent for six of the previous 12 months, VIEDA would relax the restrictions on the number of local workers for the next six months. Taking an average over time would help ensure that a lack of workers is a trend and that the relaxation in regulations is not triggered by sudden changes that are not persistent. Not reimposing the restrictions until six months after the conditions are no longer met allows firms time to hire additional local workers to stay in compliance and prevents sharp changes in policy that impose additional uncertainty on firms.
- Determine exactly how requirements for local workers will be relaxed. Some options might include the following:
  - A business participating in the Economic Development Commission tax incentive program might need to hire only five full-time resident workers instead of ten, or the residency requirement could be reduced from one year to six months.
  - For the Hotel Development and Finance Program, the local-employee requirement could be reduced to 50 percent from 80 percent, or the residency requirement could be reduced to one year instead of five years.
  - The current requirement that, "after three years of operation, at least 20 percent of management, supervisory and/or technical positions must be filled by residents of the USVI" could be reduced to 10 percent, or the period in when the requirement must be fulfilled could be lengthened.
  - The preference given to USVI residents in the employment for new construction could also be suspended, especially given a shortage of construction workers.
- Monitor impacts of the relaxed requirements and fine-tune the program over time.

Time frame

Near term, 1–2 years

Leading entities

VIEDA will lead the planning and implementation of all activities described.

Schedule Construction Work to Cause as Little Disruption as Possible During the Tourist Season

Goal	Reduce further disruptions to already-struggling local businesses.
Rationale	Construction work often requires closing nearby areas to pedestrians and vehicles, which hurts local businesses. Noise and dust from construction work can also deter tourists from visiting or staying in shopping areas. Many of the business owners in the shopping district on St. Thomas reported that their businesses had been severely interrupted by recovery-related (and non–recovery-related) projects. Because much of their business is driven by cruise ship passengers and cruise ships do not dock in St. Thomas every day, these business owners suggested, timing construction work to minimize disruptions to the tourist experience would be beneficial to them. This could include performing smaller jobs early in the morning, before cruise ships arrive, or later in the evening, after the ships depart, and doing major tasks on days when there are no or few ships in port.[11]
Implementation considerations	Implementing this recommendation would require the following steps: • Use websites that track the schedule of cruise ship arrivals and departures (such as VINow), as well as the expected number of passengers (Virgin Islands Now, undated). • Map out areas of the USVI that are considered major shopping areas. Working together with the hotel and tourism associations on each island, the Department of Tourism could produce a map of tourism-related businesses in the USVI, categorized by type of business (e.g., hotel, charter, shopping, diving). • Require construction contractors to include shopping disruption–mitigation plans in their bids for work in geographies identified as major shopping areas or other areas frequented by many tourists. This could include scheduling particularly disruptive work during early mornings or evenings or on days when no cruise ships are in port. Consulting with local shops, contractors might find other, innovative ways to reduce the impact on those businesses.
Time frame	Near term, 1–2 years
Leading entities	DPW, the Department of Tourism, and island hotel and tourism associations should collaborate at a strategic level to share data and establish work plans to be communicated to recovery contractors.

[11] Note that, because of COVID-19, cruise ship arrivals have temporarily ceased. This may be an opportune time to complete necessary construction projects.

Leverage Tourism Service Providers to Help Promote the Territory and Adapt to Changing Tourist Preferences

Goal

Better align promotion materials with needs of local tourism-related businesses, changing tourist preferences, and potential tourism experiences based on the USVI's natural and cultural resources.

Rationale

Branding and promoting tourism on the islands is a public good that benefits all tourist operators but might be too costly for any one operator to do alone. Tourism-related businesses have important knowledge about tourist preferences and how to attract people to the islands, as well as potential tourism opportunities that are currently underused. Private-sector businesses should be key stakeholders in designing and implementing the tourism marketing efforts made possible with CDBG-DR funds because they have a lot of information on the needs, trends, and challenges faced by the industry.

Implementation considerations

Implementing this recommendation would require the following steps:

- Conduct external market research. The Department of Tourism could conduct market research to determine why people choose to come to the USVI and why some choose not to visit. The study team could also look at future trends and what younger tourists seek in a destination and vacation experience. Identifying the strengths, weaknesses, opportunities, and threats to tourism in the USVI in the next five to ten years could provide insights that help local businesses plan for the future.
- Draw on a consolidated data repository of NCR assets (see Chapter Nine) to identify opportunities to develop additional tourism experiences that leverage the USVI's natural and cultural infrastructure.
- Aggregate insights from tourism-related businesses. The Department of Tourism could conduct a survey, conference, workshop, or other event with participants from across the tourism ecosystem to gather insights on needs, ideas, innovations, and suggestions for improving tourism in the USVI. This may also include the establishment of a private-sector advisory council to continuously interface with and provide input and recommendations to the Department of Tourism. Findings from the external market research could be presented to participants to quickly disseminate information.
- Leverage the Department of Tourism's many advocates within the tourism industry to develop concrete plans to address the identified challenges and determine ways to take advantage of the opportunities discovered, based on the outcomes of the first two steps. The information could also help in the design and promotion of further advertising campaigns to attract additional visitors to the islands.
- Identify and promote innovation in the tourism sector. Because its mandate is to promote tourism more generally, the Department of Tourism also has the ability to encourage innovation in the industry and to think critically about long-term sustainability, something that individual owners might not be able to do. This might include incentivizing businesses to cater to the changing preferences of young people; helping the industry to focus on sustainability; and working with other government agencies and banks to relax barriers on hotel construction, new-project financing, and housing for tourism workers.
- Coordinate activities with the Cradle to Career initiative, to ensure that workforce needs associated with alternative tourism opportunities are met. These may include, for example, training workers with the skills needed to preserve and introduce tourists to the USVI's cultural heritage and natural resources.

Time frame

Medium term, 3–5 years

Leading entities

The USVI Department of Tourism should coordinate and drive sector innovation and progress.

CHAPTER ELEVEN

Education

Box 11.1
Key Findings About Education

- The disaster-recovery process offers an opportunity to improve the USVI's public kindergarten through grade 12 (K–12) school system, which faced challenges even prior to the 2017 hurricanes, including buildings with deferred maintenance, low student scores on standardized tests, and high rates of student poverty.
- These issues were exacerbated by the 2017 hurricanes, which also brought new hardships to schools:
  - The hurricanes caused extensive physical damage to schools.
  - Educational quality and teacher and student well-being were also affected as some schools closed, others began offering double sessions, and schools lacked educational materials and supplies.
- Education recovery has progressed in the past two years in the following ways:
  - Now that some buildings have been repaired and modular classrooms built, all students can now attend school with a full school day.
  - Plans are underway for new, repaired, improved, and consolidated schools through a new master plan for facilities.
  - Some quality initiatives have progressed: Some standardized test scores have improved, the VIDE continues to implement its accountability plans, UVI will offer free tuition to USVI high school graduates, and the territory launched the Cradle to Career initiative.
- The territory's government, schools, and stakeholders offered plans and aspirations for education recovery:
  - school buildings that support safety and quality education
  - well-being of teachers and students
  - higher-quality education and academic achievement during recovery
  - enabling graduates to find opportunities in the recovery workforce.
- Although there has been substantial progress, there are also the following barriers and gaps to recovery:
  - Ongoing delays in repairing school buildings present challenges to the education environment.
  - The storms negatively affected the well-being of both students and school staff; there is not enough training for teachers or counselors to support mental health needs in schools.
  - The disasters have affected the student learning environment, reducing high school graduation rates.
  - Some high school graduates are insufficiently prepared to take advantage of opportunities in the recovery workforce.
- The education sector also faces management challenges because the VIDE lacks institutional capacity to manage complex capital projects, procedures delay hiring needed staff, and the VIDE lacks liquidity to pay contractors up front while waiting for reimbursement from FEMA.
- In addition, multiple stakeholders desire increased clarity on reconstruction plans and timelines.

Box 11.1—Continued

- We make the following recommendations to address the challenges identified:
  - Improve school building conditions during the reconstruction process by adding modular buildings and expediting repairs of common spaces, such as gyms, libraries, and labs.
  - Improve teacher and student access to mental health care resources through staff, services, and training.
  - Maintain attention to quality-improvement initiatives during recovery and reconstruction.
  - Increase the quality of CTE and workforce preparation programs.
  - Develop integrated public plans for school rebuilding that include timelines.
  - Ensure that the VIDE has the human and financial resources it needs to manage reconstruction.

A high-quality, resilient education system in the USVI is fundamental to the well-being and prosperity of USVI residents. USVI government officials have noted that the recovery of K–12 education facilities and services is a top territory government priority. Governor Bryan told the HSOAC team that the recovery of K–12 education was, for him, among the "priorities of the priorities," and he elaborated in a public address on the "need to deliver on our commitment to investing in the educational needs of [the territory's] students" (Bryan, 2019).

A disaster can offer an opportunity to rebuild a school system in ways that improve education overall, creating positive change for students and the community. In 1999, the United Nations Children's Fund (UNICEF) released a strategy for countries needing to rebuild education systems during and after emergencies and tragedies and stated, "Emergencies can . . . provide an opportunity for transforming education . . . . They allow for the possibility of reconstructing a social institution that helps develop and form the human resources that determine the way a society functions" (Pigozzi, 1999). Furthermore, after a disaster, a resilient education system can play many roles, enabling children to learn and prepare for their futures as citizens and workers and providing structure, normalcy, and support for the well-being of children, families, and communities. Schools serve as community hubs in disaster recovery because they are often in or near the center of communities and are generally viewed as safe spaces by children and adults alike (see, for example, Council on School Health, 2008). Schools are also places where community spirit and confidence can begin to be rebuilt (Mutch, 2016). Finally, as gathering places, schools give students a place to interact with and gain support from their peers, who likely have experienced the same trauma and losses during the disaster (Wolmer et al., 2005).

Similarly, the USVI can also use these difficult circumstances to rebuild its education system and improve it overall. In this chapter, we provide an overview of the education system in the USVI and the damage inflicted by the 2017 hurricanes, discuss directions for education recovery, lay out barriers and gaps in education recovery, and describe management capacity for recovery initiatives among education stakeholders. The chapter concludes with recommendations to facilitate recovery in education. The methods used in this analysis are shown in Box 11.2.

Box 11.2
Methodology and Limitations on the Analysis of Education

Methods Used in This Analysis

This analysis drew on a mixed-method approach to review needs for hurricane recovery implementation in education. The team relied on the following three main sources of information:

- **Literature review:** First, the team conducted a literature review to learn more about the education system in the USVI and how other communities—both in the United States and in other countries—have dealt with postdisaster recovery in education.
- **Stakeholder discussions and school visits:** Next, the team engaged in discussions with a variety of stakeholders in St. Thomas, St. John, and St. Croix, including representatives from FEMA, ODR, the VIDE, UVI, and several nonprofit organizations that work with students and schools. We visited five schools (selected by the VIDE) where we talked with school administrators and counselors: two high schools (one on St. Thomas and one on St. Croix) and three elementary schools (one each on St. Thomas, St. John, and St. Croix). We used a semistructured discussion guide to elicit information from stakeholders about the impact of the recovery process on the education system. We conducted a qualitative analysis of the themes raised in these discussions.
- **Secondary data analysis:** The team also analyzed relevant available data. These included FEMA Grants Manager data about the status of education project funding and the value and geographical distribution of ongoing rebuilding projects, student enrollment and teacher workforce data from the VIDE and other secondary sources, data on student performance as measured in the Smarter Balanced standardized tests, and secondary data related to the well-being of teachers and students.

Limitations of This Analysis

Although we were able to talk with many key stakeholders, we likely missed some important perspectives. In particular, although we visited five schools on all three main islands, we do not know the extent to which these schools were representative of all schools. Furthermore, during the school visits, although we spoke with principals and counselors, we were not able to hold discussions with teachers, missing their critical perspectives.

Setting the Stage

Before the Hurricanes

The public K–12 school system in the USVI consists of two districts: the St. Croix District and the St. Thomas–St. John District, which together had a total of 31 public schools before the 2017 hurricanes. The USVI also has at least 28 private schools, which are not part of the scope of this study. In the 2016–2017 school year, public schools employed 1,091 teachers and had a total student population of 13,194. K–12 education and postsecondary public education in the USVI are overseen and managed by the VIDE.

The K–12 education system in the USVI faced challenges even prior to the hurricanes. Student poverty was high, with 30 percent of USVI children living in poverty as of 2015, well above the national average of 21 percent (CFVI, 2019). In 2015, 99 percent of K–12 students at the USVI's public schools qualified for free or reduced-price lunch, while 18.9 percent of children lacked health insurance, higher rates than in any state or Puerto Rico (CFVI, 2019). Prior to the hurricanes, educational attainment in the USVI was relatively low, with high school graduation rates and standardized test scores below the U.S. average. Furthermore, many school buildings were decades old, with delayed maintenance.

High school students can pursue CTE in the high schools and through several CTE centers, including the St. Croix CTE Center and the St. Croix Educational Complex Career Tech. In addition, at the high school level, the private nonprofit My Brother's Workshop offers a workshop-based program for at-risk youths that offers high school diplomas and vocational training in construction, culinary arts, marine industries, and manufacturing.

The USVI offers several types of postsecondary education and training (also outside the scope of this study). UVI offers 47 bachelor's and graduate degree programs, with two campuses, one each on St. Croix and St. Thomas. Technical training is offered by the Raphael O. Wheatley Skill Center (a postsecondary CTE institute that is overseen by the VIDE and offers industry-based credentials); the UVI Center for Excellence in Leadership and Learning, which offers certification in a selection of business and computer skills; and private companies that train their workers.

Impact of the Hurricanes

Ongoing challenges in the USVI education system were exacerbated by the 2017 hurricanes, which brought new hardships to schools. Hurricanes Irma and Maria caused extensive physical damage to school infrastructure, damaging or destroying many school buildings, leaving many children out of school for months, and straining children and the families and teachers who are responsible for caring for them. All of the USVI's 31 public schools sustained storm damage, with 12 campuses closing temporarily while undergoing repair, four campuses closing permanently because of the level of damage they sustained, and other campuses closing some buildings or classrooms that were no longer usable. CTE facilities in high schools also sustained significant damage to buildings and equipment.

The harms caused by the hurricanes affected student learning. Kousky, 2016, lays out three ways in which disasters can harm children: by undermining their physical health, negatively affecting their mental health, and disrupting continuity of education. All three were relevant to students in the USVI. Many USVI residents (including students and teachers) suffered health issues related to the hurricanes (Kousky, 2016), as discussed in Chapter Twelve. The hurricanes affected student and teacher well-being: Administrators and counselors reported anxiety among students and frustration among teachers because of temporary facilities, environmental issues in classrooms, loss of supplies, and instability in their housing circumstances (see Chapter Eight). Many teachers and students also struggled with hurricane-related issues at home.

Continuity of learning was disrupted: Infrastructure damage led to crowded classrooms because fewer safe classrooms were available for students. Many schools were forced to share campuses and rely on double sessions of four hours each, with one school using a campus in the morning and another in the afternoon, decreasing instruction time and leaving some schools unable to implement the full curriculum. Closed schools were slow to reopen because they were either under repair or being used

as community shelters. Schools and classrooms also lost educational materials, such as books and supplies. Lost school time and trauma from the hurricanes put pressure on schools as they tried to maintain educational quality and student well-being.

Recovery Progress Since the Hurricanes

Although the education system in the USVI continues to face many challenges, there have also been multiple wins in addressing the hurricanes' effects. In the past 2.5 years, steps have been taken toward education recovery by the VIDE, individual school staffs, FEMA and other federal agencies, and community groups. We highlight some key successes in the rest of this section.

All Students Can Now Attend School with a Full School Day

Although four schools remain permanently closed and other schools have portions of their campuses closed, the VIDE and FEMA collaborated to reopen schools, removing debris, repairing buildings, restoring landscaping, and building 245 modular buildings (Government of the USVI, 2018) to substitute for lost classrooms and administrative buildings. The VIDE created enough new classroom space and restored enough existing classroom space that all students can now attend school full time. The VIDE distributed displaced students among the open schools and classrooms. Schools no longer have double sessions; the last site reopened in February 2019. Figure 11.1 shows examples of the new modular facilities.

Figure 11.1
USVI Modular School Facilities

Photos by the authors, 2020.

Plans Are Underway for New, Repaired, Improved, and Consolidated Schools

USVI will use the FEMA PA alternative procedures (also called Section 428 procedures) for school repair and reconstruction. As described in Chapter Two, this will enable the USVI to receive funding for restoration of the current slate of damaged or destroyed schools and then use that funding to repair or rebuild a smaller set of higher-quality schools. The VIDE is developing a facility master plan that will have the department reduce the number of schools from 31 to 19 by closing some schools, repairing some schools, and rebuilding a smaller number but higher-quality schools. The plan takes into account a declining student population, the need for greater quality, and the removal of schools from flood zones. The VIDE expects to have the facility master plan completed in 2020 (Bryan, 2020b) and projects implementation on a five-year time frame. The VIDE has held multiple community information sessions as part of a stakeholder consultation process to discuss the process and timeline. It developed new USVI standards and codes for future school buildings in consultation with the American Institute of Architects.

At the same time, the PA funding obligation process has been underway. FEMA completed damage assessments for all schools in January 2020. However, as discussed in Chapter Two, the VIDE's projects are behind those of all other territory agencies in progressing through the obligation process.

Other Quality and Opportunity Initiatives Have Progressed

The VIDE has continued to emphasize planned quality initiatives, aiming for implementation of the USVI state accountability plan under the federal Every Student Succeeds Act (Pub. L. 114-95, 2015; VIDE, undated). Dedicated school staff have mobilized to reinstate a positive learning environment for students despite also being affected personally by the hurricanes, as was evident in our visits to the five schools. Staff structured lessons, continued enrichment classes and physical recreation when feasible, and cared for student needs. Indeed, USVI student performance on standardized tests actually improved in the 2018–2019 school year over that in years prior to the storms (see the discussion later in this chapter).

To provide an incentive for high school students to attend four-year college, UVI began offering every USVI high school graduate (of which there were about 1,700 in 2019) the opportunity to earn a four-year degree with full tuition benefits (Hill, 2019).

Community groups have organized to support the recovery of education and opportunities for youths. In 2018, FEMA facilitated a series of community-engagement activities on St. Croix, St. Thomas, and St. John to compose individual island community response plans. These plans identify projects related to education and workforce development, support services for youths, job training, and improving the design of and engagement in schools (Microsoft Power BI, undated).

Some Mental Health Care Programs Have Been Implemented in Schools

To address personal challenges for teachers and students, some mental health care training has been provided to teachers, and some supports have been provided to students. This has included HHS-, Bloomberg Foundation–, Beautiful Dreamers– (a USVI mental health nonprofit), and VIDE-provided training on emotional well-being and classroom management to a selection of schools. Most (although not all) schools have school counselors or nurses. Administrators described to us the efforts made by school counselors, including implementing group counseling, providing referrals for mental health care outside of schools, coordinating yoga classes for students, and building a "Zen room" for teachers at one school. The U.S. Department of Education provided the USVI with a grant under its School Emergency Response to Violence program, which provides services after disasters, including materials for counselors, mental health intervention supplies, and substitute teachers.

Workforce-Development Programs Have Been Launched

The territory launched a Cradle to Career initiative through a collaboration among the VIDE, VIDOL, UVI, and nonprofits to prepare students for the workforce under the guidance of a newly reformulated territory Workforce Development Board. The initiative has five goals that are interconnected with the USVI's overall education improvement goals: school readiness, a strong academic foundation, postsecondary education, connecting job seekers with jobs that pay a living wage, and aligning workforce-development programs with economic development strategies (Bryan, 2020b).

With billions of dollars of investment coming to the USVI in coming years, it is important for USVI residents, including high school graduates, to have access to the jobs that might become available as a result (see Chapter Four for estimates of new jobs in the USVI in coming years). It is also important for employers to find some of the skills needed among territory workers to somewhat reduce the need to import workers from the continental United States. Workforce-development planning that includes the USVI's high schools is therefore critical for the territory to achieve its recovery goals and adapt to the changing economy in the long term.

Recovery Directions

The territory's government officials, school staff, and other stakeholders have offered plans and aspirations for education recovery implementation, addressing both storm damage and ongoing long-term challenges. The vision for USVI education recovery, based on existing documentation and discussions with stakeholders for this study, focuses on improving the school environment and better supporting and preparing students (Bryan, 2019; Bryan, 2020b; Government of the USVI, 2018; ODR, undated h; USVI Hurricane Recovery and Resilience Task Force, 2018; Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019). Box 11.3 shows the recovery directions.

Box 11.3
Recovery Directions for Education

- **Providing school buildings that support safety and quality education.** Reconstruction will include repairing some schools and building a consolidated set of new schools. Schools will be suited to modern education practices, support quality education, and be resilient to future storms. While reconstruction is proceeding, students and teachers will continue education in a safe, quality environment with facilities for enrichment, including physical education facilities, libraries, and science labs.
- **Ensuring the well-being of teachers and students.** Students and teachers will find the support they need at school to cope with conditions after the storms through additional mental health resources and additional training for teachers.
- **Raising the quality of education and academic achievement during recovery.** Recovery investments in new infrastructure and programs will support education quality in the long term, with continued attention to improving education outcomes.
- **Enabling graduates to find opportunities in the recovery workforce.** Graduating students will receive the quality of education needed for postsecondary education and to find opportunities in the recovery workforce. Quality CTE will be coordinated with the needs of the labor market.

Key Barriers and Gaps

Although there has been substantial progress toward implementing recovery goals in education, there are also ongoing challenges in the form of barriers to improvement and unfilled gaps in recovery efforts. In many respects, the barriers seen in education are related to its dependence on the progress of other sectors described in this report. For example, repairing physical damage to schools depends on having a sufficient workforce, fiscal capacity, and management capacity, among other factors. Student and teacher well-being is related to health, housing, and many other sectors. Student success in learning and preparation to join the USVI workforce is related to individual well-being and health and having safe school buildings, adequate resources, teacher preparation, and CTE programming aligned with labor market needs.

In this section, we describe the status of the recovery process in relation to the four goals of education recovery: constructing or repairing school buildings, ensuring the well-being of students and teachers, raising the quality of education, and enabling students to seek opportunities in the recovery workforce. For each area, we note ongoing challenges, as well as issues that appear to be preventing progress in key areas.

Ongoing Delays in Repairing School Buildings Present Challenges to the Education System

Insufficient Space Limits School Learning and Other Education Opportunities

With four campuses permanently closed and portions of other campuses closed while awaiting repair and reconstruction, ongoing building conditions are creating significant limitations on space. As of January 2020, projects with the VIDE were behind those of all other territory agencies in the PA process, and the planning process to rebuild fewer, higher-quality schools also requires more time and effort. Working through

the rebuilding process will likely take another five or ten years. Therefore, waiting on rebuilding to address space shortages while not further increasing temporary quality space is detrimental to the provision of education. From our school visits, discussions with education officials, and other reports, we heard about how these circumstances pose ongoing challenges to learning and other education opportunities:

- **Crowding:** Schools have increased class sizes to accommodate students and have repurposed space for other uses.
- **Reduction of physical education opportunities:** Although modular buildings provide more classroom space, they have often been built on available space in playgrounds and sports fields. Some school gymnasiums have closed; others were open during our visit but were still awaiting repair.
- **Shortage of books, library space, lab space, and education supplies:** After the 2017 hurricanes, some schools disposed of books and emptied library contents because of water damage; other libraries remain closed because of structural damage. Some schools also lost science labs (Allen, 2019a). In some schools, years' worth of teachers' instructional materials were cleared out because of mold concerns.

Ongoing Structural Problems Pose Potential Health and Safety Risks to Staff and Students

During our school visits, administrators pointed out structural problems on school campuses: maintenance needs, holes in roofs of some structures still in use, leaks in classrooms, drainage and sewage problems, and inconsistent electricity and internet connectivity. They noted that school staff have ongoing concerns with air quality in the schools from leaks, mold, and lack of air conditioning. Principals and teachers are doing their best to make the environment conducive to learning, but, as one administrator noted, "the buildings are sick." Teachers' unions have also expressed concerns about health conditions in the schools (St. Thomas–St. John Federation of Teachers, AFT Local 1825; United Industrial Workers/Seafarers International Union; and United Steelworkers Local 8249, 2019). One VIDE office building we visited had visible electric wires, water damage, and holes in the ceiling. Figure 11.2 shows examples of damaged school facilities that are in use, including a high school gym with leaks in the roof and the ceiling of a classroom.

The Storms Have Negatively Affected Well-Being, and Resources to Support Mental Health Needs Are Inadequate

Teachers Lack Consistent Support for Their Own Challenges and Training in How to Help Students Cope

During our school visits, administrators and counselors emphasized that healthy teachers are critical to helping children recover after the hurricanes and to creating a positive

Figure 11.2
Examples of Damaged School Facilities Still in Use

Photos by the authors, 2020.

learning environment in the schools. Studies of other disasters also emphasized that teachers and principals play important roles in education recovery. As trusted adults, they can create a sense of physical security (Vernberg et al., 1996), fill a community pastoral care role (Mutch, 2015), help children adapt by supporting mental health in a community setting (Jaycox et al., 2007), and provide insights on needed policy change to improve education and address children's mental health needs (Lai et al., 2016).

Yet, some teachers continue to be affected by storm-related stressors and, thus, struggle to create a positive environment in the classroom, according to most school administrators with whom we spoke. Only one principal felt that most teachers were functioning as well as they had before the storms. Administrators noted that most mental health efforts in schools were focused on helping students or training teachers how to help students, with assistance for teachers themselves as a gap measure.

There are multiple possible reasons for the ongoing challenges that teachers might have. First, some teachers are still coping with both personal challenges and challenges in the school environment. In terms of housing (see Chapter Eight), some teachers lost homes and must deal with insurance companies and contractors to manage home repair. Some lost family members, moved in with relatives, or had relatives move into their homes. Indeed, a February 2019 community need assessment survey revealed possible posttraumatic stress disorder symptoms in 57.5 percent of adults in the USVI (Michael et al., 2019). Second, the school environment in which teachers work every

day has degraded since the storms. Because of damage to facilities and leaks in classrooms, some teachers worry about health consequences for themselves and their students. There are also staff shortages that affect teachers' ability to do their jobs. The Departments of Health and of Human Services report 40 vacancies in staffing that have remained unapproved for advertisement (more than eight months) because of delays in internal protocols. These vacancies include teachers, food service workers, social service aides, bus drivers, and administrative and management staff. In addition, multiple school administrators reported that the responsibility of helping students cope—while the teachers are also facing similar stressors—has sometimes resulted in "compassion fatigue." We note that such challenges are not unique to the USVI: Studies of other disaster recoveries have found similar well-being challenges among teachers, many of whom developed burnout, depression, or emotional exhaustion after the disaster. The extent of these problems is often related to teachers' perceptions of the quality of organizational disaster responsiveness, the disaster's effect on personal and work domains, increased emotional work in helping students, lack of institutional support, growing workload and job complexity, teachers' own personal circumstances, the extent of damage at teachers' schools, and whether teachers had been relocated to another school building (Kuntz, 2015; Kuntz, Näswall, and Bockett, 2013; V. O'Toole and Friesen, 2016; Seyle, Widyatmoko, and Silver, 2013).

Some Students Face Ongoing Well-Being Challenges, with Inadequate Resources for Counseling

Although some school staff said that student well-being two years after the hurricanes was similar to that before the storms, others believed that a significant minority of students are struggling more as time passes. In the USVI, these challenges increase students' already-vulnerable situation, as described earlier in this chapter. Several school administrators with whom we spoke described the changes they saw in students: increases in anxiety in advance of storms, depression, emotional vulnerability, behavioral problems, and aggression. Principals and counselors noted increased stress among students stemming from multiple families moving in together, trouble studying due to crowding at home, transportation challenges, and parents being out of work leading to food insecurity and lack of school supplies. As one principal explained, "We know that there is a struggle at home. Parents don't have enough to provide for them—they haven't gotten their jobs back."

Resources for Mental Health Are Inconsistently Available in Schools and Lack Sustainable Funding

Although mental health supports for students exist, as noted earlier in this chapter, these supports were not systematically offered to all schools or funded or administered in a sustainable way. Some schools had partnerships with outside organizations for mental health service provision, but the VIDE did not have a full-time staff member responsible for oversight of mental health in schools after the storms. Funding for

external mental health support after the storms relied on temporary grants from federal agencies or foundations that were set to expire, rather than longer-term programming with budgeted funding. Because such support was external, supports were not rolled out to all schools, at the discretion of the provider; one key private program, funded by HHS, included seven schools on St. Thomas, one school on St. John, and four schools on St. Croix. Some school administrators thought that such resources were useful but generally insufficient. Most administrators described school nurses and counselors as "stretched thin" or not having their school nurse or counselor positions staffed. Administrators also noted that teachers were not trained to recognize and address signs of trauma in students, so they may have missed signs of problems among students. Other challenges included few licensed professional counselors in the USVI (see Chapter Twelve). A study of mental health needs of teachers and students in schools in Alabama, Louisiana, Mississippi, and Texas similarly showed that needed mental health supports were not sustained, although needed, and the researchers recommended mental health planning and resources for the longer term for students, school staff, and families (RAND Corporation, 2007).

The Disasters Have Affected the Student Learning Environment and Educational Progress

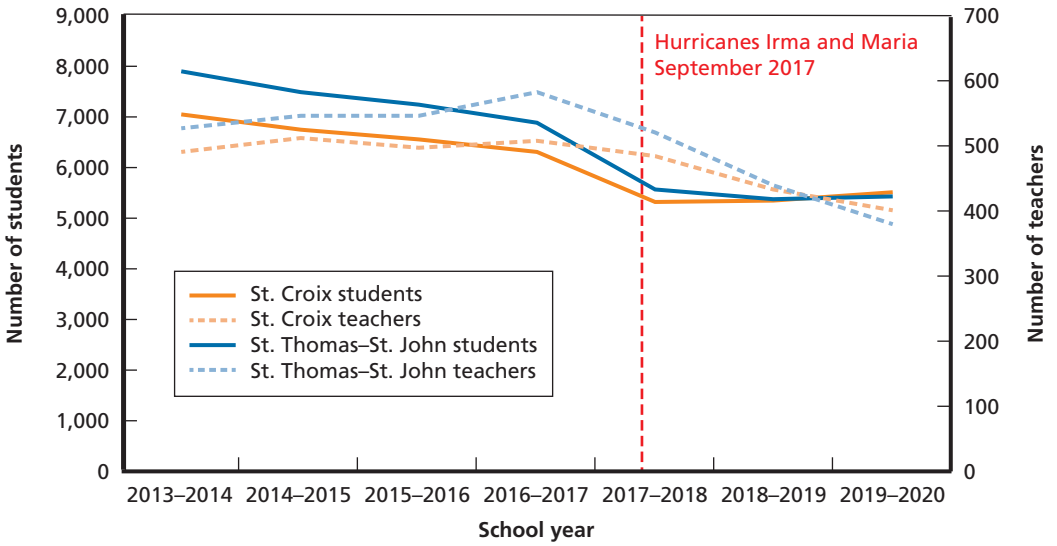
Some Teachers and Students Have Left Public Schools

Declining numbers of teachers and students likely both reflect difficult conditions on the island overall and in the schools and present further challenges to schools as teachers leave. The population of the USVI had been in long-term decline even before the 2017 hurricanes. The USVI child population dropped by 42 percent between 2000 and 2015 (Michael et al., 2019). After the storms, teacher and student populations dropped further (see Figure 11.3). From the 2016–2017 school year to the 2018–2019 school year, both public school teacher and student numbers decreased by about a fifth, with the number of teachers dropping from 1,091 to 873 and students dropping from 13,194 to 10,718. Teachers and students have left for the continental United States, while some students have also moved to private schools or homeschooling (CFVI, 2019).

High School Drop-Out Rates Have Increased While Performance on Standardized Tests Has Improved but Remains Low

The hurricanes affected education quality in multiple ways. Several principals described how the quality of education "dropped," although one principal thought that education quality had not been affected. Similar studies of other disasters in the United States have also shown that disasters and school closures can negatively affect student achievement in the near term (Baggerly and Ferretti, 2008; Sacerdote, 2012; Spencer, Polachek, and Strobl, 2016): Students displaced after disasters had poor attendance and academic setbacks in the academic year after the disasters struck (Holmes, 2002;

Figure 11.3
Numbers of Students and Teachers, by School Year



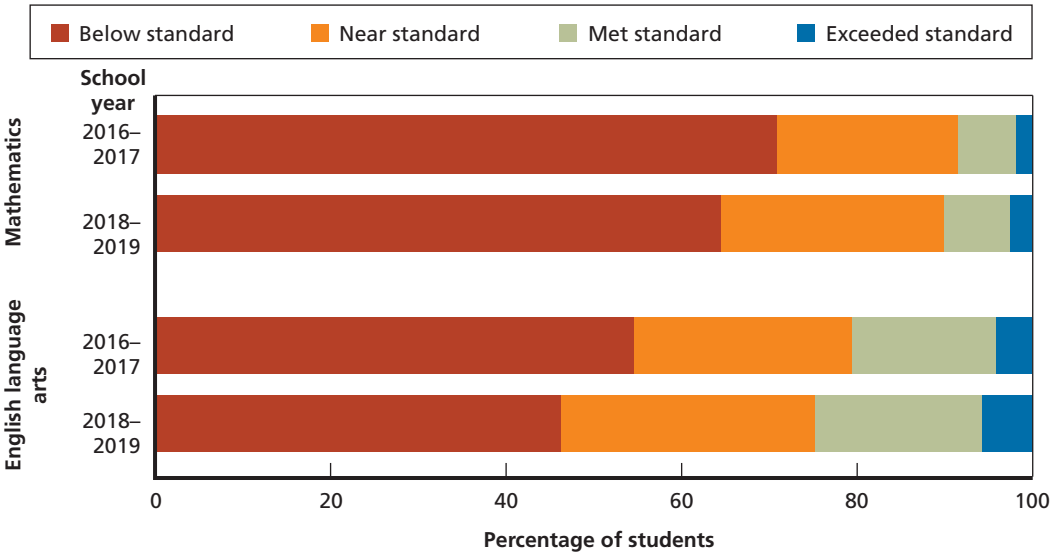
SOURCE: VIDE.

Pane, McCaffrey, Tharp-Taylor, et al., 2006; Spencer, Polachek, and Strobl, 2016). In the USVI, fewer high school seniors graduated, with both declining attendance and increasing drop-out rates; 791 of 1,115 students (70.9 percent) graduated from high school in the 2015–2016 school year in comparison with 654 of 1,050 students (62.2 percent) having graduated in the 2017–2018 school year (CFVI, 2019).

At the same time, perhaps unexpectedly, USVI student scores on the Smarter Balanced standardized test have actually *improved* since before the hurricanes (see Figure 11.4), although the USVI has had long-standing low performance on standardized, year-end achievement tests. From 2016–2017 to 2018–2019, the proportion of USVI students who met or exceeded standards in mathematics rose from 8.5 percent to 10.1 percent, and the proportion of students testing below standards dropped from 70.9 percent to 64.5 percent. Test scores similarly improved slightly in English language arts. By way of comparison, in U.S. states, proportions of students meeting or exceeding standards in mathematics for 2016–2017 ranged from 32.0 percent to 47.3 percent across grades 3 through 11, positioning even the USVI's improved scores well below national averages (Smarter Balanced Assessment Consortium, 2017).

SAT scores from 2017 to 2019 remained relatively stable, with a mean combined score of 924 in the 2016–2017 school year and 935 in both the 2017–2018 and 2018–2019 school years; the national averages were 1,060, 1,068, and 1,059, respectively (College Board, 2017; College Board, 2018; College Board, 2019). In 2019, these scores placed the USVI last in a ranking that includes the 50 states, Puerto Rico, and the District of Columbia.

Figure 11.4
Student Attainment, by Subject and School Year, on the Smarter Balanced Standardized Tests



SOURCE: VIDE.

Although improvement or stability in scores after the hurricanes seems surprising, studies of education after Hurricane Katrina in Louisiana showed that initially lower achievement scores among displaced students were mitigated over time as students enrolled in new schools and scores actually rose (Pane, McCaffrey, Kalra, et al., 2008; Sacerdote, 2012). A study ten years after Hurricane Katrina showed net improvements in student test scores, which were attributed to posthurricane education system investments and changes (Harris and Larsen, 2016). However, it would be too early to see results from posthurricane investments in the USVI because many planned initiatives have not yet started.

Many High School Graduates Are Insufficiently Prepared to Take Advantage of Opportunities in the Recovery Workforce

High School Career and Technical Education Programs Have Not Been Recently Aligned with the Skills That Employers Are Seeking

Multiple workforce stakeholders stated that the variety of CTE courses offered in the high schools do not align with needs of current employers or projected needs of the recovery economy; there has not been recent coordination between the VIDE, VIDOL, and employers on determining skills needed and high school courses to teach those skills. The new USVI Cradle to Career initiative's establishment of the USVI Workforce Development Board offers opportunities to create such alignment. Indeed,

providing quality CTE in alignment with labor market needs has the potential to improve job opportunities for high school graduates. The National Skills Coalition estimates that, in the United States, 52 percent of jobs are middle skill (defined as requiring high school and some additional training [Unruh and Mayo, 2011]), with 32 percent requiring a four-year college degree and 16 percent requiring high school only (Bashay, 2020).

Deficiencies in Basic Skills Among High School Graduates Impede Opportunities in the Recovery Economy

According to some of those in workforce-development organizations with whom we spoke, some USVI high school graduates lack the basic literacy and numeracy skills needed to obtain jobs after graduation or pursue additional training for middle-skill work in the recovery workforce. Shortfalls in basic skills, such as English language arts and mathematics (as evidenced by the low rates of "performing at standard" on the Smarter Balanced tests mentioned in the previous section), mean that some graduates do not possess the skills necessary to pass technical certification exams. These are long-standing issues, demonstrated by high rates of youth unemployment in general. Before the storms, of the 20.7 percent of youths ages 16–19 and youths ages 20–24 who reported either working or looking for work, 46.7 percent and 23 percent were unemployed, respectively (CFVI, 2019). There is the risk that, without improvement of these skills, youths will not be able to fully participate in recovery opportunities.

A Shortage of Career and Technical Education Teachers and Damaged Career and Technical Education Facilities and Equipment Impede Quality Education

Before the hurricanes, approximately 20 percent of youths ages 16–24 engaged in some CTE training in the 2015–2016 school year (CFVI, 2019); since the hurricanes, fewer students have been enrolled in CTE, according to administrators in the two high schools we visited, because high schools have had facilities and equipment destroyed and CTE teachers have left. The school system has faced difficulties in hiring and retaining CTE teachers since the hurricanes, particularly for the construction trades, according to the VIDE. Furthermore, high school CTE facilities and equipment were damaged in the storms and have yet to be restored. As a result, there is more demand for CTE courses than the schools can support because of these teacher and facility shortages, according to high school principals. The USVI faces a shortage of CTE teachers with experience in high-demand sectors because of the low pay offered by the public sector; competition from the private sector, in which demand for technical skills is high; and the general trend of teachers moving to the continental United States. To remedy the shortage of qualified teachers, the VIDE has proposed hiring CTE teachers on a part-time basis; however, this proposal has faced resistance from territory teachers' unions.

Box 11.4
COVID-19 and Education

The COVID-19 pandemic could increase risks for recovery of education in the near term in the following ways:

- In support of physical distancing, the USVI temporarily closed its schools, moving to distance education. Although the VIDE provided some online curriculum guidance via Facebook, inconsistent access to computers and the internet among USVI children could increase inequities of education outcomes over time.
- High school students might have an increased rate of dropping out because in-person educational supports are not available.
- With early child care centers and elementary schools closed, essential workers with children might face trouble finding child care to enable them to work.
- Standardized testing, such as the Smarter Balanced tests, Advanced Placement exams, and the SAT exam could be postponed or not given as widely.
- Health care supports for children, including mental health, could be more difficult to access.
- Because 99 percent of USVI public school children qualify for free and reduced-price lunches, they might not be able to access school meals if school meals are not available for takeout or delivery. Because many children have parents who will face income shortages or layoffs, there could be increases in food insecurity among students.

At the same time, many of the recovery needs and recommendations described in this report will remain highly relevant in the medium to long term: reconstruction of buildings, well-being of teachers and students, quality of education, and opportunities in the recovery workforce.

Management Capacity to Meet Recovery Needs

The process of rebuilding and consolidating damaged schools represents a significant management challenge for education stakeholders, including the VIDE, FEMA, the U.S. Department of Education, and community partners.

The VIDE currently lacks institutional capacity to manage complex capital projects, and procedures delay hiring needed staff. The VIDE will manage significant capital budgets for recovery—far more than it has the experience and staffing to currently manage. Project estimates (which are still incomplete) in the FEMA Grants Manager database for public schools come to $185 million; the VIDE puts the estimate at at least $1.3 billion. By way of comparison, the VIDE's annual operating budget is $180 million; the recovery reconstruction amounts likely will be significantly more than it typically manages in a given year. Furthermore, the VIDE lacks staff with experience in managing capital projects, given that, in recent decades, the VIDE has managed the maintenance of school buildings, not new construction. Although FEMA's PA program will provide funding so that the VIDE can hire staff for reconstruction (category Z funding; see Chapter Two), the VIDE must have the budget up front to hire employees while waiting for reimbursement. It lacks the budget to do so (see Chapter Two, "Management Capacity," and Chapter Three, "Government Fiscal Capacity"). The USVI OMB does not permit posting job positions without the budget to hire. Because FEMA funding will be made available only after the agency has fronted the money, this poses a classic "chicken-and-egg" problem. Therefore, the VIDE does not have the staff and contractors it needs to get started on this work,

including staff with the knowledge and experience in the complicated process of managing capital projects.

The VIDE lacks liquidity to pay contractors up front while waiting for reimbursement from FEMA. The FEMA PA process requires the VIDE to pay contractors for work up front and then seek reimbursement from FEMA (see Chapter Three). However, like other territory agencies, the VIDE faces liquidity constraints on its ability to complete the up-front payments. One VIDE official described this issue as the "biggest challenge." In addition, reimbursement can be a lengthy process; some reimbursements to the VIDE from FEMA for debris removal immediately after the storm were still pending at the time of this report's writing.

PA alternative procedures (Section 428) add complexity and time to reconstruction while also offering opportunities for more-flexible spending toward building new high-quality schools. For the VIDE, the alternative procedures entail multiple steps. The first is completion of damage assessments, cost estimates and validations, and obligation of funding through FEMA. The VIDE trailed all other territory agencies in this process, with most public schools completing the damage assessment step only in January 2020 (see Chapter Two). Frequent turnover in FEMA staff in the USVI has made negotiating the costs for the VIDE's sites challenging because of lack of continuity in approach. Second, the planning must be completed for which schools to repair, which to close, and which to build anew; this is underway as part of the facility master plan. Following the finalization of the facility master plan, schools will need to be designed by contracted architects and engineers, according to the new USVI school codes and standards. Third, the USVI will next need to put the school contracts to tender and hire contractors to build them, either locally or from the continental United States. The VIDE will then need to manage the significant sums mentioned, make up-front payments to contractors, manage relations with other territory government agencies (such as VITEMA, ODR, DPP, the Department of Finance, and OMB), and manage the reimbursement process with FEMA (see Chapter Two for a diagram of this process).

Multiple stakeholders desire increased clarity on reconstruction plans and timelines. Although some plans (such as the facility master plan) are still under development, integrated plans and timelines (including FEMA's funding obligation process, the territory's facility master plan, and funding measures) do not yet exist. Additionally, the VIDE has faced a steep learning curve in understanding how FEMA processes work and has found it difficult to obtain answers to questions. School staff told us that they had not received communication from the VIDE about the schedule for reconstruction and which schools would be closed.

Recommendations

In this section, we provide recommendations related to management capacity, buildings, well-being, quality of education, and opportunities in the recovery workforce. Although the recommendations are in order of these topics, the tables also specify whether these can be considered in the short term or longer term.

Ensure That the Virgin Islands Department of Education Has the Human and Financial Resources It Needs to Manage Reconstruction

Goal	Hire VIDE capital project staff and provide the VIDE liquidity for reconstruction.
Rationale	Although the VIDE is responsible for managing potentially $1.3 billion in school reconstruction and repairs, it lacks the staff and budget to manage these projects. It has not been able to hire additional staff with capital-project experience because it lacks the budget to do so and because of USVI procedural constraints. At the same time, costs for hiring staff can be reimbursed at a later date by FEMA as part of reimbursement for projects (described as category Z funding). Furthermore, the FEMA PA program requires the applicant to pay contractors for work up front, followed by reimbursement by FEMA. The VIDE lacks the liquidity needed for the up-front payments. Although setup of a $50 million line of credit is underway for the USVI, many agencies will want access to it for their projects.
Implementation considerations	Steps include the following: • Explore the use of FEMA funds to cover hiring new VIDE staff, such as category Z funds and using incremental reimbursement, as discussed in Chapter Two, "Management Capacity" (responsible parties: the VIDE and FEMA). • Work with OMB to reduce procedural barriers to hiring needed recovery staff (responsible parties: VIDE and OMB). • Explore whether the financing options presented in Chapter Three, "Government Fiscal Capacity"—particularly the $50 million line of credit—can be used to provide a revolving fund to start reconstruction projects and to hire capital project–management staff before category Z funding is available (responsible parties: the USVI legislature, the VIDE, and OMB). • Explore working with a major foundation for grant funding for an education reconstruction project seed fund similar to that proposed for infrastructure services in Chapter Six (because there will be competition for the $50 million line of credit from other agencies). • Hire a contractor to develop a school financing plan in coordination with the new facility master plan to propose for approval by the USVI legislature and the USVI governor.
Time frame	Near term
Leading entities	The VIDE, FEMA, the USVI legislature, and the USVI governor would be the leading entities.

Develop Integrated Public Plans for School Rebuilding, with Timelines

Goal	Enable stakeholders to work together toward common goals efficiently and build public confidence through a common plan.
Rationale	School administrators, territory government officials, and federal government officials all noted a lack of understanding of plans for school rebuilding; currently, no public plan incorporates actions from the VIDE, FEMA, and others with milestones, financing, indicators, and a schedule. Although the facility master plan—which will determine which schools will be repaired, closed, or newly built—is underway, numerous aspects of implementation (including time frames for FEMA PA processes) could be covered in a clear plan that supports stakeholder collaboration and keeps all schools and families notified about progress.
Implementation considerations	We suggest the following elements as part of a public plan: • Develop a timeline for the PA obligation process for FEMA's steps (responsible parties: FEMA and VITEMA). • Complete the facility master plan (responsible parties: the VIDE and a contractor). • Ensure that the VIDE has liquidity and cost-matching to start and continue the reconstruction process per steps laid out in Chapter Three (responsible parties: the USVI legislature, the USVI governor, and HUD's CDBG-DR program). • Develop a building plan and schedule for schools that takes into account the amount of time needed for architectural and land planning, selecting contractors, financing, building, and oversight. • Select indicators of progress, such as "days to obligation" from FEMA, whether buildings are ahead of or behind schedule, and amounts expended. • Plan for maintaining continuity and quality of education when a school's buildings are under construction . • Coordinate the aforementioned steps into an integrated public timeline (responsible parties: the VIDE, FEMA, and VITEMA). • Post the plan on the VIDE website. • Provide regular updates on the rebuilding timeline to school staff, parents, students, and officials involved in the rebuilding as work progresses (responsible party: VIDE). • Provide a forum for upward feedback from school staff, parents, and students to the territory government on the rebuilding process.
Time frame	Near term
Leading entities	The VIDE and FEMA would be the leading entities.

Build Additional Modular Classrooms and Prioritize Repairs of Common Facilities

Goal	Provide students and teachers with a safe, high-quality environment during the multiyear reconstruction process.
Rationale	Even now that the 245 modular classrooms have been completed, some damaged classrooms are in use and still might not be safe or conducive to quality education. Some schools are experiencing crowding. Furthermore, some gyms, libraries, and science labs are not safe for use because of structural damage and leaks. Given the complicated rebuilding process, it will be multiple years before rebuilding and repair are finished. Providing additional modular classrooms and key repairs can address some of the most-challenging situations in the buildings so that students and teachers have improved environments during the years that the building process will take.
Implementation considerations	Steps include the following: • Conduct an assessment of quality space shortages in schools (responsible parties: FEMA and the VIDE). • Obligate funding for and contract for additional modular classrooms (responsible parties: FEMA and the VIDE). • Prioritize repairs for important common spaces at schools (gyms, libraries, science labs, and similar facilities), with additional emergency funding to do these quickly (responsible parties: FEMA and the VIDE). • Harness philanthropic resources to restore gyms, libraries, and science labs if foundations can fund and organize contracting more quickly (responsible parties: FEMA, the VIDE, and leading USVI and national foundations). • Communicate these temporary steps as part of the integrated plan for rebuilding in the previous recommendation
Leading entities	FEMA, the VIDE, and foundations would be the leading entities.

Improve Teacher and Student Access to Mental Health Resources Through Additional Staff, Services, and Training

Goal	Improve the mental health, resilience, and emotional growth of teachers and students.
Rationale	Students and teachers have struggled since the storms with challenges to their mental health and well-being. However, resources for supporting mental health in the schools are inconsistent across schools and are funded by temporary sources; the VIDE does not have a full-time staff person responsible for overseeing well-being. Studies of other disasters have shown that teacher burnout can result from the expansion of teachers' roles following the disaster, therefore necessitating staff training and other institutional supports to be better prepared for what is expected of them (Kuntz, 2015; Mutch, 2015). A study of students who had teachers who were part of a teacher-mediated intervention showed that those students had better academic performance, better social behavior, and better conduct than a control group of students whose teachers were not part of the intervention (Wolmer et al., 2005).
Implementation considerations	Multiple steps could be taken to improve well-being among students and teachers and promote emotional growth and resilience to manage future stressors. These steps are as follows: • Hire and provide a multiyear budget for a VIDE staff person to oversee well-being in USVI schools and for continued and expanded mental health programming for the schools (responsible parties: the VIDE, the U.S. Department of Education, the USVI's OMB, and HHS). • Introduce an evidence-based trauma support program in the schools that includes methods for helping students and training for teachers on recognizing and addressing signs of trauma among students, such as Cognitive Behavioral Intervention for Trauma in Schools (responsible parties: U.S. Department of Education and private foundations) (Cognitive Behavioral Intervention for Trauma in Schools, undated). • Explore institutional supports to support the well-being of administrators and teachers, such as additional leave time to cope with ongoing additional poststorm personal demands. • Assess teachers' well-being at schools through an educator well-being measurement tool, such as the Affective Experience Scale or a school environment assessment, then use findings from these assessments to target assistance for teachers (Schweig, Hamilton, and Baker, 2019). • Integrate social and emotional learning into the school curriculum through an evidence-based program, such as the Yale Center for Emotional Intelligence's RULER program (RULER, undated) • Develop trauma-sensitive guidelines for disciplinary practices at schools (responsible parties: the VIDE and foundations) (McInerney and McKlindon, undated; Trauma Learning Policy Initiative, undated). • Explore telemedicine options for counseling for students and teachers when there are shortages of counseling resources in the territory.
Leading entities	The VIDE, the U.S. Department of Education, USVI's OMB, and HHS would be the leading entities.

Maintain Attention to Quality-Improvement Initiatives During Recovery and Reconstruction

Goal	Improve student educational attainment.
Rationale	Student attainment in the USVI is low, limiting postsecondary education and job opportunities for USVI graduates. The USVI has been implementing quality improvements in line with the Every Student Succeeds Act; indeed, despite the challenges presented by the 2017 storms, by some measures, student attainment has actually increased slightly since before the storms, demonstrating that quality improvements remain possible even under these circumstances. At the same time, although many middle-skill jobs will be available in the recovery economy, some USVI high school graduates lack the English language arts and math skills to take advantage of this training. In addition, during the rebuilding process, schools will experience disruption and transition, with students condensed into classrooms or moved among buildings and school facilities, imposing further strains on quality initiatives. Engaging principals in quality planning across the territory could enable new solutions and sharing of good practice.
Implementation considerations	Steps include the following: • Continue pressing forward with quality and accountability initiatives at the territory level (responsible party: the VIDE). • Create an advisory committee of school principals and teachers to develop strategies to advise on the quality of education during transitional and construction phases (responsible party: the VIDE). • Partner with another state that has dealt with improving education after a disaster, such as Louisiana, for advice and technical support. • Consider funding and technical assistance options for quality improvements (responsible party: the U.S. Department of Education). • Embed continuous improvement procedures that define quality, create measures that speak to these goals, monitor progress, support and incentivize implementation, track problems, and develop solutions.
Leading entities	The VIDE, the U.S. Department of Education, the Louisiana Department of Education, and national or USVI foundations would be the leading entities.

Increase Quality, Relevance, and Access to Career and Technical Education and Workforce Preparation Programs

Goal

Enable USVI high school graduates to find quality opportunities in the recovery economy.

Rationale

Multiple jobs will be available as part of the recovery economy. Chapter Four, "Workforce Capacity," lays out the types and number of jobs that might be available given current investment plans. It is important for high school graduates to have access to these opportunities. However, buildings and equipment for high school CTE have been damaged; the quality of high school CTE might not equip students with needed skills; courses offered in high schools have not been aligned with expected skill demand in recent years; and high schools have a shortage of CTE teachers from in-demand fields, such as the construction trades. Reasons for the CTE shortage include industry professionals being hired for greater salaries by the private sector and a lack of existing VIDE policy to hire part-time industry professionals as teachers, with resistance from teachers' unions to such steps. The newly established USVI Workforce Development Board, as part of the Cradle to Career initiative, offers an opportunity to develop new high school CTE policies and programs, drawing on USVI workforce projections and good practices from other states. Other U.S. regions and states have also worked to align high school CTE with workforce needs in recent years, with new approaches in Louisiana, Ohio, Colorado, Tennessee, Pennsylvania, and West Virginia (Buller, Menardi, and Nicholas, 2017; Culbertson, Baird, et al., 2019; National Association of State Directors of Career Technical Education Consortium, 2014). For example, Louisiana developed a program to hire industry professionals as CTE instructors to address CTE teacher shortages; created partnerships between schools and local universities, community colleges, or industry associations to offer some classes outside of the high school for students; and aligned high school CTE offerings with regional workforce need projections (Culbertson, Baird, et al., 2019).

Implementation considerations

The VIDE could pursue any of multiple options to improve CTE for high school students. These include the following:

- Coordinate with VIDOL, VIEDA, and the USVI Workforce Development Board to identify skill needs (see Chapter Four, "Workforce Capacity"), and encourage the formation of consortia to provide training or apprenticeships under the Workforce Development Program (responsible parties: the VIDE, working with high schools, VIDOL, VIEDA, the USVI Workforce Development Board, and private-sector employers or employer organizations).
- Align high school CTE offerings with projected skill demands, as laid out in Chapter Four, and CTE teacher availability. In particular, Chapter Four identifies several occupations with moderate training requirements that will be in high demand, including carpentry; heating, air conditioning, and refrigeration mechanics and installers; bookkeeping, accounting, and auditing clerks; and cost estimators. Each of these jobs requires a high school degree and up to one year of on-the-job training.
- Increase high school CTE emphasis on the skills identified by Chapter Four projections as important for a broad array of jobs that will be in high demand: customer-facing skills, soft skills, and basic math skills, which will be useful in tourism-sector jobs and recovery-related jobs, such as retail salespeople and cashiers.
- Develop a VIDE program to enable industry professionals to teach part time in high schools, with additional training in classroom management.
- Identify a single high school on St. Croix and another on St. Thomas to offer CTE in the facility master plan and invest in facilities and teachers, to both improve quality and consolidate resources (including scarce CTE teachers); provide transportation to students if they do not live in a catchment area for one of those high schools.
- Coordinate with the Raphael O. Wheatley Skill Center, the UVI Center for Excellence in Leadership and Learning, My Brother's Workshop, and other private or nonprofit CTE providers to offer training for particular skills for high school students—enrolling directly or sharing programs.

	• Use high school CTE programs to identify promising graduating students who would benefit from obtaining additional CTE training in the continental United States (see Chapter Four, "Workforce Capacity"); developing a scholarship program to cover student costs conditionally on return for several years of work in the USVI (responsible parties: the VIDE, working with VIDOL and the VI Workforce Development Board). • Partner with a community college or other CTE trainer in the continental United States to offer certain courses by video, with facilitation from USVI high school teachers; this would be useful for courses that do not require hands-on training, such as some related to soft skills or customer service skills.
Leading entities	The VIDE would be the lead, involving the U.S. Department of Education, VIDOL, the VI Workforce Development Board, UVI, the Raphael O. Wheatley Skill Center, nonprofit and private CTE trainers, and private-sector employers.

CHAPTER TWELVE

Health and Human Services

Box 12.1
Key Findings About Health and Human Services

- USVI health and human services are provided through VIDOH, the Virgin Islands Department of Human Services, nonprofit organizations, and private entities. The USVI population has an array of complex vulnerabilities: High percentages are uninsured, use Medicaid, or in need of specialty care.
- Health and human service organizations sustained significant damage from the hurricanes, including damage to infrastructure and decreases in workforce. The mental well-being of island residents, including people struggling with behavioral health issues and other vulnerable people, also suffered.
- Recovery has been slow but is progressing. Public health and health care services are being provided through temporary modular structures while key infrastructure projects get underway. Workforce issues are partly addressed through license reciprocity with the continental United States, and the government and nonprofits are helping vulnerable populations obtain medication, medical equipment, and access to care. The government has provided crisis counseling and is considering legislation on behavioral health and developmental disability. Further, hospital reconstruction has been stalled.
- The recovery vision for health and human services includes
  - rebuilding and modernizing infrastructure for health and human services
  - upgrading surveillance capacity
  - augmenting the health and human service workforce
  - improving the current conditions and future preparedness of vulnerable populations
  - addressing the increase in behavioral health concerns.
- The USVI faces several barriers to recovery in health and human services:
  - slow progress in rebuilding health and human service infrastructure
  - ongoing workforce shortages and slow procurement and hiring procedures
  - large populations of people who are uninsured, use Medicaid, or have significant need for specialty care
  - gaps in services for people with behavioral health challenges, mental health disorders, developmental disabilities, alcoholism, and substance use disorders
  - lack of adequate surveillance systems to fully understand the 2017 hurricanes' impact on vulnerable populations.
- In addition, VIDOH faces staff shortages, and several Department of Human Services projects have been slow to get started.
- Our team makes the following recommendations to address health and human service needs:
  - Conduct a strategic community health need assessment for infrastructure.
  - Closely monitor the process of rebuilding the hospitals and VIDOH through transparent accountability metrics and reporting.
  - Expand access to telehealth services using providers outside of the territory.
  - Develop a registry of populations who might require special assistance.
  - Develop a plan to address issues of access to behavioral health care, including the development of intensive outpatient therapy and a coordinated approach to manage cases of people who require inpatient care.
  - Develop a surveillance system to accurately assess disaster-associated mortality and morbidity.

The purpose of this chapter is to describe the current situation of the USVI health and human service sectors, as of March 2020. We first set the stage by discussing damage to health care and human infrastructure, implications for vulnerable populations, and recovery accomplishments to date. We then describe the territory's vision for health and human services moving forward and identify barriers and gaps to implementing the vision. Finally, we present some potential recommendations for addressing those needs. Box 12.2 describes the methods used in this analysis, as well as the limitations of those methods.

Setting the Stage

Before the Hurricanes

Key Agencies

Health and human services are vital to a healthy and well-adjusted community and cover a variety of critical community functions. The territory addresses health and human services through a combination of territory agencies and other supports. VIDOH is the chief regulatory and territory public health agency in the USVI and is responsible for preventive medicine (e.g., child health, family planning, immunizations, environmental sanitation, mental health, and drug and substance abuse prevention), as well as health promotion and protection, regulation of health care providers and facilities, and maintenance of vital statistics for the population. VIDOH also assesses public health system capacities, develops and exercises a public health emergency preparedness plan, provides nutrition education and counseling, operates community primary care clinics, and conducts disease surveillance. The Virgin Islands Department of Human Services

Box 12.2
Methodology for the Analysis of Health and Human Services

- Our team used a mixed-method approach to determine the vision, status, barriers, and gaps for hurricane recovery in the health sector.
- The project team reviewed prestorm policy documents, agency need assessments and action plans, recovery plans, and public officials' statements. Supplemental published information was gathered from media and commercial reports. Additional administrative data from FEMA were analyzed, including IA and PA aggregated data and project-tracking metrics from FEMA's Grants Manager database.
- Data and document review were supplemented by in-person and teleconference discussions with key health and human service stakeholders. We reached out to as many stakeholders in the territory as we could identify; conducted discussions with 26 public officials and nonprofit-sector leaders; and observed repairs to modular hospitals, public health facilities, and Head Start Centers.
- Analysis and recommendations for specific stakeholder agencies and sectors are presented in the "Management Capacity" section of this chapter. Notes were taken without attributing the comments to specific people.
- There were some methodological limitations, including the lack of accurate data on hurricane-related excess morbidity and mortality, which is a major limitation to understanding the hurricanes' true impact on health. In addition, the territory is absent from some relevant standard data sources (e.g., disability and health state profiles).

is responsible for a variety of family- and child-focused services, such as Head Start, child care licensing, juvenile justice services, foster care, disability services and family assistance programs (such as the Supplemental Nutrition Assistance Program), and other services (e.g., the Virgin Islands Interagency Council on Homelessness, pharmaceutical assistance program). In addition to the health and human services offered by the territory government, a broader health care system provides acute care, disease management, and preventative medical care to residents—many of whom have low or moderate incomes—and visitors to the territory.

Medical Facilities

The territory is served by two public hospitals (JFL and the Schneider Regional Medical Center) and two federally qualified health centers (FQHCs). The East End Clinic in St. Thomas and the Frederiksted Health Center on St. Croix provide the majority of uncompensated care, and more than half of their populations are Medicaid patients. There is one small residential facility for the chronically mentally ill, the Eldra Schulterbrandt Residential Care Facility, which has been operating at capacity since before the storms. Furthermore, the infrastructure of these facilities was in disrepair prior to the storms.

Nonprofits and private entities also support health and human services. The nonprofit community focuses on supporting people with disabilities and other vulnerabilities as they navigate recovery. In addition, many private entities, including pharmacies, mental health providers, and physicians' offices, are involved in providing health care and supporting human services. There are also two public specialty facilities, the Charlotte Kimelman Cancer Institute and the Virgin Islands Cardiac Center, and one public inpatient residential facility for people with chronic mental illness (Eldra Schulterbrandt). Two major private providers offer mental health care in the USVI (Insight Psychological Services and Island Therapy Solutions), and one smaller organization mainly assists with children (Beautiful Dreamers). There are also 23 pharmacies in the USVI—21 retail pharmacies and two that are located in the two hospitals.

Population Needs

The territory's population has an array of complex vulnerabilities influencing health. Of the roughly 100,000 residents serviced by the USVI health care system, 30 percent were uninsured at the time of the hurricanes, which is much higher than the 12 percent uninsured in the United States overall. Approximately 82 percent of the USVI population is medically underserved and faces some specific health challenges, including limited access to certain specialty services. Approximately 10 percent of the working-age population in the territory have disabilities (Table 12.1). Before the hurricanes, almost half of families had a female single head of household (Michael et al., 2019). The population reported higher rates of diabetes, cardiovascular disease, hypertension, cancer, obesity, and infant mortality than for the United States overall. Eighteen per-

Table 12.1
Disability Status in the Territory

Disability Type	Percentage of Population	Number of People	Base Population[a]
Any disability	9.8	10,372	105,433
Visual	3.3	3,480	105,433
Hearing	2.0	2,151	105,433
Ambulatory	5.6	5,468	97,939
Cognitive	3.2	3,170	97,939
Self-care	1.8	1,791	97,939
Independent living	4.3	3,354	78,475

SOURCE: VIDOL, undated.

[a] Base population numbers change because children under the age of 5 were asked only about visual and hearing disabilities and children under 16 were not asked about independent living

cent of the population was over 65 years of age, which is higher than the share of the population in the United States overall.

The territory was working to develop its health IT prior to the hurricanes. However, there is limited additional details about the health needs of the population given the limited capacity for health surveillance. Prior to the storms, the USVI participated in the Behavioral Risk Factor Surveillance System, which is run by CDC and is conducted in all states and most territories, and the national cancer registry. It also collected vital statistics, information on reportable diseases (including infectious diseases), and performance management and quality-improvement data (Ragster and Michael, 2017).

Impact of the Hurricanes

The 2017 hurricanes caused significant damage to health and human service infrastructure, including damage to health care facilities, as well as loss of workforce. The hurricanes affected the well-being of USVI residents, including its more-vulnerable populations, and provider shortages exacerbated mental health issues.

Facilities

The hurricanes caused significant damage to hospitals, clinics, Head Start centers, and VIDOH. The hurricanes caused both hospitals to experience loss of power, structural damage, and flooding. JFL was severely damaged, the fourth floor of the Schneider Regional Medical Center collapsed, and the building housing Schneider's cancer center was destroyed. Many patients were shifted to medical tents in the parking lots, and patients whose needs exceeded available resources were evacuated outside the territory for care. Because of a lack of power, the health care system shifted from an electronic

medical record system to paper records for approximately one month following the storm. The Myrah Keating Smith Community Health Center, the primary health care resource on St. John, was severely damaged following Hurricane Irma, when severe winds and rain breached the facility's roof, destroying furniture, medical equipment, and flooring. Currently, Head Start services are provided at five centers on St. Thomas and seven centers on St. Croix. Two centers are no longer available for Head Start use and are being utilized to support community initiatives. Three centers were closed because of hurricane-related damage. Early Head Start services continue to be provided by LSS on St. Croix at two centers. This is a reduction from prior to the hurricanes, when there were eight centers across the St. John/St. Thomas district and nine centers on St. Croix (Figure 12.1). A recent assessment by Head Start also found that 92 percent of child care facilities reported damage from the hurricanes (Roszak, 2019).

Workforce

The territory also experienced a significant loss of its workforce within health and human services. After the hurricanes, Schneider Regional Medical Center reported the voluntary resignation of 58 staff, and JFL reported losing 80 staffers (USVI Hurricane Recovery and Resilience Task Force, 2018). On average in 2016, hospitals with bed capacity between 100 and 199 beds had an average of 800 full- and part-time staff (NSI Nursing Solutions, 2016). The health care workforce deteriorated further when health care personnel left the territory because of overwhelming damage to their homes, personal health needs, or other challenges affecting their livelihoods. One year after the hurricanes, Schneider Regional Medical Center reported a loss of 175 nurses (Hall et al., 2018). More details on this shortage are included in the next section.

The health and human service workforce is insufficient to meet needs. The USVI has been designated a geographic high-need health professional and behavioral health professional shortage area, which indicated a shortage of health providers and services even prior to the impact of Hurricanes Irma and Maria. The U.S. Health Resources and Services Administration issues these designations based on a workforce profile. The most recent profile shows that, compared with the United States overall, the USVI has substantially fewer registered nurses (RNs) and licensed practical nurses (LPNs) per capita; fewer nursing, psychiatric, and home-health aides per capita; and lower median hourly wages for RNs and LPNs. There are also concerns about recruiting specialists and whether the low-income population has sufficient access to primary-care providers. Low-income residents also have only limited access to dental health care, despite the per capita number of dentists being higher than in the United States overall. There is also a shortage of physical therapists; there are only a third as many physical therapists per capita as in the United States overall. Finally, behavioral health professionals are in short supply, especially given the high need in the USVI.

Figure 12.1
Minnetta Mitchell Head Start Center, Closed Because of Damage Sustained from the 2017 Hurricanes

Photo by the authors, 2020.

Prescriptions

Obtaining prescriptions was difficult after the hurricanes. After the hurricanes, pharmacies struggled to stay open and faced many challenges, from difficulties verifying patient medication needs to depleted supplies of medications. All pharmacies in the territory rely on the same wholesaler and common shipping process because of its geographic location. Some medication inventories were compromised by the hurricanes or stolen. Pharmacies were then unable to restock their inventories because ports were closed and airports damaged.

Mental Health and Well-Being

The mental well-being of territory residents, including people struggling with mental health issues and other vulnerable people, also suffered. Recent studies of adults and

children reveal that both have experienced elevated levels of stress since the 2017 hurricanes (Michael et al., 2019). More information about the mental health challenges of school-age children is included in Chapter Eleven of this report. An analysis of services provided by Schneider Regional Medical Center showed a decline in admissions and patient-days for all service types (e.g., pediatrics, nursery, survey, emergency department visits) except for behavioral health, which had a significant increase in admissions (Michael et al., 2019). One study revealed that more than 50 percent of the adult population surveyed (Michael et al., 2019) were exhibiting symptoms of posttraumatic stress disorder, depression, or both.

Also, a growing homeless population is struggling with mental health and other issues. Discussions with local service providers, foundations, and government employees suggested that posthurricane homelessness has been increasing and that extended families are living together because of homes being damaged. This has created an environment with, as interview participants reported, a rise in domestic violence and sexual abuse. This observation is supported by the fact that calls to domestic violence support lines have nearly doubled in 2019 from their 2016 numbers (National Network to End Domestic Violence, 2017; National Network to End Domestic Violence, 2020).

Patient Demographics

There has been a shift in key differences in patient demographics pre- and posthurricane that is similar to the shifts seen after Hurricane Katrina. Studies have shown that breakdowns in routine medical infrastructure (e.g., need for prescription refills; issues related to power outages, including oxygen; social issues) have resulted in posthurricane patients being more likely to be older, self-paying, and male, with problems that were less severe. These same patterns were seen in the USVI after Hurricanes Irma and Maria among Schneider Regional Medical Center patients. Following the hurricanes, visits to the emergency room were twice as likely to be semiurgent or nonurgent (Chowdhury et al., 2019).

Child Services

Many child services experienced reductions in enrollment. The Department of Human Services is authorized to serve 894 Head Start slots, and LSS is authorized to serve 120 Early Head Start slots. However, because of the closure of damaged centers, the Department of Human Services has the capacity to serve 84 percent of authorized enrollment regardless of the number of eligible families who apply for services, and enrollment has declined more than 7 percent since the hurricanes. Happily, Early Head Start has not experienced a reduction in enrollment and is able to service 100 percent of its authorized slots. Child day care centers and preschools experienced reductions in enrollment. For example, one community need assessment found that 91 percent of private, licensed day care centers had enrollment lower than capacity and that, for many, enrollment was 50-percent lower than the facilities' capacity (Michael et al., 2019). One exception was use of the Supplemental Nutrition Assistance Program. The

number of participating households increased almost 20 percent after Hurricanes Irma and Maria (Michael et al., 2019), when eligibility was expanded, and approximately $30 million in Supplemental Nutrition Assistance Program funds were disbursed to eligible households. The reduced number of children in child care programs is consistent with the fact that many families moved out of the USVI after the storms.

Data and Monitoring

The hurricanes exposed gaps in the government's capacity to monitor mortality, disease morbidity and mortality, and the trauma care system. Interviewees reported that the vital statistics monitoring program struggled to keep up with demand following the storms because of issues with the system and lack of staff. Records were moved to paper for one month following the storm. In addition to vital statistics, as previously mentioned, there was limited surveillance capacity, which included only the Behavioral Risk Factor Surveillance System, the national cancer registry, limited information on reportable diseases (including infectious diseases), and limited performance management and quality-improvement data (Ragster and Michael, 2017). Interviewees also cited a lack of comprehensive data on those with disabilities as making it impossible to effectively monitor the status of the population with disabilities following the storms. Additionally, the lack of a comprehensive trauma management system made it difficult for people to get the appropriate level of trauma care in a timely fashion.

Recovery Progress Since the Hurricanes

Health Care Services

Critical health care services have been restored in a limited way while key infrastructure projects get underway. As of March 2020, critical health care services were restored, at a reduced level, through emergency repairs and temporary modular centers. FEMA obligated $68 million in funding to replace JFL and $10.5 million for architectural and engineering design work for the hospital. A solicitation for architectural and engineering services to initiate the design process is being drafted by hospital staff at the time of this writing (Bryan, 2020b). After a series of delays in getting the required furnishings and equipment for the modular hospital (see Figures 12.2 and 12.3) on St. Croix to provide services while JFL is rebuilt, a temporary modular hospital has opened with 56 beds and one operating room (Table 12.2). The intensive-care unit in the modular hospital opened in late March 2020 with 12 beds.

Facilities. Schneider Regional Medical Center has continued to plan for a multiyear restoration process. FEMA also provided $1.4 million in funding to USACE to install 11 temporary modular units to replace the Myrah Keating Smith Community Health Center, St. John's primary health care resource. In late March 2019, these temporary facilities—totaling 3,500 square feet—opened for patient care while repairs to the main building were taking place. Comprehensive damage assessments of the Charlotte Kimelman Cancer Institute and the Myrah Keating Smith Community Health

Figure 12.2
Emergency Room in a Modular Hospital on St. Thomas

Photo by the authors, 2020.

Center have been completed and submitted to FEMA for approval, and the staff are working on a solicitation for architectural design for both facilities (Bryan, 2020b). Both of the FQHCs are back up and running. Infrastructure repairs have allowed dialysis and other chronic-care services to be resumed (Witt O'Brien's USVI and Strategy Group Virgin Islands, 2019).

Public Health Services

Public health services are being provided through a temporary 40,000-square-foot modular clinic. After some delays, the modular Charles Harwood Clinic opened in April 2019 and offers essential public health services. However, a new biosafety level 2 and 3 laboratory was commissioned,[1] which was a major milestone for public health because it allows local testing for infectious disease and investigation of incidents of bioterrorism (VIDOH, 2019). In November 2019, VIDOH partnered with the Asso-

[1] A level 2 biosafety lab is able to work with pathogenic or infectious organisms posing a moderate hazard (e.g., human immunodeficiency virus, or HIV). A level 3 biosafety lab is able to work with agents that could cause serious or lethal disease via aerosol transmission (e.g., West Nile virus, severe acute respiratory syndrome [SARS], COVID-19).

Figure 12.3
Modular Hospital on St. Croix Under Construction

Photo by the authors, 2020.

Table 12.2
Comparison of Juan F. Luis Hospital Characteristics Pre- and Posthurricane

Characteristic	Prehurricane	Posthurricane
Certification	Center for Medicare and Medicaid Services certified	Center for Medicare and Medicaid Services certified
Inpatient capacity	188	56
Governance	Board of directors, chief executive officer	Board of directors, chief executive officer
Population served	50,000+ (on St. Croix)	50,000+ (on St. Croix)
Operating rooms	7	1
Emergency room visits per year	~20,000	17,576

SOURCE: Personal communication with hospital counsel; Government of the USVI, 2016; Government of the USVI, 2019.

ciation of Public Health Laboratories, Skyfire Consulting, and Doosan Mobility Innovation to complete a temperature-controlled trip from St. Croix to St. Thomas using a drone carrying simulation vials with live bacteria and other health supplies. This trip was to test the feasibility of using a drone to improve the timeliness of clinical testing, particularly for when planes are grounded or when testing is deemed urgent (Association for Unmanned Vehicle Systems International, 2019).

Medical Waste

Medical waste still remains a problem, with about 130,000 pounds of medical waste stockpiled on St. Croix and St. Thomas. There is no place to dispose of this waste on the islands, and the hospitals lack the funds to ship it to the continental United States for disposal. The issue of waste management is covered further in Chapter Nine.

Workforce Development

The USVI has taken steps to facilitate workforce development. The medical board began to allow license reciprocity, meaning that medical professionals licensed in other U.S. states and territories can practice in the USVI without having to pass the territory's specific exam. This flexibility is meant to incentivize providers to move to the territory and will allow medical professionals to easily and quickly provide telehealth services to aid the territory.

The territory government and nonprofit organizations have made some progress in addressing the needs of vulnerable populations. For example, the Emergency Prescription Assistance Program, which expired in August 2018, served more than 3,200 people, totaling more than $2.5 million in assistance. This program helped people in federally identified disaster areas who did not have health insurance get the prescription drugs, vaccinations, medical supplies, and equipment that they needed. It helped people and communities better cope with a disaster and reduced stress on the health care system (FEMA, 2018d).

Some support for people with disabilities has been offered. The governor's office, VITEMA, and FEMA led a readiness and resilience workshop for people with disabilities and the access and functional-need community in Christiansted. However, it was held in the evening, after the transportation service for people with disabilities stopped running for the day. In addition, the Department of Human Services has begun to assemble a registry of people with disabilities. The registry at this point is asking only for a person's name and contact information, not information on the disability, functional limitations, or needs.

Nonprofit agencies are supporting recovery efforts for vulnerable populations. CFVI helped manage the funding for the development of the 2018 USVI Hurricane Recovery and Resilience Task Force recovery plan (USVI Hurricane Recovery and Resilience Task Force, 2018). Additionally, this foundation has filled a void in publicly funded human services by funding an array of early-childhood and mental health–

support programs and established two funds to collect and distribute monetary donations to support disaster relief and long-term community renewal.

Other organizations are also supporting community renewal and disaster relief. The Building Forward Fund focuses on early childhood, youth development, volunteerism, environmental and marine issues, and emergency needs of families and older adults. The Friends and Family Fund for USVI Renewal will support long-term solutions that align with the foundation's main areas of focus. Patient Assist Virgin Islands is a nonprofit that assists patients who cannot afford their medications. Other organizations, such as LSS, provided case-management services and building assistance following the storms.

Behavioral Health Care

From November 2018 to February 2019, the Substance Abuse and Mental Health Administration provided more than $2 million to support crisis counseling for people coping with the emotional effects of the hurricanes. In addition, the first legislation to enact and establish protections for people with behavioral health and development disabilities is under consideration. This legislation is based on the recognition that the needs of those with mental health, developmental and intellectual disabilities, and drug and alcohol abuse and dependence were overlooked in the aftermath of the hurricanes. The legislation seeks to expand public health and mental health services by adding community behavioral health services, programs (e.g., care provided by a relative or friend), an official division and interdepartmental coordinating committee, a new treatment facility, expanded staff and procedures to handle commitments and examinations, treatment by telepsychology or telehealth, and specialty behavioral health services for children and adults. Island Therapy Solutions reported that, following the hurricanes, FEMA grants allowed it to see patients for free. These services were popular but have ended now, leaving most of these patients with no place to receive care. Island Therapy Solutions charges patients on a sliding scale, but many patients still cannot afford to pay for services. Insight Psychological Services recently began a day program for elderly patients and those with dementia. It has been very popular and is reaching capacity.

Recovery Directions

Continuing recovery and returning the health and human service systems to full functionality will require long-term investment to address damage from the hurricanes, as well as deeply entrenched issues that existed prehurricane. The recovery directions are shown in Box 12.3.

It will take a concerted effort not only to continue action in these five areas but also to address key barriers and gaps that have slowed progress to date and to build management capacity. These are discussed in the next sections.

Box 12.3
Recovery Directions for Health and Human Services

- Repairing, rebuilding, and modernizing infrastructure for health and human services
- Upgrading surveillance capacity
- Augmenting the health and human service workforce
- Improving current conditions and future preparedness of vulnerable populations
- Addressing the increase in behavioral health concerns

Key Barriers and Gaps

In this section, we discuss existing barriers and gaps and how they resulted from or were exacerbated by the hurricanes.

Slow Progress in Rebuilding Health and Human Service Infrastructure

As described earlier in the chapter, almost all of the health and human service infrastructure in the USVI was damaged or destroyed. This exacerbated the problem of outdated infrastructure, which was already inadequate before the storm. Initial plans suggested that rebuilding was estimated to take two to five years. Delays in releasing a solicitation for architectural design of critical infrastructure have lengthened the timeline for rebuilding these facilities.

Ongoing Health and Human Service Workforce Shortages and Slow Procurement and Hiring Procedures

As mentioned previously, hospitals and medical centers reported losing personnel post-hurricane and are experiencing staffing shortages. These shortages compounded the aforementioned insufficient health and human service workforce. Even as recruitment efforts have ramped up over time, facilities struggle to offer competitive salaries. And entities that succeed in recruiting face other hurdles. For instance, nurses interested in working in the territory must apply to the nursing board for a license. However, the nursing board is overwhelmed by demand for approval requests within the USVI and therefore unable to approve nurses to practice at a rate that is needed (Hall et al., 2018). The lack of behavioral health workers (Table 12.3) has also put additional pressure on hospitals and clinics, which, along with staff shortages, are overburdening personnel and could lead to further workforce deterioration.

Limited Emergency Treatment Capacity

There is limited emergency treatment capacity in the USVI. There is no level I trauma center, and JFL currently has only one operating room.[2] Both 911 emergency call centers are in need of updates. They currently rely on memory to direct response teams

[2] Level I trauma centers are equipped and staffed to provide care to patients suffering from major traumatic injuries (e.g., car accidents, gunshot wounds, falls).

Table 12.3
Per Capita Number of Workers and Median Hourly Wages for the Health and Human Service Workforce

Workforce Data	USVI	United States Overall
Number of RNs per 100,000 people	501.8	780
Number of LPNs per 100,000 people	118.6	242
Number of nursing, psychiatric, and home health aides per 100,000 people	230	686
Number of physical therapists per 100,000 people	15	45
Number of psychologists per 100,000 people	14.7	34.9
Number of social workers per 100,000 people	56.1	157.9
Median hourly wages for RNs	$18.69	$23.12
Median hourly wages for LPNs (as of 2002)	$11.20	$15.12

SOURCE: Bureau of Health Workforce, 2019.

to the scene of an incident; addresses are often not accurate to the location, but a computer-aided dispatch and record management system have been procured. Each island has a search-and-rescue team, both made up entirely of volunteers (USVI Hurricane Recovery and Resilience Task Force, undated).

Large Uninsured and Medicaid Populations and Significant Need for Specialty Care

The USVI has high uninsured rates, with adults more than 2.5 times more likely to be uninsured than adults living in the U.S. states and Washington, D.C. There is ongoing concern about the Medicaid reimbursement cap. Unlike the U.S. states and Washington, D.C., where funds from the state are matched by the federal government, Medicaid funding is capped in the territory, and, once those funds are exhausted, the territory no longer receives federal Medicaid funds or payments for uncompensated care. With 22 percent of the USVI population enrolled in Medicaid (compared with 24 percent in the United States overall), this translates into lower reimbursement rates for providers and potentially contributes to the shortage of providers.

In December 2019, a two-year Medicaid extension was granted to the territory, including funds to cover budget shortfalls, and the federal match was increased to 83 percent (up from the previous 55-percent cap). This extension is not a permanent fix to this Medicaid "cliff," which will be coming back into sight at the end of the extension. Although this is beyond the scope of the recovery planning effort, it is a deeply problematic issue that needs to be addressed.

Both FQHCs on the islands—the East End Clinic on St. Thomas and Frederiksted Health Center on St. Croix—are functioning at prestorm levels; however, the need for them is greater, and their patient bases have expanded poststorm.

The Frederiksted Health Center had a major increase (approximately 13 percent) in the number of patients the year after the storm: In 2016, it had 9,551 patients, 1,665 of whom had uncompensated care and 5,904 of whom were Medicaid patients. In 2018, it had 11,156 patients, 3,341 of whom had uncompensated care and 5,344 of whom were Medicaid patients. At the East End on St. Thomas, approximately 49 percent of its patients are uninsured, and this number has grown since the storm because of high unemployment on St. Thomas. The East End Clinic employs 100 people, 14 of whom are health care providers, from dental hygienists to doctors, and the others are support staff.

A lack of specialty providers and a lack of in- and outpatient public behavioral health care translates to extremely high costs to hire care outside the territory or pay for off-island care. The cost for off-island mental health care for 27 patients was more than $2 million (approximately $31,000 per month) in 2008, and hospitals are operating at a consistent deficit because they incur uncompensated costs because they cannot refuse treatment to anyone, by law, because they are FQHCs. After the hurricanes, JFL reported operating at an almost 15-percent loss (–$17.4 million), while Schneider Regional Medical Center reported operating at an almost 3-percent loss (–$3.3 million).

Together, these challenges have resulted in access and quality issues for the health care system, with hospitals receiving average or below-average ratings of hospital quality (e.g., only 28 percent of patients got appropriate care for severe sepsis and septic shock, compared with a national average of 58 percent) (Medicare, undated).

Gaps in Services for People with Behavioral Health Challenges, Mental Health Disorders, Developmental Disabilities, Alcoholism, and Substance Use Disorders

As mentioned previously, the territory is a designated behavioral health professional shortage area. This highlights the significant shortage of behavioral health providers across the territory. The lack of appropriate care for vulnerable populations is well established, and both the prior and current governors have declared behavioral health as an emergency. The Virgin Islands Behavioral Health and Developmental Disabilities Act is currently under consideration by the 33rd legislature (see Bryan, 2020a). Governor Bryan announced this legislation by saying,

> There is a pressing need in our community for these services that became even more pronounced in the wake of Hurricanes Irma and Maria. We must address this problem immediately. It can wait no longer. (Government of the USVI, undated a)

Lack of Adequate Surveillance Systems to Fully Understand the Hurricanes' Impact on Vulnerable Populations

Official reports cite only five deaths associated with Hurricanes Irma and Maria. However, these numbers are artificially low, in part because of two challenges: Vital statistics are not fully electronic, and medical examiners have not been trained in how to

detect and categorize disaster-related excess deaths. Recent studies of hurricane-related excess deaths from the estimates in Puerto Rico suggest that there were likely several hundred hurricane-related excess deaths in the USVI (Chowdhury et al., 2019). A key difference was the number of medical evacuees, with Puerto Rico listing only 171 transfers, and best estimates suggesting that more than 1,000 people were transferred out of the USVI (Jula, 2018 Vora et al., 2018).[3] Little is known about the fate of these patients, with the territory health department reporting to the legislature in April 2018 that it had follow-up data on only 536 of the total USVI evacuees, including 49 known deaths (Legislature of the Virgin Islands, 2018; Shimel, 2018). Without more information, we are unable to assess the hurricanes' impact on those who were most severely injured and ill. Improved plans and procedures are needed to maintain electronic recordkeeping, track patients, and monitor outcomes, particularly for air evacuations from the island.

With regard to homelessness, official estimates suggest that the number of people without homes has decreased since before the storms; a point-in-time count was down from 341 in 2016 to 314 in 2019 (HUD, undated). However, interviewees indicated that many of these people are actually living with friends and family members as opposed to on the street. This means that the point-in-time estimate potentially grossly underrepresents the percentage of the population who lack homes.

Management Capacity to Meet Recovery Needs

In this section, we note some of the challenges in health and human service management capacity in the USVI.

The Department of Health Faces Staff Shortages

After the hurricanes, VIDOH received $75 million in FEMA PA for 26 projects to repair or replace buildings and their contents and systems and fix damage to vehicles. Some of these funds were intended for the construction of a temporary facility for operations on St. Croix while the island's permanent facility gets rebuilt. To manage federal compliance and accountability processes and manage the flow of funds, VIDOH will have to hire and train more staff. It will also have to develop a communication strategy to update partners and the public on progress. VIDOH currently has a staffing shortage, and approximately 25 percent of all positions are vacant. This staffing shortage has worsened by roughly 8 percent since the storms.

[3] The territory health department noted 796 transfers for both St. Thomas and St. Croix, and a paper from the Atlanta area reported that there were 282 patients (97 percent from the USVI) evacuated, by air, to Georgia hospitals by the National Disaster Medical System.

Several Department of Human Services Projects Have Been Slow to Get Started

The Bipartisan Budget Act of 2018 provided $637.5 million in emergency funding for necessary expenses directly related to the consequences of Hurricanes Harvey, Irma, and Maria, including making payments under the Improving Head Start for School Readiness Act of 2007 (Pub. L. 110-134). This funding is available for obligation by HHS through September 30, 2021. Grantees may apply for funds using the following categories: facilities; materials; supplies and equipment; program operations; additional health; mental health, dental, and nutrition services; and training and technical assistance. Specifically, after the hurricanes, the Department of Human Services received $5.42 million in FEMA PA for 28 projects to repair and replace buildings, many of which were Head Start centers. A large portion of the funds is tied up in just seven projects that are still in the process of intake and eligibility determination (see the health overview in Appendix A). As of May 2020, the Office of Head Start had issued $6,278,420 to support disaster recovery efforts to the USVI. The Department of Human Services has received $5,286,559, and LSS received $991,861 based on submitted applications. The department is severely understaffed, with a vacancy rate approximately double that of the USVI average, and several Head Start centers have still not reopened. More staff are needed to manage the funds and increase the speed at which they are used.

Recommendations

Given the current as-is state of recovery, the barriers and gaps listed in a previous section, and the management-capacity challenges, we provide a series of potential recommendations for consideration by key agencies and organizations in the infrastructure for health and human services. These recommendations focus on actions in the near

Box 12.4
COVID-19 and Health and Human Services

The barriers and gaps and the priorities listed are even more critical given the myriad of ways in which COVID-19 has already affected the health and human service sector. There is currently a shortage of supplies, including personal protective equipment, ventilators, oxygen, beds in the intensive care unit and across the hospitals, and other health care essentials (e.g., gloves, swabs). This is especially concerning given the limited bed capacity in the territory. There is also a shortage of tests to identify those affected by COVID-19. Without the capability to identify and treat people affected by COVID-19, the health care system will not be able to mount an appropriate and organized response and could easily be overwhelmed. The 2017 hurricanes revealed a serious gap in the territory's ability to care for critically ill patients and underscored the importance of improving emergency medical services and patient triage and transfer procedures. The diminished care capacity and workforce could challenge the territory's response to COVID-19. The physical-distancing measures being put in place also emphasize the importance of knowing who and where vulnerable populations are and what they need. Finally, the behavioral health impacts associated with the effects of COVID-19 (from grieving lost ones, to anxiety about loved ones, to added economic and child care burdens) are anticipated to be significant. Given the limited behavioral health capacity in the territory, the recommendations listed in this chapter have become even more urgent.

term (within two years) and medium term (three to five years) and are structured to include an overarching goal, a brief rationale that provides the impetus for the recommendation, a set of next steps for implementation that should be considered by the implementing agency or agencies, and a brief description of agencies that could lead and support these critical next steps.

In the long term, significant investment will be required to improve management capacity, fiscal capacity, and governance structures needed to address the myriad of health needs and begin to rebuild a system that was deteriorating prior to the hurricanes and two years later remains operating at a reduced level. Many of the barriers to recovery are linked to long-standing challenges with the health and human service systems prior to the hurricanes. For example, issues with Medicaid reimbursement rates and the Medicaid cliff are issues that were problematic prior to the hurricanes and that will require significant intervention on behalf of the territory's governor's office and health care agencies, federal health care agencies, and the U.S. Congress to address. Although addressing these issues is critical to ensuring that the population recovers in an expedient manner through access to needed and physical and behavioral health services, it is beyond the scope of these recommendations, which are focused on near- and medium-term recovery actions. Similarly, the territory continues to struggle with how to meet the physical and behavioral health needs of its population, given its small size and shrinking workforce. Regional models for collaboration with other territories and with U.S. states to provide coordinated and specialty care will be needed in the long term to support the health and well-being of the population and response and recovery from future disasters. The rural health information hub provides data about evidence-based health models and innovations that may help the territory work more collaboratively with providers across the region to provide care within the territory and more efficiently transition care and patients in and out of the territory. For example, there are models that may help to address the limited emergency treatment capacity and to fill gaps in health care through more-proactive community paramedicine (e.g., connecting patients to a primary-care physician and other social and medical services). One study of community paramedicine has shown that it can help reduce hospital readmissions, save money, reduce the number of medical transports needed, and reduce emergency department usage (Patterson et al., 2016).

Other critical barriers related to the federal recovery process have hampered the territory's progress to date and will continue to hamper its progress in the long term, as well as its ability to recover from other future disasters. It is clear that new models for recovery are needed for places that, like the territory, have health care infrastructure deteriorating with minimal intervention and workforce shortages that are significant across physical and behavioral health care, as well as governmental personnel at VIDOH and the Department of Human Services. Having the territory government and leaders at understaffed agencies, such as VIDOH and the Department of Human Services, take on the responsibility of coordinating recovery and managing funding in

sums that exceed their typical operating budgets is not an effective or efficient path to recovery. FEMA needs to consider new models for supporting recovery of small or insular locations that, like the territory, do not have the governance structures or capacity to manage such a significant recovery investment. Redesigning the federal recovery process is beyond the scope of this report but a critical next step for FEMA to ensure that there are rightsized recovery supports for communities with limited governance capacity and significant recovery needs, like the territory.

Repair, Rebuild, and Modernize the Infrastructure

Conduct a Strategic Community Health Need Assessment

Goal

Inform reconstruction efforts to ensure that health care and human service infrastructure is rightsized, given population shifts posthurricane and emerging needs from hurricane impacts (e.g., behavioral health).

Rationale

Population shifts have occurred posthurricane, which could have led to changes in the types and amount of services required as part of an optimal health care system in the territory. Determining the needs and optimal size of the health care infrastructure is as important as the architectural design in promoting health care systems' resilience. A high-quality community health need assessment across the territory (and possibly regionally, with other island territories) could include identifying the appropriate number and size of inpatient rooms, facility flexibility, privacy and patient needs, technology and medical equipment needs, and where space might be needed if expansions become necessary to remain effective in new circumstances. It could also explore options for the territory to engage in a more integrated delivery system throughout the region. Without appropriate planning, reconstruction could result in a modern and resilient building without the patients or providers to fill it, or vice versa (Giancotti, Guglielmo, and Mauro, 2017). A strategic community health need assessment might also help the territory use the recovery dollars to transform from a more reactive acute care–focused system to a proactive, prevention-based system (Cramer et al., 2017).

Implementation considerations

Implementing this recommendation would require the following steps:

- Determine who will conduct the community health need assessment. It might be beneficial for the territory to hire an outside consultant with expertise in community health need assessments and hospital management, who can provide an independent assessment.
- Convene a multisector collaboration to advise and support the assessment. Public health literature suggests that a multisector collaboration should consist of stakeholders with a shared commitment to improving health, a shared measurement to ensure consistent data and results across participants, a mutually reinforcing plan of action, continuous communication, and backbone support through an organization with the capabilities to coordinate agencies and individuals.
- Seek feedback on public health priorities through broad and diverse community engagement. Key groups for feedback could include community hospitals and medical centers; public health agencies; voluntary, civic, and faith-based organizations engaged in community service and health improvement; health care consumers and the organizations that represent these consumers; community businesses and employers; community-based health care providers; public insurers (e.g., Medicaid employees); private insurers and administrators of employee health benefit plans and wellness programs; and education and social service agencies and organizations whose activities affect community health.
- Use high-quality data (e.g., medical records, drug spending analytics) pooled from and shared among diverse public and private sources. In addition to stakeholder feedback on gaps and priorities, high-quality data can help identify needs and disparities to address. As part of this assessment, the health care and human service workforce broadly should be considered to determine gaps.
- Use the findings from the community health need assessment to inform or update plans for reconstructing the health care and human service infrastructure. Considering whether to pair this type of health need assessment with a health care infrastructure vulnerability (to current and future threats) assessment to improve the availability and usability of information on health care infrastructure.

Time frame

Near term, within 2 years

Leading entities It is likely that VIDOH would be the funder, and the lead entity would be a consultant with expertise in community health need assessment and hospital management. A wide variety of partners would be needed to make this successful, including partners from the hospitals (JFL and Schneider Regional Medical Center) and health clinics (FQHCs and the Myrah Keating Clinic); partners from voluntary, civic, and faith-based organizations engaged in community service and health improvement, such as LSS; consumers and organizations serving these consumers, such as independent living centers and the Disability Rights Center; the Department of Human Services, which administers the Medicaid program; private insurers, such as UnitedHealthcare; and education and social service agencies, such as CFVI.

Closely Monitor the Process of Rebuilding the Hospitals, Department of Health, and Department of Human Services Through Transparent Accountability Metrics and Reporting

Goal Efficiently rebuild critical health care and human service infrastructure in the territory to allow health care services to operate at full capacity.

Rationale Transparent ways of tracking the progress of the rebuilding of the health care and human service infrastructure are needed to monitor the progress and to help prevent waste and abuse of disaster funding. Delays in beginning the rebuilding process for the major hospital suggests that major changes to procurement procedures will be needed to efficiently release calls for proposals for the architectural design and reconstruction. These are addressed in the fiscal and management-capacity chapters of this report. Human service infrastructure rebuilding projects, such as Head Start center reconstruction, should also have transparent accountability and metrics; those projects are still to be fully determined and should be based on the results of the recommended community health need assessment. To provide greater accountability for the implementation of needed reform in the procurement process and to promote fiscal transparency in the recovery process, key metrics on the progress of rebuilding the health care and human service infrastructure will need to be collected and reported to the public and key decisionmakers. Commitments to transparency in disaster recovery have a long history rooted in global humanitarian standards and are intended to bring accountability to the people whom the financing is intended to benefit.

Implementation considerations Implementing this recommendation would require the following steps:

- Establish an interagency health care infrastructure coordinating council that consists of top-level leaders who report directly to the governor could provide accountability to and help coordinate the implementation of health care infrastructure reconstruction in a way that expedites these efforts by quickly addressing any barriers. Top-level agency leadership that is needed to coordinate the processes to bid, award, and rebuild the health care infrastructure would include representatives from the hospital, public health and environmental protections, building and permitting, property and procurement, and the governor's office. A parallel system should also be developed for human service infrastructure.
- Identify milestones for the processes that would be used to bid, award, and complete the architectural design and modernize the IT infrastructure and systems for major health care infrastructure rebuilding projects. These milestones should include information about the specific activity to be completed, timeline for completion, and the individual and agency responsible. These milestones should be posted publicly to promote transparency and accountability for the public and across agencies.
- Publish regular reports that show progress and delays toward milestones for the architectural design process. These reports should include any changes to timelines, individuals and agencies responsible, and the reason for these changes.

- Repeat the process (i.e., identifying milestones and publishing regular reports that show progress and delays in reconstruction) to bid, award, and complete the actual reconstruction. Milestones should include information about whether the building is progressing on time and on budget.
- Integrating the milestones into the performance metrics of each participating government agency. The USVI's OMB has a core mission of transforming government through accountability and runs a website, Tyler Citizen Transparency, that provides current and historical information on government spending by category, department, fund, government area, and vendor.

Time frame Near term, within 2 years

Leading entities The USVI's OMB would be the lead entity, collaborating closely with the hospitals and VIDOH to identify milestones.

Augment the Health Workforce

Expand Access to Telemedicine Services Using Providers Outside the Territory

Goal Improve access to health care, behavioral health care, and specialty providers that are unavailable within the territory.

Rationale The territory has a significant shortage of physical and behavioral health professionals. The prehurricane workforce—which had already been designated a physical and behavioral health professional shortage area—further dwindled posthurricane because of damage to workers' homes, personal health needs, or other challenges affecting their livelihoods. Studies have found that use of telemedicine could increase health care access and improve quality of care, particularly in rural areas (Mehrotra et al., 2016). Telemedicine has also been used after disasters to provide needed physical and mental health care (Hunt, 2020). For example, after Hurricanes Harvey and Irma, direct-to-consumer telemedicine was used to deliver routine care (e.g., advice, refills, back and joint concerns, injuries). Although it does require that certain infrastructure, such as cellular service and Wi-Fi, remain intact, telemedicine was found to help relieve the immediate burden on the health care system so in-person visits could be used by those with the greatest need (Uscher-Pines et al., 2018). Even without sophisticated technology, telephone consultation hotlines can be useful in providing access to needed specialty services. A recent study showed that telephone hotlines that allow a primary-care doctor to immediately consult with a child psychiatrist about urgent problems appear to increase the number of children who receive aid (RAND Corporation, 2019).

Implementation considerations Implementing this recommendation would require the following steps:

- Determine the greatest telemedicine needs. Telemedicine could help address provider shortages in a wide variety of possible areas, from primary care to specialty care to behavioral health. Narrowing an initial priority or set of priorities will be critical to determining the feasibility of augmenting the existing health system with telemedicine.
- Identify a telemedicine provider that can support these needs. A large number of telemedicine companies have been emerging, offering services as diverse as connecting parents and their children with pediatric physicians (SnapMD, undated), providing clinical nutrition care delivery (Nutrimedy, undated), and connecting patients with psychologists who use the patient's native language (PSYALIVE, undated).

- Identify one or two pilot-test sites to determine the feasibility of implementing telemedicine. Several barriers to implementing telemedicine have been identified, including insufficient broadband capability, cost-prohibitive technology costs, challenges with billing and costing telemedicine services, lack of buy-in from health providers, challenges specific to the patient population (e.g., elderly patients, homeless patients, health care providers), complexities in adjusting workflow to accommodate telemedicine, difficulty identifying an adequate supply of specialists to provide telehealth services, complex and time-consuming logistics for credentialing and licensing, and challenges in working with remote providers. Pilot-test sites will allow the territory to examine barriers associated with providing medical care and behavioral health care via telemedicine before scaling up such services across multiple provider sites.
- Implement and evaluate the pilot sites' use of telemedicine. It will be important to capture the barriers to and facilitators of the use of telemedicine in the territory to inform planning for broader implementation. An outside consultant who can provide both expertise and an independent assessment might be best suited to capturing and documenting these lessons learned in a way that the territory can use to inform future planning.

Time frame Medium term, 3–5 years

Leading entities The lead entity would be the Office of the Governor's VIDOH and Department of Human Services. This office received almost $15 million to implement a health information exchange and is in the process of exploring policies and legislation to facilitate the use of telemedicine in the territory. Supporting agencies would include local hospitals and health clinics, telemedicine providers, and an outside consultant to capture and document lessons learned from the pilot test.

Improve the Current Conditions and Future Preparedness of Vulnerable Populations

Develop a Registry of Populations Who Might Require Special Assistance

Goal

Know who and where vulnerable populations are and what they need.

Rationale

Currently, there is no detailed information about or registry of vulnerable populations in the territory. More information is needed about specific vulnerabilities, functional limitations, and needs. During recovery, information on people who are at risk or vulnerable can be used to determine whether resource allocations are appropriate to address the needs of those who have suffered the most, to identify subpopulations who have suffered the most economic or emotional stress, and to track and identify ongoing problems (CDC, 2015). Vulnerable populations have been identified traditionally as those who might have additional needs in terms of maintaining independence, communicating, accessing transportation, finding supervision, and locating medical care (e.g., low-income, older adults, transportation-disadvantaged, pregnant, children) (FEMA, undated c). However, recent disasters have suggested that vulnerable groups who are socially stigmatized, such as people experiencing homelessness and those without appropriate immigration documentation, face exceptional hardships during times of crisis and might have less access to postdisaster government assistance (Torres and Alsharif, 2016).

Implementation considerations

- Frame the purpose and define *vulnerability* in the context of the hurricane recovery. Clear guidance will be needed to determine eligibility for the registry. Many people with vulnerabilities do not self-identify (Torres and Alsharif, 2016). Reframing the purpose and goals of the registry could help ensure that accurate information is collected and compiled to inform recovery efforts and disaster response moving forward. Appropriate messaging and communication are needed to increase awareness and encourage people to self-register (CDC, 2015). Kailes and Enders developed a flowchart that might be helpful in walking through considerations related to developing an emergency registry (Kailes and Enders, 2014).
- Develop a format for the registry that uses best practices. When developing a registry, policymakers need to establish methods to collect details about how and with whom information will be shared, security measures needed to protect information, and limitations on help provided based on registration (CDC, 2015). Addressing any Health Insurance Portability and Accountability Act (Pub. L. 104-191, 1996) issues and legal liabilities will be required to ensure that the registry adheres to security and privacy laws. Tracking populations without homes could be especially difficult. FEMA has developed an overview of best practices that includes links to sample registries (FEMA, 2011).
- Disseminate registration forms. Dissemination should take place in partnership with organizations that serve vulnerable populations and community outreach workers. Access to the form could also be increased through a web form and a central phone number to register. A direct-mail registration form is another format that has been used to reach people. Information will need to be disseminated in a way most appropriate to the vulnerable populations in a community through the use of trusted messengers (e.g., barbers, church leaders, advocacy organizations).

- Enter and analyze the information collected to inform recovery plans. Analysis should include looking at vulnerability and need in multiple ways (e.g., socioeconomic status, race) and mapping needs and populations to determine whether certain geographic areas are more or less vulnerable. To map the location of people at risk, partnerships with groups, such as UVI, CDC's Geographic Research Analysis and Services Program, or VITEMA, might be needed. Part of the analysis should include a review of existing recovery programs to determine how the risks and benefits of these policies or programs are distributed across populations, space, and time. Some recovery programs were not offered (e.g., case management), or research from past disasters revealed that, even when offered, some programs did not benefit the groups that needed them the most, and those programs should be modified or eliminated (Torres and Alsharif, 2016).
- Make a plan to maintain and update the registry. Registries must be regularly updated to account for changes to information among listed people, including address changes, changes in health or physical status, and emerging needs. To maintain an up-to-date registry, CDC suggests the following: Send annual reminders to existing members to review their information (e.g., with utility bills), require registrants to reregister every year, or conduct calls regularly to ensure that registrants still need to be included in the registry (CDC, 2015). Resources are also needed to accomplish this task.

Time frame	Near term, within 2 years
Leading entities	The Department of Human Services would be the lead entity responsible for developing and maintaining the registry. However, expertise and support would be required from VIDOH to help disseminate the registry; from FEMA and CDC to help design a registry that aligns with best practices; from organizations that represent consumers with vulnerabilities, such as the Disability Rights Center, to help design and disseminate the registry; and from people with vulnerabilities. An advisory committee composed of these key stakeholders will be important to inform the effort as it moves forward.

Address Behavioral Health Concerns

Develop a Plan to Address Issues with Access to Behavioral Health Care, Including the Development of Intensive Outpatient Therapy and a Coordinated Approach to Manage Those Who Require Inpatient Care

Goal

Treat behavioral health issues to improve population outcomes and reduce burden from untreated behavioral health challenges.

Rationale

The number of people with behavioral health issues, including depression, anxiety, and posttraumatic stress, has been increasing since the 2017 hurricanes (Allen, 2019b). Without appropriate and accessible treatment for affected people, recovery from hurricane impacts will not be possible. Improving access to care is a complex problem that requires a multifaceted solution. A comprehensive plan to address the array of issues that have contributed to limited access to behavior health care across the territory, including workforce shortages and limited outpatient public behavioral health care, is needed. If people can access quality care routinely, they will be able to better manage their behavioral health issues, less likely to use emergency care, and more likely to avoid the negative consequences associated with untreated behavioral health challenges. Untreated behavioral issues have societal and economic health care costs, including overdose, suicide, lost productivity, and physical illness. Having accessible outpatient care will reduce the burden on the emergency-care workforce and reduce expenditures for inpatient services.

Implementation considerations

Implementing this recommendation would require the following steps, which are standard strategic planning steps (Green and Allen, undated):

- Convene a planning committee composed of a variety of behavioral health stakeholders—including public, private, and school-based providers; administrators; consumers; and others—who can meet regularly to work through a strategic planning process. If the Virgin Islands Behavioral Health and Developmental Disability Act (Bryan, 2020a) is passed, the proposed interdepartmental coordinating committee might be a good fit to lead this type of effort (VIDOH's Division of Mental Health, Alcoholism, and Drug Dependency Services).
- Articulate a vision for behavioral health services. This should define behavioral health, describe whether a holistic or integrated approach will be prioritized, and reflect the imagined future for access to behavioral health services. This vision will need to be communicated widely to get feedback and ensure that key stakeholders are informed of the effort.
- Set goals that are specific, measurable, actionable, realistic, and time-limited (often referred to as SMART). This step requires the committee to consider how the current state compares with the imagined future and determine what is needed to close the gap between the two.
- Prioritize among the objectives to avoid being overwhelmed by having too many things to accomplish. After prioritizing a subset of objectives to begin with, the committee will have to provide more details on the activities and how to accomplish the objectives, including a timeline and assigning responsibility to specific individuals and agencies.
- Reconvene the committee regularly to monitor progress on the plan and determine when to expand to other objectives. The timeline for specific activities will help determine how frequently to reconvene, but it is recommended to have interim check-ins on progress to allow for midcourse corrections and adjustments to the timeline laid out in the plan.

Time frame

Near term, within 2 years

Leading entities	VIDOH's Division of Mental Health, Alcoholism, and Drug Dependency Services will be the lead territory entity. Other supporting partners would include public, private, and school-based providers, such as the East End Clinic, Island Therapy Solutions, and Beautiful Dreamers, respectively. Although it is not the lead entity for this recommendation, Human Services would be a critical partner especially for child-focused and disability services.

Upgrade Surveillance Capacity

Develop a System to Accurately Assess Disaster-Associated Mortality and Morbidity

Goal	Understand how disasters—from hurricanes to the COVID-19 pandemic—affect population health.
Rationale	The true impact of the 2017 hurricanes cannot be accurately estimated because of data limitations. There was no authoritative source of data on hurricane-related excess deaths. The current vital statistics system cannot accommodate this information, and medical professionals (e.g., emergency department physicians, medical examiners, coroners) have not been trained on how to determine whether mortality or morbidity is disaster-related. A surveillance system that can track postdisaster effects on public health is essential to understand who is affected by disasters, identify recovery needs, and plan for future responses. Understanding cause of death is also critical to identify who is eligible for burial assistance postdisaster and to determine whether a request for a mortuary operational response team or mutual aid is warranted.
Implementation considerations	Implementing this recommendation would require the following steps (more details on developing a cohesive disaster surveillance system can be found in CDC, 2016): • Determine objectives for disaster surveillance. These can include estimating the magnitude of a problem or tracking geographic distribution of morbidity and mortality. • Determine what data are needed to achieve these objectives. An important part of ensuring that standardized data are collected across sources is developing clear, simple, and practical case definitions that consider both direct (i.e., caused by disaster's physical forces, such as flooding from a hurricane)[4] and indirect (i.e., caused by unsafe or unhealthy conditions that develop from the effects of the disaster, such as motor vehicle accidents during evacuation). • Assess existing surveillance systems to determine whether they can provide, in a timely way, the morbidity and mortality surveillance data needed. Partnerships with health care facilities, vital statistics, poison centers, and other services might be needed to access data. Use of standardized forms that have been tested with key personnel (e.g., medical examiners) are critical to collecting reliable data. For example, HHS, CDC, the National Center for Health Statistics, and the National Vital Statistics System have released a reference guide for medical examiners and coroners to certify disaster-related deaths (CDC, 2017; National Center for Health Statistics, 2017). The Center for State and Territorial Epidemiologists has also published a set of evaluation criteria that can be useful in assessing potential data sources. • Develop a plan to analyze and share the data. Data should be shared with VITEMA for situational awareness and to monitor changes in morbidity and mortality rates.
Time frame	Medium term, 3–5 years
Leading entities	VIDOH would be the lead entity. Personnel from VIDOH's Vaccine Preventable Diseases Surveillance Program and Public Health Preparedness program would be appropriate co-leads. Other supporting partners would include health care facilities, the Office of Vital Records and Statistics, poison control, VITEMA, and news and media outlets in the territory. CDC could also be engaged to provide technical assistance.

[4] *Case definition* is a set of "standard criteria for classifying whether a person has a particular disease, syndrome, or other health condition" and generally includes criteria for person, place, and time.

CHAPTER THIRTEEN

Conclusion

The USVI faces a challenging path toward recovery from the 2017 hurricanes. The hurricanes caused unprecedented damage, severely affecting the USVI's residents, shaking the tourism economy, and reducing public revenues by roughly half (Austin, 2020). The territory has taken important steps toward recovery by rebuilding homes, businesses, and roads; restoring power and water services; and revitalizing education and social services. However, just as its economy had started to recover, the territory faced, and continues to face, another serious crisis from the effects of the COVID-19 global pandemic, which will affect the health of its people, have substantial economic ramifications, and complicate its ability to execute recovery projects.

In order to fully recover from the damage from Hurricanes Irma and Maria, the USVI government estimates, it will need to execute $11.25 billion in recovery work—a heavy burden relative to its roughly $4 billion economy. HSOAC analysis of previous major disaster-recovery efforts in the United States suggests that the USVI could expend (as opposed to obligate) up to $600 million to $800 million on recovery projects each year. However, this will likely be feasible only if the USVI makes substantial improvements in its ability to plan for, manage, fund, and execute recovery projects.

In this report, we aim to help accelerate the territory's recovery by analyzing the vision for recovery expressed in existing plans and current stakeholder consensus, identifying the roadblocks and challenges the USVI faces, and suggesting actionable recommendations that can help chart a path forward and more efficiently implement recovery. One of the main goals of this effort was to provide an overarching and consolidated overview of how recovery is progressing in the USVI. As part of this effort, we met with hundreds of stakeholders across the USVI and identified 76 key recommendations, organized by sector, that can help the USVI enhance its recovery efforts. Although many recommendations are new, some are already being considered or being implemented. We also recognize that some recommendations—particularly those related to FEMA's reimbursable model—would require policy or statutory changes that are unlikely to take place in time to affect the USVI's recovery. But we believe that there is considerable value in presenting all of these recommendations as a cohesive and comprehensive plan that ties them directly to the main challenges facing the USVI for

policymakers to consider. Additionally, each recommendation includes a series of steps that will need to be taken in order to ensure that they are successfully implemented.

FEMA can continue to play a key role in this process by expanding its efforts to provide technical assistance to help ODR organize and manage recovery efforts, working with the USVI to explore options that could ease the liquidity issues that have slowed recovery project implementation, using data related to how projects are progressing to help USVI agencies making slower progress improve their project management and procurement processes, and reducing the complexity of its own procedures in order to reduce burden on the USVI government.

Although this report presents our analysis and recommendations for many aspects of the USVI recovery, in order to rebound from these unprecedented disasters, the USVI government will need to address some crosscutting structural issues that have impeded its ability to manage, finance, and execute recovery efforts. These crosscutting issues, and the recommendations associated with them, are foundational to all recovery efforts and will thus require additional focus from the USVI government and FEMA.

Managing Recovery Efforts

The USVI has taken concrete steps to organize its government and manage recovery processes. It created ODR and charged it with overseeing recovery efforts, identified the Top 100 recovery projects, and put in place mechanisms to engage key stakeholders, such as NGOs. However, our research suggests that more needs to be done to ensure that recovery projects are not stalled and that FEMA can play a key role in helping the USVI better organize its recovery efforts.

The USVI government needs to clarify roles and responsibilities. ODR has been designated as the entity that is in charge of recovery efforts, but the governance structure of the USVI recovery has not set it up for success. ODR is located in the PFA, does not have a dedicated source of funding within the USVI government, and has only ten staffers to manage an $11 billion recovery effort. Meanwhile, funding for recovery projects is managed by VITEMA (for PA) and VIHFA (CDBG-DR), which serve as the applicants for all federal funds. ODR has limited visibility into how VITEMA and the VIHFA are managing and adjudicating applications for recovery funding, and there appears to be very little reporting on how and when recovery funds are allocated, obligated, and expended.

We make recommendations that seek to streamline how recovery is structured and empower ODR to play the key role that it has been given. These include adequately resourcing ODR and placing it directly in the governor's office, putting in place robust coordination mechanisms across the USVI government (including a PMO for recovery), and creating and disseminating metrics and reports that can be used to

manage and communicate recovery processes. FEMA could continue to support this process by expanding its current efforts to provide technical assistance tailored to helping ODR organize and manage recovery efforts.

Funding Recovery

The USVI government needs to enhance its ability to finance recovery spending. The USVI has significant liquidity challenges due to long-standing structural issues that cannot be fixed easily or quickly. Most U.S. government recovery funding, including FEMA and CDBG-DR funding, is reimbursable in nature and requires matching funds. The USVI has been struggling to get projects moving, in part because it cannot provide the up-front funding that is required. In order to fund projects, the USVI has used funds from agency operating budgets, which has affected the territory's ability to sustain quality public services and made it difficult to hire the additional staff needed to manage recovery projects and the process of seeking reimbursement. Furthermore, this has meant that each agency moves forward with its own separate priorities, rather than the USVI government collectively coordinating and financing recovery projects as a whole.

The USVI has started to address this by pursuing a $50 million line of credit with a local bank, which could be expanded to $80 million. Depending on the rate of reimbursement, this revolving loan could support up to $50 million to $200 million in spending per year. This represents a good start but will likely not be sufficient to meet USVI annual recovery spending goals. The USVI has also identified up to $169 million of HUD's CDBG-DR grants that can support $1.7 billion in FEMA PA projects in the long term—or less than half of the overall amount of FEMA PA funding that is anticipated.

We make some key recommendations that the USVI could consider to improve its liquidity. In the near term, the USVI should analyze how large a revolving fund it will need to fully pay for the recovery work it will need to undertake each year. In order to better understand its future recovery spending, the USVI could develop a separate recovery spending budget within its annual budget submissions that includes phased and sequenced spending plans for projects.

In the longer term, the USVI could explore refinancing its debt to reduce near-term payments, making additional money available to fund recovery work. However, given the current COVID-19 pandemic, financial markets might not be receptive to new issuance of debt that is below investment grade, as is the case for the USVI.

FEMA could help USVI liquidity issues by exploring ways to streamline current programs that allow for waivers to reimbursable funding requirements that exist but that are rarely used because of their complexity. It could also consider waiving the matching-fund requirement, as Governor Bryan has requested and testified is autho-

rized by the federal Insular Areas Act (48 U.S.C. § 1469a). FEMA has already invoked the Insular Areas Act to waive matching requirements for HMGP and has waived cost-share requirements for several individual PA projects.

Executing Recovery Projects

The USVI needs to enhance its ability to coordinate, staff, and execute recovery projects across its agencies. The USVI government currently lacks a systematic and pervasive way to coordinate recovery efforts across its agencies. The governor has convened heads of agencies twice to discuss the Top 100 recovery projects, which is a good a start. In order to be most effective, these kinds of coordination meetings need to be held regularly and be preceded by staff-level meetings across the government.

A related key challenge that was the lack of dedicated personnel across the USVI government's agencies who could focus on and advance recovery projects. For example, as of May 2020, few USVI agencies had a staff member whose sole job was to coordinate and oversee recovery projects. USVI agency staff working on recovery issues are generally wearing multiple hats, which makes it difficult for them to advance recovery work. Although the government has been trying to hire dedicated recovery staff, the fiscal issues outlined above have made it challenging to bring them onboard.

Another key crosscutting challenge involves the complexity of letting contracts within the USVI government, a process that can involve sign-off from ten different agencies or individuals and often takes up to a year to execute. This process often means that, by the time a contract has been fully vetted and approved, the cost estimates that were used to derive the contract are out of date and need to be updated. When combined with the complexities of federal grant funding requirements, this can result in projects taking more than a year to get started.

We make recommendations designed to help the USVI enhance its ability to execute recovery projects. To address its staffing challenges, the USVI should develop procedures for territory agencies to hire staff with incremental or rolling reimbursement, using category Z funds if available, provide guidance to agencies for suggested numbers of recovery positions based on existing management capacity and recovery demands, and create a specific class or process for recovery positions (e.g., term positions or emergency hires). In order to streamline contracting, the USVI could document the current process and the USVI governmental entities needed for each recovery or contracting initiative, develop templates and approval mechanisms for procurement contracts, and explore opportunities to create indefinite-delivery, indefinite-quantity contracts for recovery services.

FEMA could contribute to these efforts by using data related to how projects are progressing—such as the agency profiles presented in Appendix A—to help USVI agencies that are behind improve their project management and procurement pro-

cesses. It could also work with the USVI to develop "how-to" documents that can streamline reimbursements and provide assistance to develop contracting templates that can be used by all USVI agencies to procure services.

Concluding Thoughts

This report lays out steps for implementing recovery across sectors of the USVI's economy, public services, and society according to the responsibilities of specific territory and federal government agencies, as well as the nonprofit and private sectors. Although some of these recommendations may be novel, many are ideas that came directly from the USVI government or its federal partners and may be in the process of being scoped out or implemented. This approach is meant to provide a comprehensive assessment of the challenges to recovery that also highlights the recommendations that can be used to address these challenges. To this end, we included in the recommendations the specific steps that should be considered in order to enhance the effectiveness of their implementation.

Our hope is that the analysis reported here can help stakeholders identify, validate, and set priorities for recovery in the USVI. Suggested next steps for the USVI and FEMA are to build on the analysis to

- craft more-detailed implementation strategies for the key recommendations in this report
- prioritize and phase projects to maximize their efficiency and make the best use of recovery funding
- develop metrics and indicators that can be used to measure and communicate the USVI's progress toward recovery.

Last, as we write this report in the spring of 2020, the COVID-19 pandemic has not been contained, and its impacts on the public and economy of the tourism-reliant USVI is not yet clear. What is clear, however, is that the pandemic will have enormous economic and public health consequences for the United States as a whole and the USVI in particular. Some of the recommendations in this report might not be feasible during the COVID-19 crisis, and others may need to be substantially modified in order to be implemented during the pandemic. However, many of the recommendations address fundamental issues within the USVI that will continue to need action even after the current crisis subsides. We appreciate the opportunity to provide analysis and recommendations that are intended to accelerate the process of implementing recovery toward a more prosperous and resilient USVI.

APPENDIX A

Agency Profiles

Figure A.1
Agency Profile: The Virgin Islands Water and Power Authority

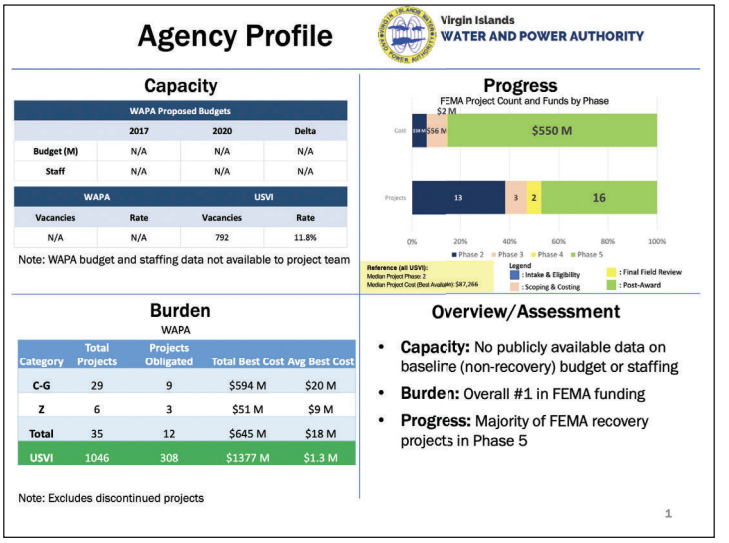


Figure A.2
Agency Profile: The Virgin Islands Department of Education

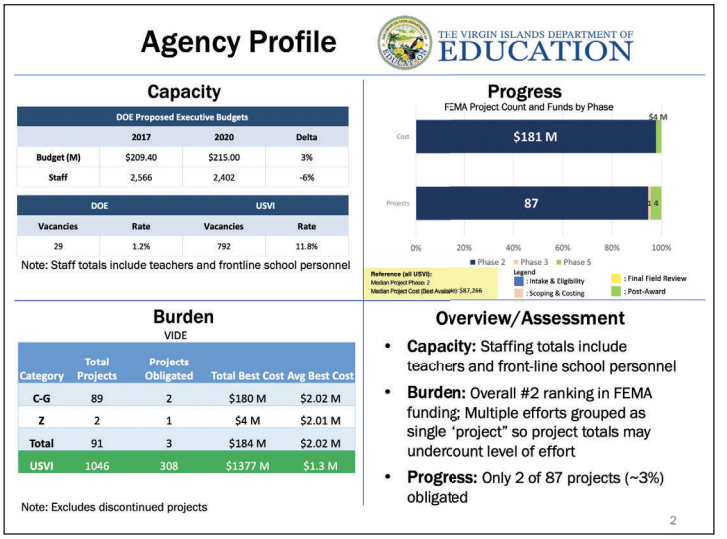


Figure A.3
Agency Profile: The Virgin Islands Territorial Emergency Management Agency

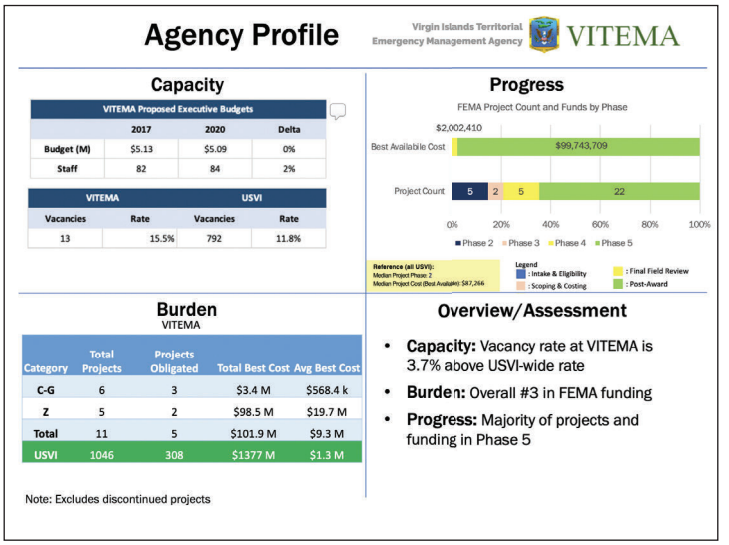


Figure A.4
Agency Profile: The Virgin Islands Housing Authority

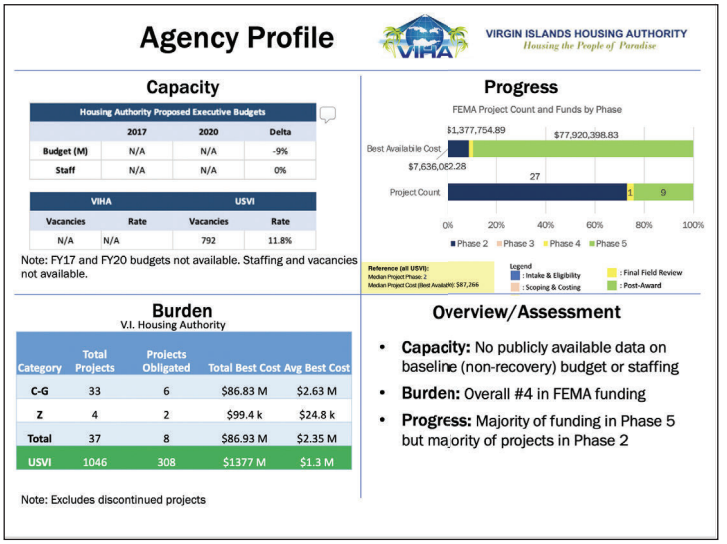


Figure A.5
Agency Profile: The U.S. Virgin Islands Department of Health

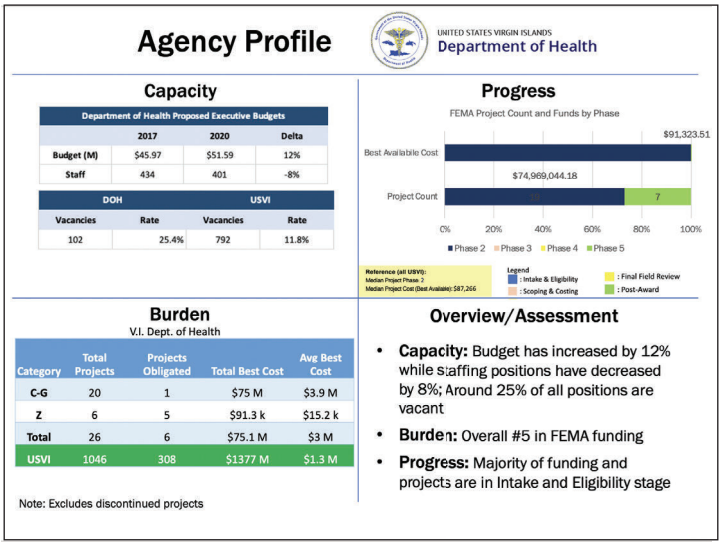


Figure A.6
Agency Profile: The Virgin Islands Public Finance Authority

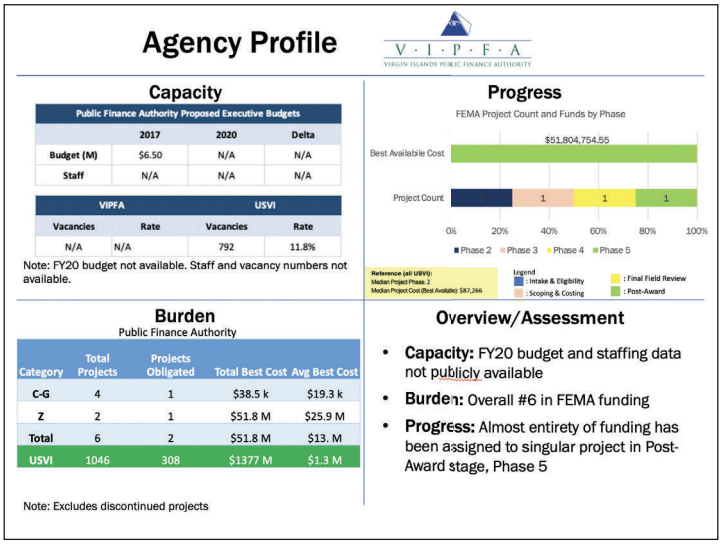


Figure A.7
Agency Profile: The University of the Virgin Islands

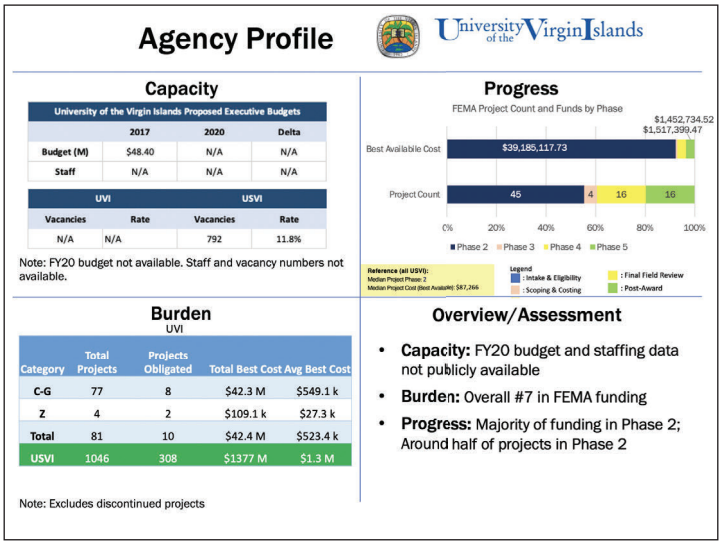


Figure A.8
Agency Profile: Governor Juan F. Luis Hospital and Medical Center

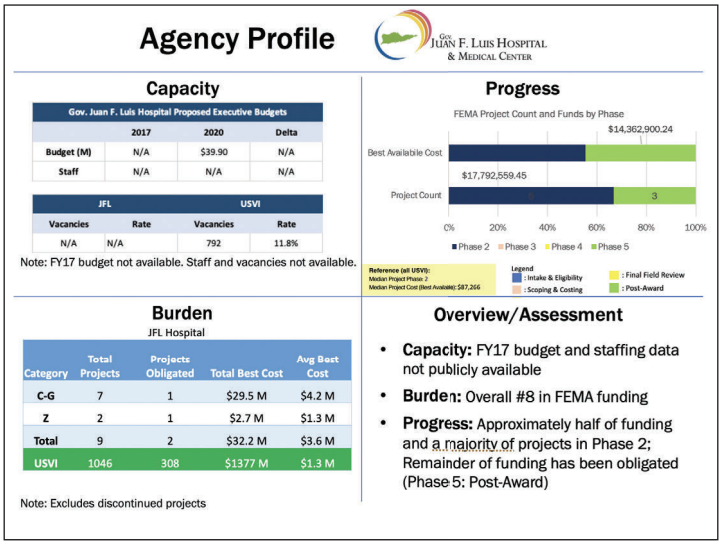


Figure A.9
Agency Profile: The U.S. Virgin Islands Department of Public Works

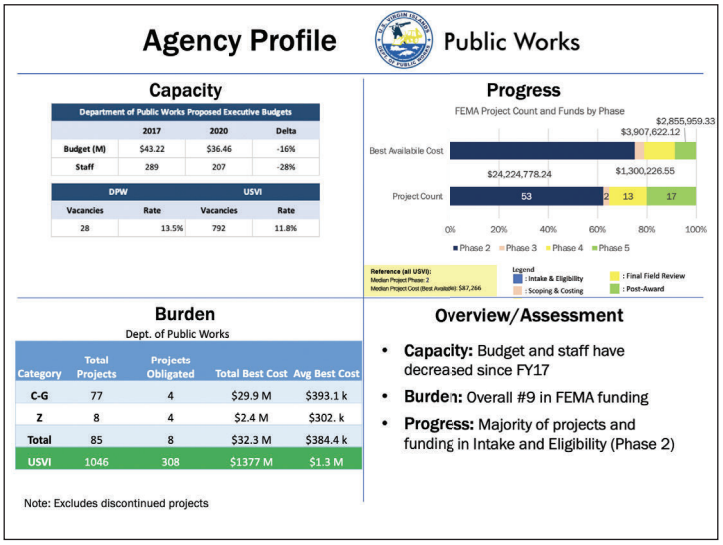


Figure A.10
Agency Profile: The Department of Sports, Parks, and Recreation

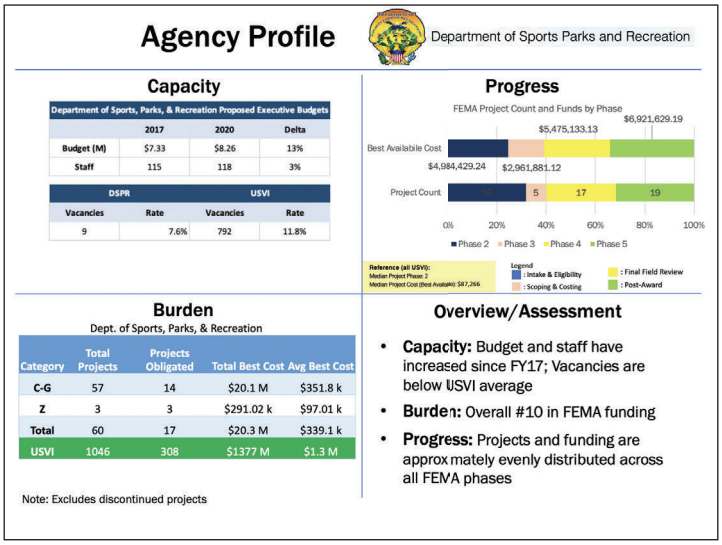


Figure A.11
Agency Profile: The U.S. Virgin Islands Economic Development Authority

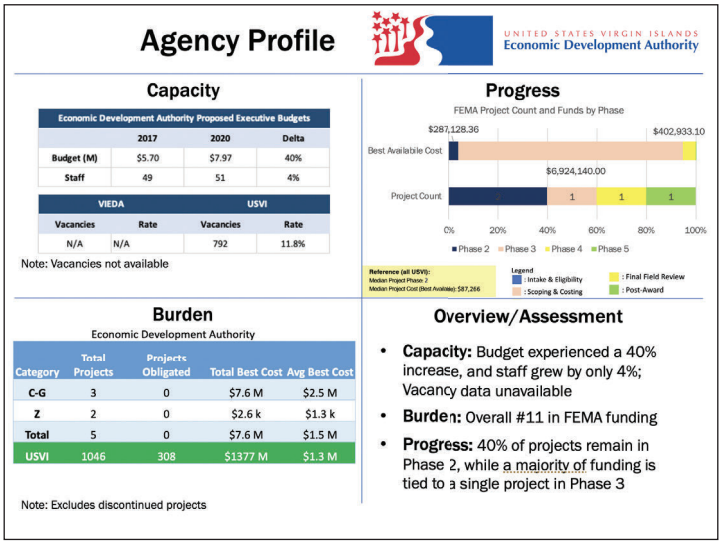


Figure A.12
Agency Profile: The University of the Virgin Islands Research and Technology Park Corporation

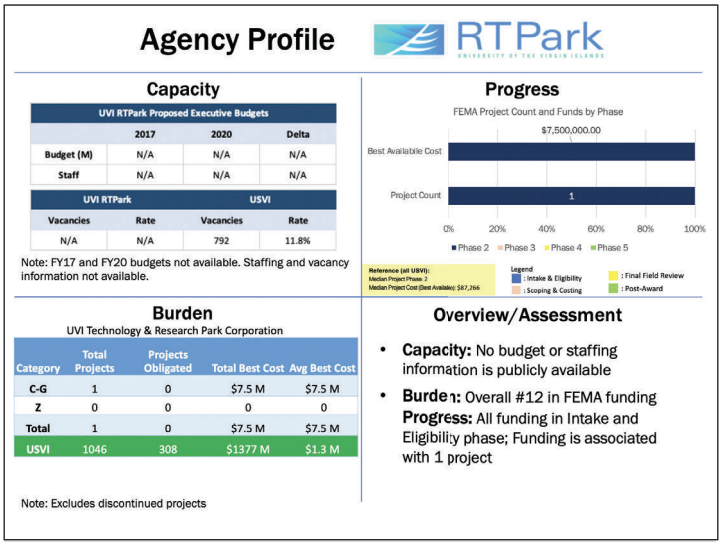


Figure A.13
Agency Profile: Government Employees' Retirement System of the Virgin Islands

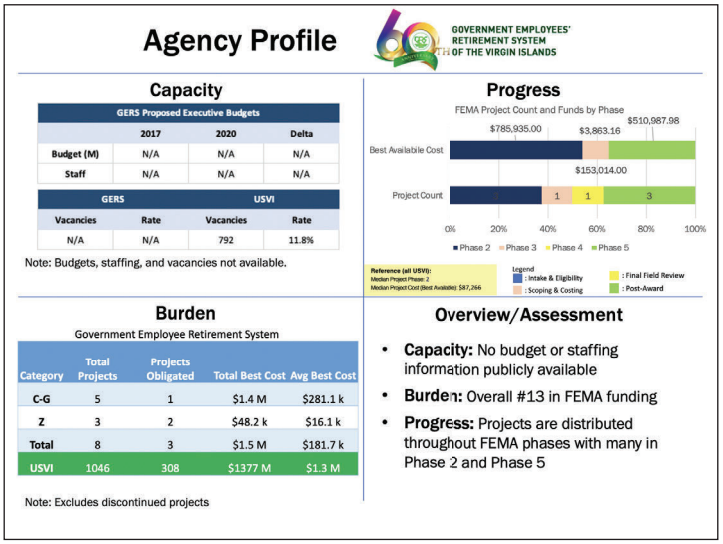


Figure A.14
Agency Profile: Virgin Islands Waste Management Authority

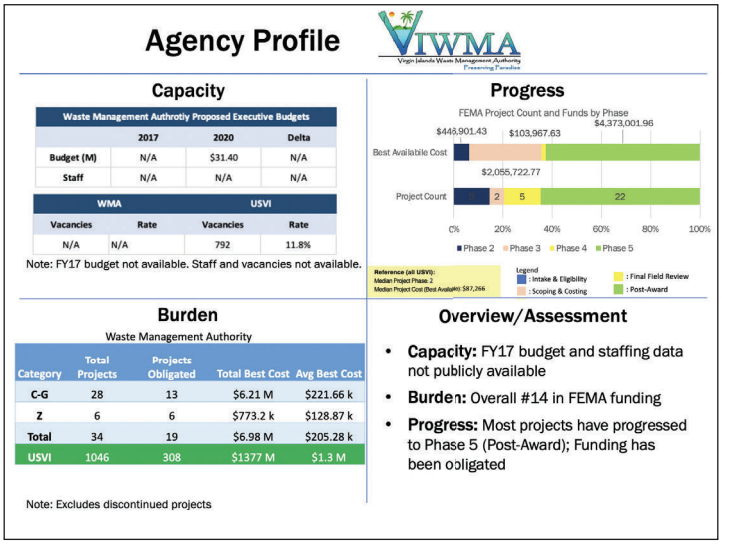


Figure A.15
Agency Profile: Virgin Islands Housing Finance Authority

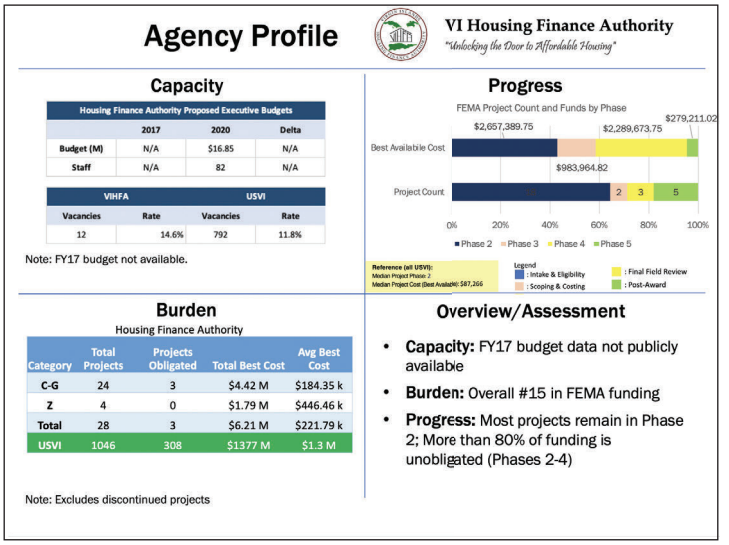


Figure A.16
Agency Profile: Virgin Islands Port Authority

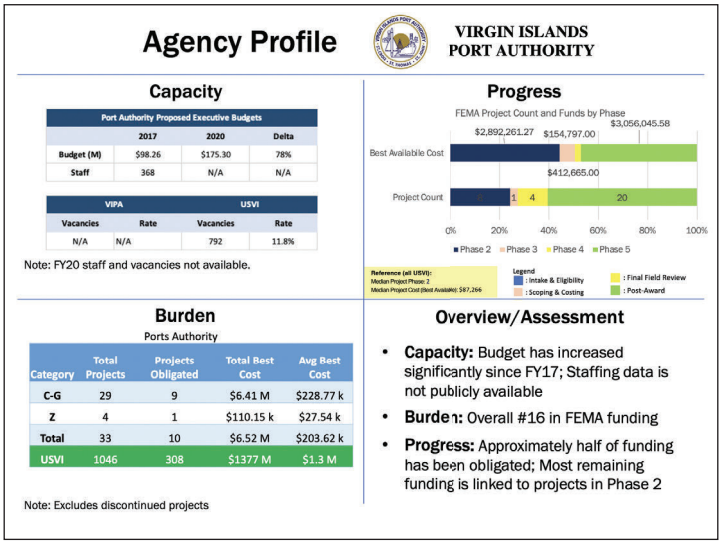


Figure A.17
Agency Profile: U.S. Virgin Islands Department of Human Services

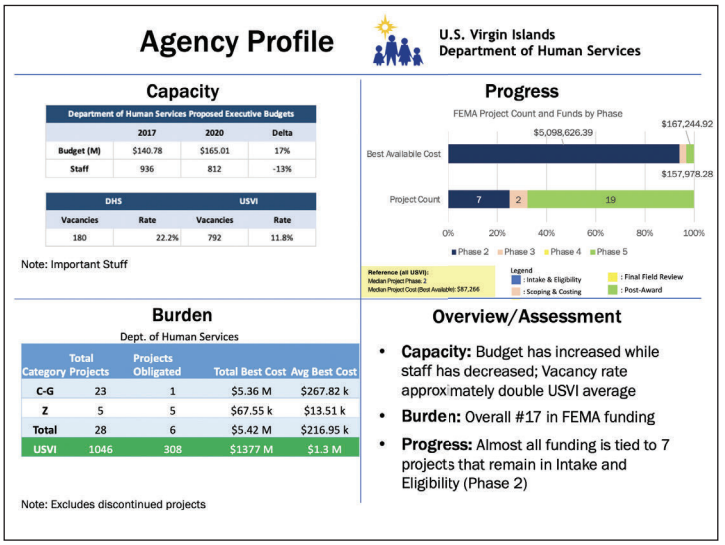


Figure A.18
Agency Profile: Bureau of Corrections

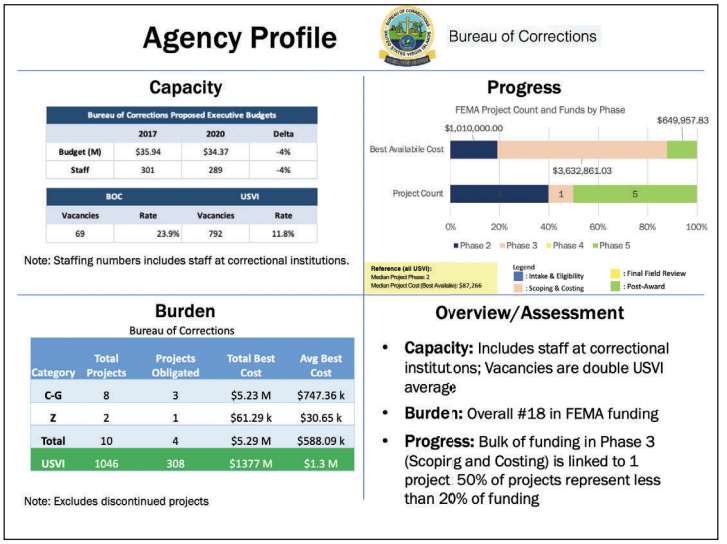


Figure A.19
Agency Profile: U.S. Virgin Islands Government House

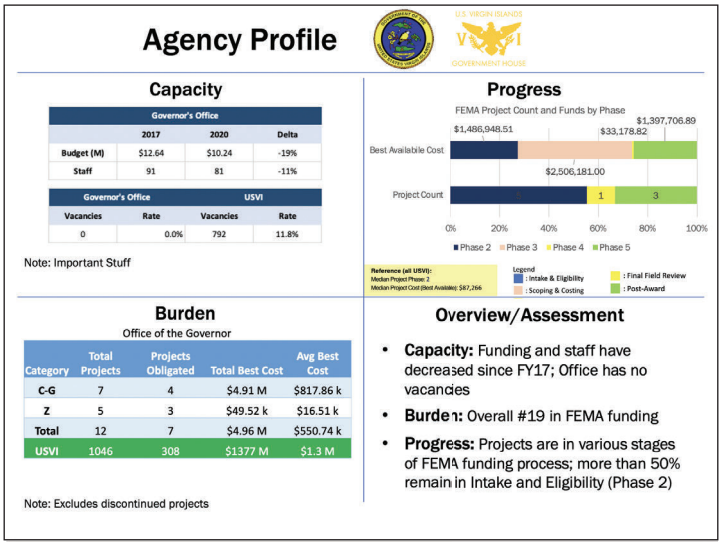
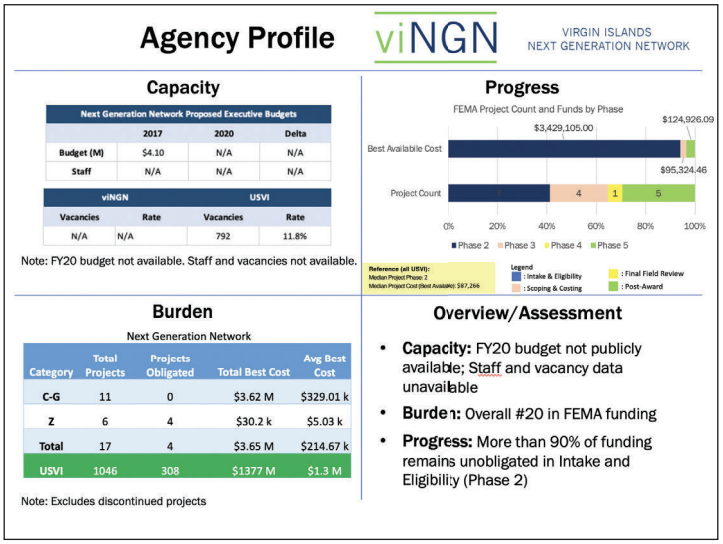


Figure A.20
Agency Profile: The Virgin Islands Next Generation Network



APPENDIX B

Difference Model for the Tourism Economy Chapter

Difference Model for Estimating the Impact of the Hurricanes

The percentage declines noted in the text in Chapter Ten use a difference model to estimate the difference in outcomes after the hurricanes to account for time trends and seasonality. Because these data are counts (e.g., number of airline arrivals, cruise ship passengers), we used a Poisson specification to model the data. Specifically, if Y is an outcome variable of interest, it follows a Poisson distribution (which describes counts):

$$\Pr\{Y = y\} = \frac{e^{-\mu}\mu^{y}}{y!},$$

where $\mu > 0$ is the mean of the distribution. If we let the mean depend on explanatory variables x_{mt}, then we have

$$\log(\mu_{mt}) = \beta_1 + \sum_{m=1}^{12}\delta_m + \varphi_t + \beta_2 Diff_{mt} + \varepsilon_{mt},$$

where δ_m is a month fixed effect; φ_t is a linear time trend (in specifications of the immediate impact, this is a year fixed effect); $Diff_{mt}$ is a dummy variable, set to 1 for each month for September through December 2017 for models looking at the immediate impact of the hurricanes, and for each month in 2018 and 2019 (September through December 2017 are dropped) for models looking at the recovery in the past two years; and ε_{mt} is an error term. Although, in the classic Poisson distribution, the mean is equal to the variance, we have used a more flexible specification that does not require this restriction. Regressions were estimated in Stata using "poisson" and "vce(robust)" commands. In this model, an exponentiated regression coefficient, $\exp(\beta_2)$, for instance, represents a multiplicative effect of the difference predictor on the mean. Thus, increasing the difference by 1 (i.e., the period after the hurricanes versus before) multiplies the mean by a factor, $\exp(\beta_2)$. All numbers reported in the text are statistically significant using a p-value of 0.05 as the threshold for significance.

As can be seen in Figure 10.2, the tourism industry in the USVI is highly seasonal, with most guests arriving between November and April. For example, between November 2015 and April 2016, almost 1.3 million cruise ship passengers disembarked in the USVI, while less than half that number (570,128) came between May and October 2016. The number of cruise ship passengers had also generally been increasing through time until about 2014, excluding the years of the Great Recession (2008 through 2010). Because of this seasonality and changes through time, it is difficult to get an exact measure of the effect on tourism because of the hurricanes. For example, if we compare the number of cruise ship passengers from September through December 2017 with the number from May through August 2017, we would underestimate the impacts of the hurricanes because we would be comparing months with generally higher cruise ship passenger visits with months that usually do not have many visitors. For this reason, we might want to compare the period September through December 2017 with the period September through December 2016. Although this is a much better comparison, it does not take into account that the number of cruise ship passengers might be growing or declining through time.

To get a better estimate of the decline in tourism because of the hurricanes, we used a regression model that adjusts (controls for) the normal month-to-month changes and the yearly changes in tourism. Our numbers for September through December 2017 represent the estimates of this model with various outcome variables to describe the actual decline because of the hurricanes, controlling for typical differences by month and trends from year to year.

Note that these estimates cannot control for other things that might have been happening—other than the hurricanes—in September through December 2017 that did not happen in other years or other months. To get even better estimates, we would need to have an area that was similar to the USVI but was not affected by the hurricanes in 2017, and then we would need to do a difference-in-differences analysis. Unfortunately, other areas of the Caribbean were affected (directly or indirectly) by the hurricanes, and detailed monthly data for other areas that could be used in such an analysis were not available.

Tourism Advertising Revolving Fund

The revolving fund was created by Act 5249 of the Virgin Islands legislature and established under Title 33, Section 3072, of the Virgin Islands Code. It consists of "all sums appropriated from time to time by the Legislature, all gifts, contributions and bequests made, and 100% of all moneys received by the Government from the collection of Hotel Room Tax," a 12.5-percent tax applied to anyone staying in a hotel or renting or leasing an apartment, condominium, timeshare, villa, or residence for less than 90 days (Legislature of the Virgin Islands, 2019). Although the tax was formerly applied only

to hotels, in May 2017, the government and Airbnb signed an agreement to allow Airbnb to collect the hotel room occupancy tax on behalf of hosts and required Airbnb to send the funds to the government (McCarthy, 2017). Of the funds received each year, $1 million must be deposited into the Agriculture Revolving Fund; $1 million must be used for the development and promotion of sports tourism; $500,000 must be transferred to the VIDE for interscholastic competitions of Virgin Island public high school athletes; and $500,000 must be used by DSPR for its programs. Taxes collected from timeshares are used for advertising the Virgin Islands (25 percent), advertising the island of St. John (25 percent), advertising the island of St. Croix (25 percent), and advertising the marine industry of the Virgin Islands. For FY 2020, the governor recommended a general-fund appropriation of $3,472,622 for the Department of Tourism, and it was expected to receive $28,385,000 from its revolving fund for a total of $31,857,622 (Legislature of the Virgin Islands, 2019).

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Soon after Hurricanes Irma and Maria hit the U.S. Virgin Islands (USVI) in September 2017, recovery activities began. But more than three years after the hurricanes, the territory still has substantial recovery needs. The USVI government estimates that, to fully recover from the damage, it will need to execute $11.25 billion in recovery work—nearly three times its annual gross domestic product. Project timing, complexity, and scale add to the challenge. The recovery process is also a chance for the USVI to reenvision its future, leveraging recovery funding to create a more modern, resilient, and equitable territory.

The authors of this report aim to help the USVI accelerate its recovery by identifying key recovery goals and accomplishments to date, assessing roadblocks and challenges, and suggesting actionable recommendations to more efficiently implement recovery. They reviewed the USVI's prior recovery plans, analyzed available data, considered good practice in other disaster recovery settings, and held more than 170 group discussions with stakeholders. They provide 76 recommendations to enhance recovery efforts, each including steps to support implementation.

The report covers multiple recovery needs: a set of crosscutting capacities required for progress in multiple sectors (management, fiscal, workforce, and supply chain), the rebuilding of physical infrastructure (infrastructure services, energy, housing, and natural and cultural resources), and the development of key aspects of the economy and public services (the tourism economy, education, and health).

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