

POST-KATRINA
Lessons From a Disaster

Since Hurricane Katrina in 2005, the United States has encountered numerous and devastating hurricanes (e.g., Sandy, Ike, Rita, Maria, Michael). Yet, the story of Hurricane Katrina is important because it not only is one of the costliest and deadliest U.S. hurricanes to date, but it also examines our ability to recover from a disaster in the face of a rapidly changing climate. As geographer James Mitchell observes, Hurricane Katrina was a truly exceptional event by almost any measure—from the size of the affected population to the degree to which buildings and infrastructure were destroyed or rendered unusable to the range and scale of the economic costs.¹ But the overwhelming impacts of the storm also made manifest the risks facing many Americans, as well as others around the world. According to the National Oceanic and Atmospheric Administration (NOAA), more than half of the U.S. population lives in 673 coastal counties, up from 39 percent in 1970. Coastal areas have always been subject to hurricanes, earthquakes, and tsunamis; they suffer from the effects of chronic processes as well, including erosion, subsidence, and saltwater intrusion. But with scientists forecasting rising sea levels and more severe storms as climate change proceeds, urban areas on the coast are even more exposed to hazards than they have been historically.²

In the late twentieth century a growing number of Americans moved to areas routinely affected by hurricanes, forest fires, earthquakes, and floods. In seeking to make such areas safer for human habitation, government policies such as subsidized flood insurance, wildlife suppression and firefighting, construction of levees, and federal relief payments fostered, rather than discouraged, dangerous settlement patterns.³ As Paul Farmer, executive director of the American Planning Association, explains, the government's message when it comes to disasters consistently has been, "We will help you build where you shouldn't, we'll rescue you when things go wrong, and then we'll help you rebuild again in the same place."⁴ Although improved building techniques, forecasting technology, and evacuation planning mitigated disaster-related losses for a time, the movement of masses of people into disaster-prone areas in the latter decades of the twentieth century has reversed that trend.⁵

Also contributing to the devastation wrought by Hurricane Katrina are entrenched poverty and racial disparities that have long bedeviled New Orleans. Although the storm affected black and white, rich and poor, the vast majority of residents hit hardest by the storm were poor and African Americans. Those same people were the least

able to evacuate, the last to be allowed back into the city to inspect the damage and retrieve their belongings, and the least well equipped to rebuild. This is a common pattern, as indicated by environmental justice experts.⁶ Sociologists Robert Bullard and Beverly Wright argue that, in general, “Race tracks closely with social vulnerability and the geography of environmental risk.”⁷ Geographers Susan Cutter and Christopher Emrich observe that physical vulnerability correlates strongly with social vulnerability, defined not just by one’s age, income, and race but also by the extent of one’s social network and access to health care and emergency-response personnel.⁸ Race and poverty affect not only the severity of damage from disasters but relief efforts as well.

Further compounding the damage caused by Katrina and the flooding that followed was the extraordinarily incompetent response by every level of government. Unfortunately, few disaster experts were surprised by the inadequate public-sector response. Geographer Rutherford Platt points out that the “Byzantine” federal disaster-management system relies heavily on a variety of partnerships with state and local governments, nongovernmental organizations, and the private sector.⁹ The Department of Homeland Security, created after September 11, 2001, undermined those already tenuous partnerships while giving natural disasters short shrift, instead directing most of the resources of the U.S. Federal Emergency Management Agency (FEMA) to counterterrorism activity.¹⁰ For their part, local governments historically have been reluctant to prepare for major disasters. Municipal officials devote most of their energies to addressing immediate concerns for which there are active constituencies, such as schools, roads, and crime.

Finally, efforts to rebuild New Orleans illustrate the challenges associated with trying to modify past practices in an effort to enhance a city’s resilience, while respecting the wishes of citizens, who typically want to restore the place that existed before. For urban planners, New Orleans’ experience illustrates a familiar set of tensions between bottom-up and top-down problem solving. Most planners believe that collaborating with stakeholders yields opportunities for mutual learning among citizens and officials and therefore results in more effective plans. But citizens’ desire to return to normalcy can impose severe constraints on efforts to introduce ecological sensitivity to the planning process. Moreover, even a plan that reflects citizens’ wishes can be thwarted by a lack of resources and capacity for effective implementation.

Meanwhile, under conditions of scarce resources, those who are wealthier can rebuild first, while bureaucratic requirements designed to ensure accountability dampen the energy of even the most determined low-income rebuilders. Nonetheless, Hurricane Katrina “was not an equal opportunity storm.”¹¹ The effects of years of discriminatory practices expose the institutionalized racism that is also evident in the environmental injustice’s wrought by Hurricane Katrina.

BACKGROUND

Established in 1718 by the French governor of Louisiana, Jean-Baptiste Le Moyne de Bienville, New Orleans originally occupied a crescent of high ground between

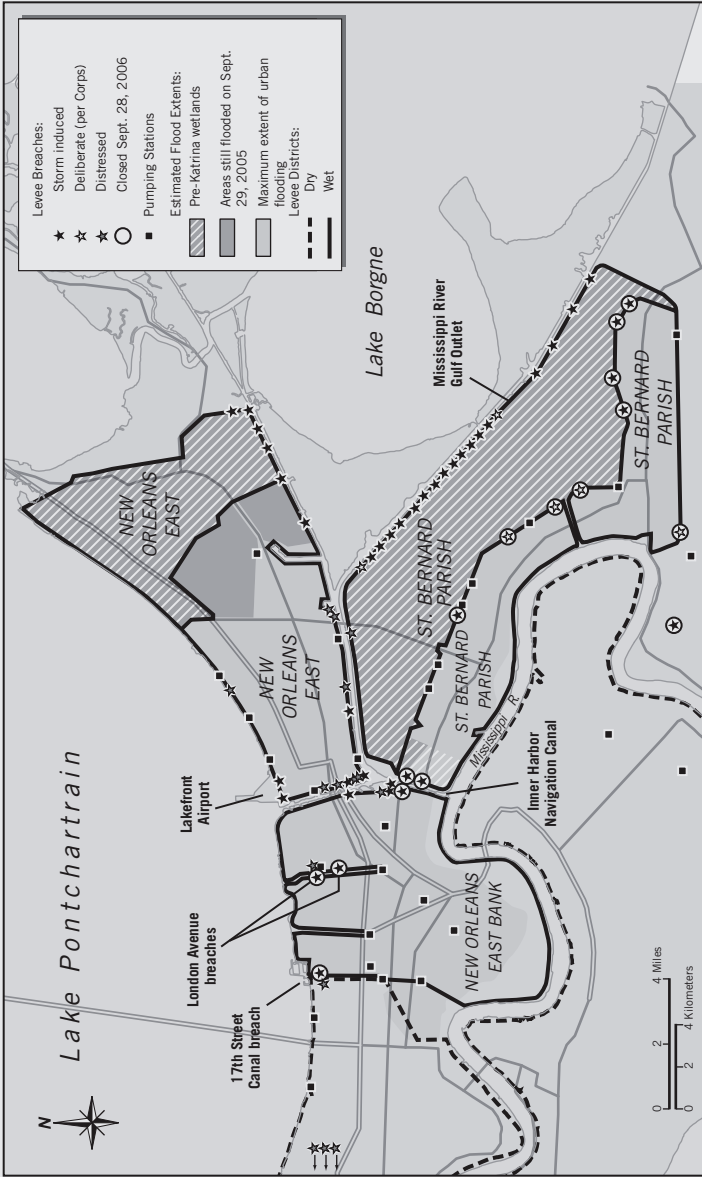
the Mississippi River and the brackish, 630-square-mile Lake Pontchartrain (see Map 16.1).¹² Bienville and subsequent settlers encountered an alluvial plain built over thousands of years, as the Mississippi River deposited vast amounts of sediment during storms and annual spring floods. The drying sand and silt compressed but was replenished each year by new infusions. As a result of this ongoing process, southern Louisiana had gradually grown into a vast expanse of marshland interspersed with bayous.¹³ Along the Mississippi River, natural levees rose ten to fifteen feet above sea level, while the banks of Lake Pontchartrain stood only a few feet or even mere inches above the bay.¹⁴ Early settlers made modest changes to this delta landscape: they built their houses on relatively high ground, often on stilts, and they erected small riverfront levees to protect themselves from periodic flooding. They were not entirely successful: the Mississippi River inundated New Orleans in 1719, 1735, 1785, 1791, and 1799.¹⁵

Aggressive efforts to confine the Mississippi River over the next two centuries dramatically changed the region's geography, however. In 1803 the United States acquired New Orleans as part of the Louisiana Purchase, and American farmers began moving to the region to build plantations along the bayous. In the mid-1800s wealthy property owners created levee districts to spread the costs of maintaining and reinforcing levees that would contain the region's waterways, but floods intermittently overwhelmed these paltry defenses. Finally, in 1879, Congress commissioned the Army Corps of Engineers (Corps) to build more substantial levees along the entire lower Mississippi in hopes of mitigating floods. This more extensive levee system had the effect of raising the level of floodwaters, however, often with disastrous consequences.¹⁶

After the great flood of 1927, Congress authorized the Mississippi River and Tributaries Project, in which the federal government assumed the entire cost of erecting levees, spillways, and other structures from Cairo, Illinois, southward to protect against an 800-year flood. Upon completing this project, the Corps boasted, "We harnessed it, straightened it, regularized it, shackled it."¹⁷ But this massive construction project had unanticipated consequences: over time, the dams and levees on the Mississippi and its tributaries, particularly the Missouri River, captured 60 percent to 70 percent of the 400 million cubic yards of sediment that for thousands of years had flowed to the delta and built up the region's marshes and barrier islands. In addition, to prevent the formation of sandbars that impeded navigation, engineers straightened the last miles of the Mississippi by building parallel 2.5-mile jetties, which carried whatever sediment did make it to the river's end over the continental shelf and out into the deep ocean. Without sediment to nourish its marshes or rebuild its barrier islands, the entire delta began to subside and erode.

Another process got under way in the early 1900s that further altered New Orleans' geography. Public officials and private entrepreneurs were intent on draining water from the city after heavy rainstorms, a regular feature of the city's weather, and in 1899 voters approved a comprehensive plan to do so.¹⁸ During the first forty years of the twentieth century, the Sewer and Water Department installed a network of drainage canals and pumps that successfully lowered the water table throughout the city.¹⁹ To keep the canals dry enough to capture water during storms, officials pumped them continuously, in the process causing the city to subside. The process

Map 16.1 New Orleans and Hurricane Katrina's Storm Surge



Source: U.S. Geological Survey and Army Corps of Engineers.

was self-perpetuating: as swampy areas were drained, the reclaimed land sank; the more the city sank, the more it flooded, and the deeper the canals and more pumping that was needed to keep it dry. The drainage system also enticed people into harm's way, while giving them a false sense of security.²⁰

The dredging of thousands of miles of channels for oil and gas and shipping aggravated the subsidence and erosion of the wetlands between New Orleans and the gulf. Beginning in the mid-1900s, fossil fuel companies dredged hundreds of miles of navigation channels and pipeline canals through the southern Louisiana marsh. Those canals not only caused massive coastal erosion, they also transported saltwater inland, where it killed the cypress swamps and the grasses and bottom-wood forests of the interior marshes. Local development interests contributed to the damage as well: at the behest of the Port of New Orleans, the Corps built a series of shipping channels to facilitate commerce.²¹ Completed in 1923, the 5.5-mile Inner Harbor Navigation Canal, universally known as the Industrial Canal, connected the Mississippi River and Lake Pontchartrain; it also allowed for docks that were shielded from the fluctuations of the unruly Mississippi. An even larger channel, the Gulf Intracoastal Waterway, was built in the 1930s.

The most controversial shipping channel of all was the \$62 million Mississippi River–Gulf Outlet, or MR-GO, known locally as “Mr. Go.” Justified as a way to allow freighters easier access to New Orleans’ inner harbor from the gulf, MR-GO cut a path directly through the unspoiled marshes of St. Bernard Parish.²² But at thirty-six feet deep, MR-GO was too shallow for the deep-draft container ships that were coming into use by the time it was completed in 1968. (This was a recurring problem for the Corps in New Orleans: by the time its projects were built, they were often obsolete.) Within a decade, traffic along MR-GO began to decline and by 2004 averaged just one vessel per day—15 percent of all Port of New Orleans traffic. Although not heavily used, MR-GO had dramatic environmental consequences. Originally dredged to 650 feet across, the channel eroded rapidly, reaching 2,000 feet wide in places by the early 2000s. With devastating efficiency, MR-GO facilitated saltwater intrusion that destroyed 28,000 acres of marsh and caused substantial changes to another 30,000 acres;²³ it also provided a pathway into eastern New Orleans and St. Bernard Parish for hurricane storm surges. Detractors had warned of all these outcomes, but they had been overruled by development interests.²⁴

The cumulative result of these processes was that Louisiana’s marshes vanished, while the land that remained began to sink. Coastal marshland disappeared at a rate of twenty-five to thirty-five square miles a year during the latter half of the twentieth century. In total, more than 1,900 square miles of Louisiana’s coastal marshland disappeared between 1930 and 2000.²⁵ Those vast marshes had once served to blunt storm surges because hurricanes weaken as they travel over the irregular surfaces of the land; a commonly cited estimate is that every four miles of marsh reduces storm surge by as much as a foot. Meanwhile, New Orleans itself was sinking by about one-quarter inch per year. As a consequence, by 2005 nearly half of the city was below sea level—although the most densely populated areas

were well above sea level.²⁶ Observers warned that in a severe storm the city would flood, and it would be hard to remove the water trapped behind the levees.

New Orleans' vulnerability was made manifest in 1965, when Hurricane Betsy struck the Gulf Coast, inundating parts of the city under eight feet of water and causing \$1 billion in damages. The Corps' response to Hurricane Betsy was to propose engineering an even more extensive levee system, to be completed in the early 1980s, that would protect the city from future Category 3 hurricanes.²⁷ An important selling point was that the new system would facilitate continued urbanization of the region: protection of existing development accounted for just 21 percent of the benefits used to justify the proposed \$80 million Lake Pontchartrain and Vicinity Hurricane Protection Project, while 79 percent were to come from the new development that would be feasible given the additional protection.²⁸ In 1965 Congress authorized the Lake Pontchartrain project as part of the Flood Control Act.

Three years later Congress passed the National Flood Insurance Act, which enabled households and businesses to insure their property against floods—something most private insurers refused to do. Under the new flood insurance program, homeowners in areas designated as flood prone—that is, with a 1 percent or more chance of catastrophic flooding in a given year—are required to buy policies from insurance companies; the government pays for flood damage with federal funds collected from homeowner premiums. Insurance was supposed to go only to property owners in communities with floodplain-management laws that were enforced—so that, ostensibly, insurance was exchanged for a commitment to reduce vulnerability. In an effort to increase the program's coverage, in 1973 Congress made insurance mandatory for anyone who took out a mortgage from a federally regulated lender to buy property in a flood zone, adding penalties in 1994 for lenders that did not comply. To entice more people into the program, Congress also limited the amount premiums could rise in a single year.

In combination, the enhanced levee system and the availability of flood insurance facilitated explosive growth into the wetlands of eastern Orleans Parish and Jefferson Parish. Critics warned, however, that these new developments were at serious risk in the event of a major storm. First of all, in designing the Lake Pontchartrain and Vicinity Project the Corps had used a “standard project hurricane” that was based on a mix of characteristics of past storms, all of which were relatively mild; the agency had concluded that stronger protection would be “cost prohibitive.”²⁹ Moreover, as the completion date for the project slipped and costs escalated, the Corps made compromises in its execution: engineers focused on fortifying existing levees and built flood walls in places where land acquisition would have been too costly.³⁰ Meanwhile, no accommodation was made for the fact that the levees themselves were sinking.³¹ As a result, according to computer simulations done in the 1990s, the 350-mile “system” of levees and flood walls that surrounded the New Orleans metropolitan area was capable of protecting against a fast-moving Category 3 storm at best. After Hurricane Georges gave the city a near miss in 1998, Congress authorized the Corps to begin studying ways of bolstering the city's defenses against a Category 5 hurricane. But that work moved slowly; by 2004 the Corps had just completed its preliminary study.

Hurricane Georges also prompted scientists, engineers, federal agencies, and the region's politicians to converge on a blueprint for restoring coastal Louisiana. At \$14 billion, "Coast 2050" was the most expensive restoration plan yet proposed in the United States. Its central elements were rebuilding the marshes and reconnecting the barrier islands, both of which would, in theory, protect the coast from storm surges. More specifically, the plan featured several key projects. First, at critical spots along the Mississippi River, engineers would build diversions to allow suspended sediments to wash down through the marshes toward the gulf. A second project involved taking 500 million cubic yards of sand from Ship Shoal to rebuild the southern barrier islands and cutting a channel in the neck of the river delta about halfway down. This would enable the Corps to stop dredging the southern end of the river and would allow the mouth of the river to fill with sediment that would eventually flow to the west and rebuild the barrier islands. A third project entailed building a new port and closing MR-GO. And a fourth consisted of building a pair of gates on the narrow straits on Lake Pontchartrain's eastern edge where it connects to the gulf. Those gates could be lowered during storms but otherwise would remain open to allow tidal flushing.

Congress refused to fund the ambitious coastal restoration plan, however, so the state had to rely on the meager \$50 million annually provided under the Coastal Wetlands Planning, Protection, and Restoration Act of 1990, known as the Breaux Act.³² Although few projects were actually built using Breaux Act money, one of the projects described in "Coast 2050" that did become a reality was the Davis Pond Diversion, a dam that opens and closes to allow water (and sediment) to flow into 33,000 acres of wetlands, oyster beds, and fishing grounds. That project mimicked the Caernarvon Freshwater Diversion Structure, near MR-GO, which releases 8,000 cubic feet per second of Mississippi River water in an effort to preserve 16,000 acres of marsh. Completed in 1991 at a cost of \$26 million, the Caernarvon project illuminated not only the benefits of restoration but also the pitfalls. In 1994 oyster farmers in the area, who had paid \$2 per acre for fifteen-year claims, filed a class action suit against the state, arguing that the project had reduced the value of their leases. In December 2000 a local jury awarded five of the farmers \$48 million in damages; applied across the entire class the award added up to \$1.3 billion. Although the verdict eventually was overturned by the Louisiana Supreme Court, the legal wrangling unnerved backers of restoration. To shield itself from further liability, the state practically shut down the Caernarvon diversion and stopped work on fifteen other restoration projects while the litigation was pending.

In short, over the course of the twentieth century, development in and around New Orleans left the city in a precarious situation, and efforts to bolster its defenses yielded negligible improvements while facilitating further development in flood-prone areas. As a result of both subsidence and migration patterns, whereas only 48 percent of New Orleans residents were below sea level in 1960, when the city's population peaked at 627,535, by 2000, 62 percent of New Orleans residents lived below sea level.³³ That New Orleans was vulnerable despite its hurricane-protection system was widely known. Journalist Elizabeth Kolbert notes that "Katrina was probably the

most comprehensively predicted disaster in American history.”³⁴ At an annual meeting shortly after the September 2001 terrorist attacks, the nation’s disaster scientists and emergency planners warned that a major hurricane would destroy New Orleans. In October 2001 journalist Mark Fischetti published an article in *Scientific American* that sought to publicize experts’ concerns. He argued that “[i]f a big, slow-moving hurricane crossed the Gulf of Mexico on the right track, it would drive a sea surge that would drown New Orleans under 20 feet of water. . . . New Orleans is a disaster waiting to happen.”³⁵ In December Eric Berger wrote in the *Houston Chronicle* about New Orleans’ dire prospects in the face of a major hurricane, predicting that hundreds of thousands would be left homeless. Then, in early summer 2002, *The Times-Picayune* ran a sobering series by journalists John McQuaid and Mark Schleifstein suggesting that the levees around New Orleans would breach in a serious storm, with “apocalyptic” consequences.

Disaster management officials struggled to devise ways of responding to the severe hurricane that many believed was inevitable. In July 2004, FEMA and the Louisiana Office of Homeland Security and Emergency Preparedness conducted a week-long simulation in which New Orleans was hit by a hypothetical Hurricane Pam, a slow-moving hurricane preceded by twenty inches of rain. The scenarios used to construct the simulation did not count on the levees failing; nevertheless, the exercise predicted ten to twenty feet of water in some parts of the city, the evacuation of 1 million people, and the need to rescue 100,000 more who would remain behind. Although it generated some useful insights, as well as a momentary burst of media attention, the exercise was never translated into a workable plan—a victim of budget cuts. Then, just months before Katrina struck, a report by the Corps on the region’s hurricane-protection plan identified weaknesses in the levee system, which was decades behind schedule, and expressed concern about a \$71 million cut in the fiscal year 2005 budget of the New Orleans District.³⁶ “Continuing land loss and settlement of land in the project area may have impacted the ability of the project to withstand the design storm,” the agency warned.³⁷

THE CASE

Despite the warnings and planning exercises, New Orleans was woefully underprepared for Hurricane Katrina and its aftermath. As a result, days after the hurricane struck, thousands were still stranded in a city that was largely under water, enduring temperatures hovering in the muggy 90s, and with limited access to food, water, or medical supplies. Subsequent analyses revealed that shoddy engineering beforehand and poor coordination among federal, state, and local governments after the fact transformed a severe storm into a disaster. Even as they struggled to untangle the causes of the disaster and provide relief to victims, Louisiana officials seized the opportunity to promote both a more protective levee system and an ambitious coastal restoration plan that scientists believed would enhance the region’s resilience in the face of storms. But skeptics wondered whether shoring up a city in

such a perilous place made sense, and Congress and the administration of President George W. Bush were reluctant to endorse the costly project. Meanwhile, local officials struggled to plan the monumental task of rebuilding, a process fraught with racial and economic tensions.

Disaster Strikes

Katrina began its life early in the week of August 22, 2005 as a tropical depression off the Bahamas. By August 25 it was officially a hurricane. By late Friday, August 26, Katrina had gained strength and, after killing nine people and knocking out electricity in south Florida, it was on track to slam into the Gulf Coast. At that point, forecasters at the National Hurricane Center in Miami were predicting it would hit southeast Louisiana on Monday, August 29, as a Category 4 storm with top winds of 132 miles per hour; they warned that if the storm moved through New Orleans the city could see storm surges of eighteen to twenty-two feet.³⁸ Ominously, forecasters expected the storm to pass over the “loop current,” a 200-foot-deep swath of 90-degree-Fahrenheit tropical seawater floating in the Gulf of Mexico. If it did, it was sure to intensify.

The normally placid Max Mayfield, director of the National Hurricane Center, called dozens of federal, state, and local officials to transmit an urgent message. “This is the ‘Big One,’” he told them. “I’m as sure as I can be.”³⁹ A computer model devised by the Louisiana State University (LSU) Hurricane Center late Saturday suggested that the New Orleans metro area could see flooding on the scale of Hurricane Betsy, with a storm surge of as much as sixteen feet moving up MR-GO, topping levees, (see Map 16.1). According to the model, high water from Lake Pontchartrain would also flood over levees to the north. (The model did not account for waves that could overtop the levees along the lake’s south shore.⁴⁰) “All indications [were] that this [was] absolutely worst-case scenario,” said Ivor van Heerden, deputy director of the LSU Hurricane Center.⁴¹ According to an unusually explicit alert sent by the National Weather Service, the New Orleans metropolitan area would experience blown-out windows, airborne debris, power outages, and uprooted trees.

State and local officials seemed to take the threat seriously. The governor’s office held a conference call with emergency preparedness directors from Louisiana parishes at 5 p.m. on Friday to update them on the forecast and review state plans. At 11 p.m. Democratic Governor Kathleen Babineaux Blanco declared a state of emergency. The following day, after speaking with Max Mayfield, the governor ordered a mandatory evacuation of all low-lying areas, and at 5 p.m. New Orleans Mayor C. Ray Nagin declared a state of emergency and issued a voluntary evacuation order.⁴² (According to *Times-Picayune* reporter Bruce Nolan, Nagin was hesitant to issue a mandatory evacuation order because of the possibility that hotels and businesses would sue the city for lost trade—a charge Nagin vehemently denied.⁴³) An hour before the mayor’s declaration, state police activated the state’s contraflow plan, which allows traffic to use both sides of I-55, I-59, and I-10 to leave the city.

Federal officials appeared to be responding to the hurricane center's increasingly strident warnings as well. On Saturday, August 27, from his vacation home in Texas, President Bush declared a state of emergency for the Gulf Coast, authorizing the Department of Homeland Security and FEMA to "coordinate all disaster relief efforts which have the purpose of alleviating the hardship and suffering caused by the emergency on the local population." On Sunday, after being told by the National Hurricane Center that Katrina's storm surge was likely to top the levees, FEMA Director Michael Brown convened a videoconference with disaster-management officials in Louisiana, Mississippi, and Alabama, as well as the president and Homeland Security Secretary Michael Chertoff. While awaiting information from the state about precisely where to deploy supplies and specialized personnel, Brown proceeded to have generators, tarps, and stockpiles of water, ice, and ready-to-eat meals delivered to bases around the Gulf Coast. He also dispatched twenty-three medical assistance teams and seven search-and-rescue teams to the region.⁴⁴

At 1 a.m. on Sunday, August 28, as predicted, Katrina was declared a Category 4 hurricane, with sustained winds of more than 140 mph. Six hours later it was upgraded to a "potentially catastrophic" Category 5 storm with sustained winds above 155 mph and a storm surge of fifteen to twenty feet topped by large, dangerous waves. At that time, it was the strongest hurricane ever recorded in the gulf.⁴⁵ Finally, at 10 a.m., Mayor Nagin ordered a mandatory evacuation and warned residents that floodwaters could top the levees. For those who could not evacuate (prequalified special-needs residents), the city provided transportation on Regional Transit Authority (RTA) buses to the Superdome, a covered sports stadium and the only building in the city designed to withstand a severe hurricane. Municipal officials publicized the twelve pickup points on TV and radio and by shouting through megaphones on the streets.⁴⁶ Those heading to the Superdome were told to bring enough food, water, and medicine to last five days—a requirement that disaster management experts generally regard as unrealistic.

The vast majority of the city's 485,000 residents heeded the orders to evacuate, and traffic was at a crawl leaving the city late Saturday and into Sunday. By 3 p.m. on Sunday, about 10,000 people had taken shelter at the Superdome. An estimated 100,000 residents remained in their homes, however.⁴⁷ Some stayed because, having survived Hurricane Betsy, they were confident they could ride out another storm. Others were worried they would have nothing to come back to if they did not stay and protect their property. Still others were resigned to whatever fate the storm dished out. But many simply lacked the resources to evacuate: the storm came at the end of the month, when the city's poorest were out of cash and so were unable to pay for gas, food, or hotel rooms, and those who were native-born residents typically did not have relatives in nearby states who could take them in. In any case, approximately 51,000 New Orleans residents (28 percent of the adult population) did not have cars.⁴⁸ Local officials knew that the least mobile residents lived in some of the most flood-prone parts of town; they were aware that water rescues were likely.⁴⁹

By the time the 460-mile-wide Hurricane Katrina made landfall at Buras, Louisiana, at 6:10 a.m. Monday, it had been downgraded from a Category 5 to a

Category 4 storm; nevertheless, it was bearing down on New Orleans packing 127-mph winds and pushing a storm surge of up to twenty-eight feet.⁵⁰ For eight straight hours, wind and heavy rains lashed the city, uprooting trees and tearing roofs and siding off houses. At 11:37 a.m., the National Weather Service issued an advisory, saying, “Widespread flooding will continue. . . . Those seeking refuge in attics or rooftops are strongly urged to take the necessary tools for survival.”⁵¹ By midafternoon, however, it appeared to many in New Orleans as though the worst was over: as of 9 a.m. the eye of the storm had passed 100 miles to the east, most city streets were dry, and newspapers around the country crafted headlines to the effect that “New Orleans Dodged a Bullet.” But the sigh of relief was premature; in fact, water had begun rising throughout the city early that morning, and by late afternoon it was painfully clear that the levees surrounding the city had been breached.⁵² Houses in the Lower Ninth Ward were inundated, and many residents had climbed onto their roofs to escape the rising waters.

By Tuesday, August 30, the city was a disaster zone. Engineers were struggling to repair massive breaks in the levees that separated New Orleans from Lake Pontchartrain, dropping 3,000-pound sandbags into a 300-foot-and-growing gap in the flood wall along the 17th Street Canal and two more on the London Avenue Canal. (This tactic had little impact on the breaches.) In the meantime, thanks to the combination of the storm surge and heavy rainfall, the surface of Lake Pontchartrain was nine feet above sea level, and water was pouring through breaches. Levees had also failed along the 80-year-old Industrial Canal, funneling water into the Lower Ninth Ward, New Orleans East, and St. Bernard Parish. The floodwaters had caused the city’s twenty-two pump stations to fail, making it impossible to drain water out of the streets; as a result, 80 percent of the city was submerged, with water levels in some neighborhoods twenty feet deep and rising as fast as three inches per hour. Only a narrow band containing the French Quarter and parts of Uptown—the same strip that was settled by Bienville almost 300 years earlier—remained dry.

The official response to the news of widespread flooding was chaotic. Late in the day on Monday President Bush had declared a major disaster in Louisiana, thereby making federal funds available for relief and recovery. FEMA chief Brown had arrived at the Emergency Operations Center in Baton Rouge, but FEMA search-and-rescue teams had difficulty getting into flooded areas. The U.S. Coast Guard was deploying helicopters to pluck people from rooftops, while personnel from the Louisiana Department of Wildlife and Fisheries conducted rescue operations by water. National Guard and wildlife officials ferried people to the Superdome by trucks. But the scale of the devastation quickly overwhelmed the capabilities of government response teams, which were severely hampered by an inability to communicate with one another: federal, state, and local officials were using incompatible equipment; different agencies used different radio frequencies; and power, cable, and telephone service had been knocked out.

As officials struggled to respond, conditions in the city deteriorated. Inside the Superdome, where some 23,000 people had taken shelter, the heat and humidity were stifling (power had gone out even before the storm hit on Monday morning),

toilets overflowed, and food and water were scarce. As the heat inside soared above 100 degrees, the stench became overpowering; the elderly, sick, disabled, drug addicted, and mentally ill began to break down.⁵³ Late on Tuesday, Governor Blanco announced that everyone needed to be evacuated from the city, including those in the Superdome, but there were not enough buses on hand to carry out her order. As the promised buses repeatedly failed to appear, despair mounted.

Throughout the rest of New Orleans, electricity was sporadic and looting was widespread. Although there was scattered theft of luxury items and reports of armed gangs looting the Walmart in the Lower Garden District, most of the stealing was done by people desperate for food and water.⁵⁴ Nevertheless, media coverage treated black and white looters differently, focusing on the former and exacerbating racial tension. Reports of widespread theft and violence caused FEMA to hold back rescue workers who might be imperiled. More worrisome from the perspective of those trying to evacuate trapped residents was the fact that in various parts of the city, including at the Charity Hospital, sniper shots had been fired.⁵⁵ Lacking the resources to maintain order and fearing for their own safety, some New Orleans police officers fled, while others joined in the looting.⁵⁶

By Wednesday, August 31, New Orleans had descended into chaos. Besieged rescuers—including citizen volunteers from surrounding parishes and, eventually, other states—were dropping people off anywhere that was dry. Overpasses, parking lots, and highway ramps became scenes of intense suffering, as people—many of them elderly and disabled—waited for help in the sweltering heat without food, water, or medical supplies. Fires broke out in empty buildings, and without water pressure firefighters were unable to respond, so a smoky pall hung over the city. Heightening concerns about the safety of rescue workers, Police Superintendent P. Edwin Compass III told journalists stories of gangs attacking tourists and beating and raping them in the streets—stories he later confessed were exaggerated.⁵⁷ Stranded travelers continued to arrive at the Superdome; after being turned away, they went to the Morial Convention Center, where frustrated evacuees had broken in and set up camp. (Eventually, some 22,000 evacuees were camped in and around the convention center awaiting transportation out of the city.) Like the Superdome, the convention center lacked working toilets, clean water, or electricity. Moreover, because it had been occupied spontaneously, there was inadequate security and people had not been searched for weapons, so many observers portrayed it as dangerous. Desperate to restore order, Governor Blanco made an urgent appeal to President Bush for federal troops. She also ordered the city's remaining police officers to stop engaging in search and rescue and focus on keeping the peace.

Late on Wednesday, Mayor Nagin reiterated the governor's order for a total evacuation of the city, but—after a frantic search—state officials were able to come up with only ten buses to bring evacuees to Houston. By Thursday, although Bush assured the nation that assistance was on its way to New Orleans, local officials were clearly at their wits' end with the pace of the federal response. Mayor Nagin estimated that 50,000 survivors remained on rooftops or in shelters awaiting rescue and evacuation. He issued a plea for help, saying, "This is a desperate SOS. We are

out of resources at the convention center.”⁵⁸ Finally, on Friday—five days after the storm hit—more National Guard units and active-duty federal troops arrived to help regain control of the convention center and restore order to the city. Even as the Coast Guard continued to pluck survivors from rooftops and attics, a large contingent of buses arrived to evacuate residents. Fifty trucks carrying food and water and other supplies—the first to reach the storm victims at the convention center—rolled into the city. And the floodwaters began to recede. On Saturday President Bush ordered 7,000 active-duty soldiers from the 82nd Airborne and the 1st Cavalry divisions to the region, and they began arriving later that day.

The Aftermath

By Monday, September 5, a week after the hurricane struck, the rescue and relief operation appeared to be running relatively smoothly. The Corps had successfully patched the levee breaches at the 17th Street and London Avenue canals and were carefully pumping water out of the city into Lake Pontchartrain.⁵⁹ Residents of relatively dry neighborhoods were being allowed to return to their houses temporarily to see what they could salvage. Although conditions were improving, only around 10 percent of the city’s pumping capacity was operational, and many neighborhoods remained under ten feet of water. On September 7, on orders from Mayor Nagin, New Orleans police officers, fire department officials, and military personnel began trying to compel the estimated 5,000 to 10,000 residents remaining in the city to leave, even those in undamaged homes, on the grounds that the risks posed by waterborne diseases and gas leaks were too great.

By the beginning of the third week after the storm, Coast Guard Vice Admiral Thad W. Allen had replaced FEMA Director Brown as overseer of the post-Katrina relief effort—a tacit admission of the federal government’s culpability. Search-and-rescue missions continued. Flights were slated to resume in and out of the Louis Armstrong International Airport after a sixteen-day hiatus. And work was scheduled to begin on repairs to the extensively damaged I-10. Mail service was resuming in patches. Twenty-seven permanent pumps and forty-six temporary pumps were removing a total of 7 billion to 8 billion gallons of water daily;⁶⁰ as a result, the city was draining faster than expected and was likely to be dry within weeks, not months as originally forecast.

Nevertheless, the city faced numerous long-term challenges as it began to contemplate large-scale reconstruction. The water and sewer infrastructure had suffered massive damage: drinking water was leaking underground, probably because uprooted trees and fire hydrants had broken water mains, and pipes were likely full of toxic material. Untreated sewage was expected to seep from broken pipes for months; what sewage the city could collect it had to pump untreated into Lake Pontchartrain and the Gulf of Mexico. Restoring electricity was expected to be slow as well, as underground conduits and soaked transformers needed to be repaired, and then the wiring in each house and building had to be inspected. The transportation network was in disarray. Schools, police stations, and hospitals were moribund.⁶¹

Meanwhile, discussions were under way about how to more effectively help those rendered homeless by the storm. FEMA had begun to issue debit cards worth \$2,000 to the 335,000 evacuees to enable them to pay for living expenses.⁶² According to the Red Cross, some 36,000 Red Cross volunteers were providing food, shelter, and other emergency help to about 160,000 Katrina evacuees at 675 shelters in twenty-three states.⁶³ But more permanent solutions were needed, and to that end FEMA ordered 50,000 trailers and mobile homes to be placed in “trailer cities” throughout Louisiana. Proposals for massive trailer parks sparked resistance among officials from surrounding parishes, who feared the additional burden on their already strained finances.

While FEMA struggled to meet the pressing needs of displaced residents, officials at every level sought to assign blame for the debacle in New Orleans. The finger pointing began on Sunday, September 4, as soon as the initial panic abated. Homeland Security chief Chertoff told reporters that federal officials had not expected the damaging combination of powerful hurricane winds and levee breaches that flooded New Orleans—a claim that was belied by the warnings issued by the National Hurricane Center, the devastating results of the Hurricane Pam exercise, and the existence of a forty-page report, submitted via e-mail to the White House Situation Room at 1:47 a.m. on August 29, that made remarkably accurate predictions about Katrina’s impacts.⁶⁴ Although FEMA officials were surveying the scene from helicopters within twenty-four hours of the storm, Chertoff had continued to insist that they were unaware of the scale of the devastation.⁶⁵ Rather than acknowledge their responsibility, federal officials disparaged Governor Blanco’s leadership and faulted Mayor Nagin for failing to order a mandatory evacuation earlier, not delivering a more urgent and detailed request for assistance, and declining to commandeer buses to transport residents in the Superdome and convention center out of the city.

For his part, while acknowledging that some of the criticism was warranted, the mayor insisted that logistical hurdles made it difficult to use the available buses. He argued that there were not enough buses for the number of people remaining in the city, there were few places dry enough to stage the buses that were available, and flooded roads would have prevented the buses from leaving anyway. State and local officials insisted that FEMA was the real problem; it had not only failed to deliver urgently needed food and ice but had thwarted rescue and medical efforts by private citizens and officials from other agencies.

Even as New Orleans struggled to regain some semblance of normalcy, four weeks after Katrina hit, New Orleans faced a new menace: Hurricane Rita was brewing offshore and threatened to inflict more damage on the tattered city. After barreling across the gulf, Rita struck on Friday, September 23, bringing floodwaters back into New Orleans. Although its main impacts were felt in southwestern Louisiana, Rita’s heavy rains and five-foot storm surge overwhelmed the patch on the Industrial Canal, reflooding the Lower Ninth Ward and St. Bernard Parish. Parts of Lakeview and Gentilly saw one to two feet of water, mainly because the pump stations that normally drained those areas were temporarily shut down to lighten the load on the Corps’ makeshift dams on the 17th Street and London Avenue canals.

Fortunately, pump operators were able to drain reflooded areas relatively quickly, and by the following week commerce in New Orleans was picking up, as people began to return. Upon arriving, however, residents beheld a massive and daunting cleanup: the city had to dispose of an estimated 50 million cubic yards of debris. There were piles of rotting food and other foul-smelling garbage piled indiscriminately throughout flooded neighborhoods; smashed, waterlogged cars and stranded boats littered the streets; an estimated 300,000 refrigerators, freezers, stoves, and other “white goods” needed to be collected and recycled; and there were 5.5 million pounds of hazardous waste, from paint thinner to bleach, awaiting proper disposal.⁶⁶ A further concern was the thick cake of mud that coated almost the entire city. That mud had mixed with an unknown assortment of hazardous materials during the flood; it was potentially harmful as it dried and turned to dust and became airborne, or as people came into direct contact with it. The Louisiana Department of Environmental Quality insisted the residue was safe, but environmentalists remained concerned about elevated levels of lead and arsenic, pesticide residues, and hazardous chemicals generated by the incomplete combustion of petroleum products.

What Happened, and Why?

Efforts to sort out exactly why Katrina was such a debacle began within a week of the storm, and it quickly became a truism to say that Hurricane Katrina was a human-made, rather than a natural, disaster. New Orleans’ levees had breached in more than a dozen locations, but discerning the causes at each site was complicated. Gradually, investigators obtained evidence that revealed how the city’s flood-protection system had failed.⁶⁷ By all accounts, the Corps had made a host of design choices that reduced the ability of New Orleans’ flood-control system to withstand a major hurricane. For example, the Corps decided to use flood walls, rather than wider earthen levees, to line the canals because it was reluctant to condemn property adjacent to the canals. “Usually, there are homes right up against the canal,” explained Corps project manager Al Naomi.⁶⁸ “You have to relocate five miles of homes [to build a levee], or you can build a floodwall.” Moreover, constructing a levee would have required building further into the canal itself, reducing the volume of water it could handle.

In many places the Corps also decided to use I-shaped walls instead of T-shaped walls, even though the latter, which have a horizontal section buried in the dirt, are generally stronger and more stable. But T walls are more expensive and, like levees, require additional land and a broad base of dense soil for support. In addition, the canal walls were built in ways that left them potentially unstable in a flood: some rose as high as eleven feet above the dirt berms in which they were anchored, even though a Corps engineering manual cautioned that such walls should “rarely exceed” seven feet because they can lose stability as waters rise.⁶⁹

But the most serious flaws in the Corps’ design and execution concerned the depth of the steel pilings and the soil into which they were driven. To save money,

the sheet piling was driven only 17.5 feet deep at 17th Street and 16 feet deep at London Avenue.⁷⁰ Yet soil-boring data revealed a five- to twenty-foot-thick layer of spongy peat soil starting at fifteen to thirty feet beneath the surface.⁷¹ Tests showed the peat soil to be unusually weak and to have a high water concentration, making it extremely vulnerable in a flood.⁷²

Corps investigators concluded that even before Katrina's eye had crossed land, her storm surge had raised the water level in the Industrial Canal, forcing the flood walls outward and opening up a gap between the wall and its earthen base. As water coursed through the gap, the wall tipped over and water poured into eastern New Orleans and Gentilly to the west.⁷³ Despite the break, the water in the canal continued to rise, eventually spilling over both sides of the fourteen- to fifteen-foot levee (see Map 16.1).⁷⁴

Then, as Katrina moved east of New Orleans, pushing a storm surge from the gulf, its winds shifted counterclockwise and drove the high water in Lake Pontchartrain south, reversing the flow in the drainage canals. Rising water put enormous pressure on both sides of the 17th Street Canal, pushing the walls outward. That movement opened a small space between the flood wall and its earthen levee. The gap quickly widened, as the pressure increased and the weak and unstable soils under the levee base became saturated. At around 10 a.m., the soil beneath the flood wall finally gave way, and eight fifty-foot concrete panels broke away with it.⁷⁵ An hour later, two breaches opened up in the London Avenue Canal, as soils gave way and flood walls collapsed.

In November 2005, Professor Raymond Seed, a civil engineer at the University of California, Berkeley and one of the heads of a team of experts financed by the National Science Foundation (NSF), told the Senate Homeland Security and Governmental Affairs Committee that the weakness and instability of the area's soils should have prompted the Corps to raise the safety factor it used in designing the Lake Pontchartrain and Vicinity levee system. In fact, the Corps used a safety factor of just 1.3—a standard that was appropriate for farmland but not for a densely populated urban area.⁷⁶ Robert Bea—also an engineering professor at the University of California, Berkeley, and cohead of the NSF team—added that malfeasance during construction of the flood-control system may have contributed to the levee failures, although the Corps' review, released in early June 2006, found “no evidence of contractor negligence or malfeasance.”⁷⁷ The LSU team commissioned by the state similarly concluded that the conditions that caused the canal flood wall failures should have been obvious to the engineers that designed them. The Corps initially argued that Katrina had exceeded the forces the system was designed to withstand, but it admitted responsibility after federal meteorologists pointed out that the sustained winds over Lake Pontchartrain only reached 95 mph, well below those of a Category 3 hurricane.⁷⁸

Although deeply culpable, the Corps did not bear sole responsibility for the weaknesses in the flood-control system; both the Louisiana congressional delegation and local officials—particularly the Orleans Levee Board and the Sewer and Water Board—had resisted measures to shore up the system and frequently

supported diverting funds to projects that would yield more tangible economic benefits.⁷⁹ For instance, early on the Corps had proposed building gates to prevent water from the Gulf of Mexico from reaching Lake Pontchartrain and flooding the canals. That project was delayed by a lawsuit filed by the environmental group Save Our Wetlands, Inc., which contended the Corps had failed to study the project's ecological impacts. Most accounts blame environmentalists for blocking the floodgates, but many other entities—including state legislators, members of Congress, and *The Times-Picayune*—opposed the plan as well. Ultimately, the levee board supported the Corps' decision to abandon the floodgate approach and instead raise the levees along the lake and the Mississippi River and add flood walls on the canals. (The Corps' analysis subsequently confirmed that the levees would be as effective as gates and would be less expensive.)

The Corps had also recommended building butterfly gates at the end of each of the city's drainage canals. But in 1990 officials from the New Orleans Sewer and Water Board and the levee board vetoed that proposal, arguing that the gates would make it more difficult to pump water out of the city. They hired an engineer to devise an alternative approach that involved building higher walls along the canals—a plan they persuaded the Corps to adopt. In addition, the levee board convinced the Corps to employ a 100-year rather than a 200-year standard as the cost of the project escalated.⁸⁰

Another egregious lapse that reflected badly on both local officials and the Corps was the lack of serious inspections and routine maintenance of the levee system. Shortly after the storm, *The Times-Picayune* reported that almost a year before Katrina hit, some residents near the 17th Street Canal levee had complained to the Sewer and Water Board that their yards were repeatedly filling with water.⁸¹ Others had reported leaks or sand boils, both indications of water running under the surface of the levee. But either no one came to investigate or those who did declined to follow up. Similarly lackadaisical were the cursory annual inspections by officials from the Corps, the levee board, and the state Department of Transportation and Development. Those affairs usually lasted a mere five hours or less and consisted mostly of photo ops and fancy lunches.

Compounding the levee failures was the lack of preparedness of government at every level once the storm actually hit. At the local level, Colonel Terry Ebbert, director of New Orleans' Office of Homeland Security and Public Affairs, had decided to make the Superdome the city's only shelter, assuming that people would be taken to better-equipped shelters outside the metro area within forty-eight hours. As the water started to rise, however, it became clear that no provision had been made to transport the evacuees. Most of the city's RTA buses had been placed at a facility on Canal Street that officials (mistakenly) believed would stay dry. Some buses parked on the waterfront did escape flooding, but as the waters rose it became difficult to move them to designated staging areas. When it became apparent that FEMA had not wrangled any buses either, Governor Blanco's staff began scrambling to find some. But as news of violence and looting was broadcast, local officials began to resist lending New Orleans their school buses; in any case, many

of the operators were afraid to drive in the rising waters. FEMA finally identified a supply of buses, but it took three days to put together a fleet that could begin moving people out; as a result, nearly a full week elapsed before the last people were evacuated from the convention center.

The complex relationships among local, state, and federal governments only made matters worse. According to journalist Eric Lipton and his colleagues, the crisis that began with the failures of the flood-control system deepened because of “a virtual standoff between hesitant federal officials and besieged authorities in Louisiana.”⁸² From the outset, negotiations among local, state, and federal officials were contentious and miscommunication was common. The main source of conflict was the question of who ought to have final authority over the relief effort.⁸³ Federal officials awaited direction from the city and state, while local officials, overwhelmed by the scale of the storm, were not only incapable of managing the crisis but unable to specify what they needed to deal with it.

For example, on August 29, when President Bush phoned Governor Blanco, she told him, “We need everything you’ve got”—a request that apparently was insufficiently precise to prompt him to order troops to the region. Two days later, when Blanco specifically asked the president for 40,000 soldiers to help quell the rising unrest in the city, Bush’s advisers debated whether the federal government should assume control over the relief effort, ultimately concluding that Bush should try to seize control of the National Guard troops. The White House proceeded to send Blanco an urgent request, in the form of a memorandum of understanding, to allow Bush to take charge of the guard. The governor refused to sign, however, arguing that to do so would have prohibited the guard from carrying out law-and-order activities. According to journalist Robert Travis Scott, Blanco’s advisers were concerned about the White House spin if the president took control.⁸⁴ For their part, the president’s advisers worried about the political fallout of federalizing the relief operation. Ultimately, the White House decided to expedite the arrival of a large number of National Guard personnel, including many trained as military police, who would operate under the direction of the governor; only belatedly did the president order federal troops to the scene.

Beyond the tensions associated with federalism, organizational issues within FEMA hampered the relief effort. Local officials expected the federal government to provide rapid and large-scale aid, but FEMA was bogged down in legal and logistical questions; cumbersome rules, paperwork, and procedures stymied efforts by volunteers, the National Guard, and first-response teams to react. In large measure FEMA’s organizational dysfunction was a product of its history. Created in 1979 by President Jimmy Carter, FEMA was a dumping ground for patronage appointments under Presidents Ronald Reagan and George H. W. Bush; as a result, it quickly earned a reputation for incompetence. President Bill Clinton broke with tradition: he appointed James Lee Witt, a highly regarded disaster management expert who had served as chief of the Arkansas Office of Emergency Services, to lead the agency, before elevating the FEMA head to a cabinet-level post in 1996. Witt proceeded to professionalize the agency and dramatically improve its performance. But President

George W. Bush returned to the practice of appointing political loyalists. As a consequence, when Katrina struck, five of the top eight FEMA officials had come to their posts with no experience in handling disasters.⁸⁵ Moreover, after the 2001 terrorist attacks, FEMA had been subsumed within the newly created Department of Homeland Security. No longer a cabinet-level agency, FEMA was diverted by terrorism threats and saw morale among its disaster-management experts plummet. Even the notoriously incompetent Brown had warned that FEMA was not up to the task of dealing with major disasters because of budget and personnel cuts.⁸⁶

Rebuilding and Conflicting Ideas About Restoration

Savvy political actors are well aware that disasters are focusing events of the first order. They can open particularly wide policy windows in which advocates can attach their preferred solutions to newly salient problems.⁸⁷ So it was not surprising when, on August 30, the New Orleans *Times-Picayune* reported that Louisiana politicians were seizing on the damage wrought by Hurricane Katrina to press for long-requested federal assistance in shoring up the state's coastline.⁸⁸ In particular, they wanted emergency financing and fast-track permitting for a \$34 billion hurricane-protection and coastal restoration plan that would cover all of southeast Louisiana.⁸⁹ Beyond the \$14 billion coastal restoration long advocated by the state, the proposal included a system of levees tall enough to withstand the twenty-foot storm surges expected with a Category 5 hurricane; floodgates at the Rigolets and Chef Menteur passes into Lake Borgne, as well as on human-made waterways; gates at the mouth of the city's drainage canals; and relocation of pump stations to the lakefront combined with replacement of canals with underground culverts so lake surges could not penetrate the city. There was no need for the Corps to conduct its usual cost-benefit test, proponents argued; Katrina had already provided one.

Not everyone believed that a massive coastal restoration plan made sense. According to journalist Cornelia Dean, scientists disagreed about how much of a difference coastal marshes actually make in blunting hurricanes.⁹⁰ Geologists Robert Young and David Bush pointed out in an op-ed that neither more wetlands nor rebuilt barrier islands would have mitigated the damage from Katrina, most of which arose because of a storm surge from the east.⁹¹ They also observed that the restoration plan did not address the root causes of wetlands loss: human-made alteration of the Mississippi River that has reduced the amount of sediment flowing into the marshes by as much as 80 percent, the saltwater allowed in by navigation canals that cut through the delta, and a lowering of ground levels throughout the region brought on by a combination of natural forces, urban drainage, and industrial activities. Young and Bush noted the irony of calling for higher levees, which exacerbate the loss of wetlands by preventing flooding that brings sediment. In any case, they added, with rising sea levels any recreated wetlands would soon be under water. Even the National Academy of Sciences, in its report on the restoration proposal, acknowledged that although the plan's components were scientifically sound, they would reduce annual wetland loss by only 20 percent.⁹²

There was even more skepticism about the idea of a Category 5 hurricane-protection system. Some observers argued it was folly to try to armor the city, given what appeared to be its inevitable trajectory. They pointed to a 2005 article in the journal *Nature*, which reported that the city and its levees were sinking faster than previously believed—an inch a year in some places—and some parts of the levee system were three feet lower than intended.⁹³ Nevertheless, in November 2005, Congress agreed to spend \$8 million for an “analysis and design” of an enhanced hurricane-protection system for Louisiana, as part of a \$30.5 billion fiscal year 2006 spending bill for the Corps. Congress gave the Corps six months to submit a preliminary report on “a full range of flood control, coastal restoration, and hurricane-protection measures” capable of protecting southern Louisiana from a storm. A final report was due in twenty-four months. Most observers acknowledged, however, that neither the president nor Congress seemed to have the stomach for Category 5 protection; rather, they seemed inclined to favor Category 3 protection and incremental improvements over time.⁹⁴

Most contentious of all, though, were debates over rebuilding the city itself. Shortly after the hurricane, a growing chorus of observers suggested that rebuilding New Orleans should involve more than simply raising levees, building new homes, and returning to the status quo. In an op-ed piece in *The New York Times*, geographer Craig Colten argued that “to rebuild New Orleans as it was on Aug. 29 would deal a cruel injustice to those who suffered the most in recent days. . . . Those who rebuild the city should try to work with nature rather than overwhelm it with structural solutions.” To this end, he suggested, “The lowest-lying parts of the city where the waters stood deepest should be restored to the wetlands they were before 1700, absorbing Lake Pontchartrain’s overflow and protecting the rest of the city.”⁹⁵ Harvard geologist Dan Schrag told Cornelia Dean that “there has to be a discussion of what responsibility we have not to encourage people to rebuild their homes in the same way.”⁹⁶ And *New York Times* business columnist Joseph Nocera argued that it was likely that the city would shrink, and that was a good thing. New Orleans’ population, he said, was too large for the jobs its economy generated, which was one reason the city was so poor.⁹⁷

Among the specific suggestions floated early on were massive landfilling, government seizure of property, and bulldozing of flood-prone neighborhoods.⁹⁸ Neighborhoods such as eastern New Orleans and Lakeview could be elevated to ten feet above the water line, making them less susceptible to flooding. All houses could be rebuilt to tougher building codes. The city as a whole could be modernized. Low-income housing, already blighted, could be razed. Underpinning such ideas was the notion that post-Katrina New Orleans was a clean slate, and there was a historic opportunity to undertake smarter planning.

Proposals to “rebuild smart” and “shrink the footprint” of New Orleans immediately encountered resistance, however, from historic preservationists, property rights activists, social justice advocates, and residents of neighborhoods that would be demolished. For example, geographer Michael E. Crutcher pointed out that a “smarter” New Orleans—that is, one that was denser and had more wetlands and a

functional mass-transit network—would not belong to the people who lived there before.⁹⁹ Beverly Wright, a sociologist at Xavier University, reacted furiously to the suggestion that some neighborhoods should not be rebuilt, pointing out that there was no discussion of abandoning the Florida coast, which was hit every year by hurricanes.¹⁰⁰ Many displaced residents suspected that Mayor Nagin and his allies in the business community hoped to discourage New Orleans' poorest residents from returning. In response to the furor, the city council passed a defiant resolution saying, "All neighborhoods [should] be included in the timely and simultaneous rebuilding of all New Orleans neighborhoods."

In hopes of providing some guidance to the rebuilding, on September 30, 2005, Mayor Nagin appointed a seventeen-member Bring New Orleans Back Commission (BNOBC), led by Joseph Canizaro, a prominent conservative real estate developer with ties to the Bush White House, and charged it with developing a master plan for the redevelopment. At Canizaro's behest, the Washington, D.C.-based Urban Land Institute (ULI) agreed in mid-October to advise the commission pro bono.¹⁰¹ In mid-November the thirty-seven-member ULI team traveled to New Orleans to tour the city and meet with residents; it also conducted town hall meetings in Houston, Baton Rouge, and other cities where evacuees were housed temporarily. In mid-November the panel issued its recommendations. It recommended that the city, having lost most of its tax base in the evacuation, turn its finances over to a municipal oversight board. It also advised creating a new redevelopment agency, the Crescent City Rebuilding Corporation, that could engage in land banking, buy homes and property, purchase and restructure mortgages, finance redevelopment projects, issue bonds, and help with neighborhood planning. They proposed restoring slivers of wetlands throughout the city, especially in low-lying areas, to enhance flood control. Most controversially, the ULI experts said the city should use its historic footprint, as well as lessons learned from Katrina, as guides in determining the most logical areas for redevelopment; the result would be to focus in the near term on rebuilding neighborhoods that suffered the least damage from post-Katrina flooding: the highest and most environmentally sound areas. For some of the lowest-lying areas—such as eastern New Orleans East, Gentilly, northern Lakeview, and parts of the Lower Ninth Ward—the city should consider mass buyouts and a transition to green space.¹⁰²

Aware that the ULI report might cause a stir, in mid-December the BNOBC endorsed the idea of shrinking the city's footprint, but it modified its implementation to make it more palatable to homeowners who wanted to rebuild in low-lying areas.¹⁰³ At first, the commission floated the idea of allowing residents to rebuild anywhere and then, if a neighborhood was not developing adequately after three years, buying out the rebuilt homes and possibly condemning whole neighborhoods. The nonprofit watchdog group the Bureau of Governmental Research was strongly critical of this *laissez-faire* proposal and urged city leaders to come up with a realistic and smaller footprint on which to build New Orleans.¹⁰⁴ In response to such criticism, the BNOBC's final report—unveiled on January 11, 2006—suggested that Nagin put a moratorium on building permits in devastated areas and give residents

four months to craft plans to revive them. A plan would have to be approved before residents could move back in. The commission also endorsed the idea of massive buyouts of residential property in neighborhoods that did not come up with an acceptable plan or attract sufficient development within a year; those areas would be transformed into open space. To help it succeed, each neighborhood would have access to teams of planners and other experts. (That said, it was never clear where residents would live while sorting out the fate of their neighborhoods, nor how they would rebuild without basic services.) The Louisiana Recovery Authority, a twenty-six-member commission established in mid-October by Governor Blanco to disburse \$2.6 billion in federal rebuilding money, said the BNOBC plan struck the proper balance between residents' self-determination and tough choices.

But the BNOBC recommendations, and particularly a map that appeared on the front page of *The Times-Picayune* depicting neighborhoods slated for conversion as green dots, infuriated exiled residents, who pointed out that wealthy Lakeview—although badly flooded—did not receive a green dot. This plan will create a “whiter, richer, and less populated New Orleans that excludes the very kinds of people that give New Orleans its character and its culture,” railed Martha Steward of the Jeremiah Group, a faith-based community organization.¹⁰⁵ Ultimately, the BNOBC planning exercise accomplished little beyond galvanizing opposition—but it did that with stunning effectiveness. Tulane geographer Richard Campanella describes the period that followed the BNOBC presentation as “one of the most remarkable episodes of civic engagement in recent American history.”¹⁰⁶ Some residents had begun meeting within weeks of the storm. Starting in late January, however, scores of new organizations formed to take stock of their neighborhoods, while residents poured into meetings of existing organizations. “Despite their tenuous life circumstances,” says Campanella, “New Orleanians by the thousands joined forces with their neighbors and volunteered to take stock of their communities; document local history, assets, resources, and problems; and plan solutions for the future.”¹⁰⁷ Soon, umbrella organizations sprang up to coordinate the work of these ad hoc groups.

Political officials responded with alacrity to residents' ire. Mayor Nagin, who was facing reelection and was concerned that negativity would scare away business, all but disavowed the ULI/BNOBC report.¹⁰⁸ Two months earlier Nagin had made a firm commitment to rebuild the Lower Ninth Ward and New Orleans East after testimony before Congress suggested uncertainty about the future of those areas.¹⁰⁹ The city council also rejected the ULI approach, instead resolving that “[r]esources should be disbursed to all areas in a consistent and uniform fashion.”¹¹⁰ Former mayor Marc Morial weighed in as well, delivering a speech in early January that called for a return of all residents to the region.¹¹¹ In February, while the BNOBC was still working, the city council initiated its own neighborhood planning process, engaging Lambert Advisory, a Miami-based planning consultancy. The Lambert planning process focused exclusively on flooded neighborhoods.

That summer, in hopes of devising a plan that would pass muster with the Louisiana Recovery Authority, which was disbursing infrastructure funding, the city planning commission instigated yet another, more “democratic” process.

On August 1, backed by \$3.5 million from the Rockefeller Foundation, the Greater New Orleans Foundation convened a series of public meetings in which groups representing more than seventy neighborhoods were asked to choose from among fifteen expert teams to help them craft rebuilding plans.¹¹² There were no comprehensive guidelines for the bottom-up process; instead, the idea was to weave the individual proposals into a citywide master plan. In late January 2007 the results of the citizen-driven planning process were released in the form of a 555-page Unified New Orleans Plan (UNOP).¹¹³ This plan left all areas of the city open to redevelopment and proposed a host of new projects—libraries, schools, transportation, flood protection, and other amenities—valued at \$14 billion. It left unclear, however, where the resources or capacity to carry out such an ambitious agenda would come from; moreover, its elements were not unified by a coherent vision of the city's future. Nevertheless, the city council approved the UNOP in June 2007, ultimately merging it with the Lambert plan.

In early December 2006, as citizens were finalizing elements of the UNOP, Mayor Nagin appointed Professor Edward J. Blakely, former chair of the Department of Urban and Regional Planning at the University of California, Berkeley, to coordinate recovery efforts for the city. In late March 2007 Blakely issued a third redevelopment plan that identified seventeen compact zones where the city would concentrate resources to stimulate reinvestment and renewal. Fourteen of the seventeen areas were in the more promising and less flooded western portion of the city. Priced at about \$1.1 billion, Blakely's plan was notably more modest than its predecessors; its aim was to encourage commercial investments rather than to define particular areas as off limits.¹¹⁴ Despite its relative modesty, even Blakely's plan faced daunting obstacles.

The proliferation of planning efforts notwithstanding, most of the redevelopment that subsequently occurred was piecemeal. Through the summer and fall of 2007 rebuilding continued in a haphazard way, resulting in precisely the “jack-o'-lantern” pattern of redevelopment that planners had hoped to avoid. Whole blocks in the Central Business District were quiet, and the downtown hospital complex remained shuttered. The poorest neighborhoods appeared abandoned. The state did not have the funding for Road Home, its federally financed homeowners' aid program, so by late 2007 only about one in five applicants had actually received money. In the spring of 2008, a full year after Blakely's plan was released, the city's designated redevelopment zones had changed hardly at all. Blakely, who had been given broad authority over a staff of 200 and jurisdiction over eight agencies, explained that federal money had been slow in arriving.¹¹⁵ A year later, he resigned.

In addition to the challenge of obtaining funds, ongoing uncertainty about the security of the levee system complicated the rebuilding process. In late September 2005 the Corps created Task Force Guardian to oversee interim repairs to the levees and plan how to restore the system to its pre-Katrina level of protection, which was the limit of its authority. That project involved fixing 170 miles of damaged or destroyed levees, canals, and flood walls—more than half the system—by June 1, 2006, the start of the next hurricane season. By the two-year anniversary of Katrina

the Corps had spent \$7 billion on levee-system repairs out of a total of \$15 billion it expected to spend by 2013.¹¹⁶

Uncertainty about the levee system in turn delayed FEMA's release of new floodplain maps designating which areas and structures the federal government would insure against floods.¹¹⁷ Homeowners who wanted to rebuild before the final maps were issued could renovate without raising their floor levels—a costly process—if their homes met the “baseflood elevation” required in the 1984 maps or if they did not have “structural damage”—that is, if their home had not lost 50 percent or more of its pre-Katrina value. Those who followed these rules could not be dropped from the National Flood Insurance Program, and their flood insurance premiums could not rise more than 10 percent per year. In June 2007, after nearly two years of work, the Corps released a map showing block-by-block where flooding was likely to occur if a 100-year hurricane were to strike. The maps reflected improvements to the hurricane-protection system where they had been completed. Finally, in 2009, FEMA released its own maps detailing local flood risks. Still, because the levee work was incomplete, the new maps did not immediately affect flood insurance rates, nor did FEMA require any parish to implement building-elevation codes.¹¹⁸ Although a great deal of progress has been made regarding improvements to New Orleans' flood control system since 2005, by no means is the work complete.

OUTCOMES

Hurricane Katrina resulted in 1,464 Louisiana deaths, with at least 135 people confirmed missing.¹¹⁹ Total Katrina-related damage (throughout the Gulf Coast region) was estimated to exceed \$81 billion, and overall economic losses associated with the storm were as high as \$200 billion, making it the most expensive natural disaster in U.S. history.¹²⁰ By comparison, New York and Washington, D.C., experienced \$87.9 billion in losses in the September 2001 attacks, which affected much smaller areas.¹²¹ By 2010 the federal government had spent \$142 billion on Gulf Coast recovery.¹²²

In the five years after the storm hit, reconstruction of New Orleans was piecemeal and largely bottom-up. As journalist Campbell Robertson explains, many residents became “staunch advocates for their corners of the city, collecting local data, organizing committees, and even, in the case of the Vietnamese community, drawing up their own local master plan.”¹²³ Despite the assistance of neighborhood organizations and out-of-state volunteers, numerous impediments faced individuals trying to rebuild, including astronomical insurance costs, grueling negotiations with insurance companies, dishonest contractors absconding with insurance money, and endless Road Home paperwork. For the city's poorest residents, such obstacles proved insurmountable, and many did not return. As a result, according to the Census Bureau, at 343,829 people, New Orleans was 29 percent smaller in April 2010 than it was a decade earlier; moreover, once more than two-thirds black, in spring 2010 the city was less than 60 percent black.¹²⁴

On the other hand, some demographers estimated that by the summer of 2010, the New Orleans area had recovered 70 percent of its pre-Katrina jobs, and 79 percent of its pre-Katrina commercial activity.¹²⁵ One important legacy of the storm was a more vibrant civic life: according to the Brookings Institution and the Greater New Orleans Community Data Center, New Orleans residents had become much more likely than other Americans to attend a public meeting. The city's newly formed civic organizations—such as Citizens for 1 New Orleans, Women of the Storm, and numerous neighborhood-scale entities—could boast tangible achievements, including unified and professionalized regional levee boards; a watchdog inspector general, public contract reform, and a police monitor in New Orleans; and a single property assessor where previously there had been seven.¹²⁶

The Brookings Institution and New Orleans have forged a biennial publication titled *The New Orleans Index at Five*. Its first publication in 2010 concluded that New Orleans was poised to become safer and more resilient—that is, better able to “absorb, minimize, bound back from, or avert future crises.”¹²⁷ Among the key improvements after Katrina was the city's adoption of a master plan. In addition, the city's experiment in education, in which nearly two-thirds of the city's public school children attend charter schools, was producing encouraging results: as of 2010, nearly 60 percent of Orleans Parish children attended a public school that met state standards—twice as many as did before Katrina; on the Tenth Grade Graduate Exit Exam, the proportion of local students scoring at or above the basic level in English language rose from 37 percent in 2007 to 50 percent in 2010.¹²⁸ A network of community-health clinics had garnered widespread recognition: with \$100 million in startup funds from the U.S. Department of Health and Human Services, the Louisiana Department of Health and Hospitals had created a network of twenty-five neighborhood health care providers that was running nearly ninety clinics throughout the city. As a result, less than one-third of respondents to a Brookings survey conducted in January 2010 lacked health care access due to cost—compared to 41 percent of adults across the United States.¹²⁹

Furthermore, there were concerted efforts in some neighborhoods, notably the Lower Ninth Ward, to rebuild more sustainably. In 2010 the city council gave final approval to the city's new master plan, which featured sustainability as a prominent goal. But even before the plan's adoption a number of green initiatives were under way. The most high profile of these endeavors, the Make It Right Foundation headed by actor Brad Pitt, was building houses in the devastated Lower Ninth Ward that featured ample windows, solar panels, mold-resistant drywall, dual-flush toilets, and metal roofs that do not retain heat. The foundation aimed to build 150 homes and had completed thirty-nine as of August 2010. The nonprofit Global Green had become involved in building new schools that are energy efficient and equipped with solar panels. And Historic Green, a volunteer group, was helping residents install insulation and had built ten residential rain gardens.

On the other hand, municipal officials were still struggling to deal with 50,000 blighted and abandoned homes—about one-quarter of the city's housing stock—as well as 5,200 blighted commercial structures and 7,400 habitable but abandoned

houses.¹³⁰ As journalist Bruce Nolan pointed out, “[I]n various neighborhoods, ugly scar tissue remains plainly visible in the form of vacant lots, empty houses, and the occasional rescue-team graffiti or dirty waterline.”¹³¹ Residents who lacked the means to rebuild faced rents that were almost 50 percent higher than before the storm, and the mixed-income developments that were supposed to replace demolished public-housing projects had not materialized; there was a list of 28,000 tenants waiting for subsidized housing.¹³² Streets, water pipes, and sewer lines had also been restored in piecemeal fashion, leaving gaps throughout the system. Scores of city-owned properties—from community centers to playgrounds and libraries—were unoccupied.¹³³ The Charity and Veterans Affairs hospitals remained shuttered; in fact, only twelve of twenty-three hospitals in the metropolitan area were operating in 2010.¹³⁴

Some other indicators were troubling as well. Chronic poverty remained a problem: average wages and median household income had risen but did so mostly because many of the city’s poorest residents had not returned; even so, half of New Orleans residents were living within 200 percent of the federal poverty level.¹³⁵ Persistent crime and stagnant job growth had returned. The city remained heavily dependent on tourism, oil and gas, and shipping—three shrinking industries vulnerable to recession—and the city’s workforce was ill-equipped for a more advanced economy. Elevated concentrations of arsenic and lead had been detected throughout the city, with the highest concentrations in soils from the poorer sections.¹³⁶ Although the administration of President Barack Obama took several steps to free up funding to facilitate improvements, federal assistance dwindled over time, and the city had to be creative in its efforts to become more resilient.¹³⁷

Hurricanes Katrina and Rita also took a toll on the natural communities of Louisiana’s Gulf Coast. Although ecologists expected some of the damage to be short term—coastal marshes evolved with hurricanes, after all—between them, the two storms shredded or sank about 217 square miles of marsh along the coastline, equivalent to 40 percent of the wetlands loss that had been expected to occur over fifty years; they wiped out the LaBranche wetlands, one of the state’s most successful restoration projects; and they decimated the Chandeleur Islands, scraping 3.6 miles of sand from the chain.¹³⁸ In 2007 coastal scientists warned that the marshes protecting New Orleans would be gone by 2040 if action were not taken within ten years or less to restore them.¹³⁹ Recognizing the accelerated pace of wetlands loss, in 2012 the Louisiana legislature approved a fifty-year, \$50 billion comprehensive master plan to shore up levees, restore barrier islands and marshes, and where necessary elevate homes and businesses to the level required by the National Flood Insurance Program. Developed by the Louisiana Coastal Protection and Restoration Authority, the plan included 109 projects to be implemented in two phases: the first from 2012 to 2031 and the second from 2032 to 2061.

To fund those projects, the plan relied primarily on three sources: about \$170 million annually in federal excise taxes from oil development due to the Gulf of

Mexico Energy Security Act, available beginning in 2017; \$75 million to \$80 million annually from the federal Coastal Wetlands, Planning, Protection and Restoration Act, for which the state must provide a match of about \$30 million per year; and the Coastal Protection and Restoration Trust Fund, which would furnish \$30 million each year from royalties and severance taxes on mineral development. Bolstering the plan's finances in the near term were two pots of money: about \$790 million dedicated by the Louisiana legislature out of federal money for Katrina rebuilding and \$3 billion to \$5 billion under the RESTORE Act, which divided fines levied against BP for the Deepwater Horizon oil spill under the Clean Water Act among the Gulf Coast states (see Chapter 11).¹⁴⁰ The Southeast Louisiana Flood Protection Authority created in the wake of Katrina had another idea for raising money: to the dismay of Governor Bobby Jindal and other state officials, in 2014 the board sued ninety-seven oil and gas companies charging them with causing more than one-third of the erosion of the Louisiana coastline and demanding compensation for that loss.¹⁴¹

Although the state struggled to fund coastal restoration, work on the structural aspects of the hurricane-protection plan was slated to be complete by the start of the 2011 hurricane season. By August 2010 the city's reinforced Hurricane and Storm Damage Risk Reduction System had been strengthened in a variety of ways: flood walls had been toughened with clay, soil had been reinforced with concrete, and I-shaped walls had been replaced with T-shaped ones. Critics noted, however, that the new hurricane-protection system was being built to withstand only a 100-year storm—a level many experts regarded as inadequate.¹⁴² The Louisiana Coastal Protection and Restoration Study prescribed more extensive protection, including building much higher levees along existing levee alignments, constructing gates for the Chef Menteur and Rigolets passes into Lake Pontchartrain, and relocating or buying out homes in areas at the greatest risk of flooding. The Corps, which had backed away from using the Category 5 hurricane as the design standard, aimed to protect New Orleans from a “Katrina-like” event—a storm with a 1-in-400 chance of hitting in any given year. In light of the improvements made after Katrina, journalist Mark Schleifstein reported that by 2013 New Orleans boasted the best flood control system of any coastal community in the United States, though he noted that the system still had serious limitations.¹⁴³

Federal and state governments have learned a great deal from their lack of preparedness from Hurricane Katrina. This served as an instrumental lesson for the October 2012 Hurricane Sandy, which affected many states in the Northeastern United States (e.g., New York, New Jersey, Connecticut). Although devastation occurred, effective response mechanisms were in place between FEMA and related agencies to act swiftly. However, this was not the case for Puerto Rico, a U.S. territory, where more than 3,000 people died in Hurricane Maria in 2017. Preparedness plans were not designed for hurricanes greater than a Category 1 in Puerto Rico. In 2018, the Florida panhandle encountered Category 4 Hurricane Michael. Florida government officials evacuated approximately 120,000 individuals, attempting to prevent the loss of lives.

CONCLUSIONS

New Orleans continues to be a place of massive social and economic inequity, which underlines the reality that it is the poor and disadvantaged who are particularly vulnerable to the impacts of environmental disaster; when disasters do strike, those who can least afford to relocate are often displaced, both internally and across national borders.¹⁴⁴ For environmentalists, the challenge is clear: attaining social justice is essential to achieving environmental sustainability and resilience, and any efforts to mitigate or adapt to the worst effects of climate change must be designed in ways that benefit the most vulnerable. One visible manifestation of the potential link between environmental sustainability and social justice is the trend toward green homebuilding that has emerged in New Orleans since the storm.¹⁴⁵ Nonprofit and social entrepreneurs regard post-Katrina New Orleans, and particularly its poorest neighborhoods, as incubators for more environmentally sustainable designs. As a result of their initiatives, according to Tulane University law professor Oliver Houck, New Orleans has become a greener, more user-friendly and financially stable city.

Ultimately, the foremost challenge is not predicting catastrophes, but preparing for them. In general, Americans underestimate the risks of flooding, do not anticipate recovering their investment in mitigation, or lack the upfront capital necessary to make improvements. As a result, they do a poor job of preparing for floods and other disasters.¹⁴⁶ As weather events have increased dramatically in frequency and severity, however, climate adaptation has gained a place on the agendas of many U.S. cities and counties. In recent years, many localities have made disaster preparedness a priority. Counties in Colorado, Florida, North Carolina, South Carolina, Texas, and Washington have constructed websites discussing their policies for management of natural disasters. Additionally, the National Association of Counties has developed an extensive report discussing the need for adequate disaster preparedness throughout the country.¹⁴⁷ This indicates that many localities are focusing on planning for natural disasters before they strike, increasing their likelihood of avoiding devastation of the magnitude seen in New Orleans following Hurricane Katrina.

Whereas the United States' approach tends to be reactive, the Netherlands has taken a far more precautionary and proactive approach to managing the natural hazards it faces. In 1953, after dikes and seawalls gave way during a violent storm that killed nearly 2,000 people and forced the evacuation of 70,000 others, the Dutch vowed to protect their country, more than half of which lies below sea level as a result of centuries of development. At a cost of some \$8 billion over a quarter of a century, they erected a futuristic system of coastal defenses that could withstand a 10,000-year storm: they increased the height of their dikes to as much as forty feet above sea level, erected a type of shield that drastically reduces the amount of vulnerable coastline, and installed vast complexes of floodgates that close when the weather turns violent but remain open at other times so saltwater can flow into estuaries.¹⁴⁸ As journalist John McQuaid bitterly observed, "The Netherlands' flood defenses—a sculpted landscape of dunes, dikes, dams, barriers, sluices, and pumps

designed to repel the twin threats of ocean storm surges and river flooding—are light years ahead of New Orleans’ busted-up levee system.”¹⁴⁹

Although heavily engineered, the Dutch system is rooted in a philosophy of accommodating water and preserving natural flows where possible. “There’s one important lesson we’ve learned as Dutch—we’re fighting a heroic fight against nature, the sea and the rivers,” said Ted Sluijter, a spokesperson for the Eastern Scheldt storm-surge barrier. “But if you fight nature, nature is going to strike back. Water needs space.”¹⁵⁰ The Dutch also spend \$500 million each year on inspection and maintenance to safeguard the system, which is known as the Delta Works. They are compulsive planners, constantly adjusting their approach to flood control in response to changing conditions. In hopes of learning from the masters, a series of workshops known as the Dutch Dialogues held at Tulane University in 2010 sought to brainstorm ways of rebuilding New Orleans that would put water at center stage.¹⁵¹

Snider argues that Hurricane Katrina has transformed Louisiana’s approach to become a formidable leader in broader-scale coastal crisis preparedness. As coastal shorelines diminish due to climate change, Baton Rouge is the home to the Water Institute’s new \$60 million water campus. This serves as a flagship research center “where a sleek, glass-encased building that straddles the levee and floats out over the main channel of the Mississippi River” brings together researchers from across the globe to collectively offer solutions for coastal communities.¹⁵²

Although it appears that hurricane preparedness has increased across the United States, many coastal areas remain vulnerable. It took Hurricane Katrina for Louisiana and the federal government to provide financial resources to attempt to prevent future crises. Major coastal cities such as Miami, Florida, and Galveston, Texas, await higher level protections. And, we often forget that Puerto Rico has been classified as a humanitarian crisis due to the lack of support from the U.S. federal government. For over a year, many families were without electricity and water. Many Americans do not even realize that Puerto Ricans are U.S. citizens.¹⁵³

QUESTIONS TO CONSIDER

- How and to what extent have racial and income disparities thwarted recovery efforts in New Orleans?
- If you were an elected official, what advice would you provide to communities such as New Orleans on whether to rebuild or return the area to its natural habitat?
- Is the United States prepared to confront environmental injustices that are a direct result of racial and income disparities post-disaster?

NOTES

1. James K. Mitchell, "The Primacy of Partnership: Scoping a New National Disaster Recovery Policy," *Annals of the American Academy of Political and Social Science* 604 (2006): 228–255.
2. Many scientists believe that climate change will exacerbate the severity of hurricanes and other storms. The rise in the number of hurricanes in the early years of the twenty-first century was part of a natural cycle: from 1970 to 1994, there were very few hurricanes, as cooler waters in the North Atlantic strengthened the wind shear that tears storms apart; in 1995, however, hurricanes reverted to the active pattern of the 1950s and 1960s. In an article in the August 2005 issue of *Nature*, MIT meteorologist Kerry Emanuel argued that global warming may already have influenced storm patterns, but he acknowledged that the pattern in the Atlantic was mostly natural. See Kenneth Chang, "Storms Vary with Cycles, Experts Say," *The New York Times*, August 30, 2005, 1.
3. Raymond Burby, "Hurricane Katrina and the Paradoxes of Government Disaster Policy: Bringing About Wise Governmental Decisions for Hazardous Areas," *Annals of the American Academy of Political and Social Science* 604 (2006): 171–191; Rutherford Platt, *Disasters and Democracy: The Politics of Extreme Natural Events* (Washington, D.C.: Island Press, 1999). Geographer Gilbert White pointed out decades ago that reliance on structures such as levees for flood protection provides a false sense of security and actually lures development into harm's way; new development, in turn, demands more protection. See Craig Colten, *Perilous Place, Powerful Storms: Hurricane Protection in Coastal Louisiana* (Jackson: University of Mississippi Press, 2009).
4. Quoted in "Why We Don't Prepare for Disaster," *Time*, August 20, 2006. Available at <http://www.time.com/time/magazine/article/0,9171,1229102,00.html>.
5. The total cost of all natural disasters in the United States averaged \$10 billion annually from 1975 to 1989, according to the National Academy of Sciences; and 1990 and 1998 the annual average cost was \$17.2 billion. See John McQuaid and Mark Schleiﬀstein, "Tempting Fate," *The Times-Picayune*, June 26, 2002, 1. In 1998 Roger Pielke Jr. and Christopher Landsea showed that hurricanes were getting worse primarily because there was more to destroy. See John McQuaid and Mark Schleiﬀstein, *Path of Destruction: The Devastation of New Orleans and the Coming Age of Superstorms* (New York: Little Brown, 2006).
6. Dennis Mileti, *Disasters by Design: A Reassessment of Natural Hazards in the United States* (Washington, D.C.: Joseph Henry Press, 1999), 105–134.
7. Robert D. Bullard and Beverly C. Wright, "Introduction," in *Race, Place, and Environmental Justice After Hurricane Katrina*, ed. Robert D. Bullard and Beverly C. Wright (Boulder, Colo.: Westview Press, 2009), 1.
8. Susan L. Cutter and Christopher T. Emrich, "Moral Hazard, Social Catastrophe: The Changing Face of Vulnerability Along the Hurricane Coasts," *Annals of the American Academy of Political and Social Science* 604 (2006): 102–112.
9. Platt, *Disasters and Democracy*, 277.
10. "Why We Don't Prepare for Disaster."

11. Gary Rivlin, "White New Orleans Has Recovered from Katrina. Black New Orleans Has Not. August 29, 2016. Available at <https://talkpoverty.org/2016/08/29/white-new-orleans-recovered-hurricane-katrina-black-new-orleans-not/>.
12. Prior to Bienville's arrival, aboriginals had occupied the Mississippi Delta for some 800 years, but they did not build fixed settlements there.
13. A bayou is a slow-moving river that can reverse the direction of its flow as the tide goes in and out.
14. Richard Campanella, *Delta Urbanism: New Orleans* (Washington, D.C.: Planners Press, 2010). Levees are earthen berms that are typically built out of local soils.
15. Campanella, *Delta Urbanism*.
16. John Barry, *Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America* (New York: Touchstone, 1997); Colten, *Perilous Place*; William R. Freudenburg, Robert Gramling, Shirley Laska, and Kai T. Erikson, *Catastrophe in the Making: The Engineering of Katrina and the Disasters of Tomorrow* (Washington, D.C.: Island Press, 2009). According to geographer Colten, the Corps accepted responsibility for flood control only reluctantly. Originally, the Corps was charged with maintaining the nation's navigation system. When Congress created the Mississippi River Commission, however, it broadened the Corps' mandate to include designing levees for flood control. See Colten, *Perilous Place*.
17. Quoted in John McPhee, *The Control of Nature* (New York: Noonday Press, 1989), 26.
18. Colten, *Perilous Place*.
19. The fortuitous introduction of A. Baldwin Wood's revolutionary screw pump in 1913 facilitated the drainage and development of vast tracts of marshland and swampland that became the city's interior.
20. By 1926 the New Orleans drainage system served 30,000 acres, with 560 miles of canals, drains, and pipes. See Campanella, *Delta Urbanism*.
21. In New Orleans, shipping interests exert particular influence because they play an outsized role in the local economy. Shipping interests control the Dock Board, which in turn shapes decisions about the city's development.
22. In Louisiana, counties are called parishes.
23. Matthew Brown, "Reasons to Go," *The Times-Picayune*, January 8, 2006, 1.
24. Freudenburg et al., *Catastrophe in the Making*.
25. Cornelia Dean, "Louisiana's Marshes Fight for Their Lives," *The New York Times*, November 15, 2005, F1.
26. Leslie Williams, "Higher Ground," *The Times-Picayune*, April 21, 2007, 1.
27. A hurricane is defined as a tropical cyclone in the North Atlantic with wind speeds above 75 miles per hour (mph). Hurricanes are categorized on the Saffir-Simpson Hurricane Wind Scale, which is based on barometric pressure, wind speeds, and other factors that indicate the likelihood of a storm surge. A storm surge is an abnormally high tide, on top of which the wind builds waves. A Category 3 hurricane has winds of

between 111 and 129 mph, a Category 4 hurricane has winds of between 130 and 156 mph, and a Category 5 storm has winds 157 mph and above.

28. Burby, "Hurricane Katrina." The Lake Pontchartrain and Vicinity Project sought to protect the portions of Orleans and Jefferson parishes that face the lake. Separate levee systems partially encircled urbanized areas and tied into the Mississippi River levees. A third levee system completely encircled New Orleans and St. Bernard parishes.
29. Michael Grunwald and Susan B. Glasser, "The Slow Drowning of New Orleans," *The Washington Post*, October 9, 2005, 1. The imaginary storm's central barometric pressure was 27.6 inches, its sustained winds were 100 mph, and it had an average storm surge of 11.5 feet—a blend of characteristics from Categories 2, 3, and 4 hurricanes.
30. A levee requires five to six feet of land at its base for every one foot of height. See Colten, *Perilous Place*. In many areas along the city's drainage canals, that much open land was not available, and the Corps would have had to condemn extensive tracts of private property to build levees. In those places, it built flood walls, which consist of concrete sections attached to steel-sheet pile drilled deep into the earth and fortified by a concrete and earthen base. The sections of a flood wall are joined with a flexible, waterproof substance that allows the concrete to expand and contract without cracking.
31. Journalists John McQuaid and Mark Schleifstein describe a decision by Frederic Chatry, chief engineer for the Corps' New Orleans District, upon learning that the existing levees had sunk below design heights. Raising hundreds of miles of levees would be extremely expensive, so Chatry decided to use the new elevation numbers only for projects not yet in the design phase. Completed projects, or those that were already under way, would be based on the old numbers—so some would be more than a foot shorter than their congressionally mandated height. See McQuaid and Schleifstein, *Path of Destruction*.
32. In 2005, after years of persistent lobbying, the Louisiana delegation managed to secure \$570 million over four years for coastal restoration projects, more than before but still a fraction of the amount needed.
33. Campanella, *Delta Urbanism*.
34. Elizabeth Kolbert, "Storm Warnings," *The New Yorker*, September 19, 2006, 35.
35. Mark Fischetti, "Drowning New Orleans," *Scientific American*, October 2001, 78.
36. Andrew C. Revkin and Christopher Drew, "Intricate Flood Protection Long a Focus of Dispute," *The New York Times*, September 1, 2006, 16.
37. Grunwald and Glasser, "The Slow Drowning."
38. Mark Schleifstein, "Storm's Westward Path Puts N.O. on Edge," *The Times-Picayune*, August 27, 2005, 1.
39. Quoted in "In the Storm: A Look at How the Disaster Unfolded," *The Times-Picayune*, September 18, 2005, 21.
40. Bruce Nolan, "Katrina Takes Aim," *The Times-Picayune*, August 28, 2005, 1.
41. Quoted in "In the Storm."
42. There are three levels of evacuation orders: voluntary, recommended, and mandatory. According to historian Douglas Brinkley, only the third carries any real weight and places the responsibility for evacuation on state and local officials.

43. Nolan, "Katrina Takes Aim."
44. Joseph B. Treaster and Kate Zernike, "Hurricane Slams into Gulf Coast," *The New York Times*, August 30, 2005, 5.
45. Freudenburg et al., *Catastrophe in the Making*.
46. Critics point out that the RTA had approximately 360 buses available, each of which could hold up to sixty people. Only a fraction of those buses were deployed, however, and service was at first erratic and later nonexistent. They also note that Amtrak trains could have moved people out on Sunday without adding to the traffic clogging the highways, but no request was made; in fact, when Amtrak tried to offer seats on an unscheduled train being used to move equipment out on Sunday, it was unable to get through to the mayor. See Douglas Brinkley, *The Great Deluge: Hurricane Katrina, New Orleans, and the Mississippi Gulf Coast* (New York: William Morrow, 2006).
47. That many people did not evacuate should not have come as a surprise. Disaster management experts have long known that about 20 percent of residents will not evacuate. See William Waugh Jr., "Preface," *Annals of the American Academy of Political and Social Science* 604 (2006): 6–9. A survey conducted by LSU in 2003 found that 31 percent of New Orleans residents would stay in the city even in the face of a Category 4 hurricane. See Peter Applebome, Christopher Drew, Jere Longman, and Andrew C. Revkin, "A Delicate Balance Is Undone in a Flash," *The New York Times*, September 4, 2005, 1.
48. Cutter and Emrich, "Moral Hazard."
49. Amanda Ripley, "How Did This Happen?" *Time*, September 4, 2005, 54–59.
50. Initially, reports said that Katrina had sustained winds of greater than 140 mph, but in December the hurricane center revised its estimate down to 127 mph and labeled Katrina a strong Category 3 hurricane. See Mark Schleifstein, "Katrina Weaker Than Thought," *The Times-Picayune*, December 21, 2005; Brinkley, *The Great Deluge*.
51. Quoted in "In the Storm."
52. Rumors of levee breaches began circulating on Monday morning, but because communication systems were knocked out, they were difficult to confirm. According to *The Times-Picayune*, Mayor Nagin announced at 8 a.m. Monday that he had heard reports that levees had been breached. See "In the Storm."
53. The descriptions of conditions in the Superdome are horrific. According to a firsthand account by Lieutenant Colonel Bernard McLaughlin, "It is a hot, brutal day—the Dome is reeking of sweat, feces, urine, discarded diapers, soiled clothing, discarded food, and the garbage strewn about is almost frightening in its sheer volume. People are openly cursing and fighting, many are openly angry with Mayor Nagin. Our focus is maintaining order and keeping things in control until the buses arrive." Quoted in Brinkley, *The Great Deluge*, 420.
54. Joseph B. Treaster, "Life-or-Death Words of the Day in a Battered City: 'I Had to Get Out,'" *The New York Times*, August 31, 2005, 1.
55. Like reports of rape, reports of sniper fire circulated widely; they were particularly damaging because they made rescue personnel wary of entering an area where shots had been reported. According to historian Douglas Brinkley, the U.S. government purposely sought to downplay reports of violence in the storm's aftermath because they

were embarrassing. And, in fact, some reports were false or exaggerated. But credible eyewitnesses confirmed many others.

56. Dan Baum, “Deluged,” *The New Yorker*; January 9, 2006, 50.
57. Although other reports confirmed that there were armed gangs roaming the streets, rampant looting, and violent incidents, subsequent investigations revealed the worst reports—particularly those about the Superdome and convention center—were overblown. During the week following the storm, there were four confirmed murders. After careful inspection, *The Times-Picayune* reported the toll was four dead in the convention center, one by violence, and six dead in the Superdome, none by violence. See “Hurricane-Force Rumors,” *The Times-Picayune*, September 27, 2005, 1.
58. Quoted in “In the Storm.”
59. Officials were pumping cautiously to avoid overtaxing the pumps: only 2 of the city’s 148 drainage pumps were online at this point; they were supplemented by dozens of smaller pumps that had been brought into the city. There was some concern about the ecological impacts of the foul water—which was laced with raw sewage, bacteria, heavy metals, pesticides, and toxic chemicals—on Lake Pontchartrain. But most scientists were sanguine about the lake’s long-term resilience. They suggested that bacterial contaminants would die off fairly quickly, organic material would degrade with natural processes, and metals would fall apart and be captured by the sediment. See Sewell Chan and Andrew C. Revkin, “Water Returned to Lake Pontchartrain Contains Toxic Material,” *The New York Times*, September 7, 2005, 1.
60. Matthew Wald, “Engineers Say a Key Levee Won’t Be Set for Months,” *The New York Times*, September 14, 2005, 1.
61. On October 6 state officials declared that tap water was drinkable again across a broad swath of New Orleans’ east bank. On October 12 the city was finally dry. And by October 18 raw sewage was being partially treated before being dumped.
62. To qualify for the grant, residents had to apply to FEMA, be displaced from their primary residence, and be living in a shelter, hotel, or motel, or with family or friends.
63. Ron Thibodeaux, “FEMA’s New Shepherd Hopes to Unite Flock,” *The Times-Picayune*, September 11, 2005, 5.
64. Bill Walsh, “Federal Report Predicted Cataclysm,” *The Times-Picayune*, January 24, 2006, 1.
65. Despite protestations to the contrary by both Brown and Chertoff, it was clear that they had been informed of the severity of conditions in New Orleans. In October 2005 Marty Bahamonde, the lone FEMA official in New Orleans, told the Senate Homeland Security Committee that he had e-mailed FEMA leaders about the city’s desperate need for medical help, oxygen canisters, food, and water. According to Bahamonde’s testimony, on Monday, August 28, at 11 a.m., he received word that the 17th Street Canal had been breached, sending floodwaters into Lakeview and central New Orleans. He immediately phoned his superiors. At 7 p.m. he finally reached Brown, who promised to contact the White House.
66. Matthew Brown, “Health Risks in Wake of Storm Hard to Gauge,” *The Times-Picayune*, November 11, 2005, 1. The cost of disposing of all this material threatened to impose a crippling financial burden on the city and state. Under federal disaster rules, state and local

governments are required to pay 25 percent of disaster-related costs. But because Katrina wiped out the region's tax base, President Bush agreed to pick up the entire cost of debris removal through November 26, 2005, and 90 percent of other costs associated with Katrina. He granted a thirty-day extension of the 100 percent reimbursement in late October.

67. There were four parallel investigations of the levee failures: one sponsored by the state of Louisiana, a second funded by the National Science Foundation, a third conducted by the American Society of Civil Engineers, and a fourth carried out by an Interagency Performance Evaluation Team (IPET) on behalf of the Corps. The Senate Homeland Security and Governmental Affairs Committee conducted a fifth, more wide-ranging investigation. In mid-December, at the behest of Defense Secretary Donald Rumsfeld, the National Academy of Sciences's National Research Council undertook a peer review of the Corps' analysis.
68. John McQuaid, "Floodwall Breaches Still a Mystery," *The Times-Picayune*, September 13, 2005, 1.
69. Christopher Drew and Andrew C. Revkin, "Design Flaws Seen in New Orleans Flood Walls," *The New York Times*, September 21, 2005, 4.
70. LSU researcher Ivor van Heerden concluded on the basis of ground sonar tests that the piling on the 17th Street Canal extended just ten feet below sea level, but the Corps disputed this. See Bob Marshall, "Short Sheeted," *The Times-Picayune*, November 10, 2005, 1.
71. The soil under New Orleans is soft, spongy, and unstable; it is composed of layers of peat soil, sand, silt, and soft clays laid down by the Mississippi River over hundreds of years, supplemented in places by garbage, trees, shells, and other materials. See John McQuaid, "Swamp Peat Was Poor Anchor, Engineer Says," *The Times-Picayune*, October 15, 2005, 1.
72. Investigators uncovered other factors that probably contributed to the flood walls' vulnerability as well. For example, in 1981 the Sewer and Water Board decided to increase the capacity of Pump Station No. 6 by dredging the 17th Street Canal. In doing so, it left the canal too deep for sheet pilings that were supposed to cut off seepage, reduced the distance water had to travel to reach the canal, may have removed some layers of clay that sealed the canal bottom, and reduced support for the wall on the New Orleans side. See Bob Marshall and Sheila Grissett, "Dredging Led to Deep Trouble, Experts Say," *The Times-Picayune*, December 9, 2005, 1.
73. Mark Schleifstein, "Corps Revises Cause of Levee Failure," *The Times-Picayune*, August 29, 2007, 1.
74. For the record, some of the investigating teams disagreed with this analysis. They suggested the main culprit was water flowing through the organic soils beneath the flood walls.
75. McQuaid and Schleifstein, *Path of Destruction*.
76. A safety factor describes the ability of a system to tolerate loads beyond what it was designed to hold or withstand. A safety factor of 2.0 is the norm for a dynamically loaded structure, such as a bridge. Adding even one or two tenths to a safety factor can dramatically increase a project's cost.
77. Bob Marshall, Sheila Grissett, and Mark Schleifstein, "Report: Flood Policy Flawed," *The Times-Picayune*, June 2, 2006, 1.

78. In any case, experts pointed out that the Saffir-Simpson scale was too crude to assess vulnerability in New Orleans, where flooding was the most serious concern. A more sophisticated analysis made clear that different parts of the city were differentially exposed to storm-surge waters. See John McQuaid, "Levee System Projections Flawed, Experts Say," *The Times-Picayune*, September 21, 2005, 1.
79. The authorization for the Lake Pontchartrain and Vicinity Project made the Corps responsible for hurricane-caused flooding. But the Sewer and Water Board, created in 1899, maintained the canals for drainage. And after the Mississippi River flood of 1927, the Orleans Levee District and its controlling board gained responsibility for flooding. This arrangement made for considerable jurisdictional confusion. For example, the Corps designs and supervises the construction of flood walls, but the levee district is responsible for ensuring the structural integrity of the levees that support those flood walls.
80. Grunwald and Glasser, "The Slow Drowning."
81. Bob Marshall, "Levee Leaks Reported to S&WB a Year Ago," *The Times-Picayune*, November 18, 2005, 1.
82. Eric Lipton, Christopher Drew, Scott Shane, and David Rohde, "Breakdowns Marked Path From Hurricane to Anarchy," *The New York Times*, September 11, 2005, 1.
83. The 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act formally made the federal government secondary to the states in responding to a disaster. But according to Richard Sylvès, the newly adopted National Response Plan (NRP), which was activated when Homeland Security director Chertoff designated Hurricane Katrina "an incident of national significance," gave the Department of Homeland Security the power to mobilize and deploy federal resources, even in the absence of a request from the state. See Richard Sylvès, "President Bush and Hurricane Katrina: A Presidential Leadership Study," *Annals of the American Academy of Political and Social Science* 604 (2006): 26–56.
84. Robert Travis Scott, "Politics Delayed Troops Dispatch to N.O.," *The Times-Picayune*, December 11, 2005, 1.
85. Sylvès, "President Bush and Hurricane Katrina."
86. William L. Waugh, "The Political Costs of Failure in the Katrina and Rita Disasters," *Annals of the American Academy of Political and Social Science* 604 (2006): 11–25.
87. Thomas Birkland, *After Disaster: Agenda Setting, Public Policy, and Focusing Events* (Washington, D.C.: Georgetown University Press, 1997).
88. Bill Walsh, Bruce Alpert, and John McQuaid, "Feds' Disaster Planning Shifts Away from Preparedness," *The Times-Picayune*, August 30, 2005, 99.
89. Bob Marshall, "La. Wants to Speed Up Its Restoration Plans," *The Times-Picayune*, September 16, 2005, 4.
90. Cornelia Dean, "Some Question Protective Role of Marshes," *The New York Times*, November 15, 2005, F3.
91. Robert S. Young and David M. Bush, "Forced Marsh," *The New York Times*, September 27, 2005, 2.
92. Cornelia Dean, "Louisiana's Marshes Fight for Their Lives," *The New York Times*, November 15, 2005, F1.

93. Dan Baum, "The Lost Year," *The New Yorker*, August 21, 2006, 46.
94. Bill Walsh and Bruce Alpert, "Category 5 Protection Support Dries Up," *The Times-Picayune*, November 10, 2005, 1.
95. Craig Colten, "Restore the Marsh," *The New York Times*, September 10, 2005, 2. An 1878 map revealed that almost every place that was uninhabited in 1878 flooded after Katrina. See Gordon Russell, "An 1878 Map Reveals That Maybe Our Ancestors Were Right to Build on Higher Ground," *The Times-Picayune*, November 3, 2005, 1.
96. Quoted in Cornelia Dean, "Some Experts Say It's Time to Evacuate the Coast (for Good)," *The New York Times*, October 4, 2005, F2.
97. Joseph Nocera, "To Be Better, New Orleans, Think Smaller," *The New York Times*, September 24, 2005, C1.
98. Bill Walsh and Jim Barnett, "Some See Opportunity in Wake of Tragedy," *Times-Picayune*, September 4, 2005, 6.
99. Michael E. Crutcher, "Build Diversity," *The New York Times*, September 10, 2005, 3.
100. John Schwartz, Andrew C. Revkin, and Matthew L. Wald, "In Reviving New Orleans, a Challenge of Many Tiers," *The New York Times*, September 12, 2005, 5.
101. Founded in 1936, the ULI is a nonprofit with more than 25,000 members worldwide. Although it functions more like a university than a trade group, the ULI is known for its prodevelopment orientation.
102. Martha Carr, "Rebuilding Should Begin on High Ground, Group Says," *The Times-Picayune*, November 19, 2005, 1; Gary Rivlin, "Panel Advises New Orleans to Relinquish Purse Strings," *The New York Times*, November 19, 2005, 1. In developing its map, the ULI panel looked at land elevation, depth of flooding from Katrina and Rita, the number of days floodwaters inundated neighborhoods, inundation before and after flood walls broke and levees were breached, historic districts, structural damage, frequency of flooding, and vulnerability to future floods. Prior to the release of the ULI recommendations, the only person to publicly propose a method for determining the safest areas to rebuild had been Tulane University geographer Richard Campanella. See Martha Carr, "Experts Include Science in Rebuilding Equation," *The Times-Picayune*, November 25, 2005, 1.
103. Jeffrey Meitrodt and Frank Donze, "Plan Shrinks City Footprint," *The Times-Picayune*, December 14, 2005, 1.
104. Gordon Russell, "City's Rebuild Plan Draws Criticism," *The Times-Picayune*, December 23, 2005, 1.
105. Brian Friedman, "Group Says Plan to Rebuild Is Biased," *The Times-Picayune*, December 15, 2005, 99.
106. Richard Campanella, "Delta Urbanism and New Orleans: After," The Design Observer Group, April 1, 2010. Available at <http://www.designobserver.com/places/entry.html?entry=12978>.
107. Campanella, *Delta Urbanism: New Orleans*, 157–158.
108. Clifford J. Levy, "New Orleans Is Not Ready to Think Small, or Even Medium," *The New York Times*, December 11, 2005, D1.

109. Christine Hauser, "Mayor of New Orleans Vows to Rebuild 2 Devastated Areas," *The New York Times*, October 21, 2005, 2.
110. Adam Nossiter, "Fight Grows in New Orleans on Demolition and Rebuilding," *The New York Times*, January 6, 2006, 1.
111. Gwen Filosa, "Former Mayor Rejects Idea of a New Orleans Reduced in Size," *The Times-Picayune*, January 8, 2006, 1.
112. Nicolai Ouroussoff, "In New Orleans, Each Resident Is Master of Plan to Rebuild," *The New York Times*, August 8, 2006, E1.
113. Adam Nossiter, "All Areas Open in New Blueprint for New Orleans," *The New York Times*, January 31, 2007, 1.
114. Campanella, *Delta Urbanism: New Orleans*.
115. Adam Nossiter, "Big Plans Are Slow to Bear Fruit in New Orleans," *The New York Times*, April 1, 2008, 1.
116. Mark Schleifstein, "Army Corps Launching \$4 Billion in Flood Projects," *The Times-Picayune*, January 11, 2009, 1. The Corps built gates at the mouth of the three major drainage canals that would eventually be replaced by pumps. At the Industrial Canal, the Corps replaced existing I-wall sheet piling with a stronger flood wall supported by concrete pilings. And at the 17th Street and London Avenue canals, engineers drove pilings that would serve as cofferdams while permanent repairs were being made. Eventually, the Corps planned to install more inverted T walls on the 17th Street and London Avenue canals; to do so, it would have to acquire at least 15 feet of property and as much as 150 feet along some stretches.
117. Even further complicating the rebuilding effort were insurance companies' efforts to avoid paying for damages from the storm. Most private homeowners' policies covered wind damage. But if the damage was the result of flooding, coverage was available only if the homeowner had separate flood insurance, purchased from the state or from a private insurer on behalf of the National Flood Insurance Program. Homeowners in "Special Flood Hazard Areas" are generally required to buy flood insurance. But many of the claims were coming from homeowners in low- to medium-risk zones. Moreover, homeowners with multiple insurance plans faced conflicts over who would pay, the private insurer or the government agencies that run disaster relief and flood insurance programs.
118. Chris Kirkham, Sheila Grissett, and Mark Schleifstein, "New Maps Detail Local Flood Risks," *The Times-Picayune*, February 6, 2009, 1.
119. Louisiana Department of Health and Hospitals, "Hurricane Katrina Deaths, Louisiana, 2005" August 28, 2008. Available at http://new.dhh.louisiana.gov/assets/docs/katrina/deceasedreports/KatrinaDeaths_082008.pdf.
120. Burby, "Hurricane Katrina."
121. Jan Moller, "Loss to State Could Top \$1 Billion," *The Times-Picayune*, October 1, 2005, 11.
122. Bill Sasser, "Katrina Anniversary: How Well Has Recovery Money Been Spent?" *The Christian Science Monitor*, August 27, 2010, 1.

123. Campbell Robertson, "On Fifth Anniversary of Katrina, Signs of Healing in New Orleans," *The New York Times*, August 28, 2010, 1.
124. Campbell Robertson, "Smaller New Orleans After Katrina, Census Shows," *The New York Times*, February 3, 2011, 1.
125. Mark Schleifstein, "Even Greater Recovery Ahead, Demographer Says," *The Times-Picayune*, March 26, 2010, 2.
126. Bruce Nolan, "After Katrina," *The Times-Picayune*, August 15, 2010, 1.
127. Sasser, "Katrina Anniversary." The study purported to measure the city's resilience using twenty social and economic indicators.
128. Amy Liu and Nigel Holmes, "The State of New Orleans," *The New York Times*, August 29, 2010, 10; Stacy Teicher Khadaroo, "After Katrina, How Charter Schools Helped Recast New Orleans Education," *The Christian Science Monitor*, August 29, 2010.
129. Mark Guarino, "Four Ways New Orleans Is Better Than Before Katrina," *The Christian Science Monitor*, August 28, 2010.
130. Michelle Krupa, "Common Neighborhood Troubles Still Hold Up Recovery After Storm," *The Times-Picayune*, August 24, 2010, 1; Robertson, "On Fifth Anniversary of Katrina."
131. Nolan, "After Katrina."
132. Bill Sasser, "Five Ways New Orleans Is Still Struggling After Katrina," *The Christian Science Monitor*, August 28, 2010. In 2008 the U.S. Department of Housing and Urban Development authorized demolishing four of the city's public-housing complexes, eliminating more than 3,000 apartments. Only a handful of those properties' former residents subsequently moved into mixed-income neighborhoods.
133. Krupa, "Common Neighborhood Troubles."
134. In 2006 the city decided not to reopen Charity Hospital and instead build a \$14 billion state-of-the-art medical complex on a seventy-acre site near downtown. The new complex is expected to open no earlier than 2014.
135. Bruce Nolan, "Storm Reshuffles Size, Wealth, Race in Region," *The Times-Picayune*, August 26, 2010, 1.
136. Both of these contaminants were present in high quantities before the storm, but research suggested that sediment deposition or flooded building materials had exacerbated the problem. See "Arsenic: New Research Reveals Hurricane Katrina's Impact on Ecological and Human Health," *Chemicals and Chemistry*, June 4, 2010.
137. Robertson, "On Fifth Anniversary of Katrina." In January 2010 the federal government released nearly half a billion dollars to rebuild the city's main public hospital and nearly \$2 billion more for the schools. In addition, the Obama administration enabled FEMA to be more flexible in disbursing funds and appointed a cabinet official to reform the city's public-service sector.
138. Mark Schleifstein, "Hurricanes Katrina and Rita Turned 217 Square Miles of Coastal Land and Wetlands into Water," *The Times-Picayune*, October 11, 2006, 1.

139. Bob Marshall, "Last Chance: The Fight to Save a Disappearing Coast," *The Times-Picayune*, March 4, 2007, 1.
140. Bob Marshall, "Coastal Restoration Financing Is Uncertain, But Louisiana Has Ideas to Find \$50 Billion," *The Lens*, April 2, 2014.
141. Jason Plautz, "As a State Wrangles, Its Coast Is Swept Out to Sea," *National Journal*, June 9, 2014.
142. John Schwartz, "Five Years After Katrina, 350 Miles of Protection," *The New York Times*, August 24, 2010, 1. A 2009 report by the National Academy of Engineering and the NRC confirmed that the Corps' \$15 billion improvements were not guaranteed to withstand a Category 5 hurricane (a 1,000-year storm).
143. Mark Schleifstein, "Upgraded Metro New Orleans Levees Will Greatly Reduce Flooding, Even in 500-Year Storms," *The Times-Picayune*, August 16, 2013.
144. The International Organization for Migration projects there will be 200 million climate change migrants by 2050; others think the number will more likely be around 700 million. See "A New (Under) Class of Travellers," *The Economist*, June 27, 2009.
145. Mark Guarino, "After Katrina, New Orleans Housing Goes Green," *The Christian Science Monitor*, August 28, 2010.
146. Howard Kunreuther, "Disaster Mitigation and Insurance: Learning from Katrina," *Annals of the American Academy of Political and Social Science* 604 (2006): 208–226.
147. See, <https://www.naco.org/resources/managing-disasters-county-level-focus-flooding-0>.
148. William J. Broad, "High-Tech Flood Control, with Nature's Help," *The New York Times*, September 6, 2005, F1.
149. John McQuaid, "Dutch Defense, Dutch Masters," *The Times-Picayune*, November 13, 2005, 1.
150. Quoted in *ibid*.
151. Sheila Grissett, "Many Residents Say They'll Never Be the Same After Katrina," *The Times-Picayune*, August 29, 2010, 1.
152. Annie Snider, "Why America Hasn't Learned Any Lessons from Katrina." *Politico*, August 2017. Available at <https://www.politico.com/magazine/story/2017/08/27/hurricane-harvey-katrina-lessons-louisiana-215543>.
153. Brian Resnick and Eliza Barclay, "What Every American Needs to Know About the Puerto Rico Disaster." October 16, 2017. Available at <https://www.vox.com/science-and-health/2017/9/26/16365994/hurricane-maria-2017-puerto-rico-san-juan-humanitarian-disaster-electricity-fuel-flights-facts>.