



# Responding to the Perfect Storm

## The U.S. Army Corps of Engineers and Disaster Response in Puerto Rico, 2017

Brig. Gen. Diana M. Holland, U.S. Army

*We've got a lot of work to do ... it's the worst Puerto Rico has seen. It's been very complex for us to respond, from a logistical nature of the island.*

—Brock Long, FEMA Administrator

*Puerto Rico ... can turn into a humanitarian crisis. To avoid that, recognize that we Puerto Ricans are American citizens; when we speak of a catastrophe, everyone must be treated equally.*

—Ricardo Rosselló Navarez, Governor of Puerto Rico

*Within days after Hurricane Irma swept across the Caribbean and Florida, Hurricane Maria makes landfall in Puerto Rico as a strong Category 4 hurricane. Within hours, the island is in crisis and emergency personnel work frantically to search for victims and render aid. Reports flow in from multiple municipalities describing villages buried by mudslides. Communication is intermittent because there is*

*limited cell phone coverage across most of the island. The majority of the electrical grid is not delivering power. Facilities operating on back-up power risk losing their electricity because the generators have been running continuously since the storm. Residents compare this hurricane to Hurricanes Hugo (1989) and Georges (1998); after each, it took months to recover. They believe that Hurricane Maria brought more devastation. Already, assessments indicate that tens of thousands of homes are damaged. Water supply and waste water service is intermittent or nonexistent in many places. Millions of cubic yards of debris clutter the neighborhoods and countryside. Some of the debris blocks drains and ditches causing water to back up; the stagnant water worries health officials. The government cautions the population about the structural integrity of thousands of facilities including schools, police stations, and apartment buildings. Streams, rivers, and reservoirs are overflowing and continuing to cause damage to vulnerable communities.*

*A survey by helicopter is both shocking and heartbreaking. As far as the eye can see, power lines and towers lie on the ground. Countless homes are missing roofs and have shifted off their foundations. Furniture, large appliances, and cars litter yards and streets. The normally lush green island is brown; most vegetation is stripped of all color. It looks as though a giant fireball landed on the southeast end of the island and traversed diagonally to the northwest, scorching everything in its path. At the same time, supplies and hundreds of disaster response workers move agonizingly slow through a narrow sustainment pipeline, impeded by limited airport and seaport*

**Previous page:** U.S. Army Corps of Engineers (USACE) workers emplace poles and electrical power lines 6 February 2018 in the mountain community of San German, Puerto Rico. The first few days were spent clearing trees and dense vegetation with chainsaws to ensure compliance with industry safety standards. A helicopter then delivered a pole to each selected site where it was secured in place. The aircraft followed with several passes to tow feeder ropes between the poles so that the three strands of "conductor" line could be winched into place and secured. (Photo by Maj. Michael N. Meyer, USACE)

*capacity. For the observer, it is hard not to feel overwhelmed by the work that lies ahead. Meanwhile, Puerto Rico is a tropical island, and the rains continue almost every afternoon, bringing more damage to property and despair to residents.*

## September 2017

In September 2017, Hurricanes Irma and Maria devastated Florida, the U.S. Virgin Islands, and Puerto Rico. Full recovery from those storms will take years, perhaps an entire generation. Though the impacts were substantial in each of those areas, the people and infrastructure of the Commonwealth of Puerto Rico suffered the most. As it has in previous disasters, the U.S. Army Corps of Engineers (USACE) supported the Federal Emergency Management Agency (FEMA) in disaster response on the island under the National Response Framework.<sup>1</sup> However, the experience in Puerto Rico was unique from previous operations for several reasons: the island's prestorm financial crisis (including \$74 billion in debt), its aging and vulnerable infrastructure, the intensity and track of Hurricane Maria, the physical challenges inherent in supporting an island, and the unexpected assignment for the federal government to assist in the repair of the electrical power grid. The combination of these elements proved to be exceptionally challenging for orga-

nizations that rushed to assist Puerto Rico.

The federal government's mission to help Puerto Rico was massive and, in some aspects, record setting. The Corps' activities constituted the largest portion (in terms of expenditures) of the work as thousands of USACE military and civilian employees and their contractors rotated through Puerto Rico in 2017 and 2018.<sup>2</sup> Many Americans learned about discrete aspects of the crisis through intermittent media coverage, but

they did not see the entire story unfold and consequently did not understand and could not appreciate the significant and enduring challenges faced by all of the assisting agencies in their effort to restore normalcy to the commonwealth. It is important to tell the story of the Corps in this crisis because few people in the U.S. fully comprehend the contributions of USACE to the nation in general, let alone the tremendous capability it brings to assist fellow citizens following manmade and natural disasters. Ultimately, the Corps was successful in Puerto Rico for the same reasons it is successful in its enduring requirements in support of the entire country: it is a civil-military organization with unique organizational composition and structure; extensive experience in crisis response and emergency management; an ability to adapt quickly to ever-changing conditions and requirements; and strong relationships with other federal, state, and local agencies forged through some of our nation's toughest challenges.

This article is organized into four parts. Part one outlines the USACE's unique missions, structure, and conceptual role in domestic disaster response. Part two highlights relevant aspects of the strategic environment in Puerto Rico. The third portion explains the Corps' actual support to Puerto Rico in 2017 and 2018. Finally, part four summarizes an assessment of the overall operation and provides some thoughts as we look ahead to the future when, if the current trend continues, the U.S. will face rising costs in federal expenditures going toward disaster response.

## The U.S. Army Corps of Engineers

The USACE is unlike any other organization in the United States. With origins dating back to 1775, it expanded from support to the westward expansion and defense of a small nation to its current status as the largest public engineering agency, with domestic and international responsibilities.<sup>3</sup> The Corps is a direct reporting unit under the Department of the Army, commanded by an Army lieutenant general who also serves as the Army chief of engineers. It has a varied and diverse mission set, much of which is organized into three programs: Civil Works, Military Programs, and Interagency and International Services. Under Civil Works, the Corps manages, on behalf of the secretary of the Army, federal water resource responsibilities that include navigation (rivers

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is the commanding general of the South Atlantic Division, U.S. Army Corps of Engineers (USACE). The division is responsible for USACE missions in the southeastern United States, the Caribbean islands, and Central and South America. Holland oversaw the Corps' support to federal, state, and local agencies following five hurricanes in 2017–2018. She holds a BS from the U.S. Military Academy, an MA from Duke University, and an MMAS from the School of Advanced Military Studies, Fort Leavenworth, Kansas.

and harbors), flood risk management (dams and levees), hydropower, and environmental programs (regulation, stewardship, and restoration). Under Military Programs, the Corps builds, renovates, repairs, and maintains facilities at Army and many Air Force installations. The Interagency and International Services portfolio includes support to other federal agencies including the Departments of State, Defense, Homeland Security, and Veterans Affairs. The Corps also provides engineer expertise and support to each of the combatant commands.<sup>4</sup> Projects under the three programs are funded in different ways, whether



directly from the administration and Congress, other federal agencies, or the Department of the Army. In many of its missions, the Corps provides technical supervision and accountability oversight of contracts that execute the labor and services.

The composition and structure of USACE are uniquely designed to accomplish its broad and diverse requirements. The Corps' thirty-five thousand-person workforce is 98 percent civilian and 2 percent military personnel. General officers

A U.S. Army Corps of Engineers (USACE) employee completes a "blue roof" application for a resident 14 October 2017 in San Juan, Puerto Rico. Following Hurricane Maria, rather than establishing stationary and centralized application centers as is normally the practice, conditions required USACE employees to walk through neighborhoods and meet one-on-one with impacted residents. (Photo by author)

command the nine USACE divisions with regional and international responsibilities in support of multiple federal and nonfederal agencies. The divisions



are comprised of four to seven districts, each commanded by engineer colonels and lieutenant colonels slated from the Army's command centralized selection lists. USACE also operates nine centers and laboratories that support the Corps and other entities with research and innovation initiatives.<sup>5</sup> This force structure brings together technically competent civilians and experienced Army engineer officers. The combination of their strengths is a key reason the Corps has been successful, has garnered a wealth of capability, and has been entrusted with a broad set of responsibilities to solve a variety of the nation's toughest challenges.

Another unique function for the Corps is support to federal relief efforts following a disaster. The Corps' first official disaster response mission occurred in 1882 during the flooding of the Mississippi River, and it has participated in response efforts for almost every major manmade or natural disaster since that event.<sup>6</sup> The Corps' federal response missions are aligned along three pillars: support to the Department of Defense, support to states using existing USACE authorities and funding, and support

U.S. Army Corps of Engineers contractors install a temporary "blue roof" 28 October 2017 in Ponce, Puerto Rico. Among its many disaster response missions, the Corps supports the Federal Emergency Management Agency by providing the temporary, reinforced blue plastic coverings to storm-damaged roofs. (Photo by Sgt. Avery Cunningham, U.S. Army)

to FEMA. Support to FEMA in Puerto Rico following Hurricane Maria was the preponderance of the Corps' emergency response workload in 2017 and will be the focus of this discussion.

When USACE provides support through FEMA, it does so using authorities and funding as legislated by Congress in the Robert T. Stafford Act (Stafford Act) and in accordance with roles and responsibilities, Emergency Support Functions (ESF), outlined in the National Response Framework.<sup>7</sup> Known as "FEMA's engineer," the Corps serves as the coordinator of ESF #3, Public Works and Engineering, and as such, organizes capabilities and resources for infrastructure protection and reestablishment, engineering services, construction management, and emergency



contracting support for lifesaving and life-sustaining services. Generally, USACE's ESF #3 missions include, but are not limited to,

- ◆ installing temporary roofing (usually using blue plastic sheeting known as "blue roof"),
- ◆ installing stand-alone, temporary emergency generators for critical facilities,
- ◆ removing debris,
- ◆ conducting structural assessments,
- ◆ providing temporary housing, and
- ◆ providing support to critical public facilities.

The Corps can also support ESFs led by other federal agencies such as ESF #6 (Mass Care, Emergency Assistance, Temporary Housing, and Human Services), ESF #9 (Search and Rescue), ESF #12 (Energy), and ESF #15 (External Affairs).<sup>8</sup>

To bring value to a disaster response operation, support must be timely and robust, which requires extensive planning and preparation. USACE uses a multifaceted program to ensure the highest possible level of readiness.

An overhead view of a neighborhood in Puerto Rico shows several of the nearly sixty thousand temporary "blue roofs" installed by the U.S. Army Corps of Engineers in 2017 and 2018 in the aftermath of Hurricane Maria. (Photo by author)

It begins with a core group of full-time, deployable civilians who specialize in planning, training for, and executing the ESF #3 tasks. This group also maintains relationships with other federal and state emergency agencies throughout the year. USACE then identifies civilian volunteer employees from all forty-three USACE districts who can deploy on short notice. Most of these volunteers serve in roles other than emergency management at their home station. They might be engineers, archaeologists, biologists, resource managers, park rangers, administrative specialists, or attorneys. As USACE builds the team for response, the Corps' acquisition community designs a suite of pre-awarded contracts that quickly mobilize commercial industry capability to a disaster



location. With these acquisition tools already “on the shelf,” the Corps is able to support the federal government and impacted communities in a more effective and timely manner. Finally, all divisions and districts have emergency operations staff and centers that prepare for and track all hazards in their areas of responsibility.<sup>9</sup>

Federal assistance under the Stafford Act is initiated when a governor determines that the requirements exceed the state’s capability. Generally, such federal assistance is the last option and, when requested, the state pays a portion of the cost. Once in a while, because of extensive damages, as was the case for Puerto Rico and the U.S. Virgin Islands, the federal government waives the state’s cost share and provides 100 percent of the funding for a designated period of time. While the Stafford Act provides timely funding for emergency operations, one of the criticisms is that agencies can only execute “emergency work.” They cannot replace, upgrade, rebuild infrastructure, or enhance mitigation for future disasters under this authority.<sup>10</sup>

As required, the Corps establishes recovery field offices (RFOs) to provide mission command and

A CH-47 Chinook helicopter from the Pennsylvania Army National Guard lifts a large sandbag called a “super sack” for emplacement in the spillway of the Guajataca Dam on 9 October 2017. The soldiers were working with the U.S. Army Corps of Engineers and the Puerto Rico Army National Guard to stabilize the dam’s spillway after it was damaged during Hurricane Maria. (Photo by Staff Sgt. Mark Scovell, U.S. Army)

manage its share of emergency work. Generally, a district headquarters provides the leadership and administrative oversight for an RFO. Such administrative responsibilities include in- and out-processing of Corps responders, occupational health and safety oversight, liaison with local governments, public affairs, internal reviews, and quality assurance of contractors.<sup>11</sup> Meanwhile, a district must continue its regular work at home, and thus, adequate manning of each RFO requires volunteer employees from across all of USACE, in addition to those already identified and trained to support ESF #3 missions. The Corps can mobilize timely and technically competent support to FEMA during an emergency because it



maintains a ready workforce and extensive acquisition capabilities for its existing programs.

## Puerto Rico: Strategic Environment

As is true for any military operation, leaders involved in domestic disaster response operations should understand the variables and characteristics that shape the environment in which they execute their missions. Puerto Rico has a unique history and relationship with the United States, a challenging financial situation, a spirited political space, and some concerning social trends. It was critical for Corps leaders to understand these threads and how they might ultimately impact the mission.

In 1899, Puerto Rico transitioned from status as a Spanish colony to “unincorporated territory” of the United States. In 1917, as part of the Jones-Shafroth Act, Puerto Ricans gained U.S. citizenship but, for those who reside on the island, not the right to vote in federal elections.<sup>12</sup> Puerto Rico’s status has been a point of debate since becoming a U.S. territory, and consequently, the island periodically conducts referendums to determine whether the island should become a U.S. state,

The U.S. Army Corps of Engineers (USACE) reinforce a spillway of the eighty-nine-year-old Guajataca Dam 9 October 2017 in Isabela, Puerto Rico. USACE, the Puerto Rico Army National Guard, and local contractors stabilized the dam’s spillway to ensure the safety of the residents downstream. The Department of Defense and other organizations assisted civil authorities to provide disaster relief in Puerto Rico in response to Hurricane Maria. (Photo by Pvt. Alleea Oliver, U.S. Army)

remain a territory, or declare independence. Interwoven in this debate is the concern that Puerto Rico’s residents do not have the same rights and benefits as fellow citizens on the mainland.<sup>13</sup> This concern emerged during the post-Hurricane Maria response as some government officials and storm victims questioned whether Puerto Rico was receiving the same amount of support as Texas following Hurricane Harvey or Florida following Hurricane Irma. Consequently, it was important for the Corps to articulate its timely responsiveness across all supported disaster responses.

Similar to the fifty states, Puerto Rico has an elected governor, house and senate legislative bodies, and a supreme court. The current governor, Ricardo Rosselló Navares, was elected in late 2016 and is the son of a





previous governor, Pedro Rosselló González, who occupied the office from 1993 to 2001. The men share the experience of serving as governor during a devastating hurricane on their island. Hurricane Georges (1998), like Hurricane Maria nineteen years later, crippled the electrical grid and other essential services. Responders worked for months to restore the power grid. Though newly elected when Hurricane Maria made landfall, the younger Rosselló had some firsthand experience in how devastating storms impact the island socially, financially, and politically.<sup>14</sup>

One of the most concerning social trends facing the governor upon entering office was the long-term, continual decline in population. According to a 2016 article in the *Wall Street Journal*, more than 9 percent of Puerto Rico's population moved to the mainland between 2005 and 2015, the worst population decline "since the Census Bureau began its first tally in 1920" and exceeded that of any U.S. state.<sup>15</sup> The potential for another exodus in 2017 loomed large and further motivated all agencies to instill confidence and hope by reestablishing essential services and jumpstarting the economy as quickly as possible.

Sgt. Dalton Rezac (left) and Staff Sgt. Matthew Butler, B Company, 249th Engineer Battalion, get a lay of the land 28 August 2018 before conducting a site assessment at La Plata Lake Dam, Toa Alta, Puerto Rico. The U.S. Army Corps of Engineers (USACE) continues to work as part of a unified effort with federal, state, and local agencies to help the U.S. citizens of Puerto Rico recover from Hurricane Maria. (Photo by Andrew Kornacki, USACE)

## The Corps in Puerto Rico

The Corps surged extensive capabilities to Puerto Rico in the aftermath of Hurricane Maria, but its presence on the island existed long before 2017. Several USACE districts execute projects year-round on the island under civil works or military programs, but the most well-known entity is the Antilles Area Office. Located in San Juan, this office represents all Corps equities in Puerto Rico and the U.S. Virgin Islands. The most significant accomplishment of this team over the last decade was completion of the Portugués and Cerillos Dams near Ponce on the south side of the island. The purpose of the pair of dams is to prevent the Portugués River from flooding

downstream communities, which was a frequent occurrence until the project was completed in 2013.<sup>16</sup> This new infrastructure successfully withstood the strong winds and rains from Hurricane Maria and serves as an example of the quality construction regularly delivered by USACE.

In the aftermath of the 2017 storms, the permanently stationed employees of the Antilles Area Office, though suffering personal losses themselves, immediately went to work to implement Corps emergency authorities and funding to the benefit of numerous communities. However, the extent of destruction in Puerto Rico following Hurricane Maria far exceeded the capability of the Antilles Area Office, and the Corps would ultimately deploy thousands of military and civilian personnel from all forty-three districts to execute USACE functions between September 2017 and July 2018. Still, the small Antilles Area Office, and the relationships formed over the history of the Corps on the island up to that point, facilitated trust and timely decisions during the disaster response in 2017.

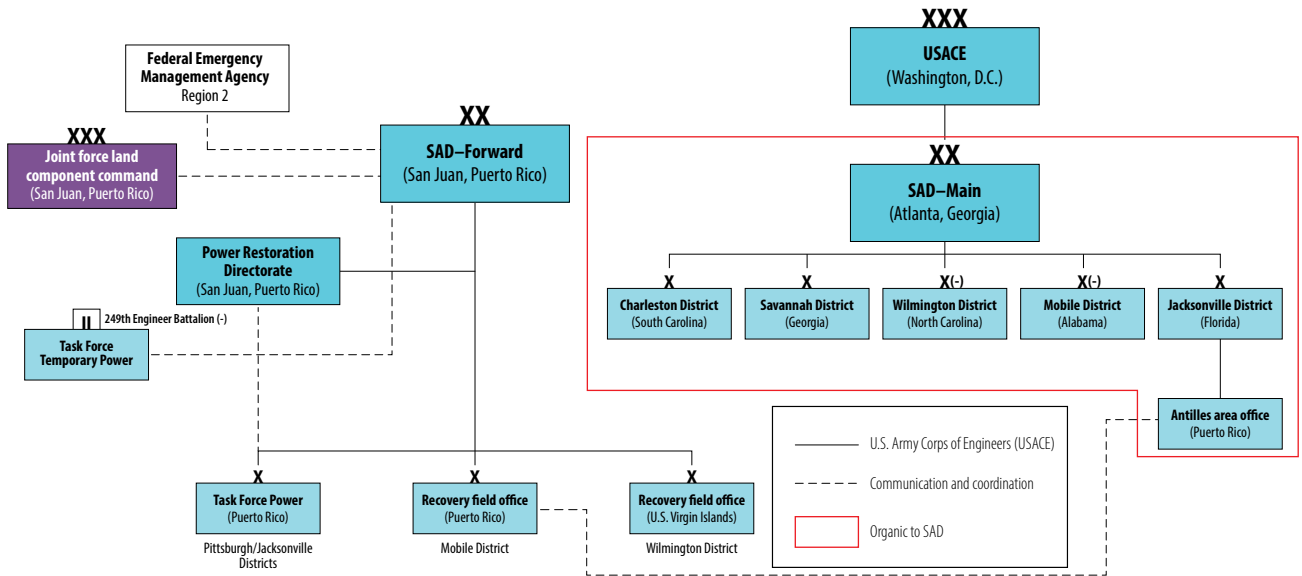
Following Hurricane Irma, and while Hurricane Maria tracked toward the U.S. Virgin Islands and Puerto Rico, leaders in the South Atlantic Division immediately recognized the need to build an effective mission command structure for a large response across multiple states and territories. The three impacted areas—Florida, the U.S. Virgin Islands, and Puerto Rico—are normally the responsibility of the Jacksonville District, headquartered in Jacksonville, Florida. However, the work ahead would exceed the capability of a single district and thus, three colonel-led districts were directed to support as follows: Jacksonville District would focus on Florida, Wilmington District (North Carolina) would oversee the response in the U.S. Virgin Islands, and the Mobile District (Alabama) would lead the effort in Puerto Rico. Each of these districts established an RFO in their designated state or territory, but RFO-Puerto Rico would stand out due to its historic levels of work including the installation of almost sixty thousand temporary roofs; the placement and operation of over 2,300 generators by the 249th Engineer Battalion (Prime Power), which was more than were installed by USACE following Hurricanes Katrina, Rita, Sandy, Irma, Florence, and Michael combined;

technical assessments of more than six thousand facilities; and removal of more than four million cubic yards of storm debris.<sup>17</sup>

As Mobile District's leadership and advanced party arrived in Puerto Rico to establish an RFO, they immediately reacted to another unplanned crisis, the potential failure of the Guajataca Dam. The dam was built in the 1920s by the government of Puerto Rico in order to provide flood protection and supply water for thousands of households on the northwest end of the island. Contrary to media reports at the time, the dam did not breach, though water overtopped and damaged the spillway. Water flowing over a spillway is not itself a problem as a spillway's purpose is to relieve pressure and prevent water from exceeding the height of the structure. However, at Guajataca, the high volume and velocity of the water flowing through the spillway caused erosion around the structure's massive concrete slabs. Over the ensuing days, the slabs broke away and compromised the integrity of the dam. The Mobile District, along with experts from across the Corps, leveraged lessons from similar incidents and, through close coordination with and assets from the U.S. Army North/Joint Task Force-Puerto Rico, the team airlifted and emplaced concrete barriers and large sandbags ("super sacks") and stemmed the erosion of the structure. They also cleared recently clogged drainage pipes and contracted large pumps to evacuate water and lower the level of the reservoir.<sup>18</sup> After the crisis, Corps technical experts designed and oversaw temporary repairs to mitigate further flood risk with additional permanent repairs to be completed under future projects.

While Corps personnel managed the crisis at the Guajataca Dam and established RFO operations in San Juan, a new requirement to restore the power grid emerged. Comprehensive repairs of an electrical grid is not an unprecedented mission for the Corps, but it is not normally executed by USACE under the Stafford Act following a natural disaster. When, ten days after the storm, Rosselló signed the official request for federal assistance to restore electricity, the extent of damage was not fully understood, but it was clear the situation was dire.

Upon receipt of the mission, USACE immediately met with the Puerto Rico Electric Power Authority (PREPA) to build relationships and share information. The Corps learned more about the organization as



(Figure provided by author)

**Figure. South Atlantic Division (SAD) Puerto Rico Task Organization (Simplified)**

well as the state of the electrical grid that it oversees. PREPA is a government utility company, the only provider of electricity on the island and, like the commonwealth, it was deep in debt and undergoing significant internal change in 2017. Early that year, Rosselló appointed Ricardo Ramos as chief executive of the company with the mandate to improve performance and financial standing. In July, only three months before Hurricane Maria, PREPA declared bankruptcy.<sup>19</sup> The USACE team further learned that Puerto Rico’s power plants are, on average, much older than the plants in the rest of the United States.<sup>20</sup> Most power is generated in the south, but the majority of the population lives in the north, making the system completely dependent on above-ground transmission lines that traverse rugged terrain of mountains and jungles from one end of the island to the other. The grid’s age and design, combined with PREPA’s internal problems including the inability to conduct routine maintenance on the system, were some of the prestorm conditions that would challenge the entire power restoration mission.

With the new mission assignment, the South Atlantic Division made two additional mission command decisions. First, it established a division-forward command post in Puerto Rico to manage all USACE disaster

response operations in the Caribbean. Second, realizing the requirements exceeded the division’s resources, leaders requested additional support to form a new organization charged with restoring the grid. The Corps’ Great Lakes and Ohio River Division tasked the Pittsburgh District to lead Task Force Power from October 2017 to February 2018. The figure depicts the South Atlantic Division task organization for operations in Puerto Rico. The expanded mission set, additional technical expert requirements, and evolving task organization demanded substantial augmentation from all forty-three districts in the USACE. The responsiveness of the USACE workforce, on short notice, was impressive and demonstrates the depth and professionalism of the organization.

The grid restoration mission for USACE was unexpected because impacted communities usually implement other solutions to restore electricity following storms. Ratified by Congress in 1996, the Emergency Management Assistance Compact provides for all states and territories the ability to leverage external support, including that of public and private utility companies. This arrangement facilitates planning and rehearsals so that when the storm clears and highways open, utility trucks and linemen can surge to problem areas. Such support to

Puerto Rico stalled for at least two reasons: (1) the transportation challenges inherent in supporting an island and (2) the island's financial situation and the related question of how Puerto Rico would reimburse other states for their assistance.<sup>21</sup> The deepening crisis demanded a solution by the federal government, and FEMA directed the USACE to lead the effort to augment PREPA. Still, it would take time to acquire all the resources for this mission, including thousands of linemen and their equipment. Even had they arrived immediately, they would not have had the materials required to make repairs.

The Corps team discovered within the first few days that PREPA lacked adequate materials to support full power restoration and immediately placed large orders through the Defense Logistics Agency. Unfortunately, stocks of electrical materials on the mainland were depleted due to other ongoing disaster response operations. Further complicating the materials shortage was the absence of a holistic sustainment system to transport and track supplies from the vendor to contractors on the ground. There were several logistics entities on the island tasked to support disaster response but not an organization to manage the overall sustainment of an unplanned, long-term power grid restoration mission. Ultimately, the solution was an ad hoc team consisting of elements from FEMA's logistics arm, the Defense Logistics Agency, the USACE Logistics Activity, 3rd Expeditionary Sustainment Command, 1st Mission Support Command, and the Logistics Civil Augmentation Program. Each organization worked a piece of the system to support the mission. Between October 2017 and July 2018, more than fifty million items (including approximately 60,000 power poles and 8,400 miles of wire) moved to Puerto Rico—mostly by sea, some by air—and were ultimately distributed to the thousands of linemen working throughout the island.<sup>22</sup>

During the initial weeks and months of the crisis, Puerto Rico was a media-rich environment and Corps leaders immediately prioritized strategic communications. Numerous U.S. and international television, print, and online media outlets positioned their journalists and reporters at the convention center in San Juan (the hub of the federal response agencies) and aggressively sought statements and stories. Meanwhile,

the extended crisis demanded immediate solutions, particularly for restoration of the power grid. However, the well-documented, prestorm vulnerabilities of the electrical grid, combined with the physical challenges of transporting utility trucks, linemen, and electrical supplies to the island, meant that the repairs would take longer than anyone wanted. Normally, FEMA serves as the hub of all messaging for the entire federal operation, but with many high-visibility missions, USACE developed its own strategic communications plan that was coordinated with FEMA but primarily executed by Corps leaders. USACE messaging served three purposes: (1) as public service announcements directed to the citizens of Puerto Rico on the status and projections of the Corps' missions, (2) to convey a sense of urgency for the mission, and (3) to instill confidence that the Corps was properly accounting for hundreds of millions of dollars in the middle of the crisis. USACE civilian and military leaders in Puerto Rico accepted every print, radio, and television interview request and issued a standing invitation for journalists to visit work sites so they would better understand the challenges and accomplishments on the ground. The Corps' communications effort in Puerto Rico was more aggressive than in other disasters, and over time, at least in Puerto Rico, opinions of the USACE effort trended positively.

The mission to augment PREPA and repair the power grid was USACE's most difficult and complicated task in Puerto Rico. At the outset, the Corps estimated that 80 percent of the grid had been impacted by the storm and that it would take months, and possibly until the summer of 2018, to restore electricity to all clients. When the USACE mission assignment ended in May 2018, the grid had been restored to just over 98.9 percent of clients who had power before the storm. PREPA completed the remaining requirements that summer. The Corps' portion of expenditures for the grid power restoration mission, including contractors and materials, would ultimately exceed \$2 billion.<sup>23</sup> Thanks to hundreds of hard-working employees and strong relationships with FEMA, PREPA, and industry experts, the Corps was able to leverage its technical competence and large acquisition tools to meet a historic challenge.

Lt. Gen. Todd T. Semonite, chief of engineers, said of the effort, "[The Corps] took on the nation's toughest challenge: rebuild the grid in Puerto Rico. When Army

engineers are needed we don't back down, we rush to the point of the need."<sup>24</sup>

## Assessment

The Corps is known for its extensive engineering expertise, but it brought many additional strengths to the response effort in Puerto Rico. Of those strengths, three stand out as particularly valuable in this case study: strong relationships across all levels of government, extensive experience in media and congressional engagement, and a diverse workforce.

Strong relationships between the Corps and other federal and state entities before a disaster are as important as strong relationships between allied armies before conflict. In 2017, many of the Corps' leaders and most of its full-time emergency operations employees had worked with FEMA in previous storms such as Hurricanes Katrina and Sandy. At the senior leader level, there was automatic trust and confidence because of previous shared experiences. Military officers from U.S. Army North and the Corps had served together throughout their careers, including in combat operations. Alongside FEMA, deliberate engagement at the national level with elected officials across the administration and in Congress greatly added to a shared understanding of the situation, garnering bipartisan support in providing the resources required to support the effort on the ground. At the execution level, Corps and FEMA employees knew each other very well. In the weeks and months after Hurricane Maria, the Corps and other federal agencies, particularly FEMA, retained a strong partnership, which was crucial for success throughout the response.

Media and congressional engagement and community relations are strengths for the Corps during normal operations and can be an advantage in disaster response. Lieutenant colonel and colonel district commanders routinely brief the media, update their local civilian communities, and interact with congressional delegations. Further strengthening relationships with communities and states is the fact that most offices in the Corps are located in city and town centers, in commercial or federal buildings, with smaller offices on military installations.<sup>25</sup> The locations of these offices result in a Corps workforce that is strongly invested and well known in their

respective communities, and they facilitate strong ties with state and other federal agencies.

The Corps values a workforce that is diverse in backgrounds, skills, and experiences, and this diversity led directly to numerous successes in Puerto Rico during very challenging times. While USACE is a federal engineering organization, a large portion of the organization performs work other than that of engineering disciplines. The broad scope of expertise required to receive billions of dollars in annual appropriations, execute an acquisition strategy to obligate that funding, manage more than twenty-five million acres in real property, serve as one of the leading federal providers of outdoor recreation, conduct reviews to balance preservation of the environment with reasonable development, serve as the nation's fifth largest electric supplier, and manage infrastructure and waterways through which 98 percent of overseas trade transits, means the Corps must employ a diverse and talented population. Following Hurricane Maria, the Corps' diversity was critical to quickly building the right organization to lead the unplanned power grid restoration mission. Furthermore, while many of Puerto Rico's residents speak English, the ability to communicate and build strong relationships with the local press, commonwealth and municipal governments, and PREPA employees was greatly enhanced by Spanish-speaking Corps employees and even more so, those who came from the island. In the initial days of the response, a handful of civilian employees who were born and raised in Puerto Rico were able to build trust and ultimately gain access to the leadership and technicians within PREPA and assure them of the Corps' genuine desire to help with the crisis. Opening these lines of communication enabled critical information sharing, which in turn gave Task Force Power the ability to assess the true status of the grid, build a comprehensive materials list, design a new acquisition strategy, and organize the arriving contractors for the work ahead. The diversity of the Corps of Engineers, established within the workforce well ahead of the disaster, proved to be extremely valuable throughout the emergency.

Though the Corps brought many strengths to the response mission, USACE also learned that there are areas to improve in order to be best postured for future catastrophic events. The most significant gap is the lack of an operational sustainment capability.



The USACE Logistics Activity is designed to support districts in basic sustainment functions such as acquiring and accounting for supplies and furniture, and managing government fleets. It has an additional role of reception, staging, onward movement, and integration for Corps employees during disaster response.<sup>26</sup> For sustainment requirements beyond those tactical level functions, the Corps normally relies on other agencies or contractors, which is sufficient when such arrangements are planned and in place before execution. However, the logistics requirements in support of the power grid restoration mission in Puerto Rico far exceeded USACE's sustainment capabilities and processes. Other agencies that would normally support USACE in a disaster, or the joint force in an expeditionary operation, could not commit to holistic sustainment of this mission because of competing priorities. The USACE is reviewing several alternatives for future contingencies such as additional pre-awarded contracting actions and memorandums of agreement with other Department of Defense entities in order to address its internal sustainment capability gap.

A worker directs placement of poles 18 January 2018 in Ponce, Puerto Rico. The Federal Emergency Management Agency (FEMA), the U.S. Army Corps of Engineers, and contracted companies worked together to deliver tens of thousands of poles to different areas around the island to restore the power grid. (Photo by Eduardo Martinez, FEMA)

Response to Hurricane Maria in Puerto Rico was difficult in ways that it would otherwise not have been had the damage occurred on the mainland with transportation nodes and networks still in place or only minimally impacted. The Corps, along with all agencies, is reviewing how it supports disaster response operations on islands and other locations that would likely sustain severe damage to transportation networks or nodes.<sup>27</sup> One of the key improvements must be to establish a system that prioritizes transportation assets and provides visibility on the flow of people, equipment, and supplies for all response agencies in support of a disaster location.

In the aftermath of Hurricanes Harvey, Irma, and Maria, and many other natural disasters of 2017, federal, state, and local governments are examining how to

better support response and recovery operations in the future. However, even with improvements, providing federal assistance in a timely manner during multiple simultaneous catastrophic events will continue to be very difficult and increasingly expensive.<sup>28</sup> Restoring power to the island of Puerto Rico following Hurricane Maria required federal, commonwealth, and off-island utility assets and almost ten months to complete. This case study should serve as a warning. It will be important for Americans at the individual, neighborhood, and community levels to emphasize self-sufficiency and preparedness so they can continue to function for days and weeks without essential services.

The USACE has formally participated in federal disaster response for more than a century. Its vast set of existing responsibilities in support of the nation, extensive competencies and authorities, and unique organizational composition and structure

make it a valuable institution to support states and territories following manmade and natural events. The historic response operation in Puerto Rico following Hurricane Maria is one example of how the two hundred and forty-three-year-old organization employs extensive capability, even under the most challenging conditions, to assist fellow Americans in their time of greatest need.

*We went next door to the Catholic church ... mass was delivered in Spanish ... At the end of mass, a lady walked up to the lectern and pointed at the three of us. She said ... 'Thank you three, thank you all for being here and helping the people of Puerto Rico. We are so grateful.' Everyone in the church ... then stood up and applauded. It was very powerful ... their gesture of kindness makes all this worthwhile.*

—Phillip Tilly, USACE Responder, 2017<sup>29</sup> ■

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## Notes

**Epigraph.** Frances Robles, Lizette Alvarez, and Nicholas Fandos, "In Battered Puerto Rico, Governor Warns of a Humanitarian Crisis," *New York Times* (website), 25 September 2017, accessed 26 February 2019, <https://www.nytimes.com/2017/09/25/us/puerto-rico-maria-fema-disaster.html>.

### Epigraph. Ibid.

1. Federal Emergency Management Agency (FEMA), *National Response Framework*, 3rd ed. (Washington, DC: Department of Homeland Security, June 2016), accessed 25 February 2019, [https://www.fema.gov/media-library-data/1466014682982-9bcf8245ba4c-60c120aa915abe74e15d/National\\_Response\\_Framework3rd.pdf](https://www.fema.gov/media-library-data/1466014682982-9bcf8245ba4c-60c120aa915abe74e15d/National_Response_Framework3rd.pdf).

2. Trevor Houser and Peter Marsters, "The World's Second Largest Blackout," Rhodium Group, 12 April 2018, accessed 18 March 2019, <https://rhg.com/research/puerto-rico-hurricane-maria-worlds-second-largest-blackout/>. While Hurricane Katrina stands as the most costly natural disaster in U.S. history, in some ways, Hurricane Maria delivered greater impacts. Damage to the electrical systems in Puerto Rico and the U.S. Virgin Islands resulted in the "largest blackout in U.S. history."

"Puerto Rico Hurricane Maria (DR-4339)," FEMA, accessed 18 March 2019, <https://www.fema.gov/disaster/4339>. In Puerto Rico, FEMA executed the largest commodity mission in their history with the delivery of sixty-three million meals and seventy-four million liters of bottled water.

FEMA, *2017 Hurricane Season FEMA After-Action Review* (Washington, DC: U.S. Department of Homeland Security, 2018), 36, accessed 18 March 2019, <https://www.fema.gov/media-library-data/1531743865541-d16794d43d3082544435e1471da07880/2017FEMAHurricaneAAR.pdf>. Under the temporary emergency power

mission, the U.S. Army Corps of Engineers (USACE) installed 2,338 generators in Puerto Rico compared to the previous record of 310 following Hurricane Katrina.

"2017 Disaster Contracting: Observations on Federal Contracting for Response and Recovery Efforts," Government Accountability Office (GAO), 28 February 2018, accessed 18 March 2019, <https://www.gao.gov/reports/GAO-18-335/#figure18>. As of December 2017, according to the GAO, the Corps' activities constituted 48.8 percent of contract obligations, which totaled \$3.5 billion. By comparison, FEMA's portion was 42.6 percent and the Department of the Army constituted 1.7 percent.

3. William Baldwin, *The U.S. Army Corps of Engineers: A History*, 2nd ed. (Alexandria, VA: USACE, 2008), 1.

4. Army Regulation 10-87, *Army Commands, Army Service Component Commands, and Direct Reporting Units* (Washington, DC: U.S. Government Publishing Office, 11 December 2017), 24–25. The assistant secretary of the Army (civil works) provides direction on behalf of the secretary of the Army for the USACE Civil Works program. The assistant secretary of the Army (installations, energy, and environment) provides similar direction for military and construction functions.

5. "U.S. Army Corps of Engineers Overview," USACE, accessed 26 February 2019, <https://www.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/475462/us-army-corps-of-engineers-overview/>.

6. Baldwin, *The U.S. Army Corps of Engineers*, 263.

7. Robert T. Stafford Disaster Relief and Emergency Assistance Act, Pub. L. No. 100-707 (2016); *National Response Framework*, 34–37. The Corps also performs emergency actions independently as authorized by the Flood Control Act of 1941, Pub. L. 84-99 (2009), and as directed by the Department of Defense.

8. FEMA, *National Response Framework*, 34–37.

9. Civil Works Emergency Management Programs, Engineer Regulation (ER) 11-1-320 (Washington, DC: USACE, 28 February 2014), 2-1-2-3; Emergency Employment of Army and Other Resources, ER 500-1-1 (Washington, DC: USACE, 30 September 2001), 1-1-1-3, 3-1-4-8; National Response Planning Guide, ER 500-1-28 (Washington, DC: USACE, 31 January 2011), 1-3-2-5, 3-7. USACE regulations at "Engineer Regulations," USACE, accessed 26 February 2019, [https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations/udt\\_43546\\_param\\_order-by/Info/udt\\_43546\\_param\\_direction/descending/?udt\\_43546\\_param\\_page=11](https://www.publications.usace.army.mil/USACE-Publications/Engineer-Regulations/udt_43546_param_order-by/Info/udt_43546_param_direction/descending/?udt_43546_param_page=11). For a brief description of USACE's contracting actions in support of emergency response, see "Contracting in Disasters," USACE, accessed 18 March 2019, <https://www.usace.army.mil/Missions/Emergency-Operations/Contracting-in-Disasters/>.
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25. For example, the Jacksonville District headquarters is located in the Prudential Financial Building, San Marco neighborhood, south of downtown Jacksonville. The Corps maintains a presence on Department of Defense installations (Army and many Air Force bases) through area or resident engineer offices but these are smaller offices designed to support Department of Defense military construction, sustainment, and maintenance missions.
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