Hazard Mitigation Plan

City of New Orleans

Office of Homeland Security and Emergency Preparedness

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Section 1: Introduction

Hazard Mitigation is defined as sustained actions taken to reduce or eliminate long-term risk from hazards and their effects. Hazard Mitigation Planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, risk reduction goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented.

The City is subject to natural hazards that threaten life and health and have caused extensive property damage. The parish has also included several man-made/technological hazards in this plan, consistent with the City's all-hazards approach to emergency preparedness. To better understand these hazards and their impacts on people and property, and to identify ways to reduce those impacts, the New Orleans Office of Homeland Security and Emergency Preparedness (NOHSEP) undertook this Hazard Mitigation Plan Update.

This plan (a) documents the Orleans Parish Hazard Mitigation Plan Update process; (b) identifies natural and manmade hazards and risks within the parish, and (c) identifies the parish's hazard mitigation strategy to make the City of New Orleans less vulnerable and more disaster-resilient. Information in the plan will be used to help guide and coordinate mitigation activities and local policy decisions.

The Orleans Parish Hazard Mitigation Plan is a multi-jurisdictional plan that includes the following plan participants who took an active role in the planning process:

- Unincorporated Orleans Parish/City of New Orleans
- Sewerage & Water Board of New Orleans (SWBNO)
- Housing Authority of New Orleans (HANO)
- New Orleans Redevelopment Authority (NORA)
- Tulane University

The following stakeholders also participated in the planning process as members of the Hazard Mitigation Planning Committee:

- Orleans Parish School Board (OPSB)
- Dillard University
- Loyola University
- Xavier University

The Federal Emergency Management Agency (FEMA), under the Department of Homeland Security, has made reducing losses from natural disasters one of its primary goals. The Hazard Mitigation Plan (HMP) and subsequent implementation of recommended projects, programs, and policies are the primary means of achieving and measuring progress towards this goal.

This Hazard Mitigation Plan is a comprehensive look at what New Orleans can do pre-disaster to reduce our risks and enhance our resilience. The Resilient New Orleans strategy defines resilience as, "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience."[i] Reducing the acute shocks caused by disasters makes our community more resilient. While hazard mitigation is rooted in emergency management and traditionally focuses on those acute shocks, we take a holistic approach to resilience and understand that underlying stressors make our community more vulnerable to the effects of disasters.

By creating this 2020 Hazard Mitigation Plan update (HMP), the City of New Orleans continues to strive for and achieve more equitable disaster preparedness and response. Social inequities create disproportionate vulnerability to the damaging effects of natural disasters and climate change (2019 Climate Action Equity Report, National Climate Assessment). The overarching goal of this plan is to promote equity, which we know is a critical component to reducing vulnerability and building resilience. For this plan, equity is broadly defined as an outcome in which every New Orleanian has the opportunity to thrive when roadblocks to success such as poverty, discrimination, and oppression are replaced by access to quality jobs, safe and affordable housing, and neighborhoods that ensure a high quality of life for all residents. This plan builds on prior planning efforts, including the 2015 Resilient New Orleans Plan, the Greater New Orleans Urban Water Plan, and the 2017 Climate Action Plan, which together create a road map for how the city responds to climate change while addressing social vulnerability and equity.[ii] The HMP discusses the impacts on the human and built environments throughout the plan; this is all done with the lens of equity to help foster greater resilience for all New Orleanians.

"Hazard mitigation" does not mean that all hazards are eliminated or prevented. Mitigation is a long-term approach to reduce hazard vulnerability. Every community faces different hazards, and every community has different resources and interests to bring to bear on its problems. Because there are many ways to deal with natural hazards and many agencies that can help, there is no one solution or cookbook for managing or mitigating the effects of hazards.

Planning is one of the best ways to correct these shortcomings and produce a program of activities that will best reduce the impact of local hazards and meet other local needs. A well-prepared plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and programs, preventing conflicts, and reducing the costs of implementing each individual activity.

Mitigation activities often require funding. Under the Disaster Mitigation Act of 2000 (42 USC 5165), an approved mitigation plan is required to receive federal mitigation funds. Therefore, this mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from FEMA. FEMA also recognizes plans through its Community Rating System, a program that reduces flood insurance premiums in participating communities. The City's participation in the CRS program is described in some detail in the Capability Assessment

section of this plan. This plan will also serve as the City's Floodplain Management Plan and will be creditable under the CRS program as such.

This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural and man-made hazards. It fulfills the federal mitigation planning requirements, qualifies for Community Rating System credit, and provides the parish with a blueprint for reducing the impacts of these natural and man-made hazards on people and property.

1.1 New Orleans Community Profile

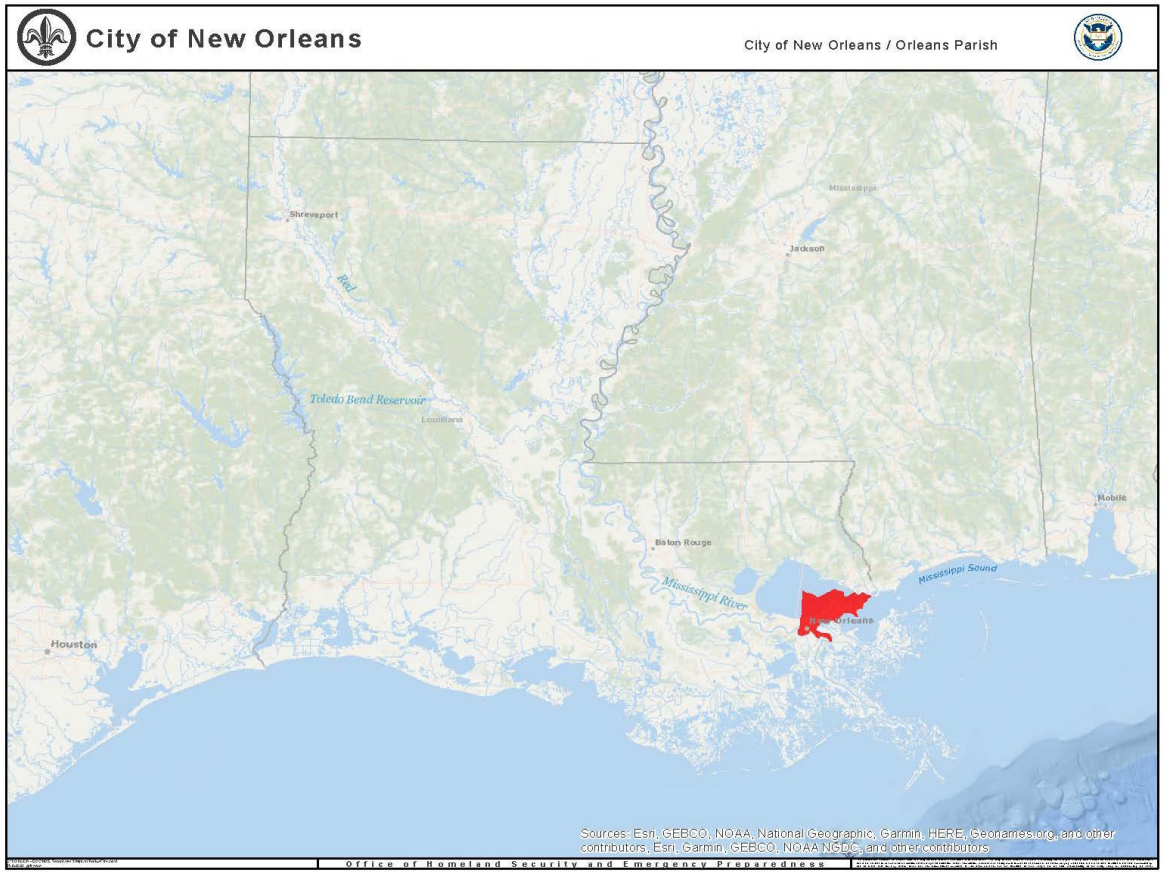
1.1.1 Location

New Orleans is located in Southeast Louisiana at roughly 30.07 degrees North latitude and 89.93 degrees West longitude, approximately 125 miles southeast of the capital city of Baton Rouge. The city sits between the Mississippi River to the south and Lake Pontchartrain to the north. It is bordered by Jefferson, Plaquemines, St. Bernard, and St. Tammany Parishes. The boundaries of the City of New Orleans and Orleans Parish are coterminous. Because of this, the names New Orleans, City of New Orleans, and Orleans Parish are used interchangeably throughout this Plan.

The topography of New Orleans consists of mostly flat land with elevations across the parish close to, or below, sea level. Although there are a few natural ridges in New Orleans, such as the Metairie Ridge and the Gentilly Ridge, the highest spots in the City are still only a few feet above sea level and are generally closest to the Mississippi River. With the exception of the easternmost section of the parish, all of Orleans Parish is surrounded by levees. These levees along the Mississippi River and Lake Pontchartrain result in a topography that is similar to a saucer. As a result of this topography, virtually all rain that falls in New Orleans must be pumped out of the city by New Orleans' extensive network of drainage pumps.

Water figures prominently in the landscape of New Orleans. In addition to being located between the Mississippi River and Lake Pontchartrain, New Orleans also contains a large area of marshland. Twenty-five percent of the parish is marshland. While most of this area is uninhabited, the marshes provide recreation areas for people and habitat areas for wildlife. The marshes also help protect the City from the effects of coastal storms.

Figure 1: Location of Orleans Parish within the State of Louisiana



Source: City of New Orleans

1.1.2 History of Orleans Parish

The City of New Orleans was founded in 1718 by Jean-Baptiste Le Moyne, Sieur de Bienville, and in 1722 became the capital of the French colony. The original settlement was in the area now known as the Vieux Carre, or French Quarter. In 1763, New Orleans became a Spanish colony under the Treaty of Paris, and soon after, became the capital of Spanish Louisiana. After being returned secretly to France in 1800, New Orleans was sold to the United States in 1803 as part of the Louisiana Purchase.

New Orleans grew in size and prominence during the 19th Century. By 1852, New Orleans was the third-largest city in the U.S. The growing population fueled development upriver and downriver from the French Quarter. Already a major port for many decades, New Orleans became a railroad hub in the late 1800s.

In the early 20th Century, many of the swampy areas of New Orleans were drained. This allowed development to continue towards Lake Pontchartrain, establishing the neighborhoods of Gentilly and Lakeview. Further increasing development in parts of town, not along the Mississippi River,

was the addition of 2,000 acres of reclaimed land, created by the Levee Board after building a seawall that extended 3,000 feet into Lake Pontchartrain in 1927. Later developments extended further east and also took place on the west bank of the Mississippi River. Starting in the 1960s and continuing into the 1980s, new neighborhoods were established in New Orleans East and Algiers. In the 1990s, the new development was confined to smaller infill projects within the urban core, including condominiums in downtown New Orleans and the redevelopment of public housing.

New Orleans has been shaped in many ways by a history of public policy, planning, and infrastructure developments that prioritized investing in affluent areas and actively discouraged investment in areas where lower-income and minority people lived. Redlining and other policies and practices created inequitable access to resources and disproportionate exposure to hazards like flooding and extreme heat [iii].

Like many major U.S. cities, New Orleans's growth was outpaced by the growth of its surrounding suburbs during the second half of the 20th Century. Commerce and industry followed the population movement to the suburbs. New Orleans's economy was further weakened by the oil bust of the late 1970s and early 1980s. Between 1960 and 1980, the New Orleans population decreased by 21 percent. Starting in the early 1990s and continuing through 2005, the rate at which New Orleans lost population slowed, and City officials worked to diversify the city's economy to attract and retain residents.

In August of 2005, New Orleans experienced one of the worst disasters in the history of the United States when Hurricane Katrina made landfall. Katrina caused almost a total evacuation of the city, flooded approximately eighty percent of the parish, and generated an estimated $17 billion in damages. Many areas of the city with the worst damage included neighborhoods developed on drained land that were originally low-lying swampy areas. Since the hurricane, population recovery has exceeded expectations. Ten years after Katrina, more than half (40) of New Orleans' 73 neighborhoods had recovered over 90 percent of the population they had before the levees failed.

On April 20, 2010, an explosion occurred on the Deepwater Horizon drilling platform, located approximately 41 miles off the southeast coast of Louisiana. The accompanying well blowout and oil spill was the largest in US history, causing devastating environmental and economic impacts for New Orleans. In June of 2015, the city accepted a $45 million settlement for losses incurred from the event. In the last decade, BP and drilling partners have put at least $71 billion toward mitigating the disaster effects along the entire gulf coast. The City has pledged to use the funds for resilience initiatives, including water management, and coastal and ecosystem restoration. A large portion of the BP settlement money has been explicitly dedicated to future restoration efforts along the Gulf Coast, with Louisiana receiving approximately $8 billion for coastal restoration and flood protection.

1.1.3 Climate

New Orleans is located in a humid subtropical climate zone characterized by hot, usually humid summers and mild to cool winters. The monthly daily average temperature ranges from 54.4°F in January to 82.9°F in July and August. The lowest recorded temperature was 6°F on February 13, 1899. According to the National Weather Service, the highest recorded temperature was 101°F in 1980, which was recorded at Louis Armstrong International Airport. The month with the highest relative humidity in the city in August, while the month with the lowest relative humidity is March.

The average annual precipitation is 62.7 inches (1,590 mm); the summer months are the wettest, while October is the driest. On average, there are 77 days of 90°F + highs, 8.1 days per winter, where the high does not exceed 50°F and 8.0 nights with freezing lows annually. In a typical year, the coldest night is around 30°F. It is rare for the temperature to reach 100°F or dip below 25°F. New Orleans experiences snowfall only on rare occasions. The three most recent snowfall events occurred in 2008, 2004, and 1989.

Climate change is already impacting New Orleans as the environment of South Louisiana changes rapidly, and these changes interact with the hazards laid out in this plan. Coastal marshes are eroding, and urban neighborhoods are experiencing subsidence, which increases flood risk. Sea levels are rising, and weather events are projected to increase in intensity, which is expected to accelerate coastal land loss. Extreme heat will continue to impact the health of residents and infrastructure, including energy demand and clean water supplies[iv]. Impacts of climate change are woven throughout the hazard profiles in this documents, reflecting the cross-cutting impacts that rising sea levels, changing weather patterns, and rising temperatures have on the people and places in New Orleans.

The City of New Orleans has demonstrated a commitment to combatting climate change through a reduction in greenhouse gas pollution and increased resilience as outlined in the City's Climate Action Plan: Climate Action for a Resilient New Orleans.[v] The Plan provides strategies to reduce greenhouse gas intensity by saving energy whenever possible and creating a culture of awareness and action about climate change and resilience.

1.1.4 Transportation

New Orleans has an extensive transportation network that is served by air, rail, water, and ground transportation systems.

Aviation

The Louis Armstrong New Orleans International Airport (LANOIA), the largest airport in the region, is owned and operated by the City of New Orleans. However, the LANOIA is located in Jefferson Parish, the Parish, directly west of Orleans Parish. LANOIA is considered a medium-sized hub airport, and as of January 2015, it has surpassed its pre-Katrina passenger levels.

The New Orleans Lakefront Airport is located in Orleans Parish on the southern shore of Lake Pontchartrain. The airport has three runways that serve mostly private and military aircraft. The largest of the three runways is nearly seven thousand feet in length, allowing it to service large aircraft.

Rail

Amtrak provides passenger rail service to New Orleans. Amtrak routes connect New Orleans to the Northeast, the Southeast, the Midwest, and Southern California. New Orleans is also served by six Class 1 freight railroads: Union Pacific; Kansas City Southern; Burlington Northern Santa Fe; Canadian National; Norfolk Southern; and CSX Transportation. In addition, the Port of New Orleans owns a non-profit switching railroad, the New Orleans Public Belt Railroad (NOPBRR), which is a Class III railroad. The NOPBRR interchanges with all Class 1 railroads serving New Orleans.

Ports and Waterways

New Orleans is located in the heart of the world's busiest port complex – Louisiana's Lower Mississippi River. The Port of New Orleans is one of America's leading general cargo ports. It is ranked number one in the country for imports of steel, natural rubber, plywood, and coffee. The port is also a critical location for products exported from the petrochemical and agricultural sectors. In 2016, the Bureau of Transportation Statistics reported that the Port of New Orleans' top commodities were: Petroleum and Petroleum Products 33.2% of throughput, Food and Farm products 30.1% of throughput, and Primary Manufactured Goods 11.9% of throughput. The Port of New Orleans is also the only deepwater port in the U.S. served by six Class 1 railroads. In 2019, the Port of New Orleans saw more than 1.2 million cruise passengers, a new annual high, up from 1.18 million in 2018. Numbers are expected to continue to increase annually with the addition of the Disney cruise line, along with more year-round itineraries available to passengers.

Important navigable waterways in Orleans Parish include the Inner Harbor Navigation Canal (IHNC, or the Industrial Canal) and the Mississippi River. The IHNC connects the Mississippi River and Lake Pontchartrain. From 1968 until 2008, the Mississippi River Gulf Outlet (MRGO) provided a shortcut from the Gulf of Mexico to the Port of New Orleans. Following Hurricane

Katrina, Congress de-authorized MRGO, closing it to all ship travel in 2008. MRGO was closed because of its magnifying effect on the storm surge from Hurricane Katrina. To permanently close MRGO, the United States Army Corps of Engineers (USACE) constructed a rock closure across MRGO at Bayou la Loutre in 2009. In 2010, the USACE constructed a floodwall with navigational gates at Bayou Bienvenue and the Gulf Intercoastal Water Way (GIWW) to reduce the risk of damage from future storm surges from the Gulf of Mexico through Lake Borgne.

Roads, Highways, and Bridges

Several major highways pass through New Orleans. The largest is Interstate 10, which handles over 131,000 vehicles per day. New Orleans also includes the spur routes I-510 and I-610. U.S. Highways 11 and 90 pass through New Orleans. While New Orleans has many major corridors, it also has an extensive network of small streets. Many of the streets in the older sections of the city are very narrow, and driving space for cars is further limited by the lack of off-street parking.

Traffic congestion is a major problem during an evacuation. The number of routes out of New Orleans is restricted by the bodies of water surrounding the City. The primary route out of New Orleans is Interstate 10, which runs east-west, crossing Lake Pontchartrain to the east, and the Bonnet Carré Spillway to the west. Highway 61 provides an alternative to Interstate 10 going west, and Highway 11 are alternative routes going east. Depending on weather conditions, the Causeway, which crosses Lake Pontchartrain, runs north to connect with Interstate 12 that runs east-west. Highway 90, which runs east-west, is the only other evacuation route from the city that crosses the Mississippi River and acts as the primary evacuation route for residents in Algiers.

These limited evacuation routes for New Orleans are the same routes used to evacuate the lower-lying parishes that border the City, compounding congestion during evacuation. The only routes out of St. Bernard and Plaquemines Parishes pass through Orleans Parish. Similarly, residents in western parishes evacuating eastward must travel through New Orleans on I-10, creating more congestion overall. In response, the State coordinates a regional evacuation plan that seeks to address this by coordinating phased evacuation and establishing contraflow, in which all travel lanes on the interstates move evacuees out of the New Orleans region.

Transit

Public transportation in New Orleans is operated by the New Orleans Regional Transit Authority (RTA). RTA operates bus lines throughout the Parish, Paratransit, Ferries, as well as four streetcar routes. New Orleans' famous streetcars currently operate along St. Charles Avenue, Canal Street, Loyola Ave, Carrollton Ave, and along the riverfront through the French Quarter and Central Business District. A new streetcar line along Rampart St., just north of the French Quarter, was completed in October of 2016, giving riders more options when traveling the city while furthering the RTA's goal of improving local routes and services.

1.1.5 Community Assets

Locals and newcomers alike take pride in the City's historic neighborhoods, food, music, art, and its diversity of lifestyles. Maintaining New Orleans unique cultural heritage is a priority highlighted in the Master Plan and the Resilient NOLA Strategy. New Orleans is perhaps best known for the French Quarter Historic District and the historic architecture throughout the city. New Orleans has 182 properties and districts listed on the National Register in the parish, including 26 National Historic Landmarks.

The Riverfront, along the Mississippi River, is the location of the Convention Center, the Riverwalk, the Moonwalk, the Aquarium of the Americas, and Woldenberg Park. Other main attractions downtown include the Superdome and the New Orleans Arena. Although several hospitals and clinics downtown were heavily damaged by flooding from Hurricane Katrina, hospital re-openings and construction of new facilities have now been completed, including a new bio-sciences district. This district houses the new Veterans Affairs (VA) and Louisiana State University (LSU)/Tulane Teaching Hospitals at the University Medical Center (UMC).

New Orleans also offers many opportunities for recreation. Lake Pontchartrain and Bayou Sauvage National Wildlife Refuge provide access to outdoor and wildlife recreation. New Orleans' major parks and wildlife recreation include City Park, Audubon Park, the Audubon Zoo, Lafitte Greenway, Crescent Park, and Armstrong Park. Armstrong Park is dedicated to the tradition of jazz in New Orleans. Congo Square lies within the confines of Armstrong Park and is host to many annual celebrations, festivals, and other culturally significant events. Following Hurricane Katrina, the City lost two important recreational assets – Six Flags New Orleans and the Audubon Louisiana Nature Center, both located in the eastern portion of New Orleans.

New Orleans has many colleges and universities. Major institutions of higher learning include the University of New Orleans, Tulane University, Loyola University, Xavier University, Southern University at New Orleans, Dillard University, Our Lady of Holy Cross College, and Delgado Community College.

New Orleans is a culturally rich city. Notably being the birthplace of Jazz and a bastion of hope during the civil rights era, New Orleans has an ingrained and invaluable cultural history. It has many community assets ranging from social aid & pleasure clubs to non-profits supporting numerous art and music effort the city over. The city also is an advantageous location for international commerce. Through the hazard mitigation planning process, the citizens and officials of New Orleans can help protect the city they call home.

NOHSEP coordinates maintenance of a list of Critical Facilities. The FEMA Local Mitigation Planning Handbook (2013) defines Critical Facilities as, "structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery."[vi] During the planning process, the Planning Team worked with several City departments to update the Critical Facilities records, which are included in Appendix C.

1.1.6 Land Use and Zoning

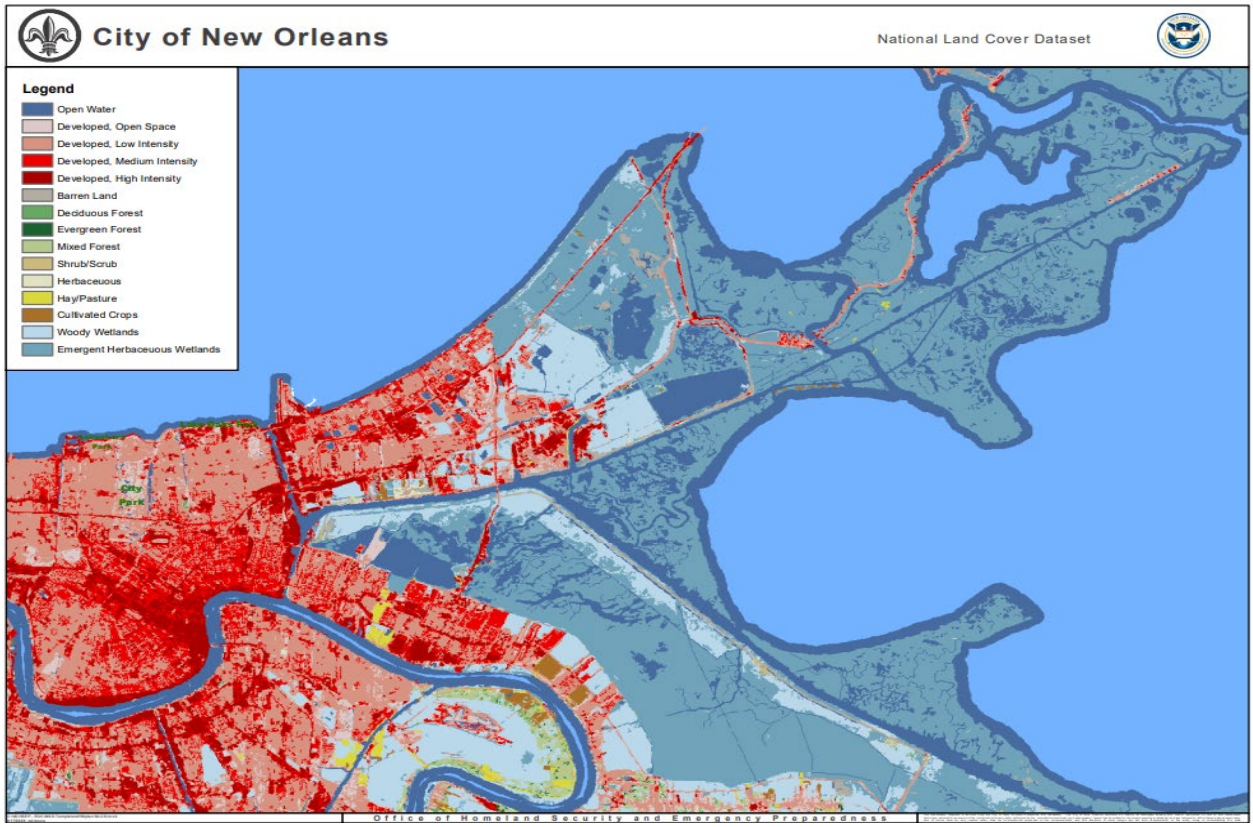
Land use affects natural processes, like water runoff, and also informs what areas or resources might be at risk based on their location relative to a hazard. Table 1 provides a summary of land use in terms of the relative area of the parish and illustrates that the majority of the developable area has been urbanized. The relative intensity of urban land use across the city is shown in Figure 2.

Table 1: Orleans Parish Land Use

Land Use	Acres	Percentage
Agricultural Land, Cropland, and Pasture	816	0.61%
Wetlands	50,754	37.61%
Forest (not including forested wetlands)	1,062	0.78%
Urban/Development	51,272	37.99%
Water	29,404	21.79%

Source: USGS National Land Cover Dataset

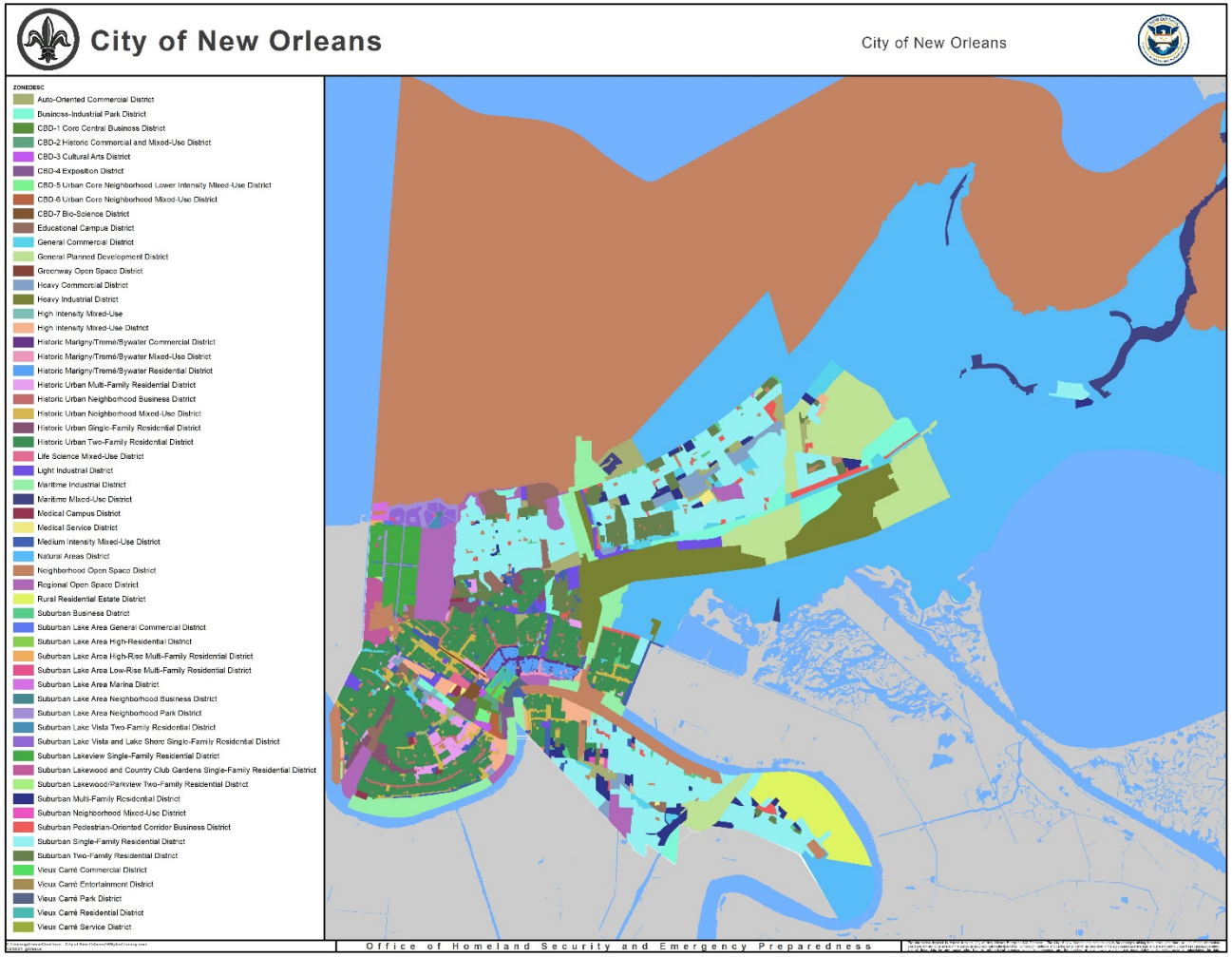
Figure 2: City of New Orleans Land Cover Map



Source: National Land Cover Dataset

Zoning is a land-use planning tool that allows a community to control the location and intensity of development. Effective land-use planning leads to development patterns that reduce, or at least do not increase, risks from known hazards. Current zoning districts are shown in Figure 3.

Figure 3: City of New Orleans Current Land Use Map



Source: City of New Orleans

Future Development Trends

Hurricane Katrina had a major impact on population and housing figures from 2000 to 2018. The widespread flooding throughout New Orleans in 2005 caused significant damage and destruction to housing. It displaced a significant portion of the population, which continues to be below 2000 figures. The U.S. Census Bureau estimates that in 2018 New Orleans had a population of 391,006, approximately 70 percent of the population in 2000. Although the population decreased by 29.1 percent from 2000 to 2010, the trend has reversed. New Orleans saw a population gain of 13.7 percent from 2010 to 2018. The tables below show the population and housing unit estimates from 2000 to 2018.

Table 2: Population Growth Rate for New Orleans

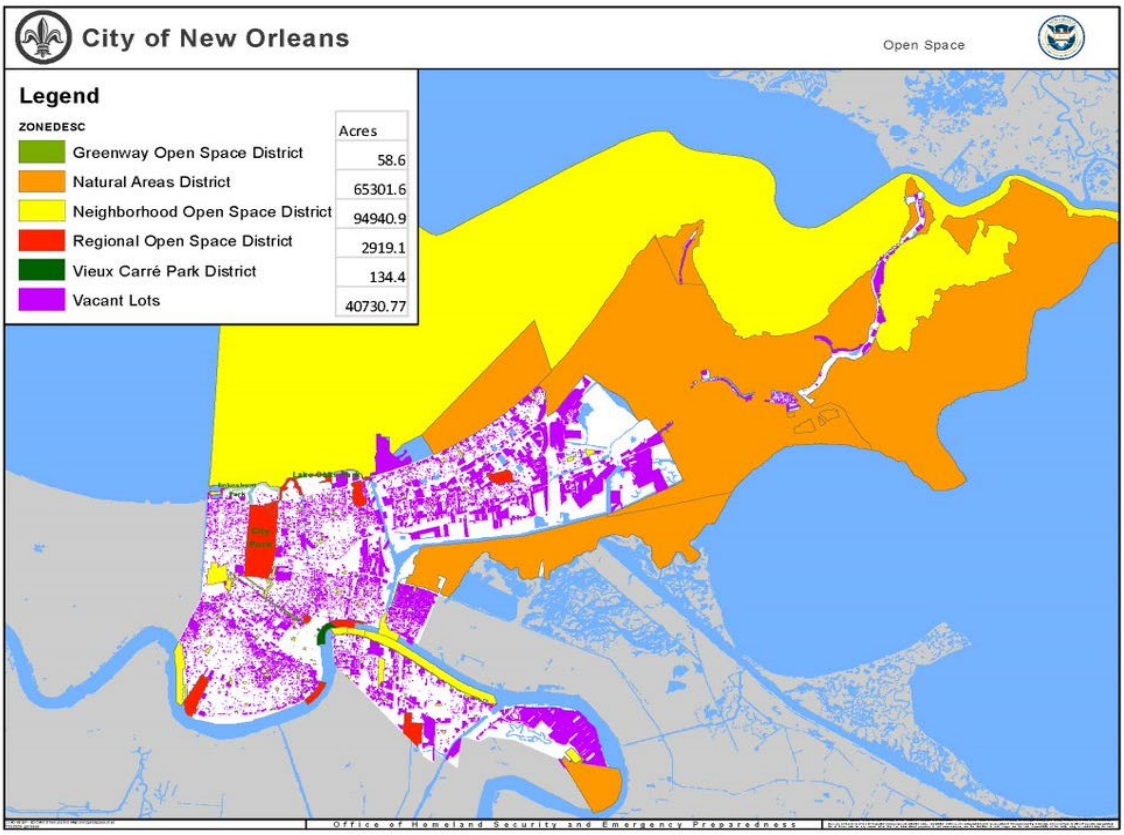
Total Population	Orleans Parish
2000	484,674
2010	343,829
2018 Estimate	391,006
Population Growth between 2000-2010	-29.1%
Average Annual Growth between 2000-2010	-3.4%
Population Growth between 2010-2018	13.7%
Average Annual Growth between 2010-2018	1.6%

Source: U.S. Census and The American Community Survey 2018

The rapid population loss and long and difficult recovery in the years after Hurricane Katrina resulted in a large dispersed area of vacant lots. Having a complete picture of where these are located is useful for planning vibrant neighborhoods that incorporate green space and water management into the urban fabric. Figure 4 shows vacant lots identified by a recent study in collaboration with the UNO Center for Hazard Assessment and Response Technology (CHART), together with areas that are zoned as open space.

The Gentilly Resilience District is a combination of efforts across the Gentilly neighborhood that are funded by a $141 million grant from the National Disaster Resilience Competition. There are a number of projects completed and underway that seek to address urban water management via rain gardens, stormwater infrastructure, and the creation of blue & green corridors throughout the district. The Gentilly Resilience District is envisioned as a model for how other neighborhoods in New Orleans and across the country can adapt to a changing environment.

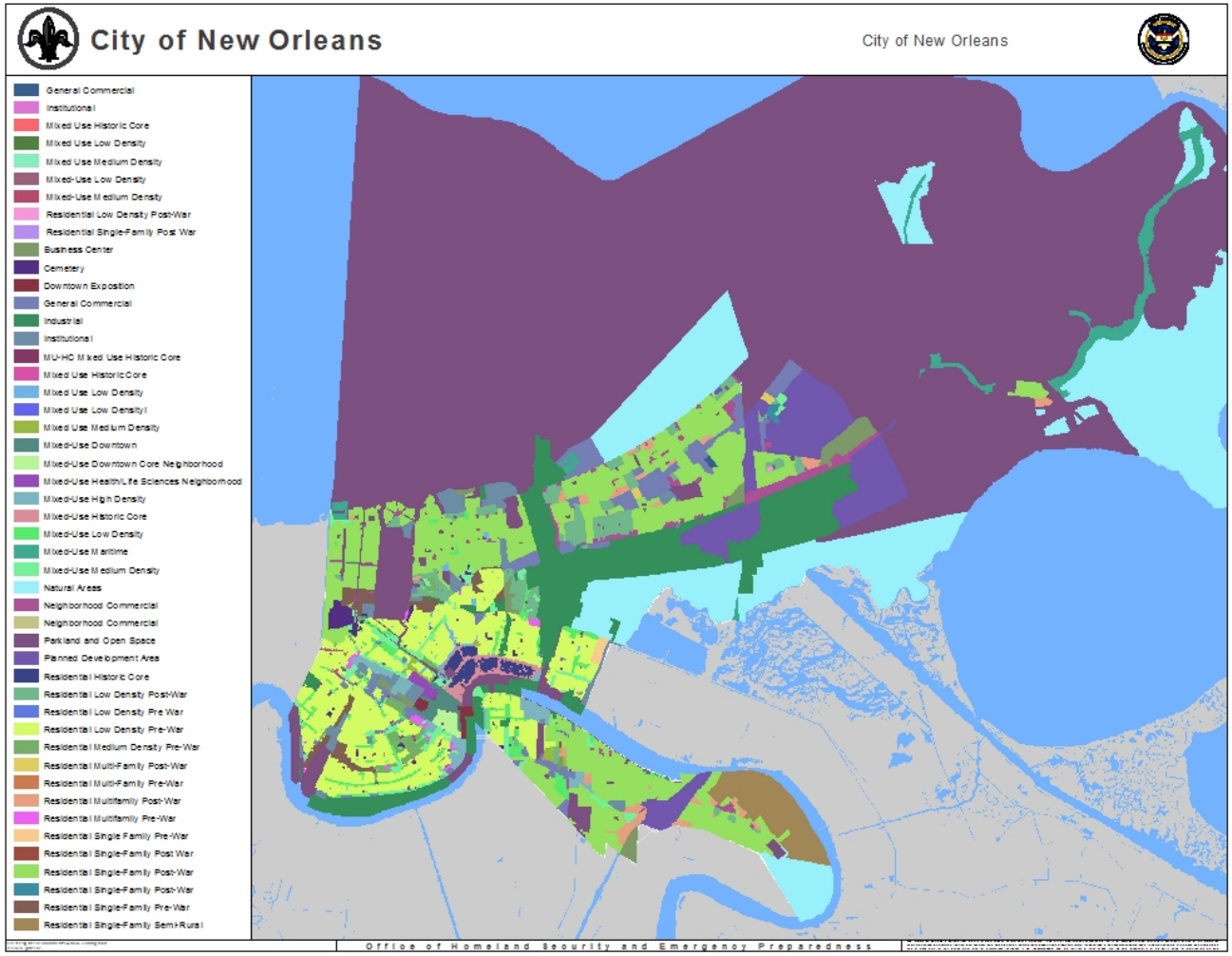
Figure 4: Open Space Map for New Orleans



Source: City of New Orleans, 2020

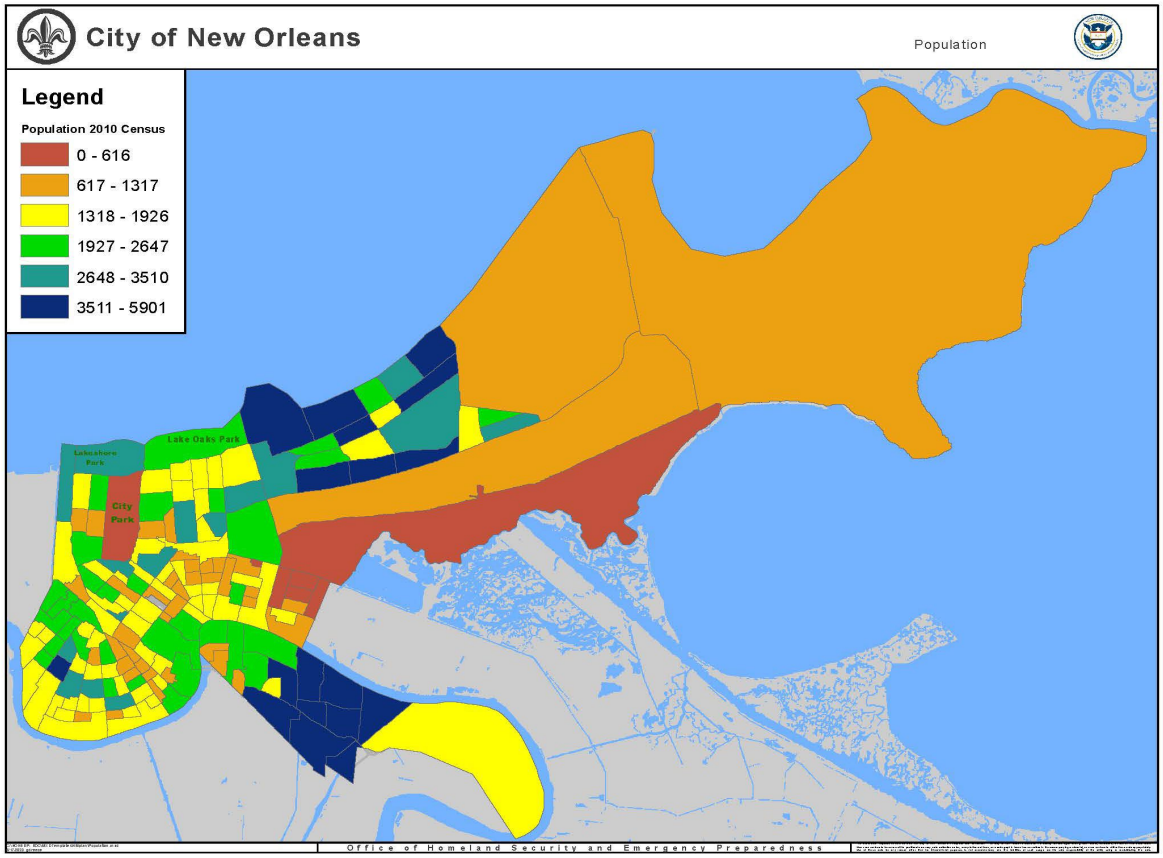
The New Orleans Comprehensive Zoning Ordinance identifies future land use zones (Figure 5). The map reflects the land uses that correspond to the long-term vision, goals, and policies expressed in the Master Plan. It constitutes the most direct link between the Master Plan and the Comprehensive Zoning Ordinance. This information is useful as we consider how the City's landscape might change in the near future.

Figure 5: City of New Orleans Future Land Use Map



Source: City of New Orleans

Figure 6: Population Distribution of New Orleans in 2010 by Census Tract



Source: U.S. Census

The change in housing units has not been as dramatic as population shifts from 2000 to the present. In 2018 New Orleans had an estimated 191,620 housing units, approximately 89 percent of pre-Katrina figures. After a decline of 11.7 percent in housing units from 2000 to 2010, the number of units is slowly increasing. From 2010 to 2018, the number of housing units in New Orleans increased by just under 1 percent (Table 3).

Table 3: Housing Growth Rate for New Orleans

Total Housing Units	Orleans Parish
2000	215,091
2010	189,896
2018 Estimate	191,620
Housing Growth between 2000-2010	-11.7%
Average Annual Growth between 2000-2010	-1.2%
Housing Growth between 2010-2018	0.9%
Average Annual Growth between 2010-2018	0.1%

Source: U.S. Census and The American Community Survey 2018

1.1.7 Population

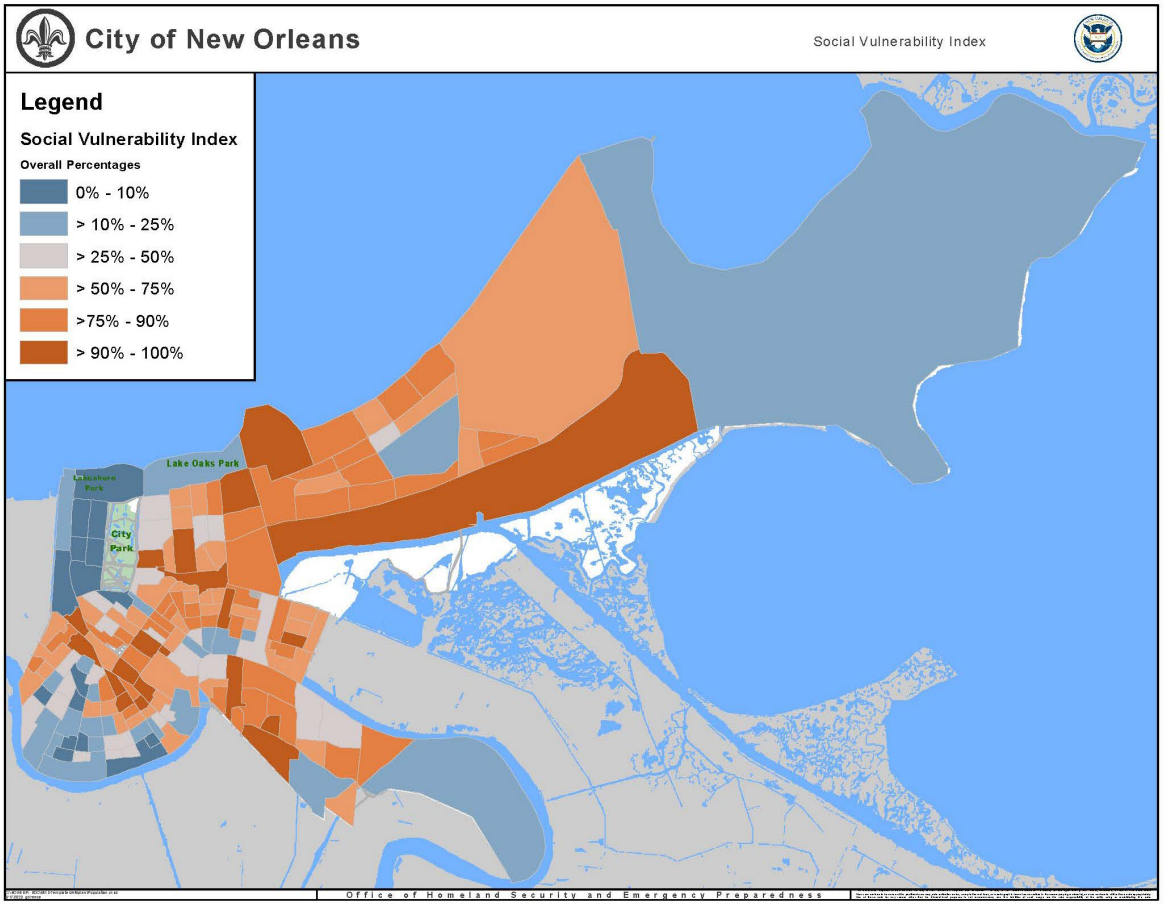
Similar to many urban centers across the country, New Orleans experienced a slow decline in population beginning in 1960. Although New Orleans lost over 130,000 people between 1960 and 1990, the decline was not as pronounced as in other U.S. cities (e.g., Cleveland, Pittsburgh, and St. Louis) whose local economies were tied closely to manufacturing. However, during the 1980s, New Orleans experienced a sharper decline in population as a result of the slowdown in the oil industry. Between 1960 and 1990, the population of New Orleans decreased by 21 percent (from 627,625 in 1960 to 496,938 in 1990). In the period from the 1990s through mid-2005, prior to Hurricane Katrina, New Orleans's population began to stabilize.[vii] In July 2005, New Orleans had an estimated population of 455,188. In August 2005, Hurricane Katrina flooded the City of New Orleans, and nearly 100% of the population was temporarily displaced. As a result, population figures dropped to approximately 208,000 people in 2006. As the city continued to recover, the population reached over 340,000 in 2010. The population continued to increase at a rate of 13.7% between 2010 and July 2018.

Table 4: Orleans Parish Population

	2006 Estimate	2010 Census	2018 Estimate	Percent Change 2010 - 2018
Total Population	208,548	343,828	391,006	13.7%

Source: U.S. Census Bureau

Figure 7: Social Vulnerability Index by Census Tract



Source: U.S. Center for Disease Control, City of New Orleans

Figure 7 shows the Social Vulnerability Index (SVI) composite score, which takes into account 15 variables from the U.S. Census, including Socioeconomic Status, Household Composition, Race/Ethnicity/Language, and Housing/Transportation. The index uses this data to predict how vulnerable people are throughout the neighborhoods and census tracts. This information can be used to help identify the people and places in New Orleans with the highest vulnerability to disasters and to inform the way the City mitigates disasters and promotes resilience.

Table 5 indicates the distribution of residents by age cohorts. More than 20% of Orleans Parish's population is under the age of 18. The city's elderly population has increased by more than 2% since the last HMP update from 11.2% to 13.5%. This is exceptionally relevant to hazard mitigation, as the elderly population may be at greater risk from specific hazards. For a more elaborate discussion of this vulnerability, please see *Section Two: Risk Assessment.*

Table 5: Orleans Parish Age Cohorts

Indicator *Total Population 2018: 391,006*	2009-2013 Estimate	2018 Estimate
Persons under 5 years	6.4%	6%
Persons under 18 years	N/A	20.2%
Persons over 65 years	11.2%	13.5%

Source: U.S. Census Bureau

The following table highlights specific populations that may be more at risk of hazardous events than others. Householders living alone can be more vulnerable to hazards due to a lack of resources or support networks that can provide information and additional resources. This can be especially true for householders over the age of 65 and veterans, who are more likely to have a disability than the general population and may need additional assistance accessing information and assistance.[viii] For example, over 16,000 or approximately 11 percent of all householders are 65 and living alone. Veterans make up a similar proportion of all householders with 16,364 households. These statistics reflect the large proportion of households that may be categorized as a vulnerable population that may need additional support to increase access to information, which could be resolved by increasing access to technology.

Table 6: Orleans Parish Households

Indicator *Total Population 2018: 391,006*	2018 Estimate
Total Occupied Households	154,036
Female householder, no husband present, family	27,721
Non-family householder living alone	67,253
Non-family householder living alone over age 65	16,842
Veteran households	16,364

Source: U.S. Census Bureau

The following table highlights ethnic cohorts in the city. Race and ethnicity correlate with social vulnerability.[ix] This vulnerability translates to a lack of access to resources, cultural differences, and the social, economic, and political marginalization associated with these disparities. Language and cultural barriers can also affect access to post-disaster funding in high-hazard residential locations.

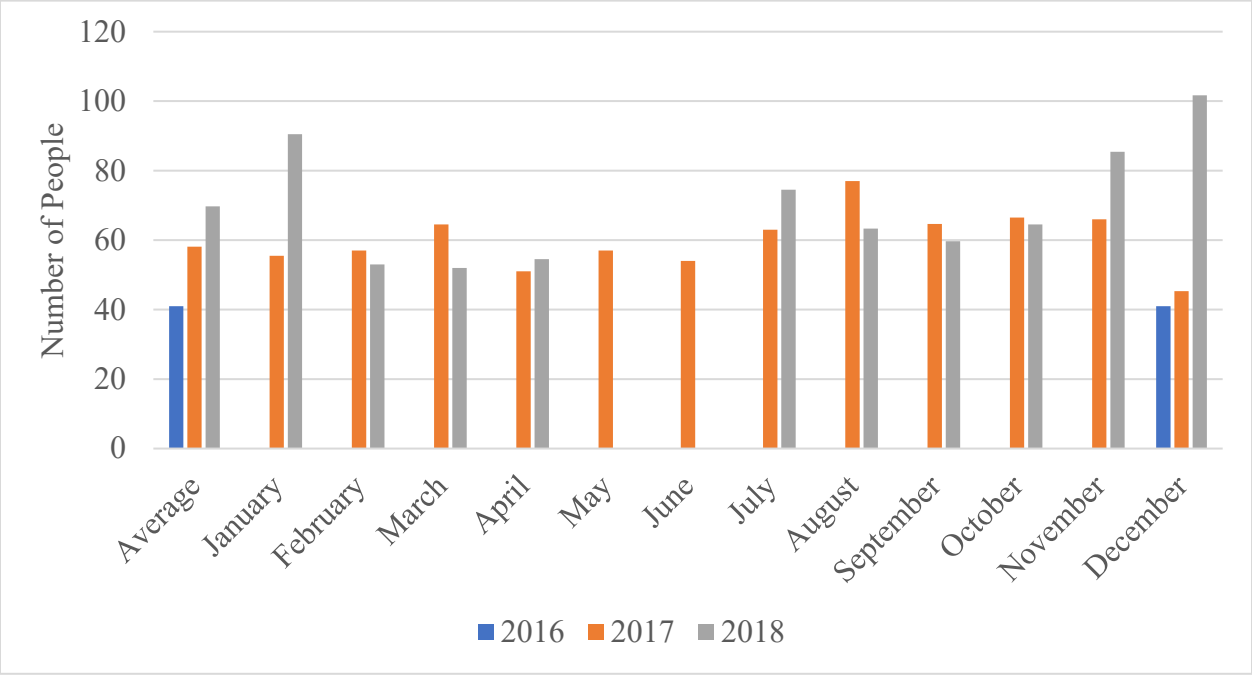
Table 7: Orleans Parish Ethnic Cohorts

Indicator *Total Population 2018: 391,006*	2018 % of Total
White	34%
Black	59.7%
Vietnamese	2.9%
Latino	5.5%

Source: U.S. Census Bureau

Homelessness and housing insecurity increase vulnerability and exposure to environmental hazards, such as extreme temperatures. New Orleans Health Department conducts outreach to the homeless community and tracks the estimated homeless population, as demonstrated in Figure 8.

Figure 8: Encampment Population



Source: New Orleans Health Department

The annual total homeless encampment population in New Orleans has risen slightly in recent years. In 2018, the highest numbers were in the winter months (Nov, Dec, Jan) and in July, when the weather is most extreme. There is a growing need for warming/cooling shelters during different seasons throughout the year.

1.1.8 Economy

Since World War II, New Orleans' economy has mainly been based on trade, energy, tourism, and to a lesser extent, industry, and manufacturing. The New Orleans economy remained strong until the 1980s with the decline in the oil sector. Since the 1980s, the New Orleans economy has relied more heavily on trade and tourism.

The New Orleans economy continues to be dominated by four major sectors: Health Care and Social Assistance; Professional, Scientific, and Technical Services; Accommodation and Food Services; and Educational Services. Today, New Orleans is still home to one of the major U.S. ports and an extensive network of ground transportation routes in and out of the city. Some of the major imports that pass through New Orleans include steel, coffee, sugar, bananas, and bauxite. Exports include oil, petroleum products, grains, and textiles. Along with this established focus on both national and international commerce, Orleans Parish boasts an ever-growing industrial sector, including major contributors in the energy and advanced manufacturing industries. While businesses such as port operations and tourism are major economic drivers in the parish, according to the Small Business Administration, statistics for the New Orleans area show that small businesses create more than 75% of new jobs. The presence of big business together with small business adds to a diversified economic base throughout the parish.

New Orleans is an emerging technological and digital media market. According to a 2018 report published by market analytics firm Emsi, New Orleans is listed as one of the top 12 leading cities for high technology jobs in North America. A separate report published by Business Analytics listed New Orleans number four on a list of the top 12 technology hubs in North America. A number of new or established tech companies are located in New Orleans, such as GE Digital, DXC Technology, inXile Entertainment, Accurent, and High Voltage Software. The city's business patterns and workforce distribution by sector are further detailed in table 8.

Table 8: Orleans Parish Business Patterns

Business Description	Number of Establishments	Number of Employees	Annual Payroll ($1,000)
Retail Trade	1,332	14,682	395,176
Manufacturing	177	3,464	194,673
Health Care and Social Assistance	987	26,032	1,316,534
Mining, Quarrying, Oil and Gas Extraction	25	780	121,328
Transportation and Warehousing	219	7,491	379,922
Construction	391	4,785	300,168
Administration/Support and Waste Management/Remediation Services	404	7,169	220,878
Real Estate and Rental and Leasing	460	2,553	109,938
Wholesale Trade	235	2,897	163,994
Other Services (except Public Administration)	926	7,975	243,583
Accommodation and Food Services	1,490	43,424	1,054,868
Finance and Insurance	485	6,506	691,323
Professional, Scientific, and Technical Services	1,555	13,339	1,126,664
Information	172	1,914	110,256
Educational Services	217	22,165	959,490
Arts, Entertainment, and Recreation	234	6,957	161,263
Agriculture, Forestry, Fishing, and Hunting	4	20-99	——
Utilities	25	1,544	206,793
Management of Companies and Enterprises	76	3,233	32,190
Industries Not Classified	8	9	382

Source: US Census County Business Patterns 2018

1.2 Hazard Mitigation Planning Overview

New Orleans' Hazard Mitigation Program is a key component of the City's approach to emergency management and disaster resilience. In the early 1980s, the newly created Federal Emergency Management Agency (FEMA) was charged with developing a structure for how the federal, state, and local governments would respond to disasters. FEMA developed the *four phases of emergency management*, an approach that can be applied to all disasters. The four phases are as follows:

- **Hazard Mitigation**—described by FEMA and the Disaster Mitigation Act of 2000 (DMA 2000) as "any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event." The goal of mitigation is to save lives and reduce property damage. Besides significantly aiding in the obviously desirous goal of saving human lives, mitigation can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities and minimize

community disruption, helping communities return to usual daily living in the aftermath of a disaster. Examples of mitigation involve a range of activities and actions, including the following - land-use planning, adoption and enforcement of building codes, and construction projects (e.g., floodproofing homes through elevation or acquisition and relocation away from floodplains).

- **Emergency Preparedness**—includes plans and preparations made before a disaster event to save lives and property and to facilitate response operations.
- **Disaster Response**—includes actions taken to provide emergency assistance, save lives, minimize property damage, and speed recovery immediately following a disaster.
- **Disaster Recovery**—includes actions taken to return to a normal or improved operating condition following a disaster.

Figure 9 illustrates the basic relationship between these phases of emergency management. While hazard mitigation may occur both before and after a disaster event, it is significantly more effective when implemented before an event occurs. This is one of the key elements of this plan and its overall strategy: reduce risk before disaster strikes in order to minimize the need for post-disaster response and recovery. The figure demonstrates how mitigation relies on updating plans in the wake of a disaster. Post-disaster plan revision is a vital component of improving mitigation. Each hazardous event affords an opportunity to reduce the consequences of future occurrences.

Figure 9: The Four Phases of Emergency Management and their Relation to Future Hazard Mitigation

Source: *National Earthquake Hazards Reduction Program*

The catastrophic events of 2005 had profound impacts on emergency management and hazard mitigation throughout Louisiana. The storms also raised awareness of the importance of hazard mitigation among decision-makers and the general population, which has been particularly important since natural hazards will likely be increasing in frequency, magnitude, and impact in the coming years due to climate change.

1.2.1 General Strategy

During the last update to the Louisiana State Hazard Mitigation Plan, the State Hazard Mitigation Team (SHMT) began a long-term effort to better integrate critical components of all plans with hazard mitigation implications in Louisiana to ensure that the programs, policies, recommendations, and implementation strategies are internally consistent. As each of these documents has been adopted by various state agencies, the SHMT has worked to incorporate this information into the decision process.

Part of the ongoing integration process is that GOHSEP encourages the parishes and the local municipalities with independent hazard mitigation plans to utilize the same plan format and methodologies as the State Hazard Mitigation Plan in order to create continuity of information from local to state mitigation plans and programs. The planning team developed this plan consistent with the Louisiana SHMP.

This 2020 plan update also coheres with the Plain Writing Act of 2010, which requires federal agencies to use clear communication that is accessible, consistent, understandable, and useful to the public. While the State of Louisiana and its political subdivisions are not required to meet such standards, the Act aligns with best practices in hazard mitigation. Since successful hazard mitigation relies on full implementation and cooperation at all levels of government and community, a successful hazard mitigation plan must also be easily used at all of these levels. The Orleans Parish Hazard Mitigation Steering Committee continues to place significant value on the detailed analysis and mitigation planning executed in previous plan updates. This plan update remains coherent with those documents, retaining language and content where appropriate, deleting or replacing it where appropriate, and augmenting it when constructive.

1.2.2 2020 Plan Update

The 2020 Orleans Parish Hazard Mitigation Plan maintains much of the information from the 2015 plan, which was organized as follows:

- Section 1: Executive Summary
- Section 2: Introduction
- Section 3: Plan Adoption
- Section 4: Community Profile
- Section 5: Planning Process
- Section 6: Hazard Identification, Profiling, Ranking
- Section 7: Vulnerability Assessment, Loss Estimation
- Section 8: Capability Assessment
- Section 9: Mitigation Strategy
- Section 10: Plan Maintenance

This 2020 plan update proceeds with the goals of the previous Orleans Parish Hazard Mitigation Plan. The current goals are as follows:

- Reduce risk and vulnerability to the human environment, including cultural resources, homeowners, renters, visitors, and transient populations.
- Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.
- Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.
- Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.
- To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.
- To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.

This plan update makes a number of textual changes throughout, but the most obvious changes are data-related and structural edits. First, the community profile and risk assessment sections use new or updated scientific data from State and Federal agencies. The National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information's (NCEI) Storm Events Database was used in the hazard profile and risk assessment, which provides historical hazard data from 1950 to 2019, as well as storm event data from other sources, including the NOAA Storm Prediction Center, National Hurricane Center, and U.S. Fire Administration. The risk assessment also includes updated information on climate-related hazards from the National Climate Assessment and the Louisiana Coastal Master Plan. Furthermore, all of the sections were updated to reflect the most current information and the most current vision of the plan update. Second, instead of ten separate sections for numerous tables, maps, and appendices, the present plan update contains four sections and five appendices. The most significant changes are the newly developed hazard profiles and risk assessments, the addition of newly proposed mitigation actions, and the removal of repetition between sections from previous plan updates. The 2020 plan update is organized generally as follows:

- Section One: Introduction
- Section Two: Hazard Identification and Parish-Wide Risk Assessment
- Section Three: Capability Assessment
- Section Four: Mitigation Strategy
- Appendix A: Planning Process
- Appendix B: Plan Maintenance
- Appendix C: Critical Facilities
- Appendix D: State Required Worksheets

Table 9: 2015 – 2020 Hazard Mitigation Plan Crosswalk

2015 Plan	Revised Plan (2020)
Section 1: Executive Summary	Section 1: Introduction
Section 2: Introduction	Section 1: Introduction
Section 3: Plan Adoption	Appendix A: Planning Process/Appendix D: Plan Adoption
Section 4: Community Profile	Section 1: Introduction; Section 2: Hazard Identification and Risk Assessment
Section 5: Planning Process	Appendix A: Planning Process
Section 6: Hazard Identification, Profiling, Ranking	Section 2: Hazard Identification and Risk Assessment
Section 7: Vulnerability Assessment, Loss Estimation	Section 2: Hazard Identification and Risk Assessment
Section 8: Capability Assessment	Section 3: Capability Assessment, Appendix E: State Required Worksheets
Section 9: Mitigation Strategy	Section 4: Mitigation Strategy
Section 10: Plan Maintenance	Appendix B: Plan Maintenance

Despite these changes, the plan remains consistent in its emphasis on hazards that pose the most significant risk to loss of life, injury, and property in Orleans Parish. Most significantly, Orleans Parish remains at high risk of flooding from various sources, including urban flooding, coastal hazards, and tropical cyclone activity. All of the parish is also at high risk of damages from high winds and wind-borne debris. Other hazards threaten the parish, although not to such great degrees and not in such widespread ways. In all cases, the relative social vulnerability of areas threatened and affected plays a significant role in how governmental agencies and their partners (local, parish, state, and federal) must prepare for and respond to disasters.

The City of New Orleans works in cooperation with other agencies and organizations that operate within the city to plan and implement mitigation efforts. The most important step forward to improve hazard management capability is to improve coordination and information sharing between the various levels of government and the whole community regarding hazards.

In an effort to make this Hazard Mitigation Plan more accessible and to improve coordination and information sharing with related efforts, the City of New Orleans has elected to transition from a paper-based plan to a web-based plan. In doing so, New Orleans will be just the second jurisdiction, behind only New York City, and the first in FEMA Region 6 to make this transition. Having a web-based plan will ultimately improve the experience of the residents of New Orleans who desire to understand the natural and manmade hazards that may impact their neighborhoods. The web-based plan will allow users to more easily navigate to parts of the plan that interest them, it will provide access to mapping and data visualization tools to help in understanding the potential impacts of hazards, and it will serve as a cross-referencing tool that will provide linkage and transparency to other city plans that impact our citizens. Ultimately, the web-based plan will serve as a vehicle for our citizens to help them make informed decisions, gain a greater understanding

of the hazards and impacts they may encounter, and better understand the plans the City has developed to mitigate the future impacts of natural and manmade disasters.

Section 2: Hazard Identification and Parish-Wide Risk Assessment

This section assesses the various risks that New Orleans faces in order to identify a strategy for mitigation. What follows details the major climatological and natural/human-influenced hazards by (1) defining them, (2) explaining how they are measured, (3) describing their geographic extent, (4) surveying their previous occurrences, and (5) evaluating their future likelihood of occurrences.

The Federal Emergency Management Agency (FEMA) requires that the City of New Orleans identify the natural hazards it faces. According to 44 CFR § 201.6[x] , Local Mitigation Plans must address the vulnerability of community assets and estimate potential losses, reflect changes in development since the last plan update, provide an overview of the future probabilities of hazard events, and detail a mitigation strategy and plan maintenance process.

2.1 Hazard Summary

Tables 10 and 11 provide an overview of the hazards that were previously profiled in the Orleans Parish Hazard Mitigation Plan published in 2015, along with the hazards that were identified for the 2020 Hazard Mitigation Plan.

Table 10: 2015 and 2020 Natural Hazards

2015 HMP Hazards	2020 HMP Hazards
Flooding	Flooding (Stormwater/Storm Surge/Riverine)
Storm Surge	
Tropical Cyclones	High Wind (Tornadoes/Tropical Cyclones/Thunderstorms)
Tornadoes	
Coastal Erosion	Coastal Land Loss
Subsidence	Subsidence
Winter Storms	Winter Weather
Drought[1]	-
Extreme Temperatures	Extreme Heat
Thunderstorms (Hail and lightening)	Severe Thunderstorms (Hail/Lightening)

[1] Deleted as it is the analysis of the planning committee that 1) droughts are infrequent and their impacts are not severe enough to lead to a declared disaster, 2) the impacts of drought (drinking water quality and surficial soil oxidation are actively addressed through Sewage & Water Board of New Orleans standard water purification, The Environmental Protection Agency (EPA) administration of the Can Water Act (CWA), and the City of New Orleans' efforts to improve water management (flooding and subsidence).

Man-made hazards are listed and addressed in alignment with the local all-hazards preparedness philosophy.

Table 11: 2015 and 2020 Man-Made Hazards*

2015 HMP Hazards	2020 HMP Hazards
Dam & Levee Failure	-
Hazardous Materials (Spills/Contamination, Fixed Site & Transportation)	Hazardous Materials (Spills/Release/Contamination)
Power Outages	-
Terrorism	Active Threats (Terrorism/Cyber Threat/Active Attack)
Infrastructure Failure	Infrastructure Failure (Levee Failure/Building Collapse/Water Systems Failure/Power Outage)
Building Collapse	-
Civil Unrest[xi]	-
Pandemic	Infectious Disease Outbreak (Pandemic/Vector-Borne Disease)
	Economic Shock

*The Hazard Mitigation Plan Steering Committee considered including Climate Change as its own hazard. Still, the committee ultimately felt it made more sense to evaluate it as a complicating factor in other natural hazards. The impacts of climate change on future risks are discussed in the profiles of individual hazards likely to be affected by climate change.

2.1.1 Previous Occurrences of Major Disasters

The most frequently occurring hazards in the City of New Orleans are tropical cyclones and flooding. 17 out of 28 (60.7%) of the Presidential Disaster Declarations that New Orleans has received have resulted from tropical cyclones.[xii] Additionally, 25% (7 out of 28) of those declarations have resulted from flooding.

Table 12: Orleans Parish Major Disaster Declarations

Disaster & Date	Nature of Event	Description
FEMA-DR-208 9/10/1965	Hurricane Betsy	Category 3 Hurricane with landfall west of New Orleans. Estimated $1.4 billion in damage, 75 deaths, 800 injuries, and164,000 homes flooded.
FEMA-DR-272 8/14/1969	Hurricane Camille	One of only two Category 5 hurricanes to make landfall on a US coastline. Hurricane Camille made landfall along the Mississippi coast near Bay St. Louis, MS, causing an estimated $1.4 billion in total damages and 259 deaths.
FEMA-DR-374 4/27/1973	Severe Storm, Flood	Spring rains caused flooding in large areas of Louisiana and along the Mississippi River for more than 1,500 miles.
FEMA-DR-448 9/23/1974	Hurricane Carmen	Category 4 Hurricane made landfall ten miles west of Grand Isle; six-foot storm surge. Orleans Parish damage estimates were reported at slightly less than $20 million
FEMA-DR-556 5/9/1978	Severe Storm, Flood	Torrential rains in excess of 10 inches, with rates of two inches per hour at times. Nearly all main arteries were flooded or inaccessible well into the evening hours.
FEMA-DR-616 4/9/1980	Severe Storm, Flood	Severe storms resulted in 10 inches of rain over several days. Drainage pumps throughout the Parish were overwhelmed and most shut down during the event. Flooding occurred in low-lying areas.
FEMA-DR-679 4/20/1983	Severe Storm, Flood	Heavy rain overwhelmed drainage pumps throughout the Parish, with resulting moderate flooding in the low-lying areas.
FEMA-DR-752 11/1/1985	Hurricane Juan	Category 1 storm made landfall in south-central Louisiana. Storm stalled over Louisiana for several days causing an estimated $38 million in damages in Orleans Parish.
FEMA-DR-849 11/19/1989	Severe Storm, Flood	Heavy rain flooded residences and businesses.
FEMA-DR-956 8/26/1992	Hurricane Andrew	Category 3 Hurricane, with winds of more than 100 miles per hour (mph) at the time it made landfall

Disaster & Date	Nature of Event	Description
		for the second time in Louisiana. Grand Isle and coastal areas were completely evacuated.
FEMA-DR1049 5/10/1995	Severe Storm, Flood	Widespread rainfall of 8 to 12 inches in less than four hours overwhelmed the capacity of drainage pumps, with some of the most widespread and severe flooding reported in the City in the past 50 years. New Orleans damage estimated at $388 million.
FEMA-DR1246 9/13/1998	Tropical Storm Frances & Hurricane George	Category 3 hurricane that made landfall to the east of New Orleans. Widespread and deep flooding in the streets of the New Orleans metropolitan area.
FEMA-DR1380 6/11/2001	Tropical Storm Allison, Flood	Slow-moving tropical storm caused widespread flooding; some locations received ten to 18 inches of rain.
FEMA-DR1437 10/03/2002	Hurricane Lili	Hurricane Lili made landfall on the central Louisiana coast as a category one hurricane. Property damages in Louisiana were estimated at $415 million.
FEMA-DR1548 9/15/2004	Hurricane Ivan	Impacted Orleans Parish as a hurricane on September 16, 2004 and then cycled back into the Gulf and came ashore again as a tropical depression on September 26, 2004.
FEMA-DR1601 7/5/2005	Tropical Storm Cindy	The tropical storm came ashore just southwest of Grand Isle. Surge flooded low-lying coastal areas and high winds caused power outages across to an estimated 300,000 homes and businesses.
FEMA-DR1603 8/29/2005	Hurricane Katrina	Made landfall as a Category 3 storm. Catastrophic flooding from storm surge and levee failures caused unprecedented flooding throughout New Orleans and the surrounding areas. A much longer discussion of the effects of Katrina can be found later in this section.
FEMA-DR1603 9/24/2005	Hurricane Rita	Made landfall as a strong Category 3 hurricane in extreme southwestern Louisiana. Rita made landfall less than a month after Hurricane Katrina, while sections of the City of New Orleans were still

Disaster & Date	Nature of Event	Description
		being drained of floodwaters. An estimated 10,000 structures were flooded.
FEMA-DR1685 2/13/2007	Severe Storms And Tornadoes	Tornadoes and severe storms impacted Jefferson, Orleans, and St. Martins Parishes. An EF2 Tornado moved through the City of Westwego and the Carrollton area of New Orleans. A total of 295 houses in New Orleans were damaged. A total of 79 houses were destroyed.
FEMA-DR1786 9/2/2008	Hurricane Gustav	Made landfall along the Louisiana coast with 105 mph winds near Cocodrie, Louisiana. Surges of 12-13 feet occurred along the Louisiana coast southeast of New Orleans, with surges of 9-10 feet in other portions of southeastern Louisiana. The storm surge overtopped the levees and floodwalls in a few parts of the New Orleans metropolitan area.
FEMA-DR1792 9/13/2008	Hurricane Ike	Landfall as a Category 2 hurricane. A storm surge ranging from four to nearly eight feet above normal occurred along the southeast Louisiana coast with a storm surge around five feet above normal in Lake Pontchartrain
FEMA-DR4015 8/18/2011	Flooding	The historic Mississippi River Flood of 2011 resulted from above-normal snowfall over the Upper Mississippi Valley, elevated river levels from heavy rain events from February to April, and a very heavy rain event in the Mississippi watershed from the end of April to the beginning of May.
FEMA-DR4041 10/28/2011	Tropical Storm Lee	Lee made landfall in S. Louisiana on Sept. 4, 2011. The large, slow-moving system produced heavy rainfall with over 12.5 inches reported at New Orleans Lake Front Airport. Lee also generated strong winds and tornados
FEMA-DR4080 8/29/2012	Hurricane Isaac	Isaac, a slow-moving system, made landfall twice in S. Louisiana, with sustained winds of 80 miles per hour. Storm surge in Orleans Parish was recorded at 4-8’ and up to 17’ in Plaquemines

Disaster & Date	Nature of Event	Description
		Parish. Over 20" of rain was recorded in New Orleans.
FEMA-DR43002/11/2017	Severe Storms, Tornadoes, Straight-Line Winds	Governor John Bel Edwards requested an expedited major disaster declaration due severe storms, tornadoes, and straight-line winds on February 7, 2017. On February 11, 2017, President Trump declared that a major disaster exists in the State of Louisiana. This declaration made Individual Assistance requested by the Governor available to affected individuals and households in Livingston and Orleans Parishes. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.
FEMA-DR4458 8/27/2019	Hurricane Barry	Governor John Bel Edwards requested a major disaster declaration due to Hurricane Barry during the period July 10-15, 2019. On August 27, 2019, President Trump declared that a major disaster exists in the State of Louisiana. This declaration made Individual Assistance requested by the Governor available to state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by Hurricane Barry; debris removal and emergency protective measures (Categories A and B), including direct federal assistance under the Public Assistance program. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.

Source: FEMA

2.1.2 Probability of Future Hazard Events

The estimated probability of a hazard event occurring in the City of New Orleans is summarized below. The percent chance of an event happening during any given year was calculated by the following equation (Number of Events/Time Period) x 100, which is the standard method for calculating the probability for a FEMA Hazard Mitigation Plan. The event history and future probability of each hazard is discussed in more detail in the sections profiling each hazard.

Past events are not always reliable indicators of future trends. For example, changes to the climate and land-use patterns affect flooding by changing how water moves through the City. Many of the plans and tools used to inform this Risk Assessment incorporate climate change in their methods and assumptions. Locally, climate-related changes like sea-level rise, increasing temperatures, and less-frequent, but heavier precipitation are almost certain to increase stress on infrastructure, ecosystems, and populations[xiii].

The probability of future hazard reoccurrence, found in Table 13, was calculated using the National Oceanic and Atmospheric Administration NCDC/NCEI Database. There are limitations to this data. However, this is the best available data at the present moment, and it was used to calculate the probabilities below.

Table 13: Probability of Future Hazard Reoccurrence

Hazard	Annual Probability
Flooding	100%
Tropical Cyclones	92%
Coastal Erosion	100%
Tornadoes	36%
Subsidence	100%
Winter Weather	36%
Extreme Heat	100%
Severe Thunderstorm	100%

Source: NCEI

2.2 Hazard Identification

2.2.1 Flooding

Definition

A flood is the overflow of water onto land that is usually not inundated. The National Flood Insurance Program (NFIP) defines a flood as:

> *A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from the overflow of inland or tidal waters, unusual and rapid accumulation or runoff of surface waters from any source, mudflow, or collapse or subsidence of land along the shore of a lake or a similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.*

Factors influencing the type and severity of flooding include:

- **Natural variables**

    - Precipitation,
    - Topography,
    - Vegetation,
    - Soil texture, and
    - Seasonality
- **Anthropogenic factors** (Originating from Human Activity)
    - Urbanization (extent of impervious surfaces like asphalt, concrete, etc.),
    - Land use (e.g., agricultural and forestry tend to remove native vegetation and accelerate soil erosion), and
    - The presence of flood-control structures such as drainage pumps and levees

Flooding in New Orleans can be the result of weather events such as hurricanes, thunderstorms (convectional and frontal), storm surge, and winter storms. Excess precipitation, produced from thunderstorms or hurricanes, is often the major initiating condition for flooding. Flooding in New Orleans can also result from infrastructure failures such as levees, floodwalls, and water main breaks. It is also important to note the potential for combined hazards, as was the case of Tropical Storm Barry and the Mississippi being at flood stage in July 2019.

Louisiana can have high rainfall totals at any time of day or year, but the weather patterns that produce these rains vary seasonally. During the cooler months, slow-moving frontal weather systems produce heavy rainfalls, while the summer and autumn seasons produce major precipitation in isolated thunderstorm events (often on warm afternoons) that may lead to localized flooding. During the warmer seasons, heavy rains that produce flash flooding are common, while river floods caused by heavy streamflow generally occur during the cooler months.

In cooler months, particularly in the spring, New Orleans is in peak season for severe thunderstorms. The fronts that cause these thunderstorms often stall while passing over the state, occasionally producing rainfall totals exceeding ten inches within a period of a few days. Since soil tends to be nearly saturated at this time (due to relatively low overall evaporation rates), spring typically becomes the period of maximum streamflow across the state. Together, these characteristics increase the potential for high water, and low-lying, poorly drained areas are particularly prone to flooding during these months.

In Louisiana, six specific types of floods are of main concern: riverine, flash, ponding, backwater, urban, and coastal.

Riverine flooding occurs along a river or smaller stream. It is the result of runoff from heavy rainfall or intensive snow or ice melt. This includes the Mississippi River; whose levels rise and fall slowly due to its large capacity.

Flash flooding occurs when locally intense precipitation inundates an area in a short amount of time, resulting in local streamflow and drainage capacity being overwhelmed.

Ponding occurs when concave areas (e.g., parking lots, roads, and clay-lined natural low areas) collect water and are unable to drain.

Backwater flooding occurs when water slowly rises from a normally unexpected direction where protection has not been provided. A model example is the flooding that occurred in LaPlace during Hurricane Isaac in 2012. Although the town was protected by a levee on the side facing the Mississippi, floodwaters from Lake Maurepas and Lake Pontchartrain crept into the community on the side of the town opposite the Mississippi River.

Urban flooding is similar to flash flooding but is specific to urbanized areas. It takes place when stormwater drainage systems cannot keep pace with heavy precipitation, and water accumulates on the surface. Most urban flooding is caused by slow-moving thunderstorms or torrential rainfall.

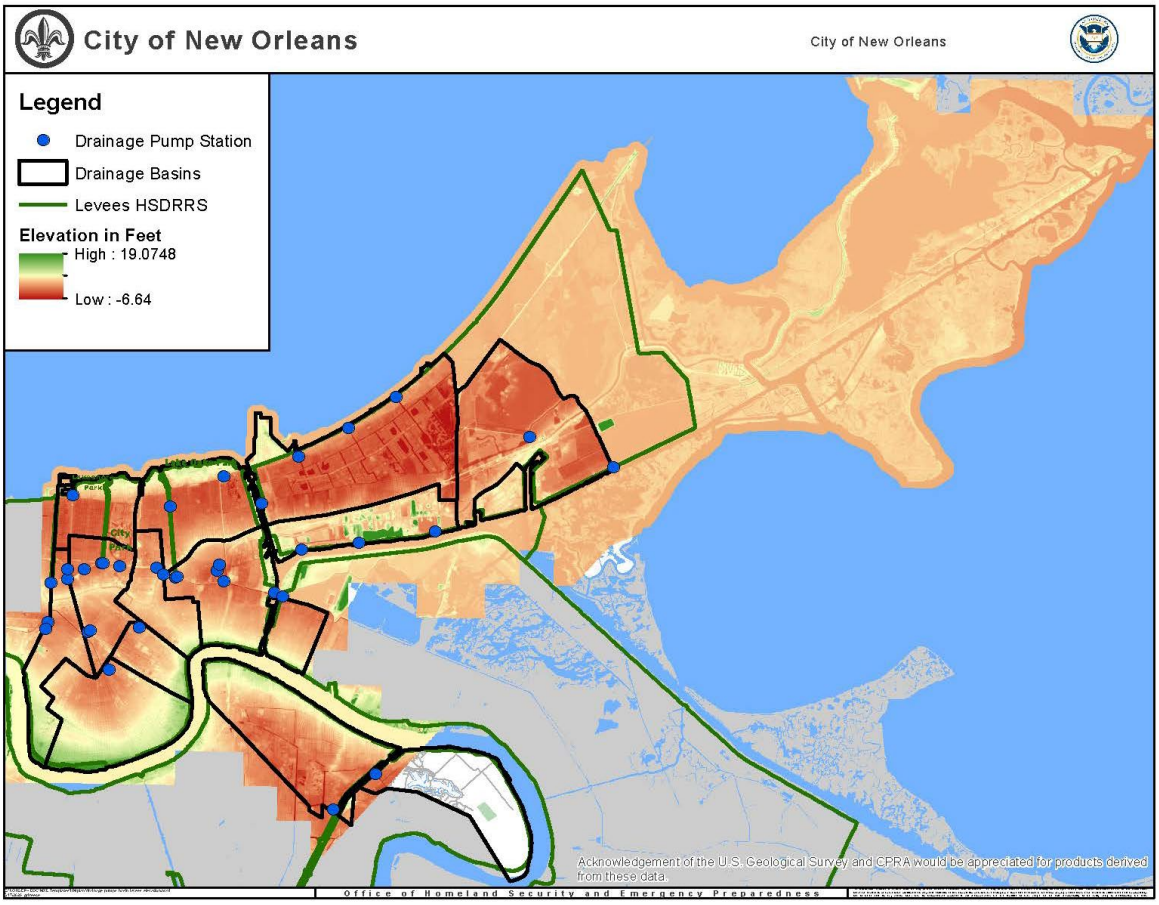
Coastal flooding can appear similar to any of the other flood types, depending on its cause. It occurs when normally dry coastal land is flooded by seawater but may be caused by direct inundation (when the sea level exceeds the elevation of the land), overtopping of a natural or artificial barrier, or the breaching of a natural or artificial barrier (i.e., when the barrier is broken down by the seawater). Coastal flooding is typically caused by storm surge, tsunami, and gradual sea-level rise.

In New Orleans, all six types of flooding have historically been observed. For purposes of this assessment, ponding, flash flooding, and urban flooding are all considered to be flooding as a result of stormwater from heavy precipitation.

Location and Extent of Flooding

Across most of the Parish, elevation varies by only a few feet. Most of New Orleans is below sea level and/or surrounded by flood levees. As such, the entire City is at risk of flooding. Figure 10 displays the topography of New Orleans, showing elevations below and above sea level in cross-section looking west. The map shows that the highest areas of the City border portions of the natural levee of the Mississippi River, particularly the area near the Garden District and Central Business District. The topography of New Orleans has been particularly influenced by the natural levee of the Mississippi River. With each Mississippi River flood, water spilled out of the river, depositing its sediment to raise the natural levee to an original average of 10 to 15 feet above sea level, and one to two miles in width, sloping very gently into the back swamp. In the New Orleans area today, the Mississippi River flows 10 feet to 15 feet above sea level. The map also shows that the lowest elevations of the City are located in the areas of Lakeview, Gentilly, and New Orleans East.

Figure 10: Topography of New Orleans Showing SWBNO Drainage Basins and Drainage Pump Stations



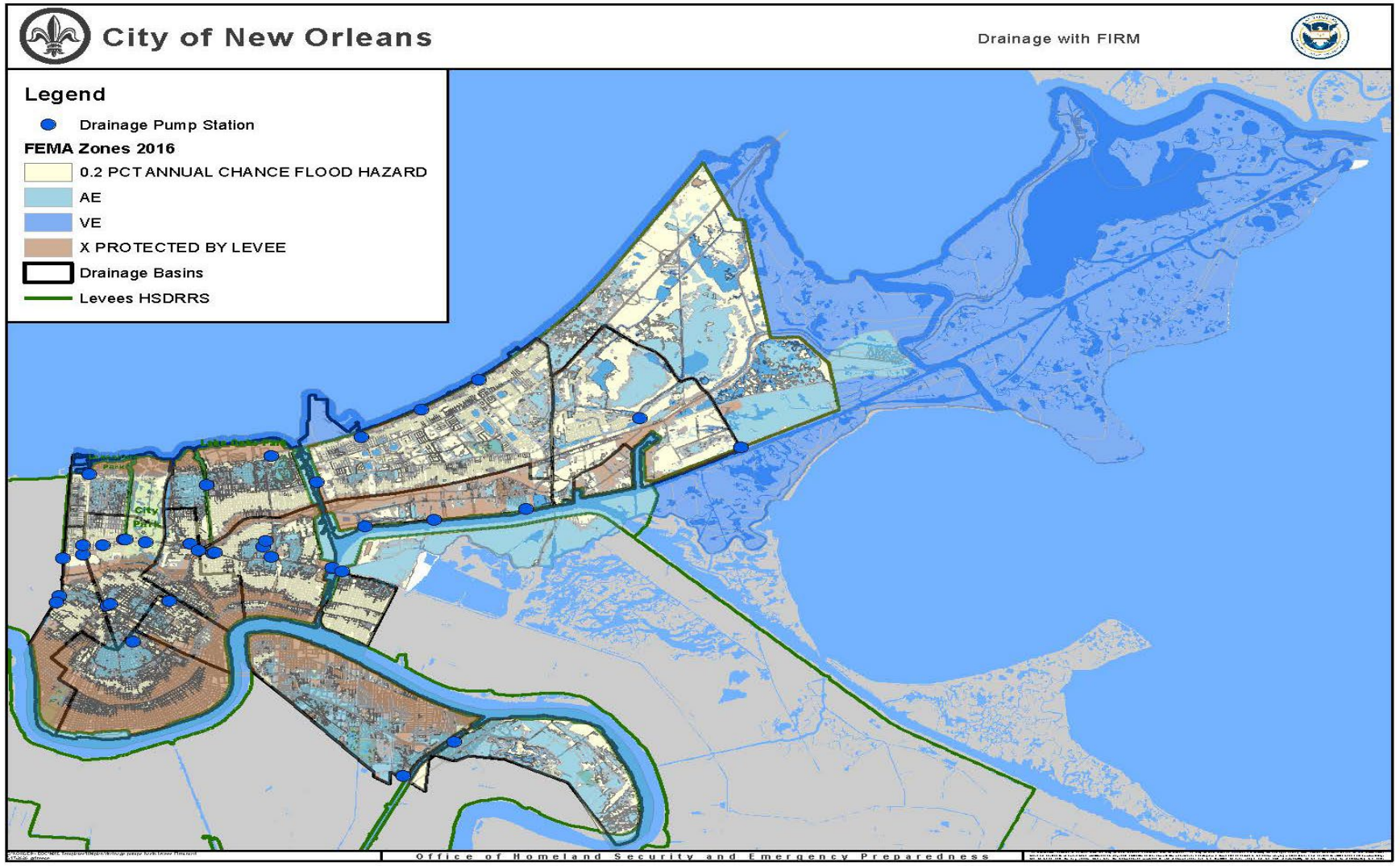
Source: City of New Orleans

As a result of this minimal elevation change, when heavy rainfall events occur, water tends to pool rather than run off rapidly. Elevations below sea level combined with little slope in topography and an extensive levee system mean that rainwater cannot flow out of the Parish and must be pumped out. The greater New Orleans metropolitan area is served by over 80 pumping stations in four Parishes (Orleans, Jefferson, St. Bernard, and Plaquemines) with a combined capacity of over 30 billion gallons per day. All stations are equipped with pumps that are either directly driven by diesel engines or by electric motors that receive their power from diesel-electric generators. New Orleans is drained by 24 pump stations with a total design capacity of 50,891 cubic feet per second. Because the river levees are higher than the lake levees, most rainwater is pumped into Lake Pontchartrain. Exceptions are the two (2) West Bank pumping stations and two (2) stations in Eastern New Orleans that pump rainwater into the Intracoastal Waterway or the Industrial Canal. Rainfall amounts of greater than 1-2 inches an hour cause flooding of 6-10 inches in some low-lying areas, particularly those shown as being below ground elevation in the above map.

Areas of highest flood risk are identified by zones AE and VE in the City's Flood Insurance Rate Map (FIRM, commonly known as the flood map, Figure 11). These areas are vulnerable to

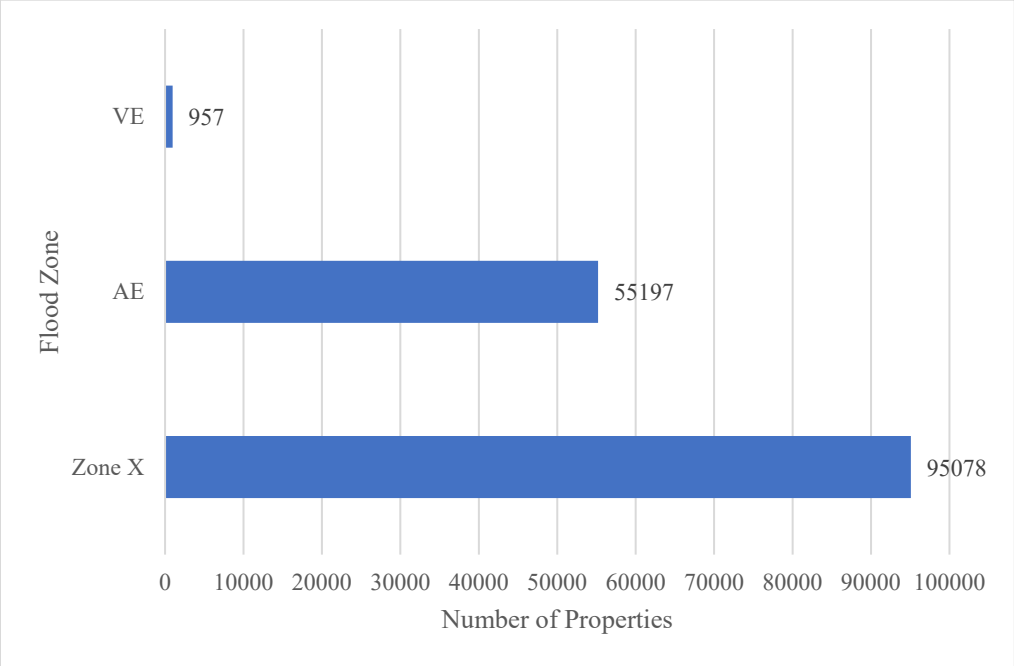
flooding from the 100-year storm. Figure 12 shows the number of parcels in each flood zone, according to the FIRM.

Figure 11: Flood Insurance Rate Map



Source: City of New Orleans

Figure 12: Distribution of Properties by Flood Zone



Floods are commonly measured by the probability of occurrence.

A **10-year flood event**, for example, is an event of small magnitude (in terms of streamflow or precipitation) but with a relatively high annual probability of recurrence (10%).

A **100-year flood event** is larger in magnitude, but it has a smaller chance of recurrence (1%).

A **500-year flood event** is significantly larger than both a 100-year event and a 10-year event. Still, it has a lower probability than both to occur in any given year (0.2%).

It is important to understand that an X-year flood event does not mean an event of that magnitude occurs only once in X years. Instead, it just means that on average, we can expect a flood event of that magnitude to occur once every X years. Given that such statistical probability terms are inherently difficult for most people to understand, the Association of State Floodplain Managers (ASFPM) promotes the use of more tangible expressions of flood probability. The ASFPM also expresses the 100-year flood event as having a 25% chance of occurring over the life of a 30-year mortgage.

The size of a specific flood event is defined through the statistical analysis of historical data on precipitation, flow, and discharge rates. The magnitude of an X-year flood event for a particular area depends on the source of flooding and the area's location. Consequently, different 100-year flood events can have very different impacts. The 100-year flood events in two separate locations have the same likelihood to occur, but they do not necessarily have the same magnitude. For example, a 100-year event for the Mississippi River means something completely different in terms of discharge values (ft3/s) than for the Amite River. The definition of what constitutes a 100-year flood event is specific to each location, source of flooding, and time since floodplain and river characteristics change over time.

The 100-year event is of particular significance since it is the regulatory standard that determines the obligation or lack thereof to purchase flood insurance. Flood insurance premiums are set depending on the flood zone, as modeled by National Flood Insurance (NFIP) and shown in Flood Insurance Rate Maps (Figure 11). The NFIP and FEMA suggest insurance rates based on Special Flood Hazard Areas (SFHAs). A SFHA is the land area covered by the floodwaters of the base flood, which is the 100-year floodplain where the National Flood Insurance Program (NFIP)'s floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

Flooding Alerts

The National Weather Service (NWS) posts flood statements, watches, and warnings based on stream gauge levels and precipitation forecasts. The NWS issues the following weather statements concerning the severity of floods:

Table 14: Flood Category Definitions

Flood Category	Definition
Minor Flooding	Minimal or no property damage, but possibly some public threat.
Moderate Flooding	Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations.
Major Flooding	Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
Record Flooding	Flooding, which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.
Flood Warning	Issued along larger streams when there is a serious threat to life or property.
Flood Watch	Issued when current and developing hydrometeorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent.

The NOHSEP Public Information Officer also prepares and issues warnings to emergency managers and the threatened population through the City's NOLA Ready public engagement campaign. Each of the potential sources of flooding, rainfall, riverine, and coastal storms is monitored differently. NWS, through the National Hurricane Center (NHC), provides tropical weather outlooks and warnings. USACE, through the River Forecast Center, tracks Mississippi River gauge height and provides forecasts and warnings. NOHSEP prepares pre-scripted warning

messages tailored to escalating impact levels and distributes these messages via multiple media to supplement the alerts provided by NWS. Residents can sign up for emergency alerts by staying connected through NOLA Ready.

Previous Occurrences

Historically, there have been 69 flooding events that have created significant flooding in New Orleans between 1997 and 2019. Below is a brief synopsis of the 12 major flooding events that have occurred since 1996, including flooding events that have occurred since the parish's last planning update. The following table represents data from the Storm Events Database from the National Centers for Environmental Information at NOAA. While this data provides a historical record of events over the last 70 years, some of the data is unreliable. For example, the NOAA data indicates that there has been no property damage associated with certain flooding events, which we know is not the case. This data is used to provide a baseline analysis and is supplemented, where appropriate, with other data sources. The blank cells in the table below are due to no data being available from the National Centers for Environmental Information, NOAA, Storm Events Database when this table was generated.

Table 15: Historical Floods in Orleans Parish with Locations from 1994 – 2019

Date	Event Type	Cause of Flood	Beginning Location	End Location
10/5/1996	Coastal Flood			
5/19/1997	Flood		New Orleans	New Orleans
1/5/1998	Flood		New Orleans	New Orleans
2/15/1998	Storm Surge/Tide		Chef Menteur	Ft Pike
3/7/1998	Flood		New Orleans	New Orleans
4/29/1998	Flood		Countywide	Countywide
8/21/1998	Flood		New Orleans	New Orleans
9/11/1998	Flash Flood		Countywide	Countywide
9/12/1998	Storm Surge/Tide		Countywide	Countywide
8/9/1999	Flood		Countywide	Countywide
6/5/2001	Flood		New Orleans	New Orleans
6/7/2001	Flash Flood		Algiers	Algiers
6/11/2001	Flash Flood		New Orleans	New Orleans
6/21/2001	Flood		New Orleans	New Orleans
8/17/2002	Flood		New Orleans	New Orleans
8/22/2002	Flood		New Orleans	New Orleans
9/25/2002	Flash Flood		Countywide	Countywide
6/19/2003	Flash Flood		New Orleans	New Orleans
6/30/2003	Flash Flood		Countywide	Countywide
6/30/2003	Storm Surge/Tide			
9/15/2004	Storm Surge/Tide			
10/9/2004	Storm Surge/Tide			
7/5/2005	Storm Surge/Tide			
8/29/2005	Storm Surge/Tide			

Date	Event Type	Cause of Flood	Beginning Location	End Location
9/23/2005	Storm Surge/Tide			
12/21/2006	Flash Flood	Heavy Rain	New Orleans	New Orleans
10/22/2007	Flash Flood	Heavy Rain	Vieux Carre	Gentilly
4/26/2008	Flash Flood	Heavy Rain	Algiers	Algiers
6/15/2008	Flash Flood	Heavy Rain	Algiers	Vieux Carre
6/29/2008	Flood	Heavy Rain	Vieux Carre	Vieux Carre
9/1/2008	Storm Surge/Tide			
9/11/2008	Storm Surge/Tide			
3/27/2009	Flash Flood	Heavy Rain	Algiers	Gentilly
9/13/2009	Flash Flood	Heavy Rain	Lee	Lee
12/12/2009	Flash Flood	Heavy Rain	Vieux Carre	Little Woods
4/23/2010	Flash Flood	Heavy Rain	New Orleans	New Orleans
5/16/2010	Flash Flood	Heavy Rain	New Orleans	New Orleans
9/2/2011	Storm Surge/Tide			
4/3/2012	Flash Flood	Heavy Rain	New Orleans	Gentilly
4/4/2012	Flash Flood	Heavy Rain	New Orleans	Algiers
7/20/2012	Flash Flood	Heavy Rain	New Orleans	Vieux Carre
7/20/2012	Flash Flood	Heavy Rain	(New)Lkfrnt Arpt New	Vieux Carre
8/9/2012	Flash Flood	Heavy Rain	New Orleans	Algiers
8/28/2012	Storm Surge/Tide			
8/29/2012	Flash Flood	Heavy Rain / Tropical System	New Orleans	New Orleans
5/2/2013	Flash Flood	Heavy Rain	New Orleans	New Orleans
11/26/2013	Coastal Flood			
5/9/2014	Flash Flood	Heavy Rain	Mc Donoghville	Algiers
5/9/2014	Flash Flood	Heavy Rain	Mc Donoghville	Vieux Carre
4/14/2015	Flash Flood	Heavy Rain	Chef Menteur	South Pt
5/31/2015	Flash Flood	Heavy Rain	New Orleans	Mc Donoghville
10/25/2015	Coastal Flood			
4/1/2016	Flash Flood	Heavy Rain	New Orleans Lakefront	Vieux Carre
6/21/2017	Storm Surge/Tide			
8/5/2017	Flash Flood	Heavy Rain	Vieux Carre	New Orleans
8/8/2017	Flash Flood	Heavy Rain	Vieux Carre	Vieux Carre
10/2/2017	Flash Flood	Heavy Rain	Vieux Carre	Vieux Carre
10/2/2017	Flash Flood	Heavy Rain	Vieux Carre	Vieux Carre
10/7/2017	Storm Surge/Tide			
5/18/2018	Flash Flood	Heavy Rain	Gentilly	Algiers
7/3/2018	Flash Flood	Heavy Rain	Cutoff	Mc Donoghville
7/3/2018	Flash Flood	Heavy Rain	Cutoff	New Orleans
8/18/2018	Flash Flood	Heavy Rain	Mc Donoghville	Vieux Carre

Date	Event Type	Cause of Flood	Beginning Location	End Location
10/15/2018	Flood	Heavy Rain	New Orleans	New Orleans
5/12/2019	Flash Flood	Heavy Rain	Mc Donoghville	Gentilly
7/10/2019	Flash Flood	Heavy Rain	New Orleans	New Orleans
7/11/2019	Storm Surge/Tide			
7/20/2019	Flash Flood	Heavy Rain	New Orleans	New Orleans
8/26/2019	Flash Flood	Heavy Rain	New Orleans	New Orleans

Source: National Centers for Environmental Information, NOAA, Storm Events Database. Accessed May 2020.

Hazard Impacts

Property Damage

The depth and velocity of floodwaters are the major variables in determining property damage. Flood velocity is important because the faster water moves, the more pressure it puts on a structure, and the more it will erode stream banks and scour the earth around a building's foundation. In some situations, deep and fast-moving waters can push a building off its foundation. Structural damage can also be caused by the weight of standing water (hydrostatic pressure).

Another threat to property from a flood is called "soaking." When soaked, many materials change their composition or shape. Wet wood will swell, and if dried too quickly, will crack, split, or warp. Plywood can come apart, and the gypsum wallboard can deteriorate if it is bumped before it has time to dry completely. The longer these materials are saturated, the more moisture, sediment, and pollutants they absorb.

Soaking can also cause extensive damage to household goods. Wooden furniture may become warped, making it unusable, while other furnishings such as books, carpeting, mattresses, and upholstery are usually not salvageable. Electrical appliances and gasoline engines will flood, making them worthless until they are professionally dried and cleaned.

Many buildings that have succumbed to floodwaters may look sound and unharmed after a flood. Still, water has the potential to cause severe property damage. Any structure that experiences a flood should be stripped, cleaned, and allowed to dry before being reconstructed. This can be an extremely expensive and time-consuming effort. The City of New Orleans provides guidance on cleaning up after a disaster for residents and businesses.[xiv]

Threat to People

Just as with property damage, depth and velocity are major factors in determining the threat posed to people by flooding. It takes very little depth or velocity for floodwaters to become dangerous. A car will float in less than two feet of moving water and can be swept downstream into deeper waters, trapping passengers within the vehicle.

Major health concerns are also associated with floods. Floodwaters can transport materials such as dirt, oil, animal waste, and chemicals (e.g., farm, lawn, and industrial) that may cause illnesses

of various degrees when coming in contact with humans. Floodwaters can also infiltrate sewer lines and inundate wastewater treatment plants, causing sewage to backup and creating a breeding ground for dangerous bacteria. This infiltration may also cause water supplies to become contaminated and undrinkable.

Estimated Potential Losses

Using the HAZUS 4.2 Flood Model, along with the Parish DFIRM, the 100-year flood scenario was analyzed to determine potential losses. Table 21 shows the total economic losses that would result from this occurrence.

Table 146: Estimated Losses in Orleans Parish from a 100-Year Flood Event

Jurisdiction	Estimated Total Losses from 100-year Flood Event
Orleans Parish	$45,088,500,000

Source: HAZUS 4.2

The HAZUS 4.2 Flood Model also provides a breakdown of potential building damages for seven primary sectors (HAZUS occupancy) throughout the parish. The losses by sector are listed in the tables on the following pages. These sectors are comprised of privately-owned structures/facilities, as well as locally, state, and federally owned structures/facilities.

Table 157: Estimated 100-Year Flood Losses for Orleans Parish by Sector

Orleans Parish	Estimated Total Loss from 100-Year Flood Event
Agricultural	$40,971,000
Commercial	$7,422,191,000
Government	$560,202,000
Industrial	$1,088,619,000
Religious	$1,246,887,000
Residential	$33,606,098,000
Education	$1,123,532,000
Total	$45,088,500,000

Source: HAZUS 4.2

Vulnerability

Based on data over the past 25 years from 1994-2019, there is a 100% annual probability that there will be a flood in Orleans Parish. The vulnerability of a particular structure to flooding depends on its elevation and method of construction. The Hazard Mitigation Office uses data from several sources to understand property-level flood risk. See Appendix C for parish and municipality buildings that are susceptible to flooding due to proximity within the 100-year floodplain.

2.2.2 Flash Flooding and Urban Flooding

In New Orleans, heavy rains can occur at any time of the year. However, the rainiest months are June, July, and August, when tropical moisture is plentiful along the Gulf Coast. This section addresses flooding from rain events, including those that are the result of hurricanes, tropical storms, thunderstorms, and winter storms.

NOAA's Atlas 14 is the current authoritative source for rainfall probability estimates. Figure 13 shows the probability assigned to various storms described by both volume and duration of rainfall. NOAA's analysis makes some attempt to account for changing climate baselines, but the Administration is continuing to develop scientific methods of incorporated climate projections into the data and may not fully capture the probability for major rainfall events.[xv] Recently published scientific studies of extreme rainfall in the US Southeast found a consistent, region-wide trend of increasing extreme rain intensity[xvi]. Across all levels of government, funding and coordinated effort to update and maintain precipitation forecast data have not been consistent, and these finding underscore the importance of continued support for scientific study to support planning and decision-making.

One challenge in measuring rainfall is a lack of official measurements, which means that the recorded values may not capture the actual rainfall in a given area. For example, on August 5, 2017, the rain gauge at Louis Armstrong International Airport recorded 2" total precipitation, while unofficial local government measurements were as high as 8-9 inches. The City of New Orleans, SWBNO, and private individuals in the City currently maintain rainfall gauges that help supplement NWS data; these local rainfall monitoring systems are discussed in the Capability Assessment and Mitigation Strategy sections of this plan.

Figure 13: NOAA Atlas 14 Point Precipitation Frequency Estimates, Station Name New Orleans WSO City

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.553 (0.437-0.684)	0.629 (0.497-0.778)	0.759 (0.598-0.942)	0.872 (0.683-1.09)	1.04 (0.785-1.34)	1.17 (0.863-1.52)	1.31 (0.930-1.74)	1.45 (0.988-1.99)	1.65 (1.08-2.32)	1.81 (1.15-2.57)
10-min	0.809 (0.640-1.00)	0.921 (0.728-1.14)	1.11 (0.875-1.38)	1.28 (0.999-1.59)	1.52 (1.15-1.96)	1.71 (1.26-2.23)	1.91 (1.36-2.55)	2.13 (1.45-2.91)	2.42 (1.58-3.39)	2.65 (1.68-3.76)
15-min	0.987 (0.781-1.22)	1.12 (0.887-1.39)	1.36 (1.07-1.68)	1.56 (1.22-1.94)	1.85 (1.40-2.38)	2.09 (1.54-2.72)	2.33 (1.66-3.11)	2.59 (1.76-3.55)	2.95 (1.93-4.14)	3.23 (2.05-4.59)
30-min	1.50 (1.19-1.86)	1.72 (1.36-2.13)	2.10 (1.65-2.60)	2.42 (1.89-3.02)	2.89 (2.19-3.72)	3.27 (2.41-4.26)	3.66 (2.60-4.88)	4.07 (2.77-5.57)	4.64 (3.03-6.50)	5.09 (3.22-7.21)
60-min	2.03 (1.61-2.52)	2.32 (1.84-2.87)	2.85 (2.24-3.54)	3.34 (2.61-4.16)	4.09 (3.12-5.33)	4.73 (3.51-6.22)	5.42 (3.87-7.29)	6.18 (4.22-8.51)	7.26 (4.75-10.2)	8.14 (5.16-11.6)
2-hr	2.57 (2.05-3.14)	2.92 (2.34-3.58)	3.60 (2.87-4.42)	4.25 (3.37-5.25)	5.29 (4.10-6.87)	6.19 (4.65-8.10)	7.18 (5.20-9.61)	8.28 (5.73-11.4)	9.88 (6.55-13.9)	11.2 (7.17-15.8)
3-hr	2.89 (2.33-3.52)	3.29 (2.65-4.00)	4.07 (3.27-4.97)	4.86 (3.87-5.95)	6.14 (4.81-7.98)	7.27 (5.52-9.52)	8.55 (6.24-11.4)	9.98 (6.96-13.7)	12.1 (8.07-16.9)	13.8 (8.91-19.4)
6-hr	3.45 (2.81-4.15)	3.95 (3.21-4.75)	4.95 (4.01-5.97)	5.96 (4.80-7.22)	7.62 (6.05-9.85)	9.11 (7.00-11.8)	10.8 (7.97-14.3)	12.7 (8.95-17.3)	15.5 (10.5-21.6)	17.8 (11.6-24.8)
12-hr	4.02 (3.32-4.79)	4.67 (3.84-5.56)	5.91 (4.85-7.06)	7.13 (5.82-8.56)	9.09 (7.27-11.6)	10.8 (8.38-13.9)	12.7 (9.48-16.7)	14.8 (10.6-20.0)	18.0 (12.2-24.8)	20.5 (13.5-28.4)
24-hr	4.64 (3.87-5.46)	5.44 (4.54-6.41)	6.94 (5.76-8.19)	8.35 (6.88-9.90)	10.5 (8.49-13.2)	12.4 (9.71-15.7)	14.5 (10.9-18.8)	16.7 (12.0-22.3)	20.0 (13.8-27.3)	22.7 (15.1-31.1)
2-day	5.34 (4.50-6.21)	6.27 (5.28-7.30)	7.97 (6.69-9.31)	9.55 (7.97-11.2)	12.0 (9.76-14.8)	14.1 (11.1-17.6)	16.3 (12.4-20.9)	18.8 (13.6-24.7)	22.3 (15.5-30.2)	25.2 (16.9-34.3)
3-day	5.77 (4.90-6.67)	6.76 (5.74-7.82)	8.57 (7.25-9.95)	10.3 (8.63-12.0)	12.9 (10.6-15.8)	15.1 (12.0-18.8)	17.5 (13.4-22.3)	20.2 (14.7-26.4)	24.0 (16.8-32.3)	27.1 (18.3-36.7)
4-day	6.12 (5.23-7.04)	7.14 (6.10-8.23)	9.03 (7.68-10.4)	10.8 (9.12-12.5)	13.5 (11.1-16.6)	15.9 (12.7-19.6)	18.4 (14.1-23.4)	21.2 (15.5-27.7)	25.2 (17.7-33.8)	28.5 (19.3-38.5)
7-day	7.07 (6.10-8.06)	8.14 (7.02-9.29)	10.1 (8.71-11.6)	12.0 (10.3-13.8)	14.9 (12.4-18.2)	17.4 (14.1-21.4)	20.2 (15.7-25.4)	23.2 (17.2-30.1)	27.5 (19.5-36.7)	31.1 (21.3-41.7)
10-day	7.96 (6.91-9.02)	9.10 (7.89-10.3)	11.2 (9.67-12.7)	13.2 (11.3-15.0)	16.2 (13.5-19.5)	18.8 (15.2-22.9)	21.6 (16.8-27.0)	24.6 (18.3-31.8)	29.0 (20.7-38.6)	32.6 (22.5-43.7)
20-day	10.7 (9.37-11.9)	12.1 (10.6-13.5)	14.5 (12.7-16.4)	16.7 (14.6-18.9)	20.0 (16.8-23.6)	22.7 (18.6-27.2)	25.5 (20.1-31.5)	28.6 (21.5-36.3)	32.8 (23.6-43.1)	36.2 (25.2-48.1)
30-day	13.0 (11.5-14.4)	14.7 (13.0-16.3)	17.5 (15.4-19.5)	19.9 (17.5-22.4)	23.4 (19.8-27.3)	26.2 (21.5-31.1)	29.1 (23.0-35.5)	32.0 (24.2-40.4)	36.1 (26.1-47.0)	39.3 (27.6-52.0)
45-day	15.9 (14.2-17.6)	18.0 (16.0-19.9)	21.3 (18.9-23.7)	24.1 (21.3-26.9)	27.9 (23.7-32.2)	30.9 (25.5-36.3)	33.8 (26.9-40.9)	36.8 (27.9-46.0)	40.8 (29.6-52.6)	43.8 (30.9-57.7)
60-day	18.5 (16.6-20.3)	20.9 (18.7-23.0)	24.7 (22.0-27.2)	27.7 (24.6-30.8)	31.9 (27.1-36.5)	35.0 (29.1-40.9)	38.1 (30.4-45.8)	41.2 (31.3-51.1)	45.1 (32.9-57.9)	48.0 (34.0-63.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

Source: NOAA's National Weather Service Hydrometeorological Design Studies Center

Recent Flash Flooding and Urban Flooding Events

New Orleans has experienced several major urban flooding events since the last Hazard Mitigation Plan update in 2015. As the definitions above note, urban flooding is similar to flash flooding but is specific to urbanized areas. It takes place when stormwater drainage systems cannot keep pace with heavy precipitation, and water accumulates on the surface.

Flash Flood Event August 5, 2017

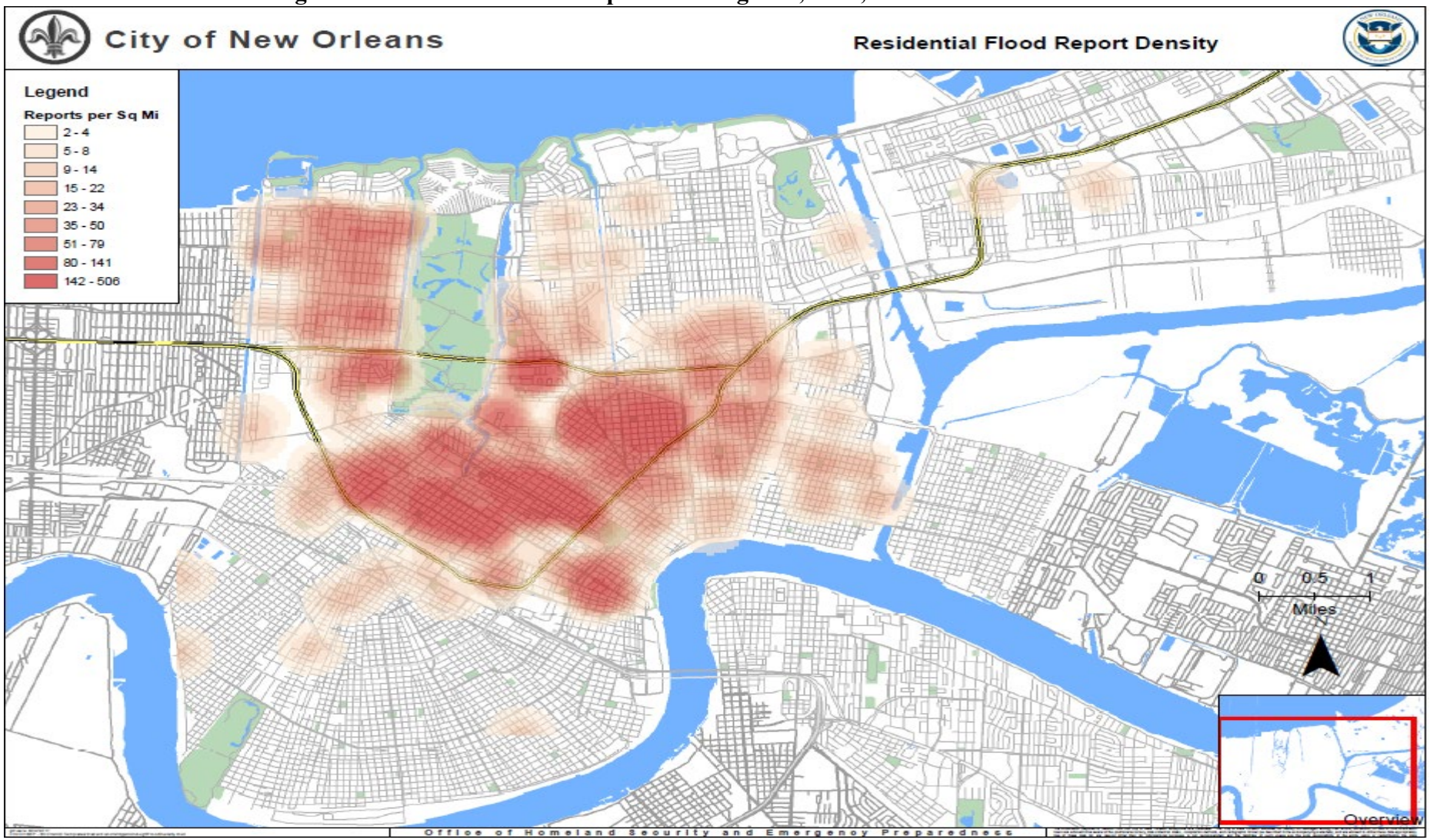
A weakened frontal boundary along the Interstate 10 corridor in southeast Louisiana and south Mississippi, along with local land-lake/sea breeze interaction, aided in the development of thunderstorms producing heavy rain along this corridor on all Aug. 4th, 5th, and 6th. Reports of flash flooding were received from the New Orleans area on the 4th and 5th.

Thunderstorms repeatedly developed over the same area of New Orleans from mid-afternoon into early evening, producing 4 to 9 inches of rain during a 3 to 5-hour period. The rainfall overwhelmed the drainage system leading to widespread and deep street flooding. Many streets were impassable from the Mid-City area to just north of the French Quarter and Central Business District, and road and highway underpasses were deeply flooded. Numerous automobiles were also damaged by the flooding. Water entered at least several hundred homes and a number of businesses.,

During the August 5, 2017 flash flood event, there were a total of 685 flood claims from properties under the National Flood Insurance Program. FEMA paid out a total amount of $4,299,953 in damage costs to insureds. NFIP data only captures damage to structures that are covered by flood insurance; we can estimate that actual damages are much higher by looking at the rates of flood insurance coverage. Another significant impact of flash floods is damage to automobiles. Direct losses to vehicles from a city-wide 100-year flood occurring the daytime could be as high as $1.8 Billion (HAZUS 4.2). Non-NFIP losses are not tracked in a way that is accessible to us in developing this plan, but it is understood that actual damage numbers are relatively higher than initial estimates.

NWS analysis determined that this storm had approximately a one-in-one hundred annual chance of occurrence (roughly the 100-year storm). At the time of the storm, there were no direct measurements of flood depth and extent available. During floods, OPCD receives calls to report flood conditions. Using records of the number and density of these calls, we can estimate the general extent and severity of flooding that occurred (Figure 14).

Figure 14: Residential Flood Reports for August 5, 2017, Flash Flood Event



Source: City of New Orleans

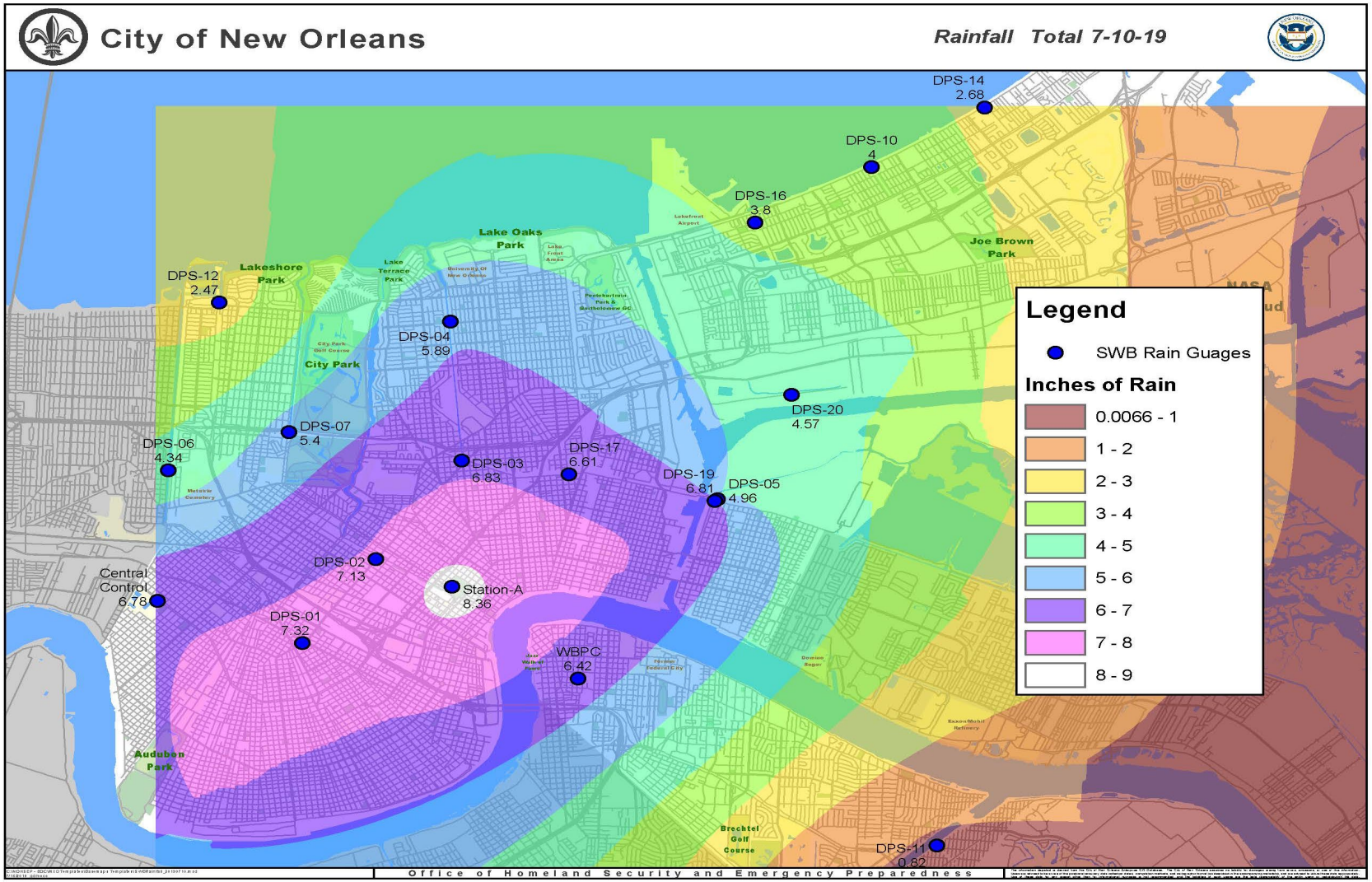
Flash Flood Event May 18, 2017

An upper-level trough of low pressure over the central Gulf Coast combined with increasingly moist and unstable air to produce several severe thunderstorms during the afternoon hours of May 18, 2017. Extensive street flooding was reported in the Central City, Tremé, and Bywater neighborhoods of New Orleans. Radar rainfall estimates indicated that 3 to 5 inches of rain fell in a swath from Metairie through City Park and Mid-City, into the Bywater and Lower 9th Ward. Some vehicles were flooded at the height of the storm. Most of the rain fell between 3:30 pm and 6:00 pm.

***Flash Flood Event July* 10, 2019**

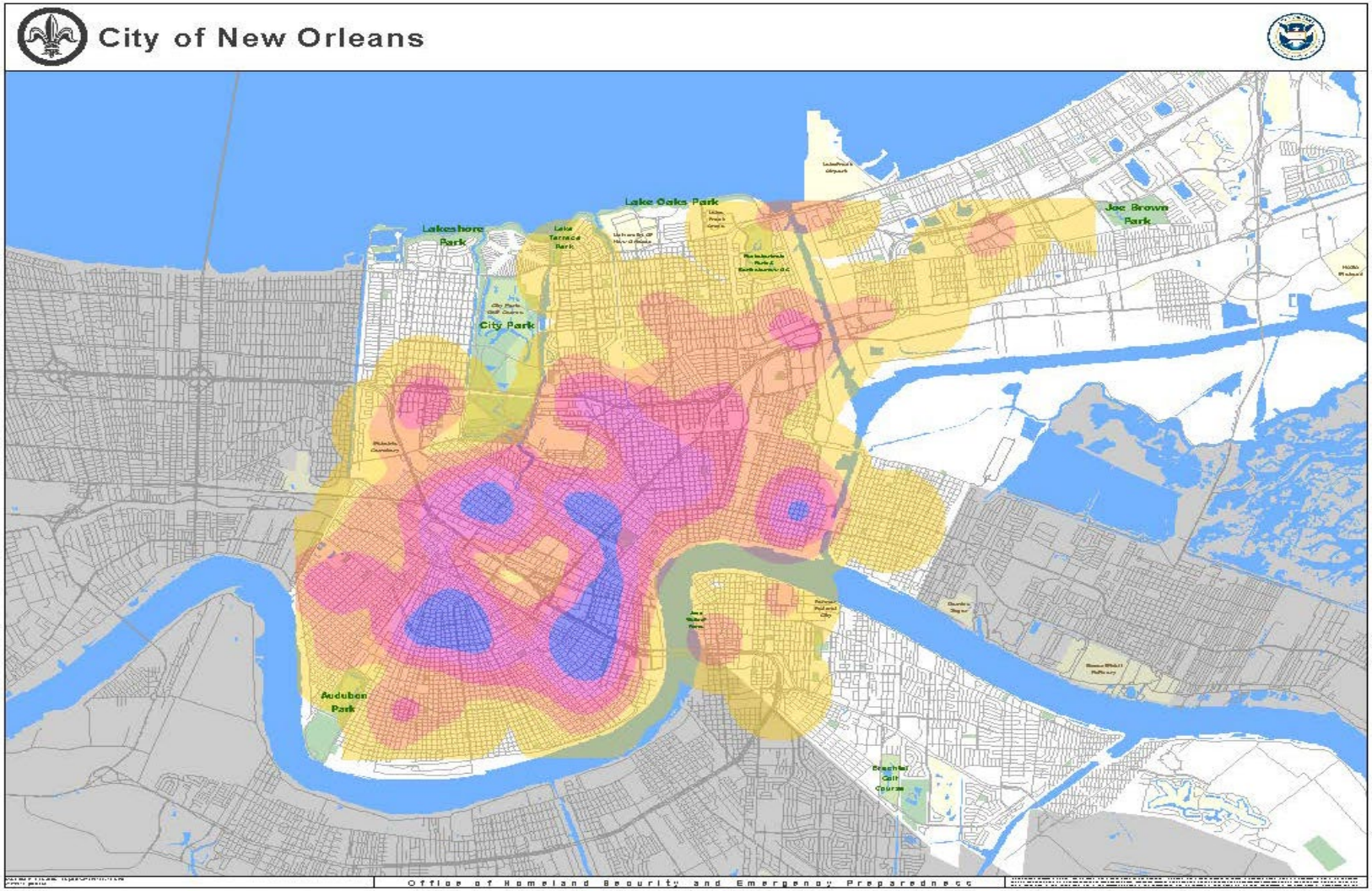
On the morning of July 10, an outer band of the weather system that would produce Tropical Storm Barry caused heavy rain over large parts of New Orleans between 6:00 am and 9:00 pm. A SWBNO rain gauge in Tremé measured almost 8.4" of rain, and a gauge in the Lower 9th Ward measured over 9", most of which fell within about three hours. Almost six hundred flood insurance claims were made in the days following. This event led to road closures, damage to automobiles, and minor damage to structures.

Figure 15: Rainfall Totals July 10, 2019



Source: Sewerage & Water Board of New Orleans

Figure 16: Flood Report Density July 10, 2019



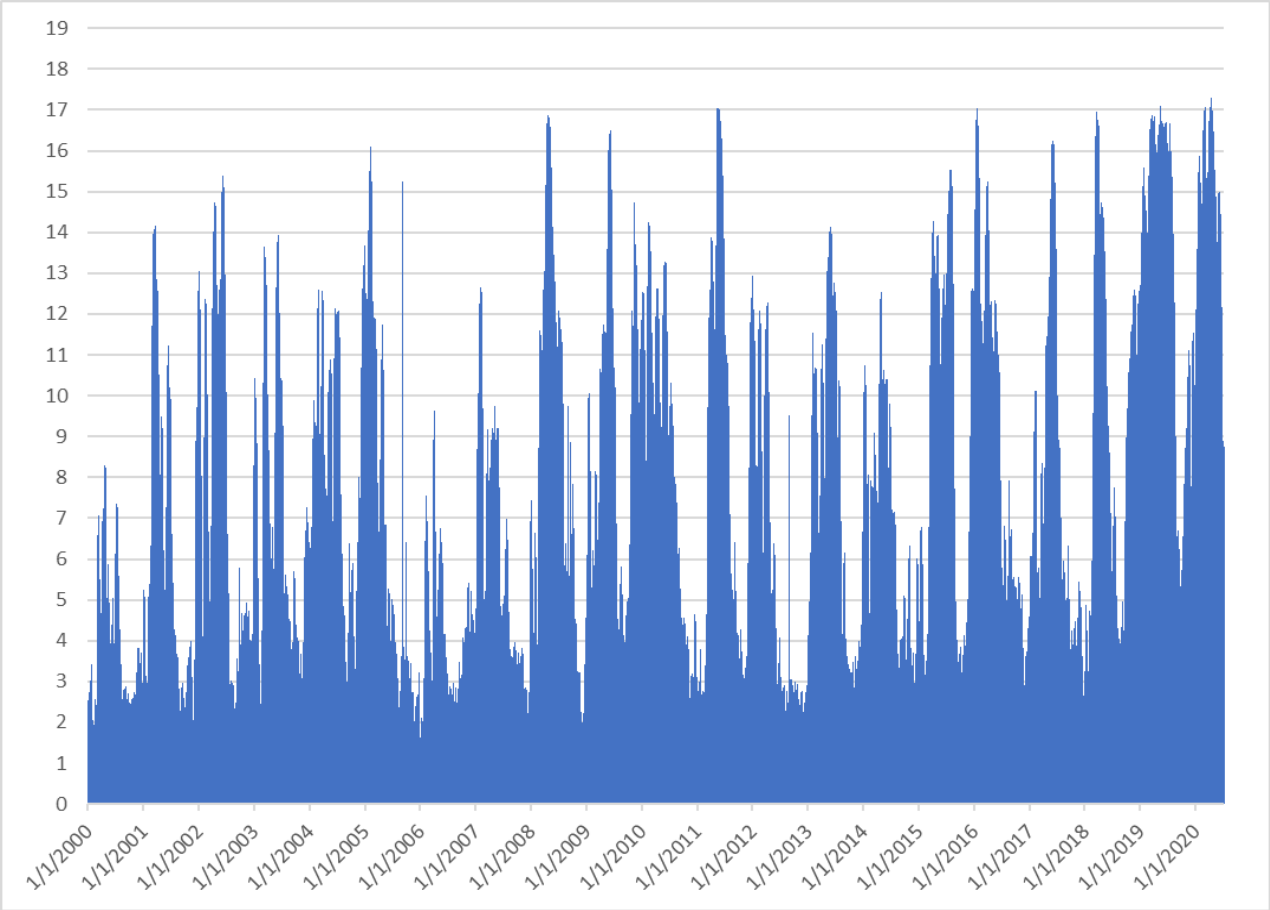
Source: City of New Orleans

2.2.3 Riverine Flooding

New Orleans' location on the Mississippi River, and the risk of experiencing riverine flooding, is one of the defining features of the city. In 1719, a year after the colonial French established a settlement at the present site of New Orleans, a flood on the Mississippi River left the city underwater. The city is currently protected from flooding by the Mississippi River by a federal levee system managed by the United States Army Corps of Engineers (USACE). These levees are part of a larger project known as the Mississippi River and Tributaries Project (MRT), authorized by Congress after the devastating 1927 floods made clear that a coordinated approach to managing the river was needed. The city has not been flooded by the river since the system was completed.

The Mississippi River flood gauge at New Orleans has surpassed the 17-foot flood stage level 20 times since 2000, including six days in May of 2011, two days in January of 2016, one day in May 2019, one day in February of 2020, and 10 days in April 2020.[xvii] As the following figure demonstrates, river levels remained higher for longer periods of time in 2019 and 2020 in comparison to past years.

Figure 17: Flood Gauge Levels by Feet for Mississippi River at New Orleans – Carrollton



Source: US Army Corps of Engineers

River floods at New Orleans are most often controlled by the Bonnet Carré Spillway, which was constructed by USACE to provide an outlet for river water and to relieve pressure on the New

Orleans-area MRT levees. Historically, the spillway was opened roughly once a decade. In recent years, the river stage has required opening the spillway more frequently and for longer periods than historically averaged. A number of factors influence the frequency and severity of Mississippi River flooding, including land use throughout the watershed, shifts in the water cycle associated with climate change, and management of the river for navigation and flood control.

Table 168: Bonnet Carré Spillway Openings

Year	Dates Open	Number of Bays Open	Maximum Flow in Cubic Feet Per Second (CFS)
1937	Jan. 28 to Mar. 16	285	211,000
1945	Mar. 23 to May 18	350	318,000
1950	Feb. 10 to Mar. 19	350	223,000
1973	Apr. 8 to June 21	350	195,000
1975	Apr. 14 to Apr. 26	225	110,000
1979	Apr. 17 to May 31	350	191,000
1983	May 20 to June 23	350	268,000
1997	Mar. 17 to Apr. 17	350	243,000
2008	Apr. 11 to May 8	160	160,000
2011	May 9 to June 20	330	316,000
2016	Jan. 10 to Feb. 1	210	203,000
2018	Mar. 8 to Mar. 30	183	196,000
2019	Feb. 27 to April 11	206	210,000
2019	May 21 to July 27	168	161,000
2020	April 3 to May 1	90	90,000

Source: U.S. Army Corps of Engineers (USACE)

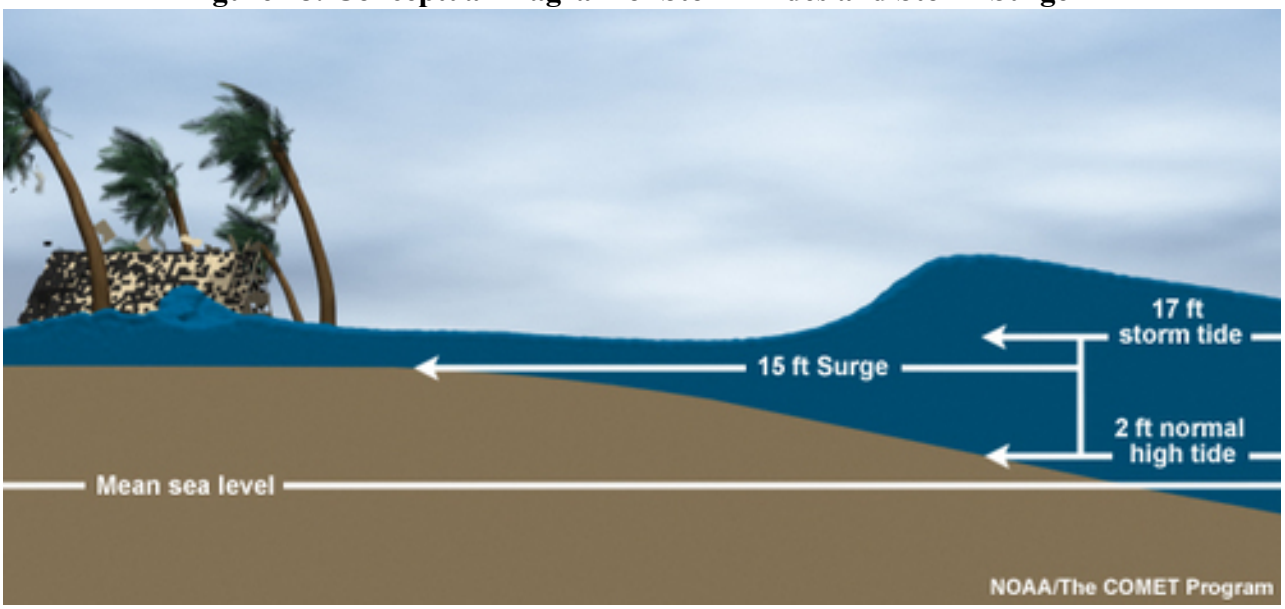
2.2.4 Storm Surge and Coastal Flooding

Definition

Storm surges inundate coastal floodplains by raising tidal elevation in inland bays and ports and causing backwater flooding through coastal river mouths. Severe winds associated with low-pressure weather systems cause an increase in tide levels and water surface elevations. Storm systems also generate large waves that run up and flood coastal areas. The combined effects create storm surges that affect the beach, marsh, and low-lying floodplains. Shallow offshore depths can

cause storm-driven waves and tides to pile up against the shoreline and inside bays. Storm surge flooding is most often associated with Tropical Cyclones. Still, strong winter storms and other weather systems can produce similar, though less severe, coastal flooding.

Figure 18: Conceptual Diagram of Storm Tides and Storm Surge



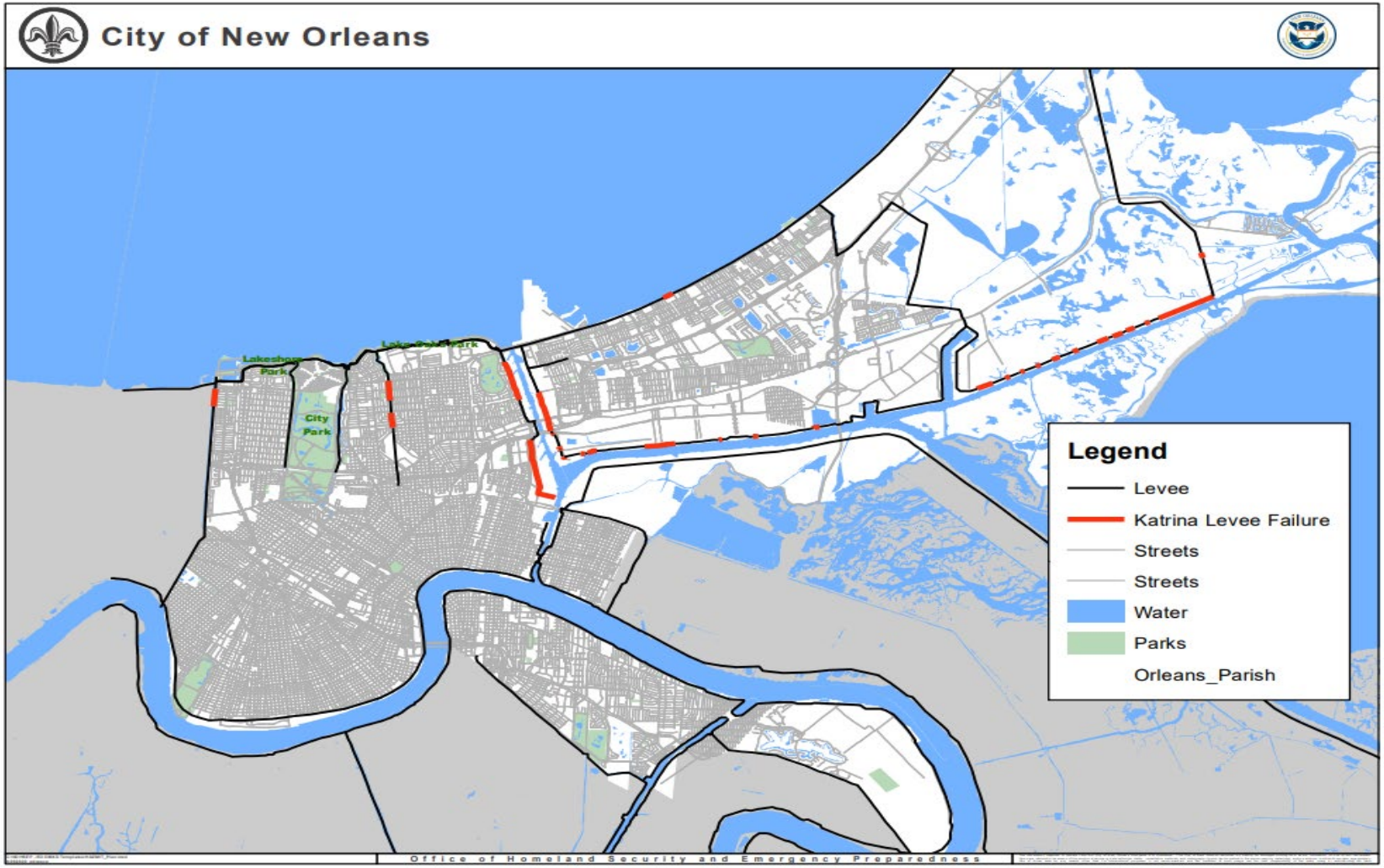
Source: NOAA National Hurricane Center

Location and Extent of the Storm Surge Hazard

The storm surge hazard associated with hurricanes and other severe storms is responsible for most coastal flooding along the Louisiana Gulf Coast. Storm surge in New Orleans is primarily the result of hurricanes that approach land from the Gulf of Mexico. The effects of storm surge can be felt in the Parish from hurricanes that make landfall as far away as Texas, Mississippi, or Alabama. The extent of the storm surge hazard covers the entire planning area. It is made worse in some areas based on such factors as elevation and proximity to flood sources (which are, in turn, related to potential levee failures). The storm surge threat in New Orleans has increased over the past 150 years due to a variety of factors such as coastal erosion, loss of wetlands, sea-level rise, and the construction of canals for navigation and drainage.

New Orleans is protected from storm surge by a system of federal levees known as the Hurricane Damage Risk Reduction System (HSDRRS) (Figure 19). The levee system was rebuilt by USACE in the years following Hurricane Katrina. Levee operations and maintenance are the responsibility of the Southeastern Louisiana Flood Authority-East and West, which were created by the State Legislature in 2006 to coordinate levee maintenance regionally. The levee system is designed to provide protection from storm surge up to the 100-year flood level.

Figure 19: New Orleans Hurricane Risk Reduction System, with Locations of Levee Failures caused by Hurricane Katrina in 2005



Source: City of New Orleans

Severity of the Storm Surge Hazard

In coastal areas such as southern Louisiana, storm surge is the most dangerous aspect of hurricanes, although the wind is a very significant hazard as well. Storm surge causes nine out of every ten hurricane-related deaths.[xviii] The severity of storm surge is determined by a variety of factors such as the path of a hurricane, wind speeds, shape of the coastline, and the forward speed. The forward motion of a storm complements the counterclockwise rotation of the wind field, which usually results in the highest surges from hurricanes occurring on the right-front (northeast) quadrant of the storm's track. Table 19 identifies the factors that can influence the severity of storm surge.

Table 179: Factors that Influence the Severity of Storm Surge

Factor	Effect
Wind Velocity	The higher the wind velocity, the greater the damage
Storm Surge Height	The higher the storm surge the farther inland the inundation area and the greater the damage
Coastal Shape	Concave shoreline sections sustain more damage because the water is driven into a confined area by the advancing storm, thus increasing storm surge height and storm surge flooding
Storm Center Velocity	The slower the storm moves, the greater potential for damage along the immediate coastline. The worst possible situation is a storm that stalls along a coast, through several high tides.
Nature of Coast	Damage is most severe on low-lying island barrier shorelines because they are easily over washed by wave action.
Previous Storm Damage	A coast weakened by even a minor previous storm will be subject to greater damage in a subsequent storm.
Storm Size	The size of a storm and extent of hurricane force winds can influence the area of coastline impacted by storm surge. Larger hurricanes with expansive hurricane-force winds can create significant surge over a large section of coastline.

Factor	Effect
Central Pressure	The lower a hurricane's central pressure the greater the wind speeds and potential for stronger storm surge.
Storm Track (or Path)	The right-front (northeast) quadrant of the storm track typically experiences the most severe surge as a hurricane eye makes landfall.
Forward Speed	The forward speed of a hurricane can influence the peak height and how far inland a surge will reach.
Human Activity	With increased development, property damage increases, and more floating debris becomes available to knock down other structures

Source: NOAA National Hurricane Center, New Scientist Magazine, April 2009

Previous Occurrences of the Storm Surge Hazard

As part of the plan update, the planning team examined various sources to identify past storm surge events that have impacted New Orleans. As indicated elsewhere in this section, one source for identifying past storm surge events is NOAA's NCEI database. The NCEI indicates eleven storm surge events impacted New Orleans between 1950 and 2019. Table 20 summarizes the storm surge events reported by the NCEI that have impacted southern Louisiana and New Orleans between 1998 and 2019. The events are summarized following Table.

Table 18: Storm Surge Events, Orleans Parish, 1998-2019

Date	Type	Property Damage
2/15/1998	Storm Surge/Tide	$0
9/12/1998	Storm Surge/Tide	$0
6/30/2003	Storm Surge/Tide	$100,000
9/15/2004	Storm Surge/Tide	$400,000
10/9/2004	Storm Surge/Tide	$10,000
7/5/2005	Storm Surge/Tide	$250,000
8/29/2005	Storm Surge/Tide	$17,900,000,000
9/23/2005	Storm Surge/Tide	$4,320,000
9/1/2008	Storm Surge/Tide	$750,000
9/11/2008	Storm Surge/Tide	$0
9/2/2011	Storm Surge/Tide	$15,000
8/28/2012	Storm Surge/Tide	$62,500,000

Date	Type	Property Damage
6/21/2017	Storm Surge/Tide	$0
10/7/2017	Storm Surge/Tide	$0
7/11/2019	Storm Surge/Tide	$0
Totals		$17,968,345,000

Source: NOAA National Centers for Environmental Information

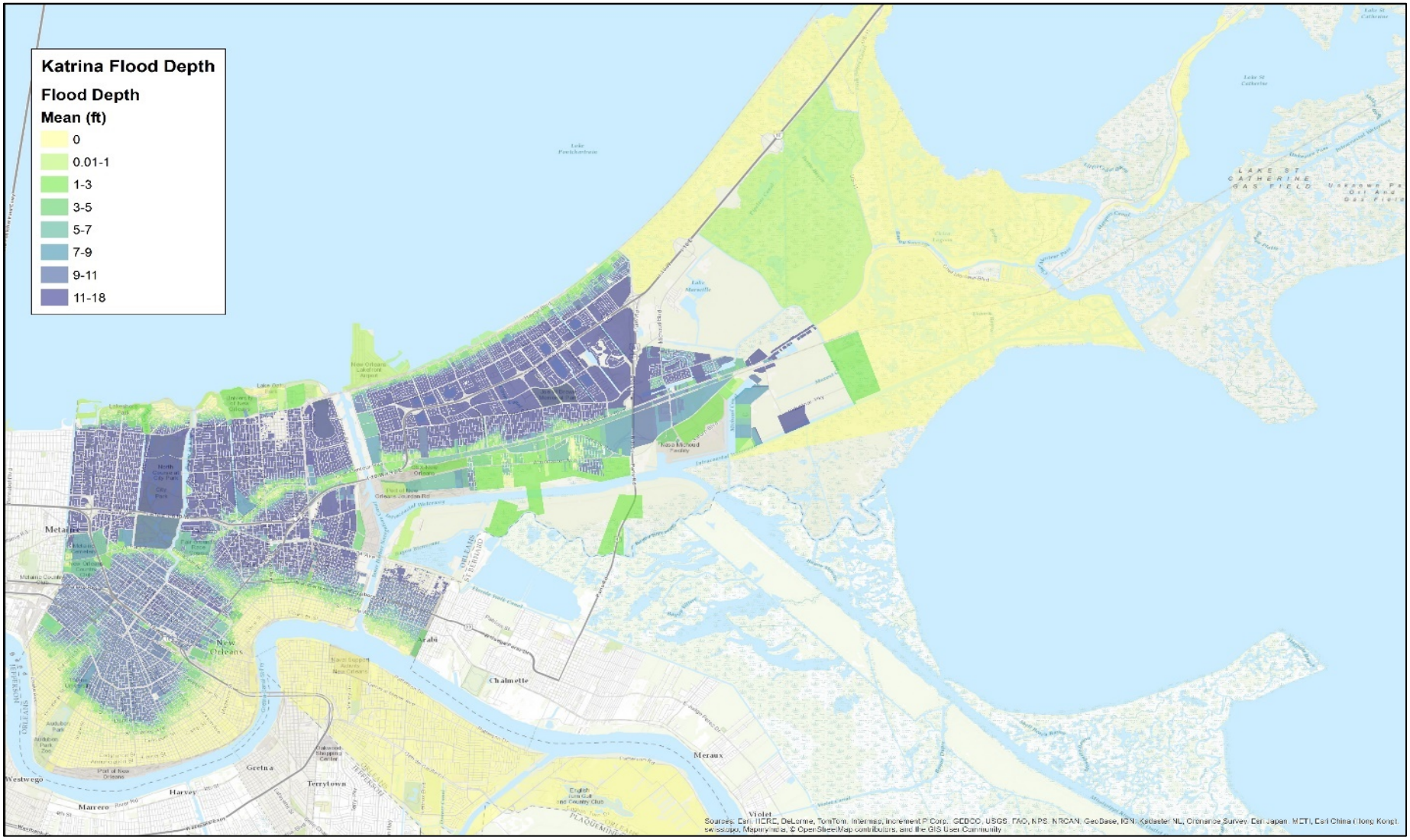
Hurricane Katrina

Hurricane Katrina made landfall in September of 2005 as a powerful Category 3 hurricane that had a devastating impact on the New Orleans area and the entire Gulf Coast region. Hurricane-force winds from Katrina produced the greatest recorded storm surge in the United States. Data collected by FEMA shortly after the event indicated a storm surge of 15 to 19 feet occurred in eastern New Orleans, St. Bernard Parish, and Plaquemines Parish. At the same time, the surge was 10 to 14 feet in western New Orleans along the southern shores of Lake Pontchartrain. Farther west, observations indicate a storm surge of 5 to 10 feet along the shores of western Lake Pontchartrain.

The storm surge on August 29 severely strained the levee system in the New Orleans area. Several of the levees and floodwalls were overtopped and/or breached at different times on the day of landfall. Most of the floodwall and levee breaches were due to erosion on the backside caused by overtopping. The surge overtopped large sections of the levees east of New Orleans, in Orleans Parish and St. Bernard Parish, and it also pushed water up the Intracoastal Waterway and into the Industrial Canal. The water rose in Lake Pontchartrain strained the floodwalls along the canals adjacent to its southern shore, including the 17th Street Canal and the London Avenue Canal.

The volume of water entering the City when the levees failed immediately overwhelmed the 23 major pump stations throughout New Orleans, which are designed to remove surface runoff during rain events. The inundation of the city flooded an estimated 147,000 residential homes. As the floodwaters rose, thousands of residents who were unable to evacuate became trapped, many on rooftops and some in their attics. Figure 20 below identifies the location and flood depths throughout the City on September 2, 2005. Within about 24 hours of Katrina's landfall, about 80 percent of the City of New Orleans flooded to varying depths up to about 20 feet.

Figure 20: City of New Orleans: Estimated Water Depths on September 2, 2005

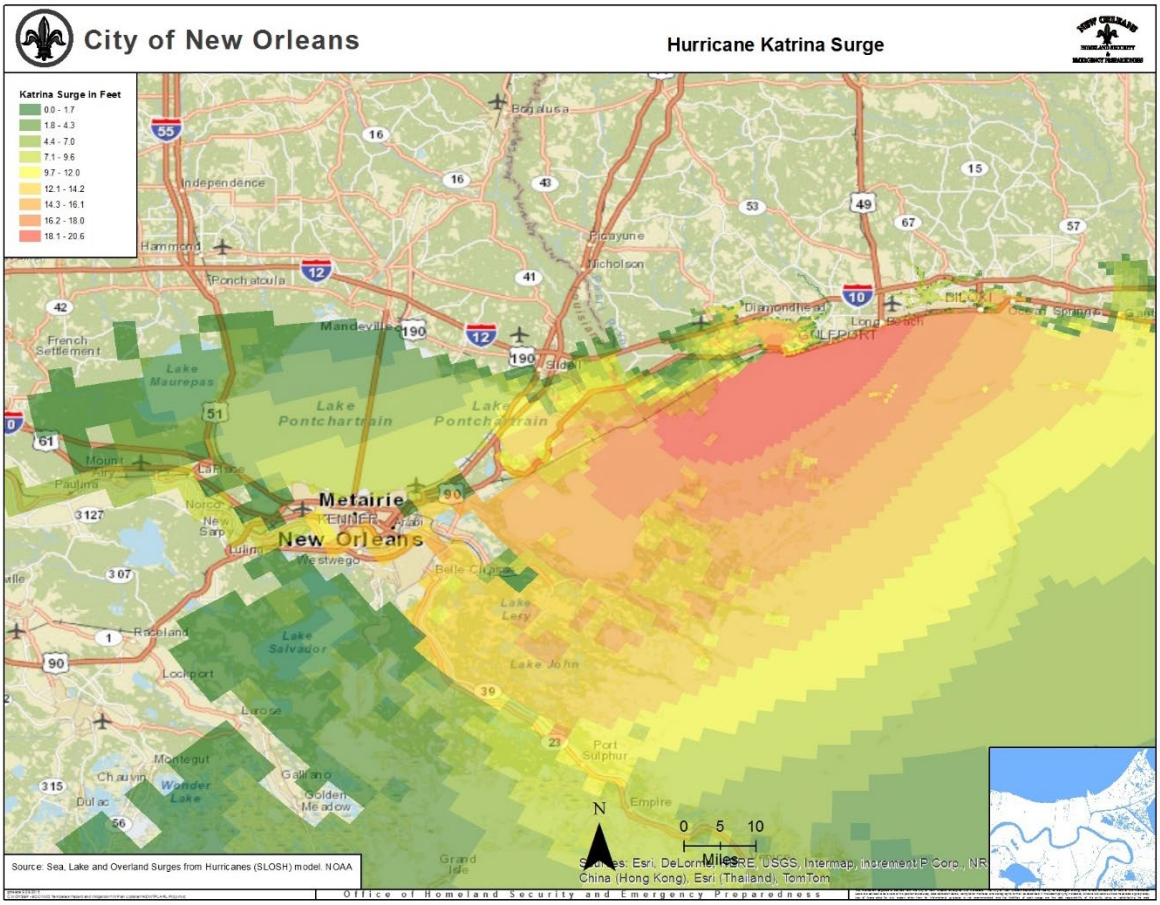


Source: USGS 2002 LiDAR Data

The consequences of the flooding were catastrophic for the City of New Orleans. Large developed areas were inundated with floodwater for extended periods before repairs could be made to the levees and pump stations, and the water drained out of the City. The pumps were brought back online on October 11, 2005, 43 days after Hurricane Katrina made landfall.

After Katrina, the NHC used the SLOSH (sea, lake, and overland surges from hurricanes) model to develop a computerized model of the storm surge. The SLOSH model is used to estimate storm surge heights and winds by considering the pressure, size, forward speed, track, and winds. Figure 21 below shows the storm surge estimated by the NHC.

Figure 21: Storm Surge for Hurricane Katrina



Source: NOAA National Hurricane Center

Before Katrina, SLOSH models developed for the Louisiana coastline estimated storm surge flooding inland up to 18 feet above sea level. The damages caused by Hurricane Katrina demonstrate that storm surge-related flooding can reach depths of up to 30 feet above sea level, with the ability to reach either the north shore of Lake Pontchartrain, just north of New Orleans, or the south shore in Jefferson and Orleans Parishes.

The most detailed current estimate of currently storm surge risk is based upon a recent study using the SLOSH model. Utilizing the Maximum of Maximums (MoM) for a Category 3 storm, which compiles the worst-case inundations based upon hundreds of possible tracks, the scenario shows

an overtopping of the levees and significant inundation throughout the city can result from a Category 3 storm.

Figure 22: New Orleans Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model

Source: FEMA HAZUS Data, City of New Orleans

Hazard Impacts

Impact on Life and Property

Storm surge is considered one of the most deadly and destructive components of a hurricane. As described in more detail below in the Occurrences of the Storm Surge Hazard, numerous past storm surge events associated with major Hurricanes (Category 3 or stronger) have caused considerable, sometimes catastrophic, damage to portions of New Orleans. These surge events have also been accompanied by considerable injuries and loss of life within the planning area.

Although the available data limit the ability to identify figures relating to the specific causes of death, it is widely accepted based on a review of numerous reports and studies that the majority of deaths associated with these events were the result of storm surge.

Future Probability

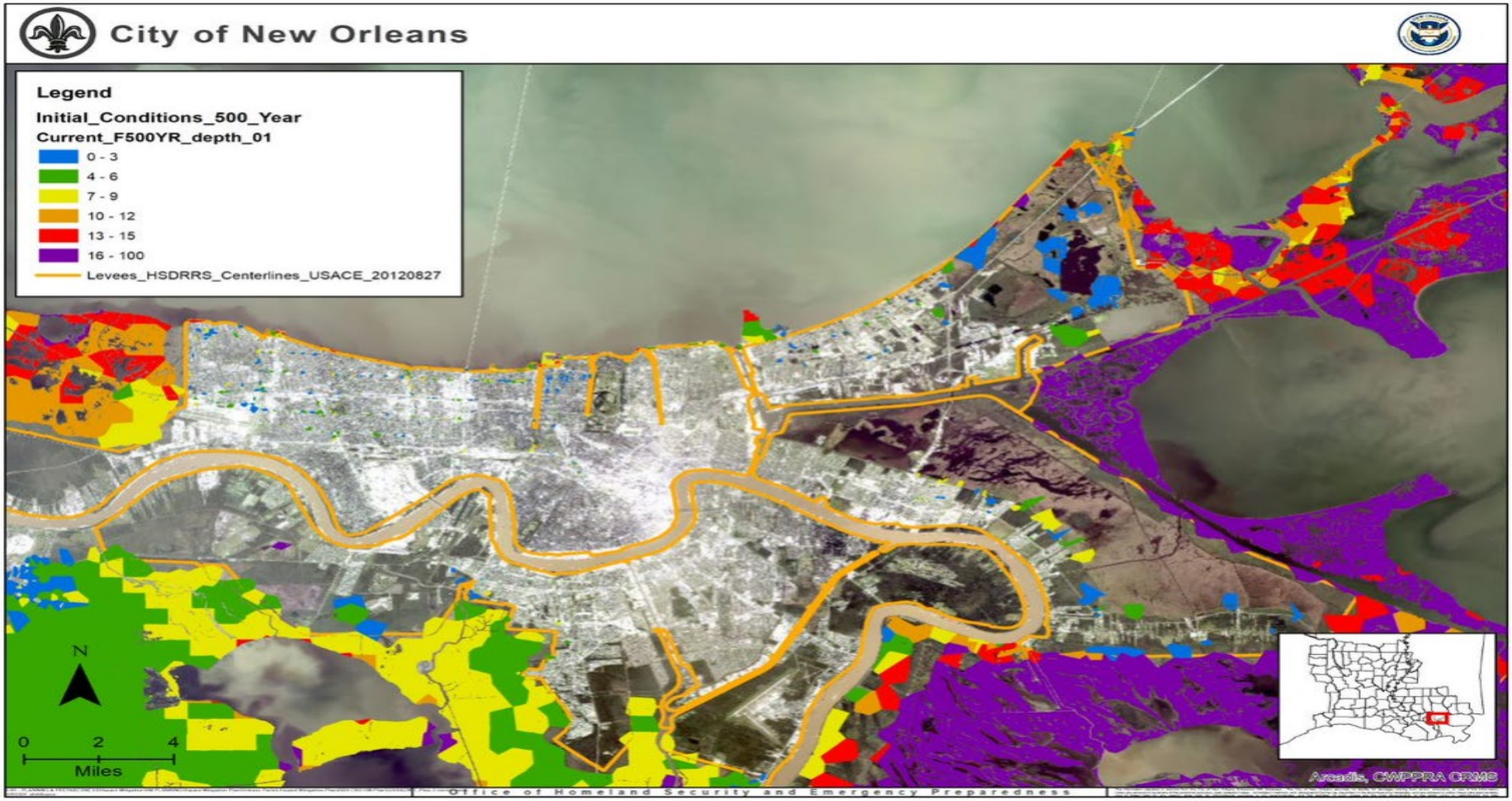
The threat of flooding caused by storm surge will continue to be a significant problem for New Orleans. Over the next several decades, a number of factors related to storm surge hazards can be expected to change the risk of flooding in New Orleans. These include increases in the relative sea level of the region due to geological subsidence and global sea-level rise, loss of coastal wetlands, and potential increases in hurricane activity in the Gulf of Mexico[xix].

The Louisiana Coastal Preservation and Restoration Authority and others have done extensive work to forecast the extent and severity of future storm surge flooding. While the predictions vary and are influenced by uncertain factors including implementation of coastal restoration projects and global climate change, the data clearly show increasing risk from storm surge in the future (Figures 23-26)).

Figure 23: Flood Depths During a 100-Year Storm Surge Event

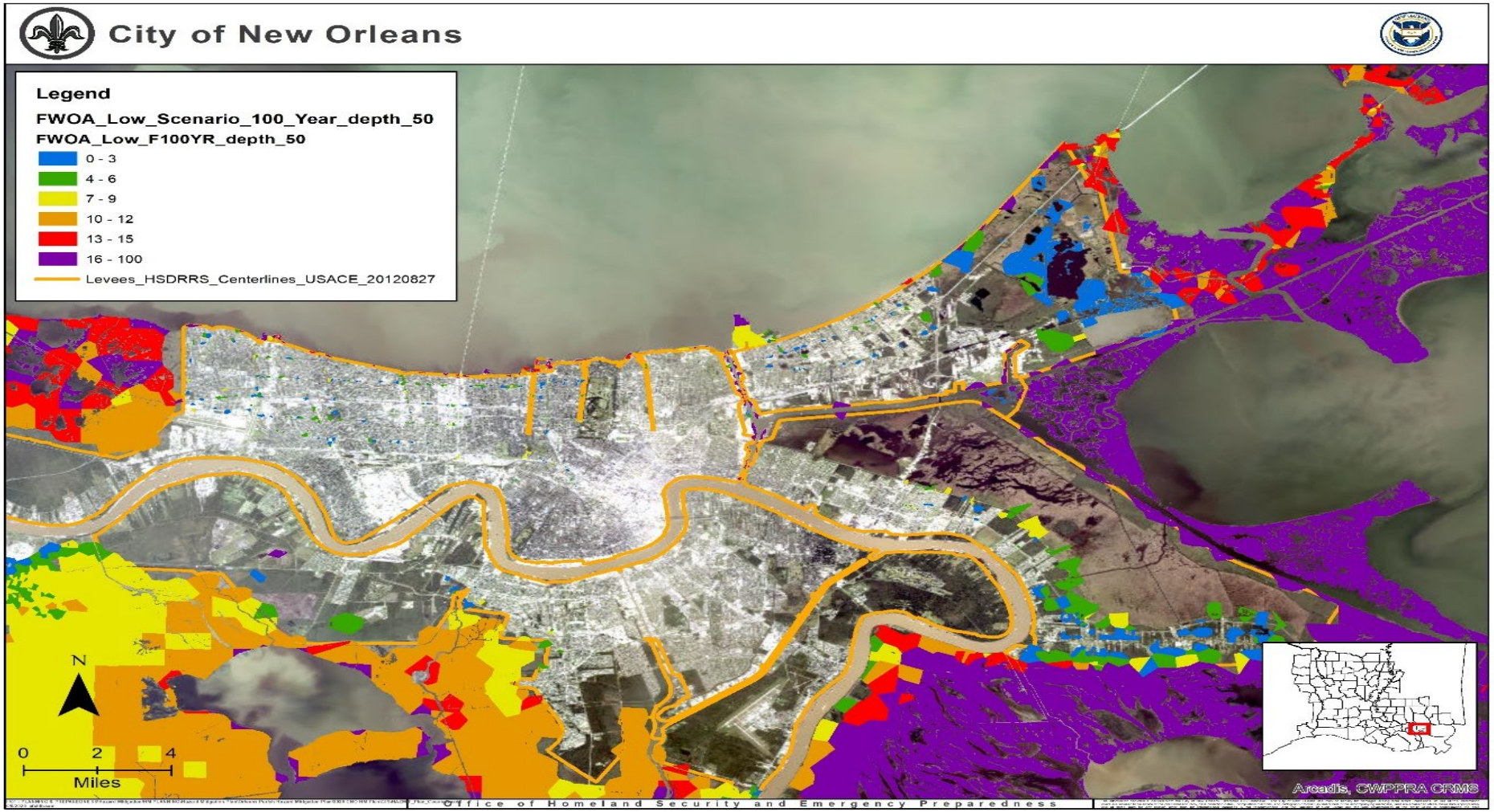
Source: Coastal Protection and Restoration Authority (CPRA), City of New Orleans

Figure 24: Flood Depths During a 500-Year Storm Surge Event



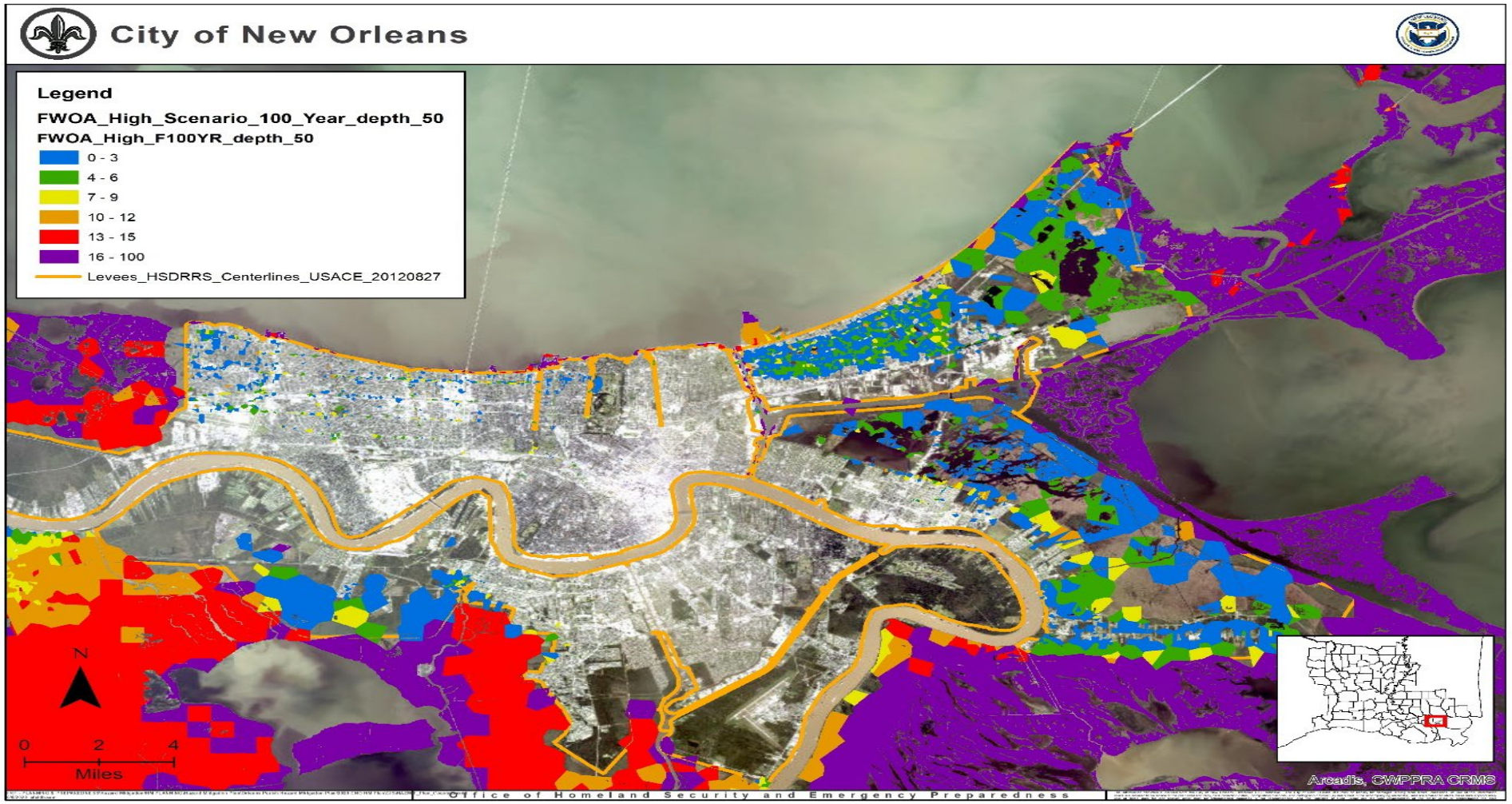
Source: Coastal Protection and Restoration Authority (CPRA), City of New Orleans

Figure 25: 100-year Storm Surge Flood Depths, 50 years in the Future Without Implementation of the Coastal Master Plan, under a "Low" Climate Scenario



Source: Coastal Protection and Restoration Authority (CPRA), City of New Orleans

Figure 26: 100-year Storm Surge Flood Depths, 50 years in the Future Without Implementation of the Coastal Master Plan, under a "High" Climate Scenario



Source: Coastal Protection and Restoration Authority (CPRA), City of New Orleans

2.3 Tropical Cyclones

Definition

Hurricanes, tropical storms, and typhoons, collectively known as tropical cyclones, are among the most devastating naturally occurring hazards in the United States. Tropical cyclones generate several different hazards, which are all addressed in this plan. High winds, heavy rainfall, tornadoes, and storm surge are all associated hazards produced by tropical cyclones.

A hurricane is defined as a low-pressure area of closed circulation winds that originates over tropical waters. A hurricane begins as a tropical depression with wind speeds below 39 mph. As it intensifies, it may develop into a tropical storm, with further development producing a hurricane.

A tropical cyclone is a storm system characterized by a large low-pressure center and numerous thunderstorms that produce strong winds and flooding rain. The wind speeds from a tropical storm range between 39 and 74 mph. In most of the world, a storm is given a name when it reaches tropical storm intensity.

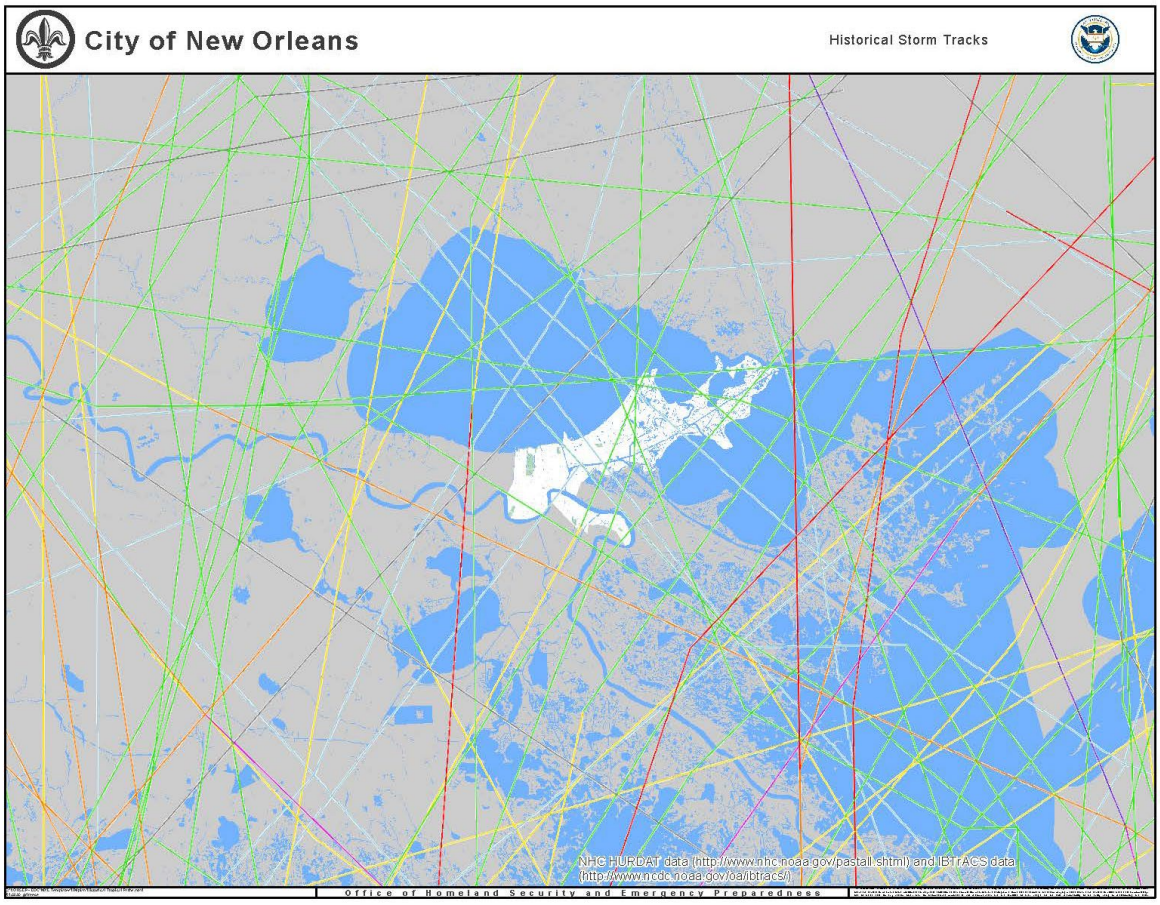
Storm surge is often the greatest tropical cyclone-related threat to property and human life. In New Orleans, the area's low elevations and network of levees make it especially vulnerable to the surge of a tropical cyclone and, more specifically, hurricanes. The effects of an intense hurricane can be catastrophic to any location. However, New Orleans is especially vulnerable because of the threat to a system of levees that channel and hold the waters of canals, Lake Pontchartrain, and the Mississippi River. A detailed discussion of the storm surge hazard associated with hurricanes is included in the Flood hazard profile. The risks associated with Levee Failure from storm surge can be found in the Infrastructure Failure section. This subsection focuses on the effects of high winds associated with hurricanes.

Location and Extent of the Tropical Cyclone Hazard

Tropical cyclone risk in the United States extends along the entire east coast from Maine to Florida, the Gulf Coast (including Florida, Alabama, Louisiana, and Texas), and Hawaii. The southeastern United States and Gulf Coast are at most significant risk based on historical storm tracks and the warmer waters of the Gulf of Mexico and the Atlantic Ocean. The City of New Orleans is threatened by tropical cyclones that develop in the Atlantic Ocean and the Gulf of Mexico, and the entire Parish is susceptible to hurricanes and tropical storms. The greatest threat to New Orleans comes during the Atlantic Ocean/Gulf Hurricane season, which runs from June 1 to November 30. Figure 27 shows all major historical hurricanes (Category 3 or higher) that impacted southeastern Louisiana within 100 miles of New Orleans from 1950 to 2019. The database was queried, and the map developed using NOAA's Historical Hurricane Tracks database. Due to the variation in size,

strength, and other variables in tropical cyclones, the entire New Orleans area is at risk for up to a Category 5 hurricane.

Figure 27: Major Historic Hurricanes Impacting Southeastern Louisiana



Source: NOAA Coastal Service Center – Historical Hurricane Tracks Database

Severity of the Tropical Cyclone Hazard

The severity of hurricanes and tropical storms is measured primarily by wind velocity, flooding, central pressure, and storm surge. Using a system known as the Saffir-Simpson Hurricane Scale, Hurricanes are classified as Categories 1 through 5 based on wind speed and damage potential (Table 21).

Table 19: Saffir-Simpson Hurricane Scale

Category	Winds	Damage
1	74 - 95 mph	Minimal: Damage to building structures possible, primarily to unanchored older model mobile homes. Damage to poorly constructed signs, shrubbery, and trees. Loose outdoor items become projectiles. Numerous power outages.
2	96 - 110 mph	Widespread from very strong winds: Some roofing material, door, and window damage to buildings. Considerable damage to trees, vegetation, mobile homes, and piers. A number of high-rise building glass windows dislodged to become projectiles. Widespread power outages up to several days
3	111 - 129 mph	Extensive from dangerous winds: Some structural damage to small residences and utility buildings with minor amount of wall failures. Mobile homes destroyed. Many trees uprooted or snapped. Power outages lasting several days or weeks.
4	130 - 156 mph	Devastating from extremely dangerous winds: Some wall failures with complete house roof structure failures. Extensive damage to doors, windows, and trees. Electricity unavailable for weeks.
5	> 156 mph	Catastrophic: Complete roof failure on many residences and industrial buildings. Some complete building failures with small buildings blown over or away. Power outages for weeks or months.

Source: National Oceanic and Atmospheric Administration (NOAA)

Previous Occurrences of the Hurricane and Tropical Storm Hazard

The following tables provide data obtained from NOAA for hurricanes and tropical storms from 1994 to 2019. During this period, there were eight hurricanes and 15 tropical storm events that affected New Orleans. According to the NOAA data, the total property damage from 1994 to 2019 was over $3.6 billion, which includes over $3.5 billion in property damage resulting from Hurricane Katrina in 2005.

Table 202: Tropical Cyclone (Hurricane) Events, Orleans Parish, 1994-2019

Date	Type	Name	Deaths	Injuries	Property Damage
7/17/1997	Hurricane (Typhoon)	Hurricane Danny	0	0	$0
9/27/1998	Hurricane (Typhoon)	Hurricane Georges	0	0	$6,000,000
10/2/2002	Hurricane (Typhoon)	Hurricane Lilli	0	0	$5,540,000
9/15/2004	Hurricane (Typhoon)	Hurricane Ivan	0	0	$240,000
7/5/2005	Hurricane (Typhoon)	Hurricane Cindy	0	0	$17,000,000
8/28/2005	Hurricane (Typhoon)	Hurricane Katrina	638	0	$3,560,000,000
9/1/2008	Hurricane (Typhoon)	Hurricane Gustav	0	0	$6,170,000
8/28/2012	Hurricane (Typhoon)	Hurricane Isaac	0	0	$26,800,000
Totals			638	0	$3,621,750,000

Source: NOAA National Centers for Environmental Information

Table 213: Tropical Storm Events, Orleans Parish, 1994-2019

Date	Type	Magnitude	Deaths	Injuries	Property Damage
9/10/1998	Tropical Storm	Tropical Storm Frances	0	0	$4,300,000
9/19/1998	Tropical Storm	Tropical Storm Hermine	0	0	$0
8/4/2002	Tropical Storm	Tropical Storm Bertha	0	0	$0
9/14/2002	Tropical Storm	Tropical Storm Hanna	0	0	$0
9/25/2002	Tropical Storm	Tropical Storm Isidore	0	0	$6,390,000
6/30/2003	Tropical Storm	Tropical Storm Bill	0	0	$2,000,000
10/9/2004	Tropical Storm	Tropical Storm Matthew	0	0	$3,000
7/10/2005	Tropical Storm	Hurricane Dennis	0	0	$0
9/23/2005	Tropical Storm	Hurricane Rita	0	0	$0
9/11/2008	Tropical Storm	Hurricane Ike	0	0	$100,000
11/9/2009	Tropical Storm	Hurricane Ida	0	0	$0
9/2/2011	Tropical Storm	Tropical Storm Lee	0	0	$10,000
9/2/2011	Tropical Storm	Tropical Storm Cindy	0	0	$10,000
6/20/2017	Tropical Storm	Hurricane Barry	0	0	$0
7/12/2019	Tropical Storm	Tropical Storm Frances	0	0	$0
Totals			0	0	$12,813,000

Source: NOAA National Centers for Environmental Information

Hurricane Katrina

Hurricane Katrina made landfall as a powerful Category 3 Hurricane that had a devastating impact on the New Orleans area and the entire Gulf Coast region. The storm initially formed over the southeastern Bahamas on August 23, 2005, as Tropical Depression 12. As the cyclone moved north and eventually west of the Bahamas, it continued to strengthen, reaching Category 1 hurricane status on August 25 shortly before making landfall on the southeast coast near Miami, Florida. Once back over open water, the storm quickly gained strength and briefly reached Category 5 intensity over the central Gulf of Mexico before making landfall near Buras, Louisiana, as a Category 3 hurricane.

On August 29, 2005, Hurricane Katrina made landfall with maximum sustained winds of 130 mph and a massive storm surge of up to 28 feet that devastated parts of the Gulf Coast. The NHC attributed the catastrophic storm surge to several factors, including the size of the storm and the vast area of hurricane-force winds. See the Flood hazard profile for additional details about the storm surge associated with Hurricane Katrina.

Although storm surge and flooding from levee breaches were the dominant cause of damage, high winds from Hurricane Katrina caused considerable damage to some regions of the City of New Orleans and the Gulf Coast. As the eye of the storm passed to the east of New Orleans, wind speeds near the center and to the east of the storm were near Category 3 intensity on the Saffir-Simpson scale. To the west of the eye, the NHC estimates that sustained winds throughout the New Orleans metropolitan area were less than Category 3 intensity. At the surface, the New Orleans area most likely experienced maximum sustained winds between 96 -110 mph (Category 2).

Along the Gulf Coast, inland from the storm surge areas, the leading causes of damage were high winds and wind-borne debris. After Katrina, FEMA studied the performance of buildings from New Orleans to Mobile, Alabama. The results were published in the July 2006 report titled "Hurricane Katrina in the Gulf Coast, Mitigation Assessment Team (MAT) Report" (FEMA 549). This report included the assessment of wind-induced envelope damage to residential, commercial, and critical facilities. It concluded that high winds and wind-borne debris from Katrina caused significant damage to roof systems, windows, exterior-mounted electrical, mechanical, and communication equipment. Blow-off of building envelope components and rooftop equipment also caused damage to adjacent buildings, as well as to the building themselves. Common windborne building envelope debris during Hurricane Katrina included roof coverings (particularly aggregate surfaces and asphalt shingles) and vinyl siding.

Although wind speeds in the New Orleans area were approximately 100 mph, slightly higher wind speeds were most likely experienced at elevations above the surface, as evidenced by the damages that occurred to many of the downtown high-rise buildings. Many of the high-rises experienced extensive window damage, which then allowed wind-driven rain into the interior. As noted in FEMA 549:

Several buildings in downtown New Orleans had isolated window breakage. These windows may have been broken by windborne debris, or they may have been weakened by scratches and failed when over-stressed by wind pressure. However, nine buildings along or near Poydras Street had extensive glazing damage that was indicative of damage caused by windborne roof aggregate. Except for two of these buildings, virtually all of the glazing damage occurred on the windward facades.

FEMA 549 indicates that the damages to the buildings within Cluster A were generally more significantly damaged than in Cluster B. This figure is followed by a sample of the type of window glazing damage that was experienced due to windborne debris from the high winds. Window glazing is considered the glass on the exterior of the building.

As mentioned earlier, Katrina's winds also caused damage to rooftops and exterior windows and doors, allowing wind-driven rain to penetrate into the interior of both residential and commercial structures. After the hurricane, the National Institute of Standards and Technology (NIST) also studied the performance of structures and found that roof failures on buildings and residential structures were evident throughout the area. Typical roof damage included the failure of roof coverings, loss of roof decking, and, in some cases, the support structure. This is consistent with the conclusions found within FEMA 549. Figure 28 shows typical roof damage to residential structures in New Orleans. Most of the residential structures inspected by the MAT had asphalt shingle roof coverings. The vast majority of the observed roofs experienced damage, ranging from loss of a few hip trim shingles or tabs to loss of a large number of shingles and underlayment. FEMA 549 indicates that the house in the lower right-hand corner is circled to highlight that the roof damage was most likely initiated by blow off of a deck panel from the corner.

Figure 28: Typical Wind Damage to Residential Structures – Hurricane Katrina

Source: Hurricane Katrina in the Gulf Coast, Mitigation Assessment Team (MAT) Report Hurricane, FEMA 549, July 2006

Table 22: Summary of Damages and Deaths from Hurricane Katrina

	Orleans Parish	Louisiana	Louisiana, Mississippi, Alabama
Total Damages	$16.9 Billion	$38.8 Billion	$81 Billion
Number of Structures Damaged or Destroyed flood, storm surge, and wind	134,344	205,000	275,000
NFIP estimated paid claims, $	$7.9 Billion[1]	$12.6 Billion	$15.3 Billion
Schools Damaged	124[2]	875	1,154
Deaths	800	1,464	1,810

Note 1: Estimate of $7.9 billion for Orleans Parish based on 83,500 claims in the New Orleans area with an average claim of $94,803.
Note 2: Estimate is for public schools only. All Orleans Parish School Board (OPSB) schools experienced at least minor damage. Approximately 33 were severely damaged.
(Sources include: General Accounting Office: NFIP, New Processes Aided Hurricane Katrina Claims Handling, but FEMA's Oversight should be Improved. NOAA – NCDC; LA Department of Health and Hospitals; AIR Worldwide – Insurance Information Institute; US Department of Commerce – Gulf Coast Recovery; Louisiana Recovery Authority; National Association of Home Builders - American Red Cross; Louisiana Long-Term Community Recovery Planning; FEMA Federal Insurance Administration.

Hurricane Rita

On September 24, 2005, Hurricane Rita made landfall as a strong Category 3 hurricane in extreme southwestern Louisiana just west of Johnson's Bayou in Cameron Parish. The storm occurred only three weeks after Hurricane Katrina had a devastating impact on Louisiana and the Gulf Coast. Similar to Katrina, Rita was also an intense hurricane that, at one point in the Gulf of Mexico, was a Category 5 on the Saffir-Simpson scale.

Approximately 48 hours before reaching the Gulf Coast, the storm began to weaken. It made landfall as a Category 3 hurricane near the Texas/Louisiana border. With the exception of a small portion of western Louisiana, most of the southern part of the State experienced wind speeds ranging between 80-100 mph, the equivalent of a Category 1 or 2 hurricane.25

The highest observed wind gusts from Hurricane Rita were reported in Port Arthur, Texas, and Calcasieu Pass, Louisiana. Table 25 below provides a summary of the peak wind gusts.

Table 23: Observed Peak Wind Gusts – Hurricane Rita

Location	Peak Gust	Direction
Port Arthur, Texas	116	N
Calcasieu Pass, LA	112	E
New Orleans	42	NE
Marsh Island, LA	93	S
Lake Charles	74	NE

Source: NOAA – Hurricane Research Division

On the day the storm made landfall, a Presidential Disaster Declaration (DR-1607) was declared for parts of southern Louisiana. In the City of New Orleans, the disaster assistance from FEMA included emergency work (Categories A and B) for public assistance. The NHC estimated the

storm caused an estimated $11.3 billion in damages to the Gulf Coast. In New Orleans, the maximum sustained winds were estimated at 34 mph.[xx]

Hazard Impacts

Impact on Life and Property

Past hurricanes and tropical storms have had a major, and in some cases devastating, impact on life and property in New Orleans. Events such as Hurricane Betsy in 1965, and more recently, Hurricane Katrina in 2005, have resulted in many hundreds of deaths and thousands of injuries.

Table 26 summarizes the number of residential structures in Orleans Parish that sustained damage exclusively from high winds as a result of Hurricanes Katrina and Rita in 2005. As noted in Section on Tropical Cyclones, the storm surge associated with Hurricane Katrina overtopped or breached numerous levees protecting the City of New Orleans. The widespread flooding damaged or destroyed thousands of residential properties in the Parish, many of which also experienced wind-related damage. The data indicate that 26,965 residential structures experienced only wind-related damage (no flood damage) from Hurricanes Katrina and Rita. This total represents approximately 14.3% of the 188,251 residential structures in the Parish based on 2000 US Census data.

Table 24: Orleans Parish Residential Structures Damaged by High Winds from Hurricanes Katrina and Rita

Occupancy	Minor	Major	Destroyed	Total
Owner-Occupied	10,944	1,635	122	12,701
Rented-Occupied	10,855	3,037	372	14,264
Grand Total	21,799	4,672	494	26,965

Source: FEMA, Housing Unit Damage Estimates: Katrina, Rita, Wilma, April 2006

Vulnerability

Based on the past 25 years (1994-2019) of NOAA data, the annual probability that New Orleans will experience a tropical cyclone is 92%. Due to its proximity to the Gulf Coast, in conjunction with ongoing coastal land loss and the likely impacts of climate change, New Orleans is especially vulnerable to tropical cyclones.

2.4 Coastal Erosion

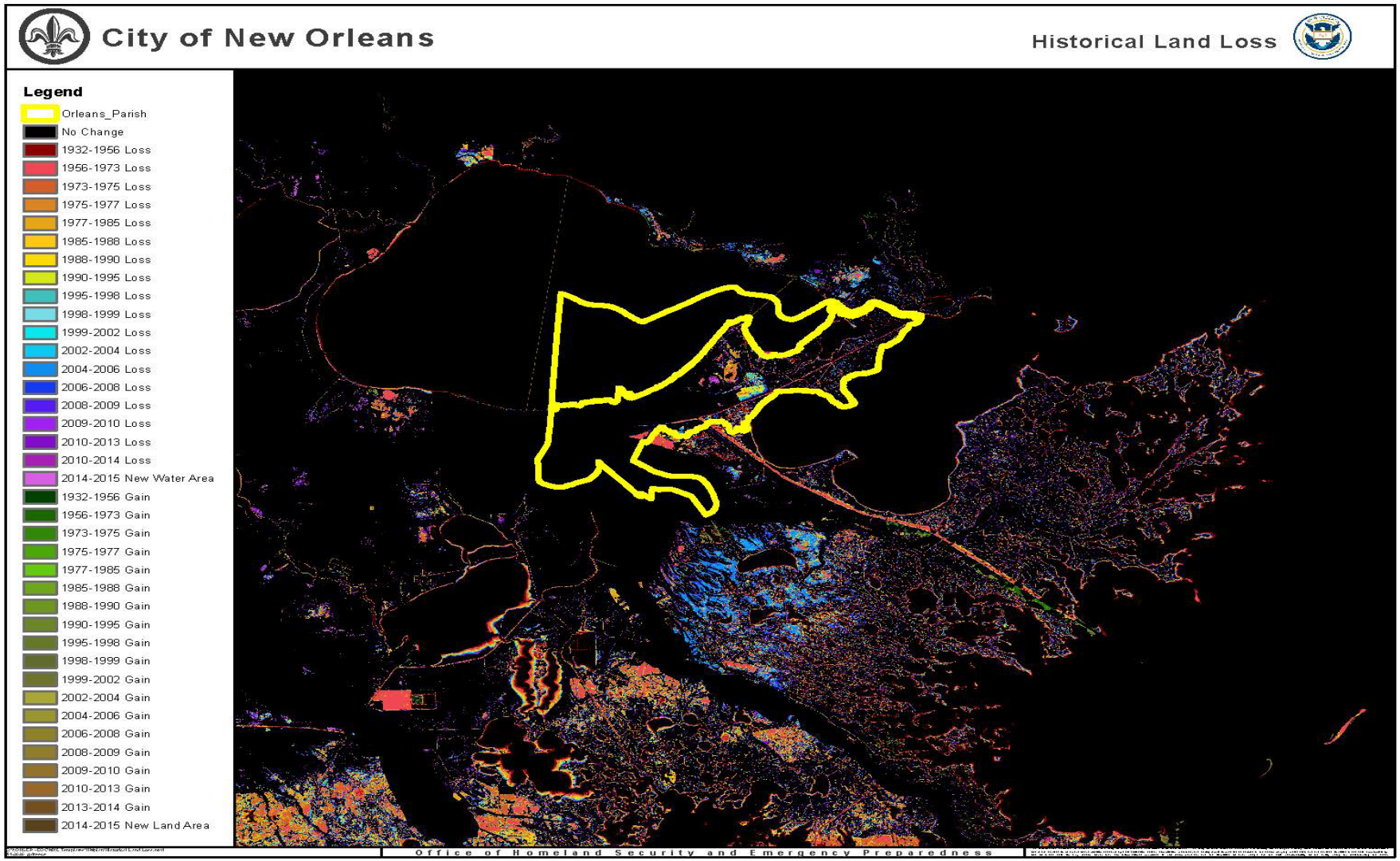
Definition

Coastal erosion is the wearing away of land or the removal of coastal wetland, beach or dune sediments by wave action, tidal currents, wave currents, or drainage. The physical processes that cause barrier island erosion and wetland loss throughout the Louisiana delta plain are complex and varied. The Louisiana coast is unique among the Gulf Coast States in that its coastal population centers are all buffered from the Gulf of Mexico by an expansive, although rapidly eroding, coastal wetland system. Coastal erosion is a significant problem along the entire Louisiana Gulf Coast.

Location and Extent of Coastal Erosion

The USGS has identified areas of coastal erosion that have occurred between 1932 and 2015 in southeastern Louisiana (Figure 29). The City of New Orleans is susceptible to Coastal Erosion in the areas outside of the levees, i.e., the eastern and southern portions of the parish. Land loss is driven by complex interactions between factors including, but not limited to, sediment supply, wetland plant health, water quality, global mean sea level change, and subsidence.

Figure 29: Geomorphic Classification of Coastal Land Loss between 1932 and 2015 in Southeastern Louisiana



Source: USGS – Coastal Erosion and Wetland Change in Louisiana

Severity of the Coastal Erosion hazard

Louisiana has the highest rate of wetlands loss in the Country, with the State accounting for 80 percent of the nation's coastal wetland loss.[xxi] In total, the USGS estimates that Louisiana has lost approximately 1,900 square miles of its coast since 1932.

Within the past 100 years, Louisiana's barrier islands have decreased in area by more than 40 percent, and some islands have lost more than 75 percent of their land area. If these loss rates continue, several of the barriers are expected to erode entirely within the next three decades. Their disappearance will contribute to further loss and deterioration of wetlands and back-barrier estuaries and increase the risk to infrastructure.

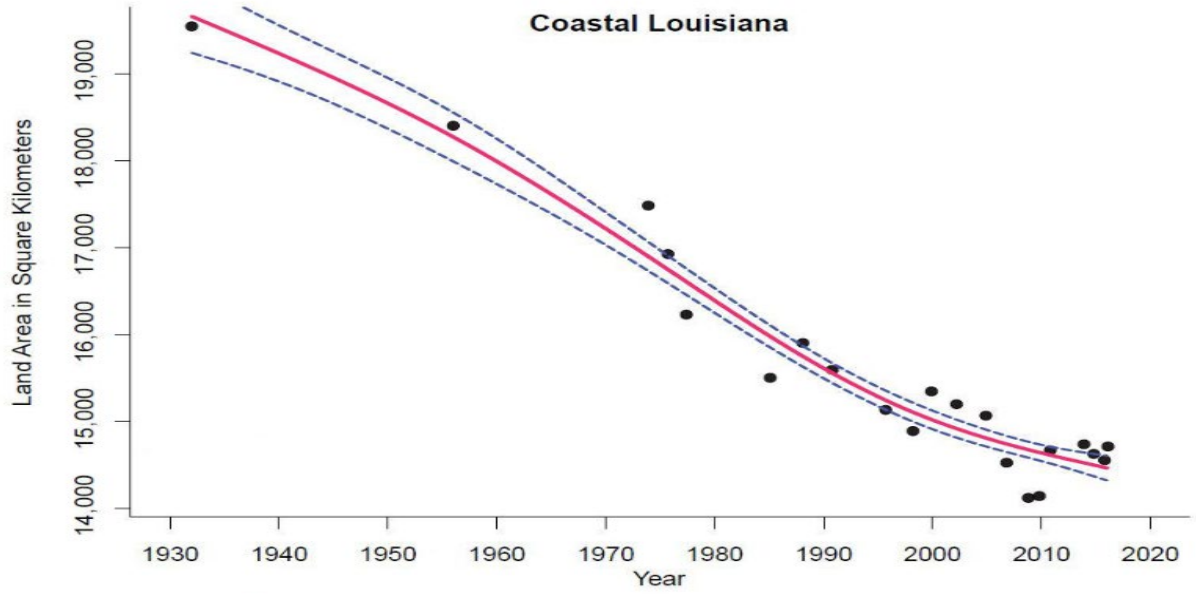
On April 19, 2017, Governor John Bel Edwards declared a state of emergency for the Louisiana coast due to the effects of coastal land loss. "The emergency proclamation will be sent to President Donald Trump and members of Congress as a necessary means of raising the national profile of this crisis and expediting priority restoration projects with the level of urgency those projects require."[xxii] The state's Master Plan, administered by the Coastal Protection and Restoration Authority, is the primary vehicle for addressing coastal land loss.

Previous Occurrences of Coastal Erosion

Although there are specific areas of more severe coastal erosion along the Louisiana coastline, this is an ongoing process that impacts the entire coastal region of Louisiana. The amount of coastal erosion varies from year to year (Figure 30).

Hurricanes Katrina and Rita resulted in the destruction of more than 217 square miles of coastal wetlands during their landfalls.[xxiii] The loss attributed to these storms exceeds the wetland losses that had been projected to occur in the entire state over the next 20 years. In addition, Hurricane Katrina destroyed or substantially damaged about one-half of the State's barrier islands along the Gulf of Mexico.[xxiv]

Figure 30: Change in Louisiana's Coastal Wetland Areas, 1932 – 2016



Source: United States Geological Survey (USGS) - Coastal Erosion and Wetland Change in Louisiana

Hazard Impacts

Impact on Life and Property

The slow movement and advancement of coastal erosion are not in itself life-threatening; however, the continued loss of wetlands along the Louisiana coastline can have a direct effect on the severity of hurricanes and tropical storms. The wetlands act as a buffer to reduce hurricane wind speeds and storm surge heights, thus reducing the severity of these events. Without protection from coastal wetlands, areas such as New Orleans are at greater risk from major hurricane events.

Coastal erosion also has the potential to cause substantial property damage and negative impacts to the Louisiana economy. This includes threats to transportation assets, including U.S. 11, U.S. 90, the train tracks, which are outside the levee, and in areas of high erosion and exposure to coastal storms. If losses continue at the current rate, coastal erosion has the potential to have direct implications on the nation's energy supplies, economic security, and environmental integrity. Numerous studies have been conducted to identify the major contributing factors that have caused such extensive land loss in southeastern Louisiana. Most studies agree that land loss and the degradation of the coastal ecosystem are the results of both natural and human-induced factors, producing conditions where wetland vegetation can no longer survive or is directly extracted, and wetlands are lost.

Although New Orleans is not at immediate physical risk from coastal erosion, the loss of coastal wetlands represents a severe vulnerability for nearly all facilities, populations, and operations in the area. There are numerous studies that include projections of potential losses from storm surges

under various future coastal erosion scenarios (please see the Storm Surge Flooding hazard profile).

In the next several decades, sea-level rise has the potential to cause further coastal land loss in Louisiana. Absent significant intervention, 2,250 square miles could be lost over the next 50 years.[xxv] This is a conservative estimate since it presumes a continuation of what has been observed over the past 50 years, without factoring in the acceleration of sea-level rise from potential climate change. Over the long term, the loss of coastal landmasses that provide some protection for the City of New Orleans from hurricanes is vitally important. The loss of this critical natural barrier will have a tremendous impact on all of New Orleans and the surrounding parishes by making them more vulnerable, especially to powerful hurricanes.

An LSU report, Regional Impacts of Coastal Land Loss and Louisiana's Opportunity for Growth, estimates that infrastructure replacement costs and business disruptions in the New Orleans Region (including Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Tammany parishes) could total $1.7 billion due to land loss over the next 50 years if no action is taken to protect or restore the state's coast.[xxvi]

Assuming an eastern-track storm (similar to Hurricane Katrina's path), the report estimates that storm surge would intensify due to the loss of coastal land, increasing pressure on the levee system and the chances of widespread flooding within the levee system and resulting in $130 billion in replacement costs and $26 billion in business disruption.

Additionally, the report estimates that physical damage to the New Orleans region due to the impacts of coastal erosion could reach $1.3 billion in 25 years and $1.7 billion in 50 years. This includes replacement costs for businesses, residences, and infrastructure. In addition to physical damage, over 9,000 jobs and $568 million in wages could be lost within 50 years.

Vulnerability

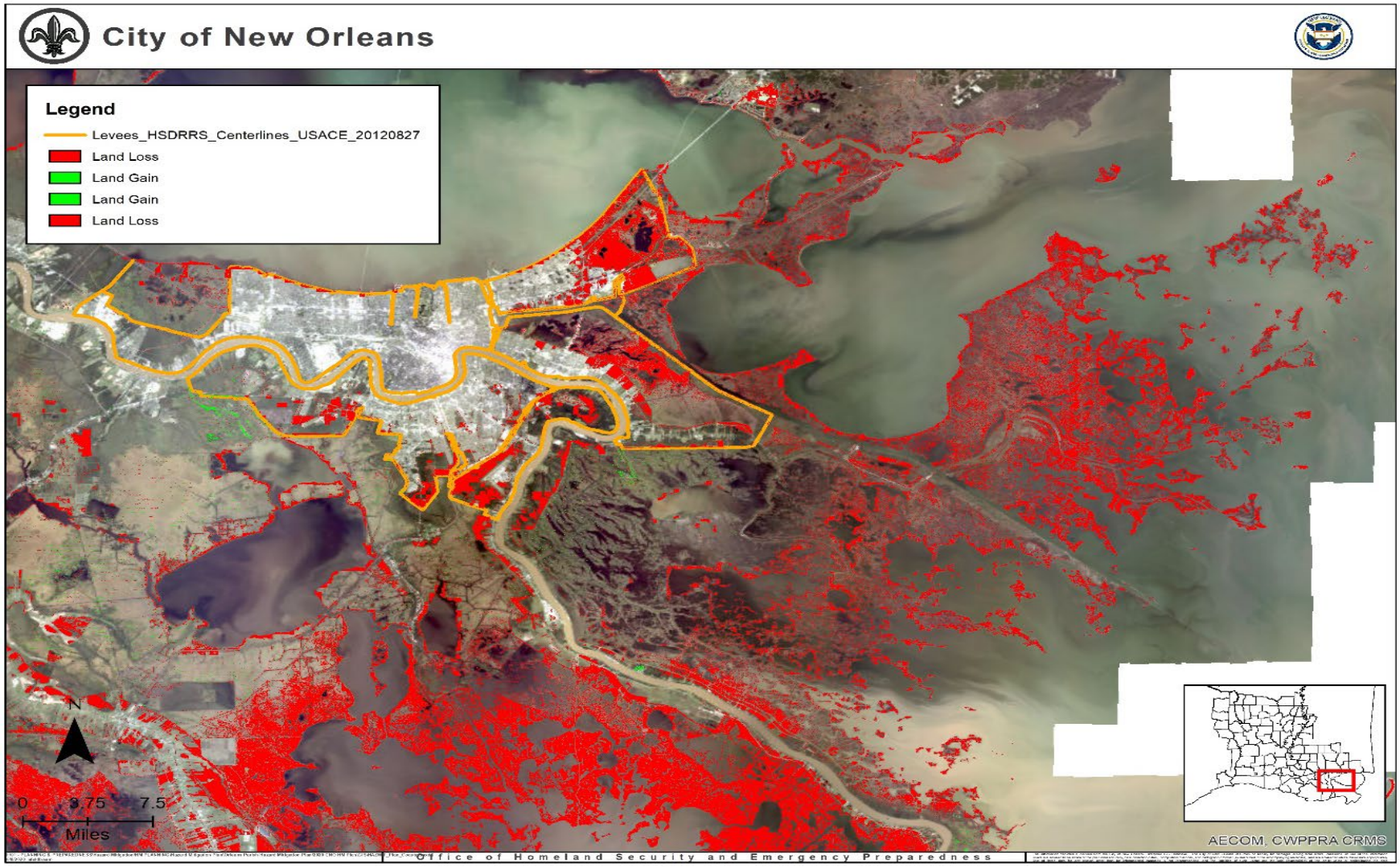
Based on extensive and ongoing studies of the Louisiana coastline, there is a 100% statistical probability that additional erosion will occur in the future. The Coastal Protection and Restoration Authority models demonstrate projected land loss over the next 10 years to primarily impact New Orleans East, making these neighborhoods more vulnerable to storm surge, other flooding events and negatively impacting existing homes and businesses. Figure 31 identifies the projected land loss (shown in red) in Orleans Parish; significant erosion may occur in or near the far eastern and southern part of East New Orleans.

Figure 31: Projected Land Loss and Land Gain in Year 10, Future Without Action

Source: Coastal Protection and Restoration Authority 2017, City of New Orleans

The same model estimates that over the next 50 years, additional land will be lost along Lake Pontchartrain and the coastal wetlands outside of the levee system.

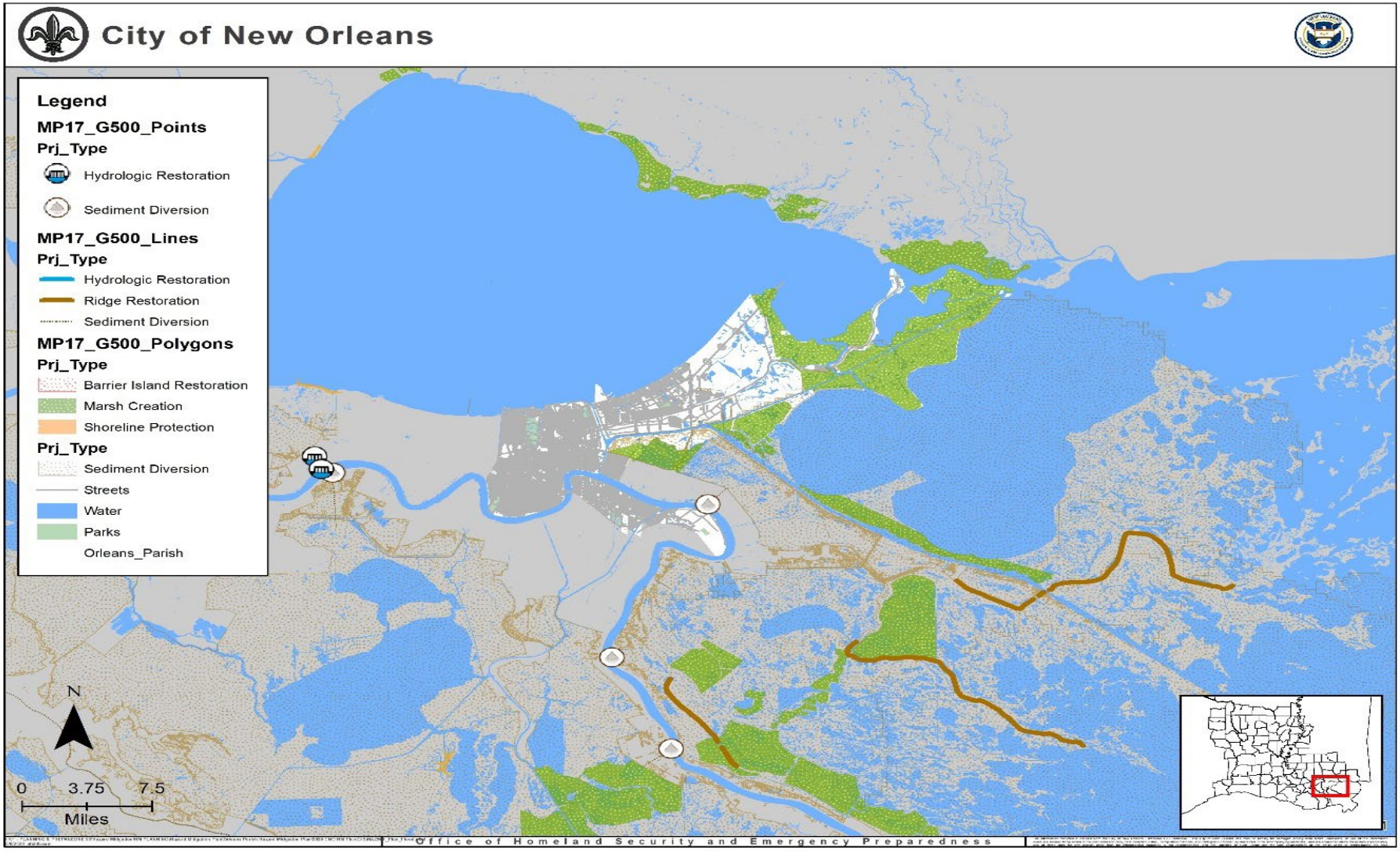
Figure 32: Land Loss and Land Gain, Year 50 Future Without Action



Source: Coastal Protection and Restoration Authority 2017, City of New Orleans

The Louisiana Coastal Preservation and Restoration Authority (CPRA) has a master plan that includes a suite of projects intended to offset the most severe impacts of coastal erosion (Figure 33) [xxvii]. The goal of these projects is to fortify marshlands and help rebuild the coast and protect the communities of coastal Louisiana. However, there is uncertainty as to what the future holds for these projects and what their broader impacts might be for the New Orleans region. The Mitigation Strategy identifies actions related to some of the Coastal Master Plan projects that would have major impacts on New Orleans. The work of the Coastal Protection and Restoration Authority explains coastal erosion in detail in the Coastal Master Plan and other reports found at the CPRA's website.

Figure 33: Wetland Restoration Projects including Louisiana's Coastal Master Plan



Source: Coastal Protection and Restoration Authority 2017, City of New Orleans

2.5 Tornadoes

Definition

Tornadoes are rapidly rotating funnels of wind extending between storm clouds and the ground. For their size, tornadoes are the most severe storms, and 70% of the world's reported tornadoes occur within the continental United States, making them one of the most significant hazards Americans face.

Tornadoes and waterspouts form during severe weather events, such as thunderstorms and hurricanes, when cold air overrides a layer of warm air, causing the warm air to rise rapidly. This usually results in a counterclockwise rotation in the northern hemisphere. The updraft of air in tornadoes always rotates because of wind shear (differing speeds of moving air at various heights), and it can rotate in either a clockwise or counterclockwise direction; clockwise rotations (in the northern hemisphere) will sustain the system, at least until other forces cause it to die seconds to minutes later.

Location and Extent

Tornadoes, in general, are a climatological based hazard and have the same approximate probability of occurring at any location in New Orleans. Because a tornado has a similar probability of striking anywhere within the planning area for New Orleans, all locations are equally at risk for tornadoes.

Since February 1, 2007, the Enhanced Fujita (EF) Scale has been used to classify tornado intensity. The EF Scale classifies tornadoes based on their damage pattern rather than wind speed; wind speed is then derived and estimated. This contrasts with the Saffir-Simpson scale used for hurricane classification, which is based on measured wind speed. Table 27 shows the EF scale in comparison with the old Fujita (F) Scale, which was used prior to February 1, 2007. When discussing past tornadoes, the scale used at the time of the hazard is used. Damage and adjustment between scales can be made using the following tables.

Table 25: Comparison of the Enhanced Fujita (EF) Scale to the Fujita (F) Scale

Enhanced Fujita Scale						
	EF0	EF1	EF2	EF3	EF4	EF5
WIND SPEED	65-85	86-110	111-135	136-165	166-200	> 200
(MPH)			Fujita Scale			
	F0	F1	F2	F3	F4	F5
	< 73	73-112	113-157	158-206	207-260	> 261

Source: National Weather Service, NOAA

Table 26: Fujita and Enhanced Fujita Tornado Damage Scale

Scale	Typical Damage
F0/EF0	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1/EF1	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2/EF2	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; light-object missiles generated; cars lifted off ground.
F3/EF3	Severe damage. Roofs and some walls torn of well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4/EF4	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5/EF5	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Source: National Weather Service, NOAA

The National Weather Service (NWS) has the ability to issue advisory messages based on forecasts and observations. The following are the advisory messages that may be issued, along with definitions of each:

- **Tornado Watch:** Issued to alert people to the possibility of a tornado developing in the area. A tornado has not been spotted, but the conditions are favorable for tornadoes to occur.
- **Tornado Warning:** Issued when a tornado has been spotted or when radar identifies a distinctive "hook-shaped" area within a thunderstorm line.

Peak tornado activity in Louisiana occurs during the spring, as it does in the rest of the United States. Nearly one-third of observed tornadoes in the United States occur during April. About half of those in Louisiana, including many of the strongest, occur between March and June. Fall and winter tornadoes are less frequent, but the distribution of tornadoes throughout the year is more uniform in Louisiana than in locations farther north.

Previous Occurrences

SHELDUS reports a total of 6 tornadoes occurring in New Orleans between the years of 1994 - 2019. The NOAA's database recorded 9 tornadoes during the same period. These tornadoes have ranged from EF0 to EF3. The NOAA records for tornadoes in the parish are provided in the following table. For the New Orleans, East Tornado on 2/7/2017, the property damage amount was supplemented with additional data beyond that of NOAA.

Table 27: Tornado Events, Orleans Parish, 1994-2019

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
New Orleans	8/10/2000	16:12	Tornado	F0	0	0	$0
Lake Catherine	6/30/2003	11:45	Tornado	F0	0	0	$5,000
New Orleans	2/2/2006	2:42	Tornado	F2	0	0	$500,000
New Orleans	2/13/2007	3:03	Tornado	EF2	0	15	$2,000,000
Gentilly	2/13/2007	3:10	Tornado	EF2	1	10	$1,000,000
Gentilly	7/6/2010	8:44	Tornado	EF0	0	0	$10,000
Vieux Carre	8/4/2016	14:30	Tornado	EF0	0	2	$0
New Orleans East	2/7/2017	11:12	Tornado	EF3	0	33	$38,200,000
Vieux Carre	7/10/2019	7:26	Tornado	EF1	0	0	$300,000
Totals					1	60	$3,815,000

Source: NOAA National Centers for Environmental Information

Significant events are summarized below from the details of the NOAA database:

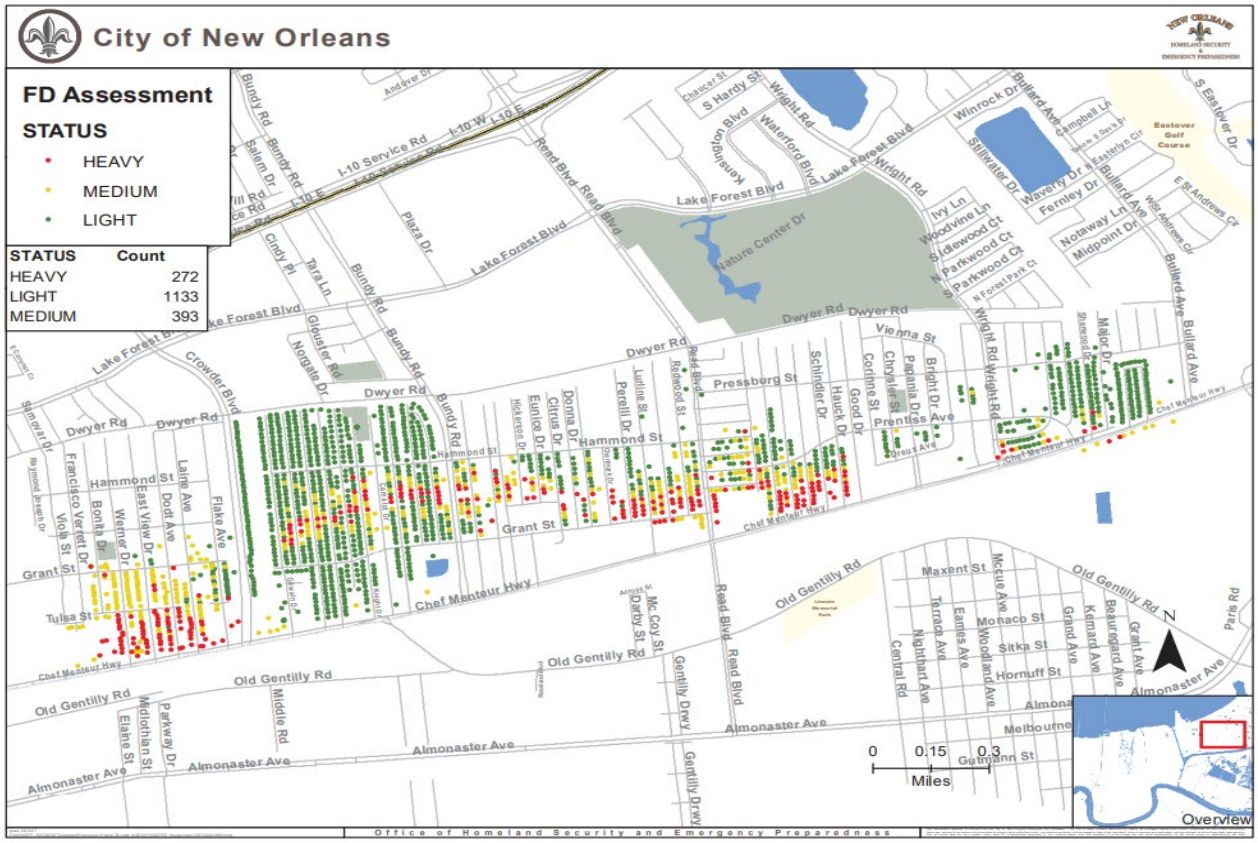
February 2, 2006: The tornado, which initially moved through the eastern portions of Metairie, continued to move northeast through the Lakeview and Lakefront neighborhoods of New Orleans. The same areas had previously been flooded by Hurricane Katrina in 2005, and most homes were unoccupied. Several homes suffered substantial damage to roofs, windows were blown out, and power poles were toppled. Several two-story homes suffered substantial damage to the second floor. A large communication tower was toppled at a former State police building. Damage estimates from the event totaled $500,000.

February 13, 2007: An EF-2 Tornado (Enhanced Fujita Scale) moved through the City of Westwego and the Carrollton area of New Orleans. The damage observed indicated an intensity in the mid-to-upper range of an EF-2 tornado on the Enhanced Fujita Scale with winds estimated to be in the 125- 130 mph range. A total of 295 houses in New Orleans and 231 in Jefferson Parish were damaged. A total of 79 houses were destroyed in both Jefferson and Orleans Parishes. One woman was killed, and 25 people were injured. A Federal Disaster Declaration (DR-1685) was declared for three Parishes, including Orleans. Damage estimates from the event totaled approximately $2 million. A second EF-2 tornado touched down just south of the intersections of Franklin Avenue and Prentiss Street and moved east northeast across the southern portion of Pontchartrain Park to the Industrial Canal. Roofs were blown off of several homes, and the upper

portions of two-story houses were partially collapsed. One fatality occurred when a travel trailer was destroyed, killing the 86-year old occupant.

February 7, 2017: A tornado touched down just east of the industrial canal and moved northeast into the Evangeline Oaks Subdivision, where it quickly strengthened into a multi-vortex EF-2 tornado. In this area, it snapped several power poles and caused significant roof damage to an apartment complex as well as a building similar to an automobile service building. The tornado then turned toward the east and continued to move almost due east through neighborhoods just north of Chef Menteur Boulevard. The worst damage was generally along and just north of Grant Street from Read Blvd to Chalmark Drive. In this area, dozens of homes lost all or large portions of their roof structures. Several homes also had numerous collapsed walls. A few two-story homes suffered almost complete destruction of the top floor, with the exception of one or two interior corner walls. The tornado also bent at least 3 steel electrical transmission poles. The tornado continued moving toward the east, causing damage to the NASA Michoud facility, National Finance Center, and a few other industrial buildings in the area, and rolling a rail tanker car east of the Michoud Canal. The track is terminated at Lake Borgne, but the tornado likely continued for some time after that over water. Of the 33 injuries, 5-6 of them were considered serious. The maximum estimated wind speeds were around 150 mph. In total, the tornado caused moderate to severe damage to 638 homes, of which around half were considered total losses. At least 40 businesses also suffered moderate to severe damage. The path of the tornado, and preliminary structural damage assessments conducted by NOFD, are shown in Figure 34.

Figure 34: Damage Assessment of February 7, 2017 Tornado in New Orleans East



Source: City of New Orleans

Hazard Impacts

Impacts on People and Property

The impacts of a tornado event can dramatically impact both people and property. Structures within the direct path of a tornado vortex are often reduced to rubble. Structures adjacent to the tornado's path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path that the building type and construction techniques are critical to the structure's survival. Although tornadoes strike at random, making all buildings vulnerable, mobile homes, homes with crawlspaces, and buildings with large spans are more likely to suffer damage.

The major health hazard from tornadoes is physical injury from flying debris or being in a collapsed building or mobile home. Within a building, flying debris or projectiles are generally stopped by interior walls. However, if a building has no partitions, any glass, brick, or other debris that is blown into the interior is life-threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged.

Vulnerability

Although New Orleans is subject to occasional tornadoes, this area of the country is not a high probability location for these events. Also, given the relatively small physical area being considered, the statistical likelihood of a significant tornado impacting the Parish is moderate, calculated at approximately 30% annually. Based on the past 25 years (1994-2019) of NOAA data, the annual probability that New Orleans will experience a tornado is 36%.

2.6 Subsidence

Definition

Subsidence is the motion of the Earth's surface as it shifts downward, relative to sea-level. Land subsidence, the loss of surface elevation due to the removal of subsurface support, ranges from broad, regional lowering of the land surface to localized collapse. Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. In the New Orleans area, subsidence occurs for several reasons at different layers beneath the surface. Deep subsidence is caused by the shifting of faults and by the dewatering and consolidation of relatively young rock. Shallow subsidence generally results from either desiccation and shrinkage, or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of years.

Human developments have changed the hydrology of southeast Louisiana in ways that contribute to coastal land loss. These changes include constructing canals and roads through wetlands and controlling the Mississippi River to prevent floods and aid navigation. These changes to the hydrology of south Louisiana have reduced the supply of new sediment to offset the impacts of subsidence on coastal wetland loss. River deltas naturally undergo accretion and subsidence. Accretion is the process by which sediments accumulate through the flooding of the banks and natural levees. Subsidence occurs as these sediments compact over time. Prior to the 20th Century, the accretion process equaled or exceeded the subsidence process in the Mississippi River Delta. However, the creation of flood-protection levees along the Mississippi River has reduced sediment supply in recent decades. Thus, there is nothing to counteract the natural subsidence that occurs in this area, which leads to an overall loss of elevation and causes coastal land loss.

In the United States, the average annual damage from all types of subsidence is estimated conservatively to be at least $125 million. Cities where cumulative damage from subsidence exceeds $100 million, include Long Beach, California; Houston, Texas; and Orleans and Jefferson Parishes, Louisiana.

Location and Extent of the Subsidence Hazard

The Mississippi River Delta Basin in southeastern Louisiana, including New Orleans, is characterized by relatively high rates of land subsidence. The subsidence of the land surface in the New Orleans region is mainly attributable to the drainage and oxidation of organic soils, aquifer-system compaction related to groundwater withdrawals, natural compaction, and dewatering of surface sediments. As mentioned above, the problem is exacerbated as a result of flood-protection measures and disruption of natural drainage paths that reduce sediment deposition in the New Orleans area. Higher land subsidence rates in the Parish can be found where former marshland has been built upon by buildings, roads, and levee causeways. Figures 35 and 36 also show that higher subsidence rates are found along the Mississippi River levee area and the south shoreline of Lake

Pontchartrain. While rates are variable across space and time, the entire region is subject to subsidence.[xxviii]

Severity of Subsidence

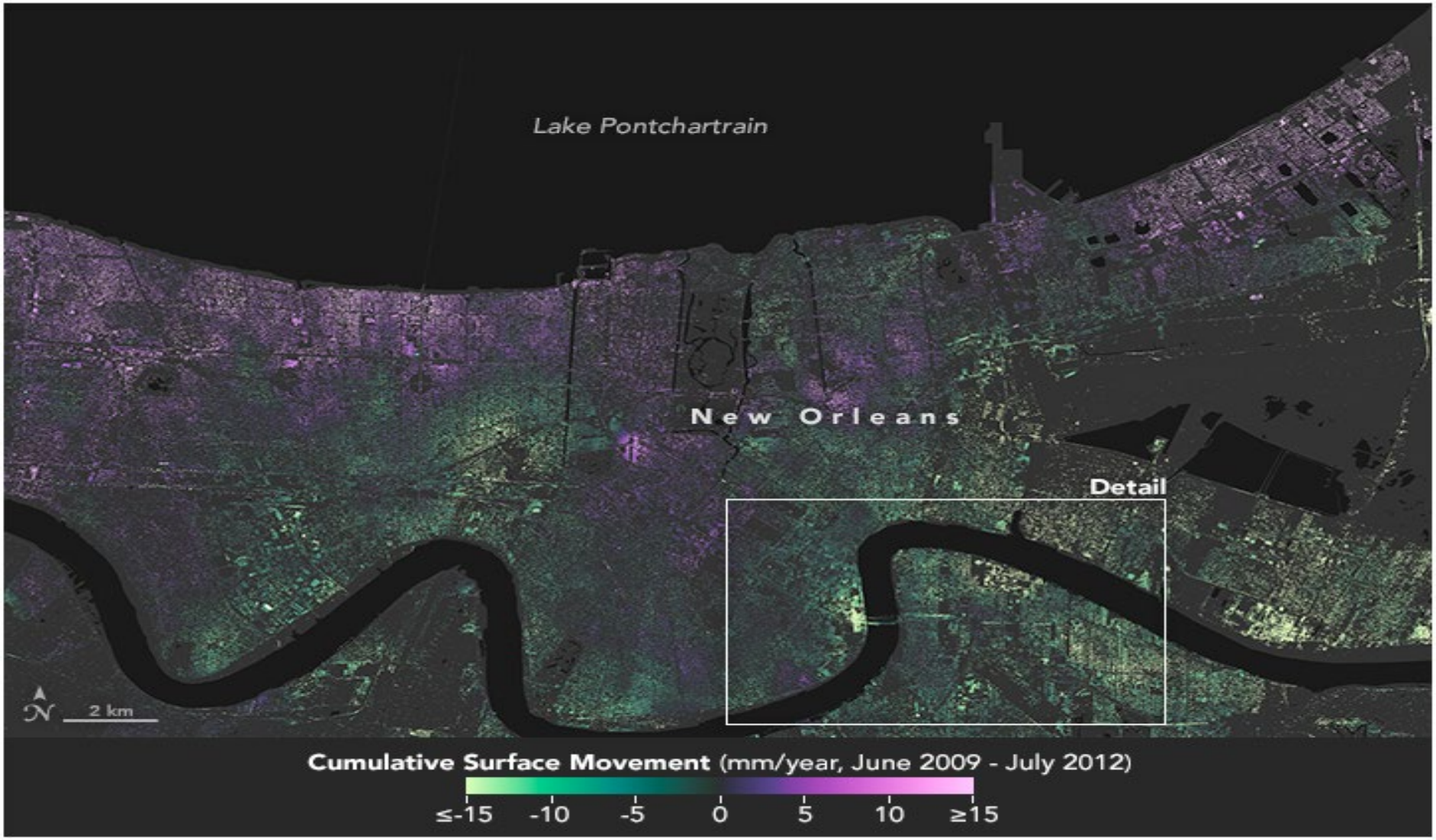
The severity of land subsidence has no generally established measure, except that it can be described in terms of the rate of change in ground elevation relative to sea level. Land subsidence occurs slowly and continuously over time or on abrupt occasions, as in the case of sudden formation of sinkholes. Procedures for determining the probability or frequency of land subsidence have not been established.

The sinking problem in Louisiana, as a result of subsidence, has been estimated anywhere from 6 to 20 inches over the past 20 years, depending on location. This necessitates maintenance to address resulting infrastructure problems. Subsidence continues to be a problem for the Greater New Orleans area, including all of New Orleans. Most of these areas are built on the Mississippi River silt, and the silt is slowly settling and compacting. Houses not built on deep pilings are experiencing differential settlement and cracking. Subsidence is also responsible for infrastructure problems, including ruptured water and sewer lines. However, it is coastal subsidence that poses the greatest threat to New Orleans. Loss of landmass makes the City more vulnerable to the effects of hurricanes, including high winds and storm surge. See pages (80-87) for a detailed description of the coastal erosion hazard.

In New Orleans, higher rates of subsidence are found in areas that had once been marshland and had been developed into buildings, roads, and levee causeways. A 2006 study used satellite radar data to determine the subsidence rates from 2002 to 2005. The average rate of absolute subsidence across the city of New Orleans was 0.2 inches +/- 0.1 inches (5.6 mm +/- 2.5 mm) per year. Higher rates of subsidence were found in the Lakeview region along the southern shores of Lake Pontchartrain, and parts of New Orleans were subsiding at more than 0.8 inches (20 mm) per year, including locations along the levee system that bounds the MRGO. The study also determined that a number of the levee breaches that occurred as a result of Katrina corresponded with the locations of some of the highest rates of subsidence.

Figure 35 shows subsidence rates in New Orleans, as measured by NASA. Subsidence values are established by measuring the motion of land away from NASA's satellite. Negative values indicate motion away from the satellite, consistent with subsidence. Red indicates the areas of highest subsidence rates, up to over an inch (28.6 millimeters) each year. Blue indicates the areas of least subsidence. This graphic shows that the extent of the subsidence hazard is across the entire planning area.

Figure 35: Subsidence Rates (mm/year) in New Orleans and Vicinity

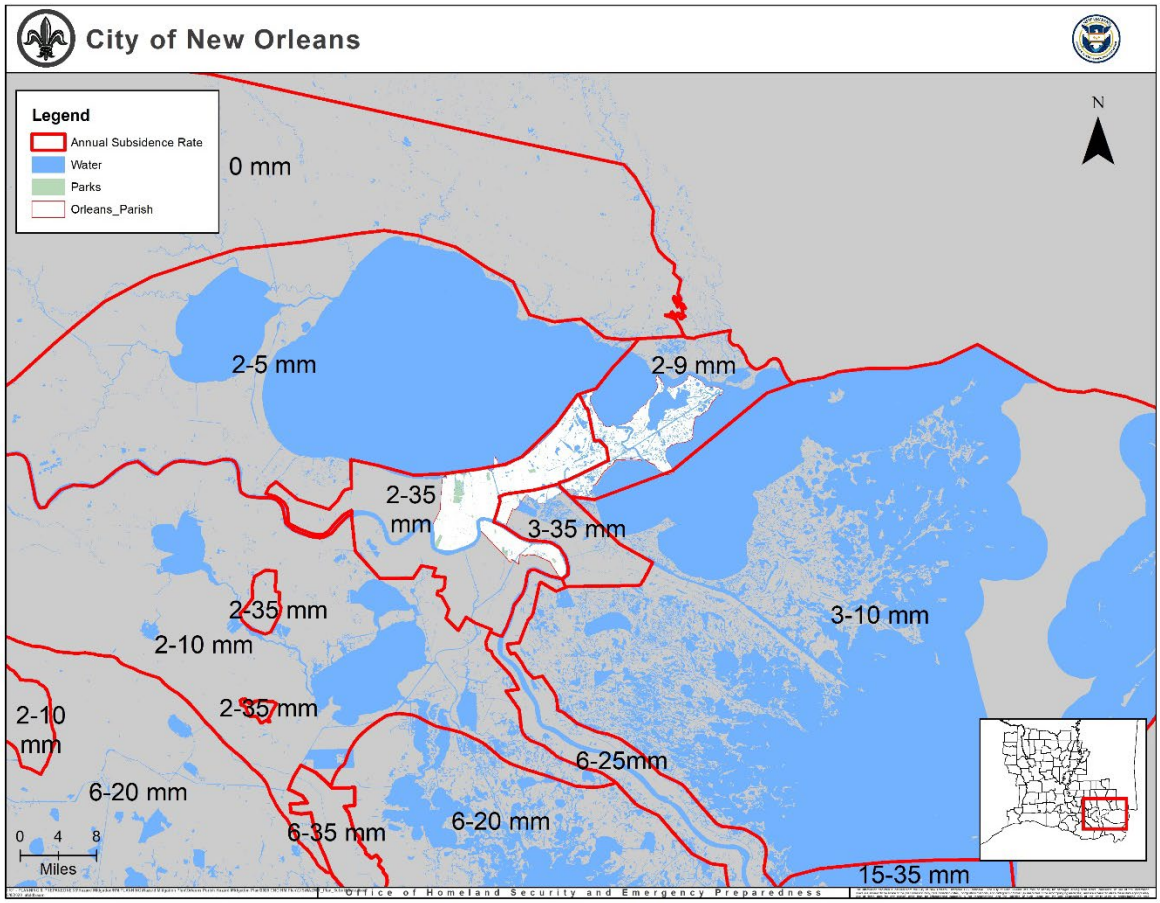


Source: National Aeronautics and Space Administration, Earth Observatory, May 2016

Figure 36: Subsidence Rates (mm/year) in New Orleans and Vicinity

Source: National Aeronautics and Space Administration, Earth Observatory, May 2016

Figure 37: Range of observed subsidence rates used by CPRA for the Coastal Master Plan



Source: Coastal Protection and Restoration Authority 2017, City of New Orleans

The subsidence and soils maps indicate a moderate correlation between soil type and subsidence rates. The highest subsidence rates are on Urban land, followed by Aquents and Allemands soils. Westwego clay is also in many of the intermediate- to high-subsidence rate areas. The slowest subsidence rates are found in Harahan clay, Commerce, and Sharkey soils. Efforts continue to be made to combat subsidence by reducing the amount of impervious surfaces in the city. Several local non-profits are working to help residents convert front yards into permeable surfaces, and City, through its CZO requirements, is increasing the inclusion of permeable open space and permeable paving in new developments.

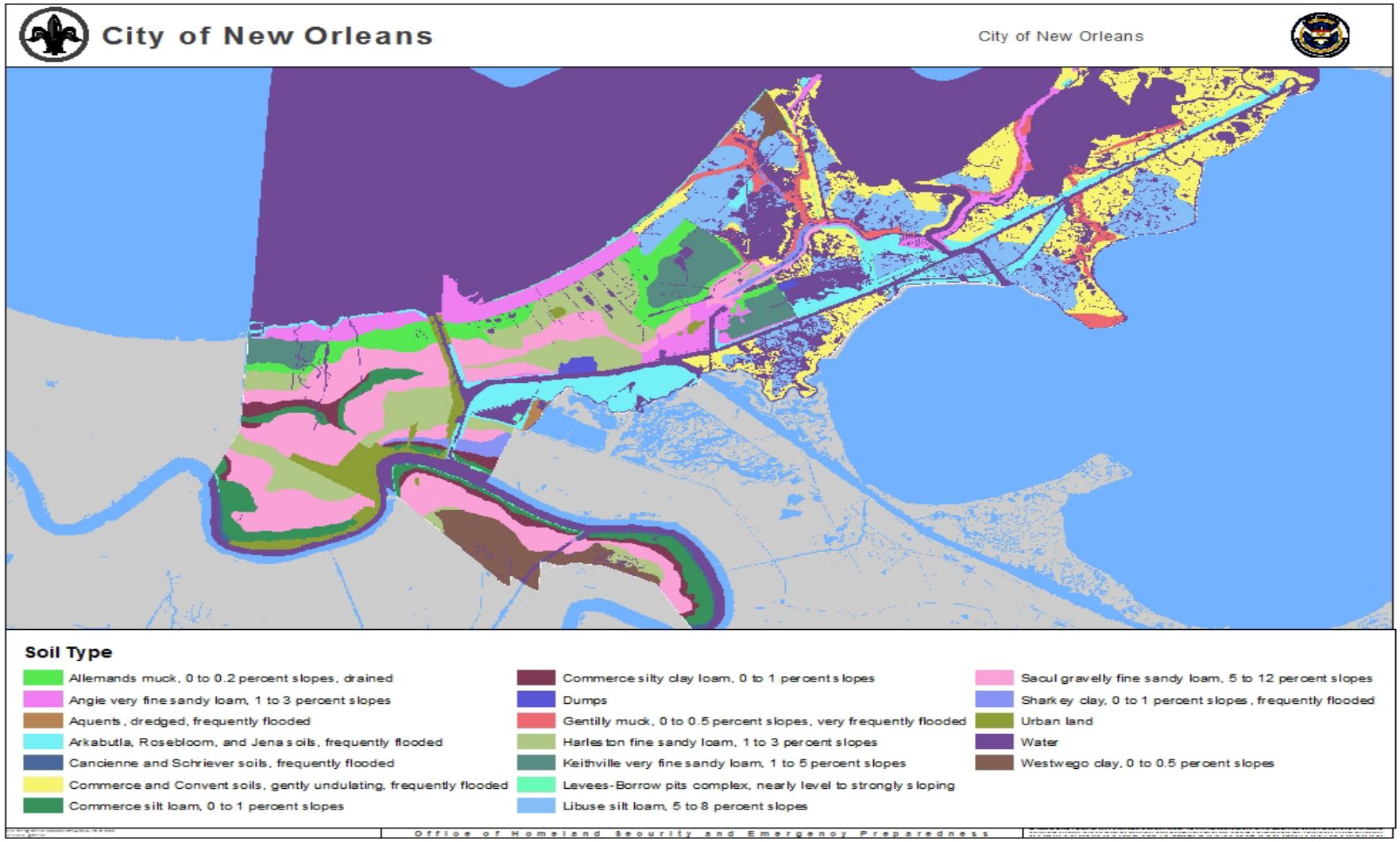
The table below provides a list of soil types located in Orleans Parish. Note that cells with an asterisk were fields left blank and omitted from the source table.

Table 28: Orleans Parish Soil Types

Map Symbol	Soil Name	Depth (inches)	% Clay	% Organic Matter
Ae	Allemands Muck, drained	0-6 6-30 30-46 46-60	-- -- 60-95 20-95	30-85 for Surface layer only
An, AT	Aquents dredged			
CE	Clovelly muck	0-31 31-72	-- 50-90	30-60 surface…
Cm	(Commerce) Cancienne silt loam	0-5 5-33 33-60	14-27 14-39 14-39	.5-4 surface…
Co	(Commerce) Cancienne silty clay loam	0-4 4-32 32-60	27-39 14-39 14-39	.5-4 surface…
CS	(Commerce) Cancienne and Schriever	0-5 5-29 29-60	14-27 14-39 14-39	.5-4 surface…
GE	Gentilly muck	0-10 10-40 40-80	45-90 60-95 60-95	--
Ha	Harahan clay	0-6 6-36 36-72	50-95 60-95 60-95	2-25 surface…
Ke	Kenner muck drained	0-36 36-40 40-75	-- 45-85 --	30-60 surface…
LF	Lafitte muck	0-75 75-90	-- 60-90	30-70 surface…
Sh	(Sharkey) Schriever silty clay loam	0-5 5-24 24-60	27-35 60-90 25-39	.5-4 surface
Sk	(Sharkey) Schriever clay	0-5 5-37 37-60	40-60 60-90 25-39	.5-4 surface…
Ww	Westwego clay	0-29 29-38 38-70	50-95 60-90 60-95	2-25 surface…

Source: USDA Soil Survey

Figure 38: Soil Types in New Orleans



Source: USDA Soil Survey

Occurrences of Subsidence

Most of the land surface within the New Orleans Metropolitan Statistical Area, a region that includes all or parts of seven parishes, is sinking or "subsiding" relative to mean sea level. This is an ongoing occurrence, and, therefore, it is difficult to identify specific occurrences of the land subsidence hazard. Although no specific cases are presented in this subsection, it is possible to characterize subsidence rates over the years. Given the virtually continuous nature of this hazard, there is assumed to be a 100% annual statistical probability of occurrence. However, there are variations from year to year in the exact degree of subsidence.

Assuming that historical subsidence rates are a reasonable indicator of future trends, the risk from subsidence will continue to threaten property in New Orleans. Since subsidence is an ongoing occurrence, it has a 100% annual probability. Although subsidence by itself has the potential to negatively affect infrastructure, operations, and the general population of the Parish, a more significant effect of subsidence is that it potentially exacerbates the effects of other hazards. Subsidence not only results in lower ground elevations (and hence more damage when floods occur) but can: (a) damage elements in the Hurricane Protection System; (b) reduce the elevations of levees and other flood control structures, making it more likely surge will overtop them; and (c) lower coastal elevations, with a resulting loss of some of surge attenuation effects, meaning that surges may be more likely to reach farther inland.

Hazard Impacts

Impact on Life and Property

The costs associated with structural damage due to differential subsidence caused by drainage of organic soils appear to be high. Increased flooding is the most severe problem associated with organic soil subsidence.

Losses from natural sediment compaction, particularly in the Mississippi River Delta, are difficult to estimate because of the uncertain value of coastal wetlands. Increased flooding potential is the principal impact because affected areas commonly are low lying and naturally subject to flooding. Annual revenue losses are estimated in the order of millions of dollars. For example, collapsible soils added more than $2.5 million in mitigation costs to interstate highway construction in Louisiana. The two states with the highest damage caused by land subsidence are California and Louisiana.

Land subsidence can undermine the integrity of the levee system, potentially leading to levee failure. In New Orleans, land subsidence has caused extensive damage to roads and drainage systems, which can cause increased flooding, and increases long-term infrastructure maintenance costs.

Land subsidence is an ongoing problem in New Orleans. While the effects on property in the New Orleans metropolitan area can be significant, subsidence is generally a creeping hazard, one with chronic, not acute impacts. Subsidence is a constant process that cannot be easily mitigated through

comprehensive mitigation actions. Subsidence problems are generally addressed on an individual basis as problems are discovered.

Vulnerability

Considering subsidence as a separate and distinct natural hazard, New Orleans' vulnerability to its effects is relatively low. It is important to note that, although subsidence itself does not pose a high threat to New Orleans, the fact that the hazard is lowering ground elevations relative to sea level exacerbates flood and storm vulnerabilities.[xxix] This is especially true in areas that are experiencing higher rates of subsidence, leading to greater vulnerability. Many studies of flood risk and vulnerabilities in southern Louisiana incorporate various scenarios of coastal erosion, subsidence, and storm surge to characterize potential losses.

2.7 Winter Weather

Definition

Winter months in Louisiana (December, January, and February) have average seasonal temperatures ranging from the mid-40s over northern Louisiana to the low 50s across southern parishes. While average seasonal temperatures remain above the freezing mark statewide, cold fronts extending from Canada through the state occur at least once during most winters. Severe winter weather in Louisiana consists of freezing temperatures and heavy precipitation, usually in the form of rain, freezing rain, or sleet, but sometimes in the form of snow. Severe winter weather affects all but the extreme coastal margins of the state.

Because severe winter storm events are relatively rare in Louisiana, occurrences tend to be very disruptive to transportation and commerce.

Severe winter weather within the City, as indicated by activation of the City of New Orleans Freeze Plan, can be defined as when the outside temperature or wind chill reaches a sustained temperature of 35 degrees or below for more than 4 hours.

The **wind chill temperature** is how cold people and animals feel when outside. The wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually lowering the internal body temperature. The updated Wind Chill Formula was implemented in 2001. The new formula uses advances in science, technology, and computer modeling to provide a more accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures.

Table 29: Average Temperatures with Days Below 32 Degrees in Planning Area, 2019

Month	Average Temp (F°)	Days per Month Below 32°
January	54.5	0
February	65.1	0
March	63.2	0
April	70	0
May	79.6	0
June	84.1	0
July	84.3	0
August	85.5	0
September	85.3	0
October	75.5	0

Month	Average Temp (F°)	Days per Month Below 32°
November	60.6	0
December	59.6	0
Annual	72.3	0

Source: National Weather Service Forecast Office, New Orleans/Baton Rouge, LA

Location and Extent of the Winter Weather Hazard

Nearly the entire United States is considered at some risk for severe winter storms.

While Louisiana is far less likely to have heavy snow and ice accumulation than most other states in the United States, winter storms or conditions of ice, snow, or dangerous wind-chill factors occur at least once a year. According to data from NOAA's NCEI database, Louisiana is in the lowest category of probable snow depth of any State with 0 – 1-inch snow depth, with a 5-percent chance of being equaled or exceeded in any given year. Louisiana winter storms that have had severe consequences for the State have generally delivered between 1 and 3 inches of ice accumulations.

Because there is no defined geographic boundary for winter storms, all people and property in New Orleans are exposed to the risk of damage from these severe weather hazards. Temperatures in New Orleans usually dip to the mid-teens in any given year. The maximum depth of snow that New Orleans would expect would be about 2 inches.

All people and assets are considered to have the same degree of exposure to winter weather. Certain populations – mainly the homeless and those with poor access to heat or utilities – are at additional risk, as are some types of infrastructure, such as pipes, and to a lesser degree, electrical services.

Severity of Winter Storms

Because severe winter storms are relatively rare in Louisiana, occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice an extreme hazard to motorists and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways, collapsed roofs from fallen trees, and downed telephone poles and lines, electrical wires, and communication towers. As a result of severe winter storms, telecommunications and power can be disrupted for days.

Previous Occurrences of the Winter Weather Hazard

The NCDC and SHELDUS databases indicate that there have been 18 winter weather events in Orleans Parish between 1962 and 2019 over 57 years. Table 32 summarizes the winter weather events reported by SHELDUS for Orleans Parish. There has been one winter weather event (reported in the NOAA database) in January 2014. This event saw freezing rain and sleet in the

city, which made roads, bridges, and highways impassable. The event closed schools and workplaces. In 2018, there was widespread damage in many homes due to freezing pipes and prolonged boil water advisories.

In another historical event, on December 31, 1963, a low-pressure system that developed in the southern Gulf of Mexico and moved towards the Florida peninsula interacted with intruding cold air across the Deep South to produce heavy snow along the Gulf Coast. New Orleans Audubon Park measured 4.5 inches of snow while the Slidell area measured 9 inches. This was the most significant snowfall to occur in the Greater New Orleans area in the last century.

Figure 39 shows a streetcar traveling along snow-covered tracks on St. Charles Avenue. Portions of the region became snowbound due to a lack of snow removal equipment.

Figure 39: December 31, 1963 Snowstorm – Snow-covered Streetcar along St. Charles Street

Source: National Weather Service – New Orleans / Baton Rouge Office

On January 12, 1997, a record ice storm hit southern Louisiana and New Orleans. Thousands of customers were without electric power for up to six days due to downed trees and power lines from the wind. Numerous traffic accidents were attributed to icy roadways. Tons of debris were removed, and numerous homes received minor roof damage due to trees and tree limbs falling on them.

In addition to these more severe events, the City experienced a snow event on December 11, 2008, when about two inches of snow fell, with accumulations mainly in grassy areas. There were about 7,000 power outages Statewide, but the New Orleans area was spared any significant effects, except school, office, and some road/bridge closures. After the snowfall, the weather changed to freezing rain and sleet, which compounded the traffic and driving problems. Fortunately, the weather warmed up significantly the following day, so there were few lasting effects from the event. The following provides a summary of winter storm events.

Table 30: Winter Storm Events, Orleans Parish, 1962 – 2019

Year	Property Damage Amount	Occurrences
1962	$781,251	2
1963	$1,172	3
1965	$0	1
1971	$781	1
1973	$7,813	1
1976	$0	1
1977	$80,723	2
1982	$7,812	1
1983	$78,125	1
1985	$781	1
1989	$7,813	1
1993	$0	1
1996	$0	1
2008	$0	1
2018	$0	1

Source: NOAA, Spatial Hazard Events and Losses Database for the U.S. (SHELDUS)

Table 31: Winter storm events in Orleans Parish since 1996

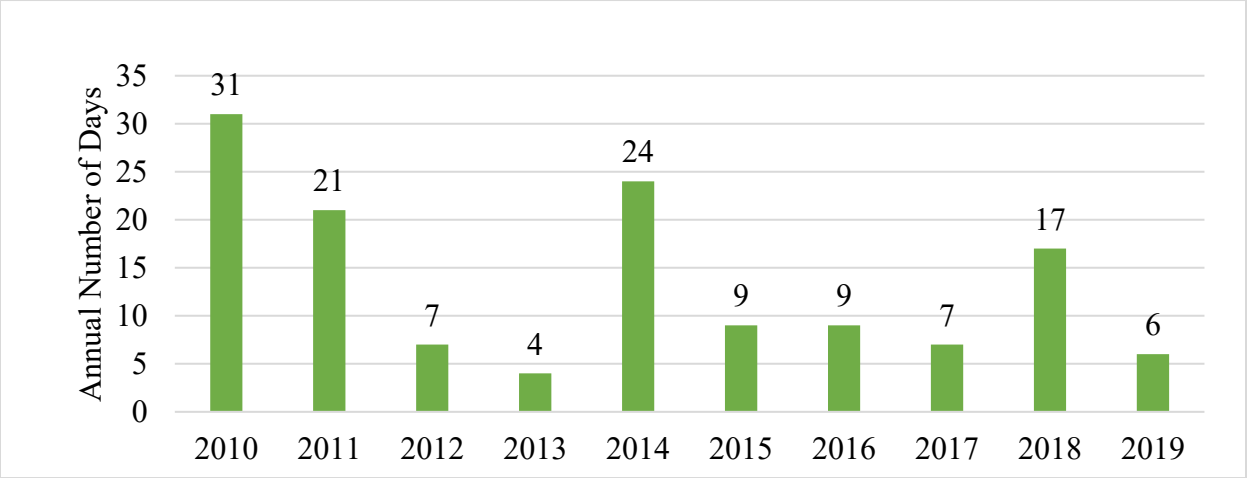
Date	Event Type	Direct Deaths	Summary
2/2/1996	Cold/Wind Chill	0	An arctic airmass overspread much of SE Louisiana bringing the longest extended period of cold weather since 1989. The 16-degree reading at Moisant International Airport also established a record minimum temperature for the month. The temperature at the Baton Rouge Airport remained below freezing for 68 consecutive hours.
12/18/1996	Cold/Wind Chill	0	The parishes west and north of Lake Pontchartrain experienced four nights of freezing temperatures with lowest readings for the period in the mid-teens. The parishes south of the Lake experienced a two to three-night freeze event with lowest readings in the mid-20s. Record minimum temperatures of 26 and 25 degrees were established at Moisant International Airport in New Orleans.
12/15/2004	Winter Storm	0	A dusting of snow and sleet to one half inch of accumulation across much of east central and southeast Louisiana. The heaviest sleet and snow accumulation occurred south of New Orleans where one half to one inch was observed. While amounts were not heavy, accumulation of winter precipitation in extreme southeast Louisiana is very unusual and resulted in considerable transportation problems. Many bridges, overpasses, and other elevated roadways become icy which resulted in some traffic accidents, and many of the elevated roadways were closed due to icing. New Orleans Armstrong International Airport was also closed for several hours due to icing conditions.
1/3/2008	Cold/Wind Chill	2	Overnight lows in the area were in the upper 20s.
1/24/2014	Winter Weather	0	A combination of freezing rain, sleet and snow fell across southeast Louisiana. Although amounts of the freezing and frozen precipitation generally remained below one quarter inch liquid equivalent, the precipitation produced very hazardous road conditions. Especially affected were bridges, overpasses and other elevated roadways. Travel was especially impacted in the Baton Rouge area with much of the interstate system shut down.
1/17/2018	Winter Weather	0	Air behind a strong arctic cold front changed precipitation from rain to freezing rain and snow across portions of the area to the north of Interstate 10. The Arctic airmass that spread into the region behind the

Date	Event Type	Direct Deaths	Summary
			front brought some of the coldest temperatures to the region in the past 10 years. Low temperatures on the morning of the 17th ranged from the mid-teens in interior parts of southeast Louisiana to low and mid 20s along in coastal area. Record low temperatures on the Jan 17th included 20 degrees at New Orleans International Airport and 14 degrees at Baton Rouge Airport. Due to unusually cold temperatures and bursting of water pipes occurred in many locations in coastal parishes, especially elevated houses.

Source: NOAA Storm Events Database

On average, New Orleans experienced 13.5 days with temperatures below 40 degrees between 2010 to 2019. During this period of 10 years, there were four years that had had more days than average for the timeframe as demonstrated below.

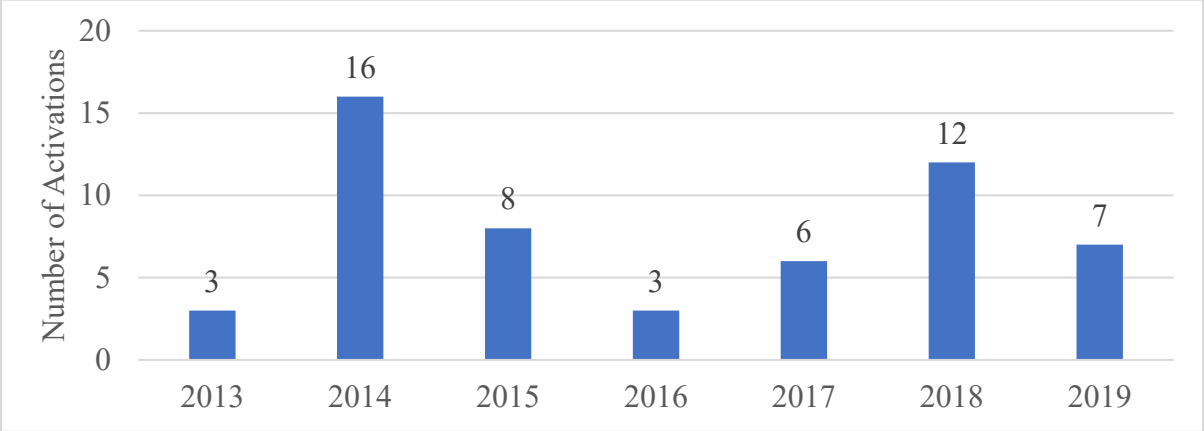
Figure 40: Number of Days of Temperature Less than 40°F



Source: Southern Regional Climate Center, August 2020

The following figure provides the number of City of New Orleans Freeze Plan activation days from 2013 to 2019. During that time, there was an average of eight New Orleans Freeze Plan activation days. When a Citywide Freeze Plan is activated, shelters for the homeless are opened free of charge to offer temporary overnight shelter.

Figure 41: New Orleans Freeze Plan Activation Days



Source: New Orleans Health Department, August 2020

Hazard Impacts

Impact on Life and Property

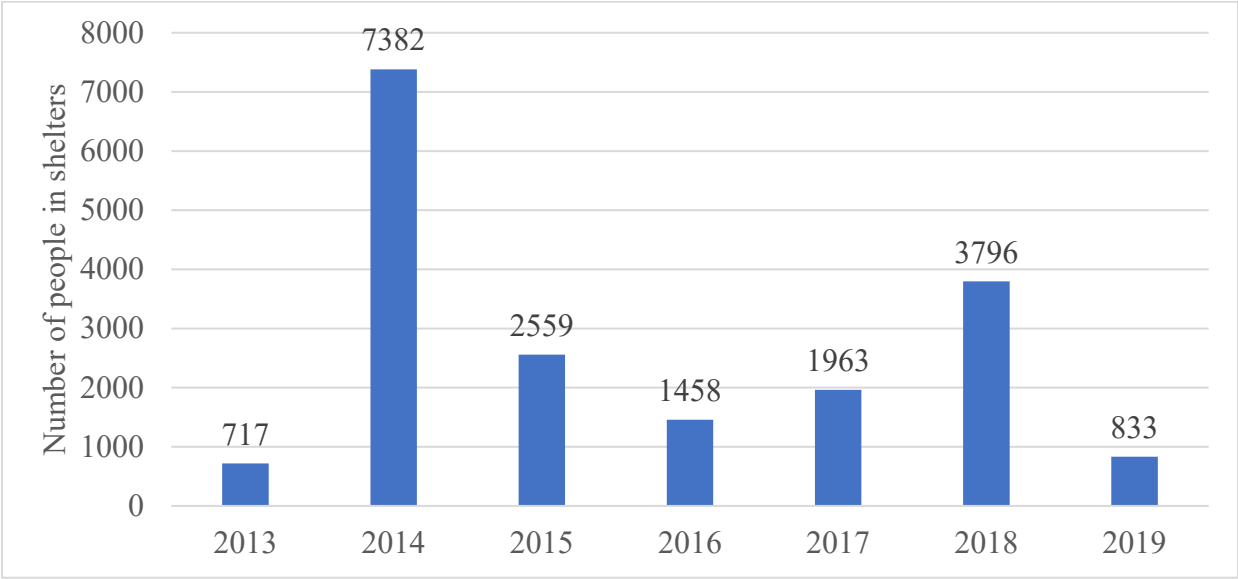
In New Orleans, where the climate is subtropical, severe winter storms are rare and pose a minimal threat to life and property. Other risk factors such as homelessness and substandard housing increase exposure to winter weather and increase health risks. Also, the improper use of space heaters and poorly maintained heating systems can create a fire and/or carbon monoxide hazard, potentially resulting in injuries and fatalities. The NCEI database shows no injuries, deaths, or property damage from winter storms between 1950 and 2020 in New Orleans. There are occasional highway accidents and broken pipes related to freezing and ice, but these are not reported in any public database and cannot be readily related to specific events.

Long periods of freezing temperatures can impact the infrastructure of the City of New Orleans and other jurisdictions within the parish as well. If multiple pipes burst, pressure in the water distribution system can impact businesses and residents. If severe enough, low pressure may lead to a boil water advisory, as occurred in January 2018. The need to "drip" pipes puts a large burden on SWBNO water plants and has an environmental impact in terms of energy use and greenhouse gas emission.

Heavily populated areas are particularly impacted when severe winter storms disrupt communication and power due to downed lines from high winds and icing. Debris associated with heavy icing may impact utility systems and transportation routes. Interruptions to daily affairs have a high aggregate cost in lost household incomes, lost tax revenue, and public safety response to close roads and provide essential services.

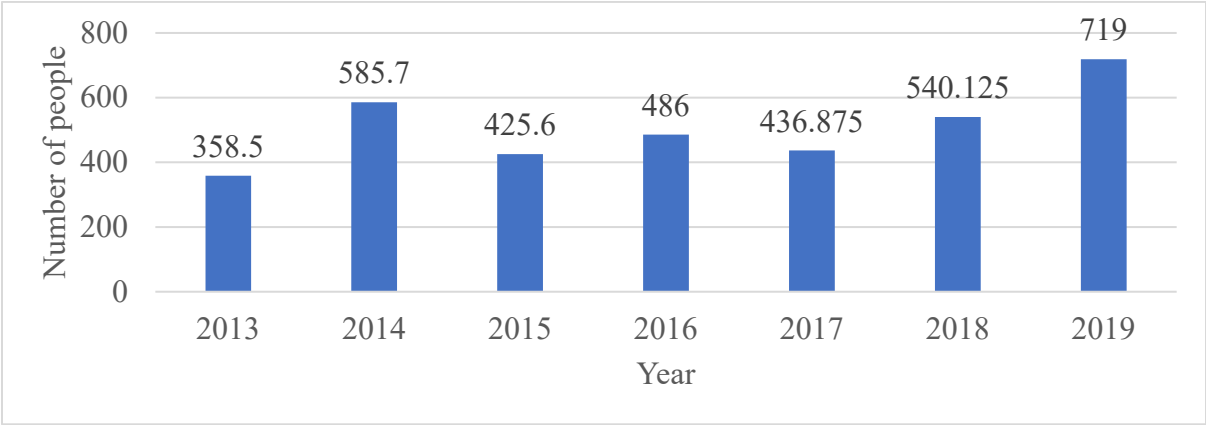
The potential impacts on the Human Environment include CO2 poisoning and fire hazards due to substandard housing and the resultant use of ovens, space heaters, etc., for warmth. Additionally, any vulnerable populations, including persons experiencing homelessness, are in need of shelter during a winter storm event. The need for freeze shelters tends to be highest in years that there are multiple freeze events. However, demand for shelter was over 1,400 in 2016 over the course of three freeze plan activation days, averaging nearly 500 people a day.

Figure 42: Total Aggregated Population in Freeze Shelters



Source: New Orleans Health Department

Figure 43: Average Annual Population of Freeze Shelters



Source: New Orleans Health Department

With respect to the natural environment: freezes can damage vegetation, including recently planted trees, and may impact ongoing efforts to increase canopy cover or establish constructed wetlands. Freezing temperatures may help control some pest species.

Vulnerability

Due to its geographic location in the southeastern part of the State, New Orleans is at annual probability for winter weather (Blizzard, Cold/Wind Chill, Freezing Fog, Frost/Freeze, Heavy Snow, Ice Storm) around 36%. This hazard has a very low probability of significant impacts on the Parish.

The Parish is not particularly vulnerable to the winter storm hazard. Although clearly there is always the potential for traffic accidents and interruptions to functions throughout the area, the

most significant vulnerabilities to the winter storm hazards are typically failures of structures and infrastructure due to snow and ice loads. New Orleans is not subject to heavy snow or ice loads, and there is a minimal history of damages from this hazard. Thus, the Parish's vulnerability to this hazard should be considered relatively low.

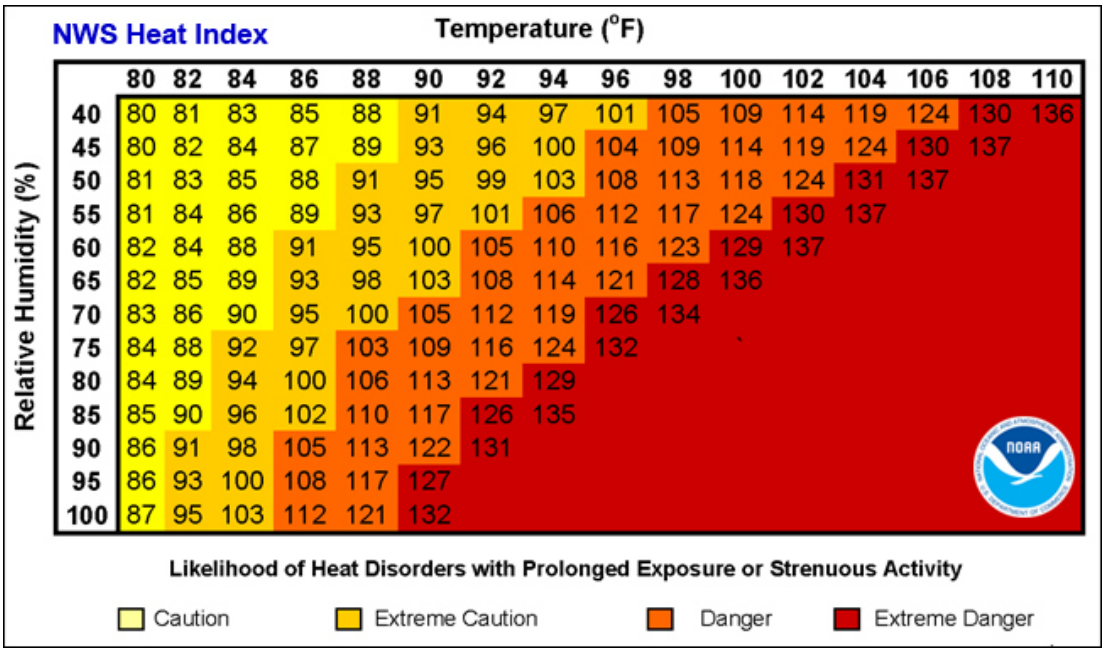
2.8 Extreme Heat

Definition

Extreme heat is often characterized by long periods of high temperatures in combination with high humidity. During these conditions, the human body has difficulties cooling through the standard method of the evaporation of perspiration. Health risks arise when a person is overexposed to heat. Extreme heat can also lead to increased air conditioner use, which can lead to power failures. For the planning area, the months with the highest temperatures are May, June, July, August, and September. During the summer months, the average temperatures are around 81° F.

Another factor to consider in extreme heat situations is the humidity level relative to the temperature. As is indicated in the following figure, as the relative humidity increases, the temperature needed to cause a dangerous situation decreases. For example, for 100 percent relative humidity, dangerous levels of heat begin at 86°F, whereas a relative humidity of 50 percent require 94°F. The combination of relative humidity and temperature result in a heat index: 100 percent relative humidity + 86°F = 112° heat index.

Figure 44: NOAA Heat Index



Source: National Weather Service, NOAA Heat Index

Table 32: Average Temperatures with Days Above 90 Degrees in Planning Area, 2019

Month	Average Temp (F°)	Days per Month Above 90°
January	54.5	0
February	65.1	0
March	63.2	0
April	70	0
May	79.6	6
June	84.1	22
July	84.3	17
August	85.5	27
September	85.3	28
October	75.5	10
November	60.6	0
December	59.6	0
Annual	72.3	110

Source: National Weather Service Forecast Office, New Orleans/Baton Rouge, LA

The National Weather Service issues public warnings about extreme heat:

- Excessive heat outlooks,
- Excessive heat watches, and
- Excessive heat warnings.

Excessive heat outlooks are issued when the potential exists for an excessive heat event in the next 3 to 7 days. Excessive heat outlooks can be utilized by public utility staff, emergency managers, and public health officials to plan for extreme heat events.

Excessive heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. An excessive heat watch should provide local officials and residents in the area enough time to take appropriate actions to mitigate the effects of extreme heat.

Excessive heat warnings are issued when an excessive heat event is expected in the next 36 hours. Excessive heat warnings are issued when an extreme heat event is occurring, is imminent, or has a very high probability of occurring.

Location and Extent of the Extreme Heat

Based on historical records for the New Orleans Area as reported by NOAA, the extreme maximum temperature is approximately 102° Fahrenheit for the Parish. For the purposes of this plan, extreme heat events are quantified as days with temperatures exceeding 90° Fahrenheit. Given the zonal nature of extreme heat events, they have the potential to impact the entire Parish.

Developed areas feel the impacts of extreme heat more than naturally vegetated areas due to the impact of surface temperatures of roofs and pavement, which can be 50 – 90 degrees hotter than the air, creating urban heat islands. Areas that are shaded and areas of natural vegetation tend to remain closer to the ambient air temperature.[xxx] The increased temperatures in urban areas increase demand for energy to cool homes and businesses, elevating emissions of air pollutants and greenhouse gases. Heat islands also impact individuals, including vulnerable populations, which may experience general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality.[xxxi]

Severity of the Extreme Heat

The months of July and August are when most extreme heat events occur. Periods of high temperatures can make people vulnerable to heatstroke, heat cramps, heat exhaustion and pose a threat to human life. Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat. Persons that are homeless or living without air conditioning are more susceptible to extreme heat as they do not have a way to avoid heat exposure. Building stock, such as critical facilities, are not at risk; however, periods of extreme heat place a significant demand on utilities, such as water and electricity, which can cause a failure in the system. Power loss could occur with the high demand for energy, making an extreme heat event even more dangerous. The current record high of 102 degrees Fahrenheit occurred on 8/22/1980.

Occurrences of Extreme Heat

Based on data provided by the National Climatic Data Center and SHELDUS for the period of record between 1981 – 2019, there are, on average, 56 days each year in which the temperature is at least 90 degrees Fahrenheit in New Orleans.

NOAA's NCDC and SHELDUS database also records extreme heat events. For the time period between 1996 and 2019, there have been two extreme heat events recorded in this database for Orleans Parish, causing two injuries and one death. August 14, 1999. At an outdoor rally for public schools in New Orleans, 25 people were treated for heat-related illness, with two people sent to the hospital for treatment. July 16, 2000. A New Orleans man was discovered dead in his home as a result of excessive heat.

Hazard Impacts

Impact on Life and Property Extreme Heat

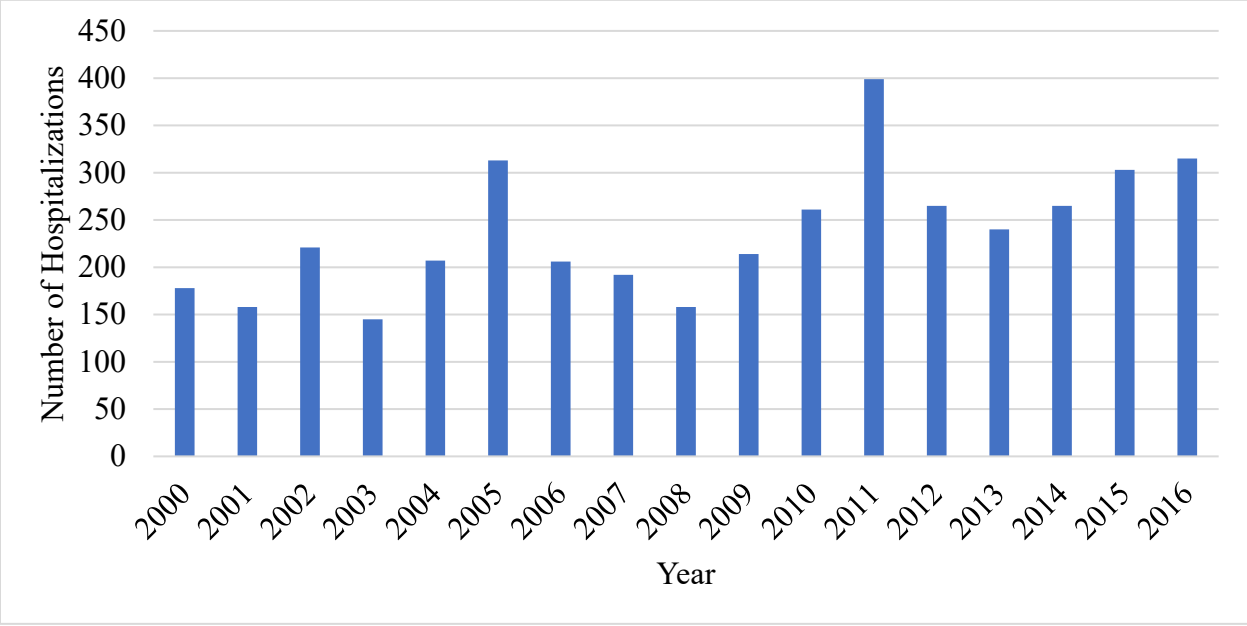
The direct and indirect effects of extreme heat are difficult to quantify. There is no way to place a value on the loss of human life. Potential losses, such as power outages, could affect businesses, homes, and critical facilities. High demand and intense use of air conditioning can overload the electrical systems and cause damages to infrastructure.

According to the FEMA publication "What is a Benefit: Guidance on Benefit-Cost Analysis of Hazard Mitigation Project (June 2009)", if an extreme heat event occurred within the planning area, the event could potentially cause a loss of electricity for ten percent of the population at the cost of $126 per person per day. At 2018 population levels, this would result in $4.9 million of assumed damage per day.

One of the many factors contributing to rising temperatures is the urban heat island effect. This effect happens when metropolitan communities experience a peak in rising temperatures due to an increase in built structures, pavement, impermeable surfaces, pollution, overcrowding, overproduction of waste heat and chemicals (industrial processes), and decreased vegetation that would normally absorb heat. Low-income and minority populations in the urban core are disproportionately affected by the urban heat island effect[xxxii]. Adults 65 and older are especially vulnerable to health impacts due to extreme heat, as they are more likely to experience a heat-related illness than any other age group.

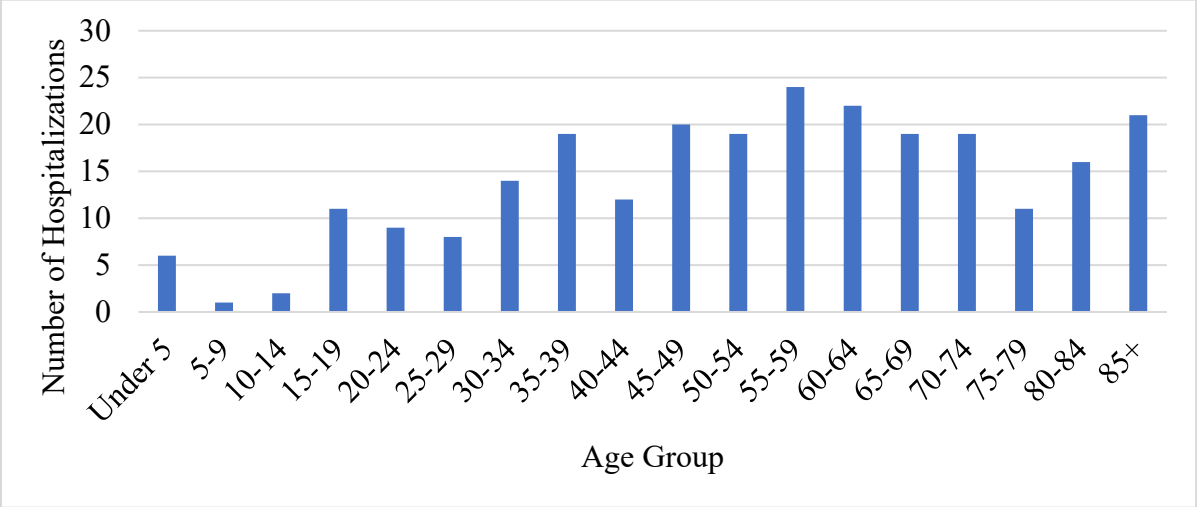
According to the New Orleans Department of Health, the number of heat-related hospitalizations has been rising annually since 2013. Of those hospitalizations, those ranging from 55 to 65 years old are the most vulnerable age group to heat-related hospitalization. Men are most likely to visit the hospital for heat-related issues, at 2.75 times the rate of women and 2.47 times more likely to be hospitalized. Black New Orleanians are 3.59 times more likely to visit the emergency department and 2.5 times more likely to be hospitalized due to heat-related illness compared to White New Orleanians. In addition, since 1979, more than 9,000 Americans have died as a direct result of heat-related illnesses[xxxiii].

Figure 45: Heat-Stress Related Hospitalizations in Orleans Parish



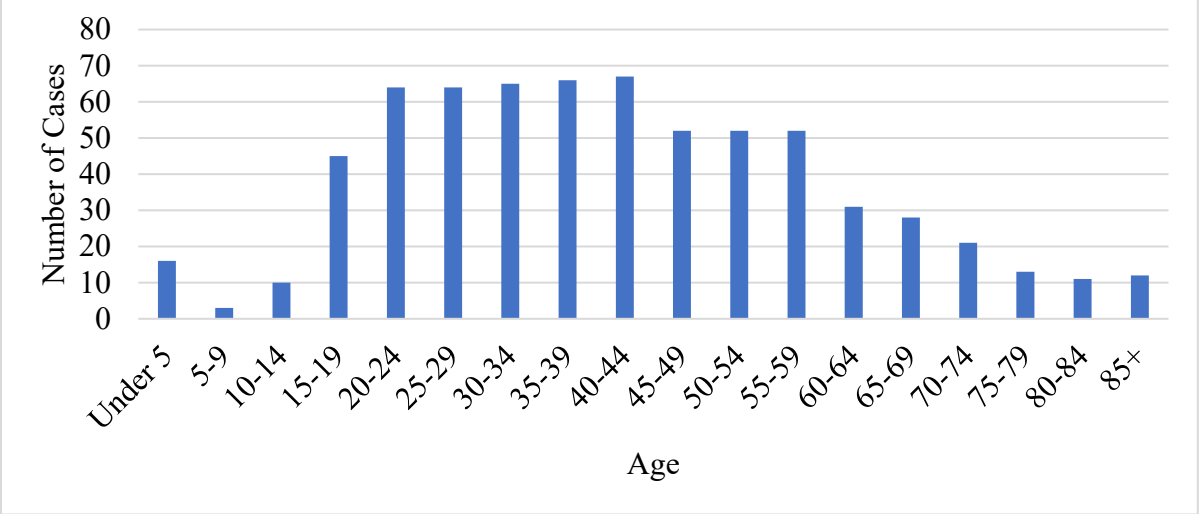
Source: New Orleans Health Department

Figure 46: Heat Stress Hospitalizations by Age in Orleans Parish



Source: New Orleans Health Department

Figure 47: Heat Stress Emergency Department Visits by Age in Orleans Parish



Source: New Orleans Health Department

Vulnerability

The statistical probability of extreme heat impacting New Orleans is 100% on an annual basis, with an average of 56 days per year with a temperature over 90 degrees Fahrenheit. Future climate patterns are projected to increase the frequency and severity of extreme heat across the planning area.[xxxiv] An increase in extreme heat events will likely correspond with increased energy demand for cooling, which may, in turn, have implications for housing affordability and the ability to meet greenhouse gas reduction targets.

Exposure to extreme heat events is affected by energy efficiency and power grid resilience. In 2019 the City Council passed a Nursing Home Generator Ordinance to help protect vulnerable elderly adults from extreme heat events.

2.9 Severe Thunderstorm - High Winds

Definition

In general, high winds can occur in a number of different ways, within and without thunderstorms. The Federal Emergency Management Agency (FEMA) distinguishes between these, as shown in the following table.

Table 33: High Winds Categorized by Source, Frequency, and Duration

High Wind Categories			
High Wind Type	**Description**	**Relative Frequency in Louisiana**	**Relative Maximum Duration in Louisiana**
Straight-line Winds	Wind blowing in a straight line; usually associated with an intense low-pressure area	High	Few minutes – 1 day
Downslope Winds	Wind blowing down the slope of a mountain; associated with temperature and pressure gradients	N/A	N/A
Thunderstorm Winds	Wind blowing due to thunderstorms, and thus associated with temperature and pressure gradients	High (especially in the spring and summer	Few minutes – several hours
Downbursts	Sudden wind blowing down due to downdraft in a thunderstorm; spreads out horizontally at the ground, possibly forming horizontal vortex rings around the downdraft	Medium to High (~5% of all thunderstorms)	~15 – 20 minutes
Northeaster (nor'easter) Winds	Wind blowing due to cyclonic storm off the east coast of North America; associated with temperature and pressure gradients between the Atlantic and land	N/A	N/A
Hurricane Winds	Wind blowing in spirals, converging with increasing speed toward eye; associated with temperature and pressure gradients between the Atlantic and Gulf and land	Low to Medium	Several days
Tornado Winds	Violently rotating column of air from the base of a thunderstorm to the ground with rapidly decreasing winds at greater distances from the center; associated with an extreme temperature gradient	Low to Medium	Few minutes – a few hours

Source: Making Critical Facilities Safe from High Wind, FEMA

The only high winds of present concern are thunderstorm winds and downbursts. Straight-line winds are common but are a relatively insignificant hazard (on land) compared to other high winds. Downslope winds are common but relatively insignificant in the hilly areas of Louisiana, where

they occur. Nor'easters are cyclonic events that have at most a peripheral effect on Louisiana, and none associated with high winds. Winds associated with hurricanes and tornadoes will be considered in the respective profiles for each of these hazards.

The Beaufort Wind Scale, first developed in 1805 by Sir Francis Beaufort, aids in determining relative force and wind speed based on the appearance of wind effects (Table 36).

Table 34: Beaufort Wind Scale

Force	Wind (MPH)	WMO Classification	Appearance of Wind Effects on Land
0	<1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	N/A
12	64+	Hurricane	N/A

Source: NOAA /National Weather Service Storm Prediction Center

Location and Extent

Because high winds caused by thunderstorms are a climatological based hazard and have the same probability of occurring in New Orleans as all of the adjacent parishes, the entire planning area for Orleans Parish is equally at risk for thunderstorms.

Previous Occurrences

Table 35: Storm Events, January 2005 – May 2020

Location	Date	Event Type	Mag	Deaths	Injuries	Property Damage ($)
New Orleans	1/13/2005	Thunderstorm Wind	50	0	0	$1,500
Algiers	7/3/2005	Thunderstorm Wind	50	0	0	$1,500
Little Woods	8/15/2006	Thunderstorm Wind	50	0	0	$300
(NEW) Lakefront Airport	11/6/2006	Thunderstorm Wind	50	0	0	$1,000
New Orleans	5/4/2007	Thunderstorm Wind	50	0	0	$1,000
(NEW) Lakefront Airport	2/6/2008	Thunderstorm Wind	63	0	0	$0
(NEW) Lakefront Airport	2/12/2008	Thunderstorm Wind	59	0	0	$0
(NEW) Lakefront Airport	2/12/2008	Thunderstorm Wind	50	0	0	$2,000
New Orleans	5/15/2008	Thunderstorm Wind	50	0	0	$1,500
(NEW) Lakefront Airport	3/27/2009	Thunderstorm Wind	50	0	0	$1,000
South Pt	4/2/2009	Thunderstorm Wind	50	0	0	$4,000
Gentilly	5/16/2009	Thunderstorm Wind	50	0	0	$3,000
(NEW) Lakefront Airport	7/2/2009	Thunderstorm Wind	52	0	0	$0
New Orleans	6/4/2010	Thunderstorm Wind	52	0	0	$2,000
Gentilly	11/30/2010	Thunderstorm Wind	61	0	0	$50,000
(NEW) Lakefront Airport	4/4/2011	Thunderstorm Wind	51	0	0	$0
(NEW) Lakefront Airport	5/26/2011	Thunderstorm Wind	69	0	0	$0
Gentilly	4/3/2012	Thunderstorm Wind	60	0	0	$15,000
Gentilly	7/3/2012	Thunderstorm Wind	55	0	0	$5,000
New Orleans	4/24/2013	Thunderstorm Wind	52	0	0	$0
New Orleans	4/24/2013	Thunderstorm Wind	56	0	0	$1,000
New Orleans	4/24/2013	Thunderstorm Wind	52	0	0	$10,000
Greens Ditch	5/10/2013	Thunderstorm Wind	70	0	0	$60,000
New Orleans	2/21/2014	Thunderstorm Wind	51	0	0	$0
New Orleans	4/27/2015	Thunderstorm Wind	55	0	0	$0
New Orleans	5/26/2015	Thunderstorm Wind	51	0	0	$0
Vieux Carre	8/4/2016	Thunderstorm Wind	60	0	0	$100,000
(NEW) Lakefront Airport	9/5/2016	Thunderstorm Wind	55	0	0	$10,000
(NEW) Lakefront Airport	2/7/2017	Thunderstorm Wind	58	0	0	$0
New Orleans	1/11/2018	Thunderstorm Wind	45	0	0	$2,000
(NEW) Lakefront Airport	3/11/2018	Thunderstorm Wind	56	0	0	$0
Vieux Carre	5/18/2018	Thunderstorm Wind	45	0	0	$50,000
Vieux Carre	5/18/2018	Thunderstorm Wind	45	0	0	$1,000
Little Woods	7/2/2018	Thunderstorm Wind	50	0	0	$0
Gentilly	11/1/2018	Thunderstorm Wind	50	0	0	$0
Vieux Carre	2/5/2020	Thunderstorm Wind	50	0	1	$0

Source: NOAA National Center for Environmental Information

Hazard Impacts

Major damage directly caused by thunderstorm winds is relatively rare, while minor damage is common and pervasive, and most noticeable when it contributes to power outages. These power outages can have major negative impacts such as the increased tendency for traffic accidents, loss of revenue for businesses, increased vulnerability to fire, food spoilage, and other losses that might be sustained by a loss of power. Power outages may pose a health risk for those requiring electric medical equipment and/or air conditioning.

Vulnerability

Based on the past 25 years (1994-2019) of NOAA data, the annual probability that New Orleans will experience high winds caused by severe thunderstorms is 100%.

2.10 Severe Thunderstorms - Lightning

Definition

Lightning is a natural electrical discharge in the atmosphere that is a by-product of thunderstorms. Every thunderstorm produces lightning. There are three primary types of lightning: intra-cloud, cloud-to-ground, and cloud-to-cloud. Cloud-to-ground lightning has the potential to cause the most damage to property and crops while also posing a health risk to the populace in the area of the strike.

Damage caused by lightning is usually to homes or businesses. These strikes have the ability to damage electrical equipment inside the home or business and can also ignite a fire that could destroy homes or crops.

Lightning continues to be one of the top three storm-related killers in the United States per FEMA, but it also has the ability to cause adverse long-term health effects to the individual that is struck. The following table outlines the lightning activity level that is a measurement of lightning activity.

Table 36: Lightning Activity Level (LAL) Grids

LAL	Cloud and Storm Development	Lightning Strikes/15 Min
1	No thunderstorms.	-
2	Cumulus clouds are common, but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered, and more than three must occur within the observation area. Moderate rain is common, and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy, and lightning is frequent.	> 25
6	Similar to LAL 3 except thunderstorms are dry	

Source: National Weather Service

Location and Extent

Because lightning is a climatological based hazard and has the same probability of occurring in New Orleans as all of the adjacent parishes, the entire planning area for New Orleans is equally at risk for lightning.

Previous Occurrences

The NOAA records for lightning in the parish are provided in the following table.

Table 37: Lightning, Orleans Parish, 1994-2019

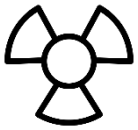
Location	Date	Type	Deaths	Injuries	Property Damage
New Orleans Lakefront	4/14/1996	Lightning	0	0	$0
New Orleans Lakefront	4/17/1996	Lightning	1	0	$0
New Orleans	6/21/1998	Lightning	0	0	$120,000
Algiers	9/6/1999	Lightning	0	0	$50,000
New Orleans	6/4/2000	Lightning	2	0	$0
New Orleans	5/30/2005	Lightning	0	0	$0
New Orleans	6/6/2005	Lightning	0	0	$0
New Orleans	6/4/2007	Lightning	0	0	$50,000
Totals			3	0	$220,000

Source: NOAA National Center for Environmental Information

Vulnerability

There is no way to accurately predict the future occurrence of lightning or to quantify vulnerability.

2.11 Hazard Identification – Man-Made Hazards



2.12 Hazardous Materials Spills/Contamination

Definition

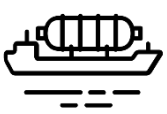
Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive materials, airborne carcinogens, and industrial/petrochemical byproducts. These substances are most often released as a result of transportation accidents or because of chemical accidents in plants.

Hazardous materials in various forms can cause death, serious injury, long-lasting health impacts, and damage to buildings, homes, and other property. Many products containing hazardous chemicals are used and stored in homes routinely. These products are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This section focuses on incidents that relate to sudden hazardous material releases that occur at facilities and along transportation routes.

Location and Extent of the Hazardous Materials Spills/Contamination Hazard

New Orleans faces the threat of a hazardous material spill/accident from a variety of sources. The Parish has many facilities that use or store toxic chemicals. A leak at one of these facilities could cause health problems for residents, property damage, and economic losses due to downtime at businesses that are evacuated.

New Orleans also faces threats from chemicals transported through the City on highways, railways, and waterways. Interstate 10, a major east-west corridor, runs through New Orleans. Because of its proximity to several major ports (including Jacksonville, New Orleans, and Houston), I-10 serves as a major transportation route for many freight trucks. Six major freight rail companies operate in the New Orleans area, including Illinois Central, CSX, Norfolk Southern, Kansas City Southern, BNSF, and Union Pacific. Many toxic chemicals are transported by rail through New Orleans routinely. The area is also home to several of the nation's largest petrochemical refineries, which process and ship vast quantities of hazardous materials on a daily basis.



New Orleans also has an extensive system of navigable waterways, including the Mississippi River and the Industrial Canal. Also, because of the many modes of transportation that can be found in New Orleans, there is reason to believe that chemicals are traveling on the City's streets as part of the intermodal transportation of these products.

The Emergency Planning and Community Right-to-Know Act of 1986 requires certain facilities, known as Tier II facilities, to submit reports detailing the type and amount of certain chemicals to the State Emergency Response Commission, the Local Emergency Planning Committee, and the local fire department. Table 40 shows the location of TRI facilities in New Orleans.

As of 1999, companies of all sizes that use certain flammable and toxic substances are required to submit a Risk Management Plan (RMP) to the EPA. Each RMP must include a description of the "worst-case" scenario for the facility. Due to security concerns following September 11, 2001, these reports are not readily available. However, the extent of the damage from a chemical accident will depend on factors that cannot be predicted: the specific chemical involved in the accident, the amount of chemicals involved, and the meteorological conditions at the time of the accident. Furthermore, the effects of a chemical spill will vary depending on which chemical is involved and which environmental medium the chemical is emitted into (i.e., land, air, water, or underground injection).

Toxic Releases

The US EPA maintains the Toxic Release Inventory (TRI) database. This contains information reported annually by some industry groups as well as federal facilities. Each year, companies across a wide range of industries (including chemical, mining, paper, oil, and gas industries) that produce more than 25,000 pounds or handle more than 10,000 pounds of a listed toxic chemical must report it to the TRI. As of 2018, New Orleans had the following four TRI facilities.

Table 38: TRI Facilities in New Orleans

Facility	Address	Chemical Released	Total Onsite Releases	Total Offsite Transfers
Us Gypsum Co	5701 Lewis Road, New Orleans, LA 70126	Lead Compounds	0	83
Air Products & Chemicals, Inc.	14700 Intracoastal Dr, New Orleans, LA 70129	Methanol	7,940	0

Source: EPA TRI Database, 2019

The vulnerability of New Orleans to chemical accidents along transportation routes is more difficult to gauge because hazardous chemicals are not located at a fixed site and because many different chemicals are transported through New Orleans. A recent study analyzed the potential effects of a chemical leak along the southern Mississippi River rail corridors using the Area Locations of Hazardous Atmospheres (ALOHA) model available from the EPA. The researchers modeled two leaks from a railcar, a large breach, and a small hole for five different meteorological conditions. Simulations were run on 46 "extremely hazardous substances," as defined by the EPA that are transported along the Mississippi River corridor. The researchers identified vulnerability zones for each chemical under each set of meteorological conditions. A vulnerability zone is defined as the "total area where any time following an accident, the concentration of a given

chemical meets or exceeds the level which is "Immediately Dangerous to Life and health." The results of the model showed that 15 chemicals that are transported along rail lines in the region have vulnerability zones of less than one mile, six chemicals have vulnerability zones of between one mile and fewer than six miles, and five chemicals have vulnerability zones of six miles or more under some conditions.

Severity of the Hazardous Materials Spills/Contamination Hazard

The severity of a hazardous material release relates primarily to its impact on human safety and welfare and on the threat to the environment.

The Threat to Human Safety and Welfare

- Poisoning of water or food sources and/or supply
- Introduction and dispersion of airborne toxins and irritants
- Presence of toxic fumes or explosive conditions
- Damage to personal property
- Need for the evacuation of people
- Interference with public or commercial transportation

The Threat to the Environment

- Injury or loss of animals or plants or habitats that are of economic or ecological importance, such as commercial, recreational, or subsistence fisheries (marine plants, crustaceans, shellfish, aquaculture facilities) or livestock; seal haul-outs; and marine bird rookeries
- Direct damage and contamination of private property
- Impact on recreational areas such as public beaches
- Impact to ecological reserves, forests, parks, and archaeological and cultural sites

One method of classifying incident severity is by ranking from 1 to 4, with a Level 1 incident considered minor, a Level 2 moderate, a Level 3 major, and a Level 4 severe. Thresholds depend on the type of incident and hazards. Incidents categorized as minor or moderate are often associated with known hazardous materials and limited in the area impacted. Incidents categorized as major or severe are typically associated with a fire, explosion, or toxic cloud that impacts a large area, possibly disrupting essential services. Events of this magnitude present an immediate danger to the public, potentially causing deaths and injuries and may require the evacuation of large numbers of the population. Emergency response by local agencies will require assistance from outside resources to adequately respond to the incident.

Occurrences of the Hazardous Materials Spills/Contamination Hazard

Like most cities its size, New Orleans has a history of small chemical spills and accidents. The New Orleans Fire Department (NOFD) HazMat unit responds to all hazardous materials calls, whether from a fixed-site or on a transportation route. Table 41 details the number of fixed site

and transportation incidents responded to by the New Orleans Fire Department between 2015 and 2019.

Table 39: Number of Transportation & Fixed Site Incidents Per Year in Orleans Parish, 2015-2019

HazMat Category	2015-2019
Fixed Sites	4,214
Transportation	667
Grand Total	427

Source: New Orleans Fire Department HazMat Unit

The data in Table 42 below breaks down hazardous materials incidents in Orleans Parish by Transportation category.

Table 40: Number of Transportation Incidents Per Year in New Orleans, 2015-2019

Incident Type	2015	2016	2017	2018	2019	Total
Highway	146	111	77	47	46	427
Railroad	22	16	12	0	10	60
Wharf/Vessel						0
Airport/Aircraft	40	28	49	27	36	180
Grand Total	208	155	138	74	92	667

Source: New Orleans Fire Department HazMat Unit

Table 41: Number of Fixed Site Incidents per Year in New Orleans, 2015-2019

Incident Type	2015	2016	2017	2018	2019	Total
Explosions (no fire), other						
Hazardous Condition, other	192	167	119	0	2	480
Flammable gas or liquid condition, other	36	31	21	23	21	132
Gasoline or other flammable liquid spill	189	151	191	108	141	780
Gas leak (natural gas or LPG)	268	266	264	226	263	1287
Oil or other combustible liquid spill	245	236	197	151	137	966
Toxic condition, other	1	0	3	4	12	20
Chemical hazard (no spill or leak)	7	1	8	4	5	25
Chemical spill or leak	10	15	10	5	12	52
Carbon monoxide incident	27	40	24	15	24	130
Radioactive condition, other	0	0	1	0	0	1
Radiation leak, radioactive material	0	0	1	0	0	1
Biological hazard, confirmed or suspected	16	9	43	68	73	209
Incident Type	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Building or structure weakened or collapsed	20	22	17	23	18	100
Explosive, bomb removal	2	2	2	1	0	7
Hazmat release investigation with no hazmat	0	0	0	0	2	2
Bomb scare, no bomb	5	6	5	5	1	22
Fumigations						
Grand Total	1018	946	906	633	711	4214

Source: New Orleans Fire Department HazMat Unit

The statistical probability of a hazmat spill or contamination annually somewhere in New Orleans is 100%. However, the extent and severity are highly variable, and as a practical matter, impossible

to predict except very generally. Although not included in the HazMat data reported in the tables above, the City of New Orleans has experienced at least one major chemical spill. In 1987, a railcar filled with butadiene spilled, ignited, and exploded in a Gentilly neighborhood. A total of 19,000 residents were evacuated from their homes for 3 days as the fire burned. No one was killed in the incident, but many residents complained of respiratory ailments and other health problems.

Spills and Contamination Related to Hurricane Katrina

As previously described in detail within several of the hazard sections (Flood, Hurricanes and Tropical Storms, Storm Surge, Levee Failure), in addition to the direct structural damages from Katrina's floodwater, contamination was a significant problem after the event. Floodwater within the City of New Orleans and surrounding areas was contaminated from a variety of sources, including leaking oil and gas from automobiles, rotting animal carcasses, leaking appliances, raw sewage, and household and commercial chemicals.

Throughout the flooded areas of New Orleans, contamination occurred from the flooding of potential sources of toxic chemicals such as hydrocarbon fuel storage, distribution facilities, and commercial chemical storage.

Contamination was also caused when floods affected several extensive chemical and petroleum production facilities operating in and around New Orleans and old contaminated sites that have undergone or were currently undergoing remediation at the time of the disaster.

The July 2006 Hurricane Katrina in the Gulf Coast, Mitigation Assessment Team (MAT) Report (FEMA 549) studied the effects of long-term flood impacts on contamination. Through the study of floodwater, sediment, and air samples, the Mitigation Assessment Team made detailed their findings in chapter eight of the report. A link to this full chapter is included in the footnote below.[xxxv]

In addition to the possible contamination from the fixed sites described above, a study completed in 2009 by the University of Texas titled Hurricane Katrina: Environmental and Engineering Concerns identified numerous possible contaminants released into the floodwater of Katrina.

Hundreds of commercial establishments, such as service stations, pest control businesses, and dry cleaners, use potentially hazardous chemicals that may have been released into the environment by the floodwater. The potential sources of toxins and environmental contaminants included metal-contaminated soils typical of old urban areas and construction lumber preserved with creosote, pentachlorophenol, and arsenic. Compounding these concerns is the presence of hazardous chemicals commonly stored in households and the fuel and motor oil in approximately 400,000 flooded automobiles. Uncontrolled biological wastes from both human and animal sources also contributed to the pollutant burden in the City.

Hazard Impacts

Impact on Life and Property

Hazardous material incidents (fixed sites) refer to uncontrollable releases of hazardous materials at a facility that pose a risk to the health, safety, property, and the environment (MSP/EMD). The most well-known example of a large-scale fixed-site hazardous material incident is that which occurred at the Union Carbide plant in Bhopal, India, in 1984. This incident caused 2,500 deaths and injuries to many others. Although events of this scale are relatively rare, smaller-scale incidents - those requiring a response and evacuation or other protective measures - are relatively common. Table 44 below illustrates the relatively small number of Hazardous Material-related incidents that led to a Presidential Disaster Declaration.

Table 42: Hazmat Related Federal Disaster Declarations, 1953-2019

DR-Number	Declared	State	Description
3375	1/16/2016	Michigan	Contaminated Water
3366	1/10/2014	West Virginia	Chemical Spills
3094	09/16/1992	Rhode Island	Water Contamination
3092	09/04/1987	Wyoming	Methane Gas Seepage
636	03/17/1981	Kentucky	Sewer Explosion, Toxic Waste
3080	05/21/1980	New York	Chemical Waste, Love Canal
3066	08/07/1978	New York	Chemical Waste, Love Canal
139	11/05/1962	Louisiana	Chlorine Barge Accident
135	10/10/1962	Mississippi	Chlorine Barge Accident

Source: FEMA

The declared incident in Louisiana occurred in 1962, about 125 miles from New Orleans, after a barge carrying 2.2 million pounds of liquid chlorine sank while being pushed in the Mississippi River near Vidalia, Louisiana. After the incident, the Federal Government studied the risk posed by such a substantial load of chlorine at the bottom of the Mississippi River.

The study concluded that if any lethal chlorine gas escaped from the barge, it could potentially result in a large number of casualties. In November 1962, a Presidential Disaster Declaration (DR-139) was declared, and the barge was eventually raised safely.

Although there is clearly some vulnerability to widespread contamination during significant flood events in New Orleans, vulnerability to hazardous materials spills and contamination is most often site- and material-specific. Thus, as a practical matter, it is impossible to characterize the vulnerability of the entire Parish as associated with spills or releases from events unrelated to major disasters or floods. In most cases, vulnerability is a function of the proximity to the spill or air release event, as well as the type of material involved. Vulnerability is increased with proximity to hazmat transportation routes (including water routes) and by being downwind of areas where air releases are likely.

Impact on the Environment

While New Orleans is not located directly on the Gulf of Mexico, New Orleans Parish, Lake Pontchartrain, and the Mississippi are directly affected by the Gulf of Mexico water. Water flows

in and out of Lake Pontchartrain in an area known as the East Orleans Land Bridge via either the Rigolets or the Chef Menteur Pass - both located on the far east end of the lake and via the Mississippi River. Preservation of Orleans Parish water is vital to the quality of life for Orleans Parish residents both recreationally as well as economically via water-related tourism and the fishing industry. Commercial fishing in Orleans Parish brings approximately $1,500,000 into the Parish economy every year; this represents dockside values, not the seafood in local restaurants. The overall economic impact is several times this. Commercial fishing includes (but is not limited to) shrimp, crab, and oysters. Recreational fishing is common in Orleans Parish water as well. The Bayou Sauvage National Wildlife Refuge is located in eastern Orleans Parish at the south end of the Lake Pontchartrain Sanctuary, and Fort Pike State Park is found at its north end. According to the U. S. Fish & Wildlife Service, "Bayou Sauvage National Wildlife Refuge" was established in 1990. Its 24,293 acres of fresh and brackish marshes, all within the city limits of New Orleans, make it the nation's largest urban wildlife refuge. Bayou Sauvage is only 15 minutes from the French Quarter. Most of the refuge is inside massive hurricane protection levees, built to hold back storm surges and maintain water levels in the low-lying city."

Deepwater Horizon Oil Spill

On April 20, 2010, the Deepwater Horizon drilling rig exploded, killing 11 people and leaking oil into the Gulf of Mexico. An April 27, 2010, Times-Picayune newspaper article stated: "Advocates for preserving Louisiana's battered coastal ecosystem are sometimes accused of hyperbole in assessing its diversity and productivity. But that criticism may end after the list of species coastal scientists said are threatened by the oil spill moving toward the coast reached more than 400.109 From whales and tuna to shrimp and neo-tropical songbirds, the array of life that depends on the clean Gulf of Mexico and functioning coastal estuaries can stun even those who make a living studying the area. The economic impacts of the oil spill are still being determined.

The U.S. Fish and Wildlife Service states:

> An enormous wading bird rookery can be found in the swamps of the refuge from May until July, while tens of thousands of waterfowl winter in its bountiful marshes. The refuge contains a variety of different habitats, including freshwater and brackish marshes, bottomland hardwood forests, lagoons, canals, borrow pits, chenieres (former beach fronts), and natural bayous. The marshes along Lakes Pontchartrain and Borgne serve as estuarine nurseries for various fish species, crabs, and shrimp. Freshwater lagoons, bayous, and ponds serve as production areas for largemouth bass, crappie, bluegill, and catfish. The diverse habitats meet the needs of 340 bird species during various seasons of the year. Peak waterfowl populations of 75,000 use the wetland areas during the fall, winter, and early spring months.

While shrimp are primarily taken in the Gulf, they are also harvested in Lake Pontchartrain and the surrounding wetlands and brought into stations within the Parish.

2.13 Active Threats - Terrorism

Definition

Terrorism is defined in the Code of Federal Regulations as "*the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives"* (28 C.F.R. Section 0.85).

There are different types of terrorism, depending on the target of an attack, which are:

 Political Terrorism

 Bio-Terrorism

 Cyber-Terrorism

 Nuclear-Terrorism

 Narco-terrorism

Terrorist activities are also classified based on the motivation behind the event:

- Ideology (i.e., religious fundamentalism, national separatist movements, and social revolutionary movements).
- Terrorism can also be random, with no ties to ideological reasoning.

The FBI also provides clear definitions of a terrorist incident and prevention:

- A terrorist incident is a violent act or an act dangerous to human life, in violation of the criminal laws of the United States, or of any state, to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.
- Terrorism prevention is a documented instance in which a violent act by a known or suspected terrorist group or individual with the means and a proven propensity for violence is successfully interdicted through investigative activity.

The Department of Homeland Security and its affiliated agencies are responsible for disseminating information regarding terrorist activities in the country. The system in place is the National Terrorism Advisory System (NTAS). NTAS replaced the Homeland Security Advisory System (HSAS), which was the color-coded system put in place after the September 11th attacks by Presidential Directive 5 and 8 in March of 2002. NTAS replaced HSAS in 2011.

NTAS is based on a system of analyzing threat levels and providing either an imminent threat alert or an elevated threat alert.

- An Imminent Threat Alert warns of a credible, specific, and impending terrorist threat against the United States.
- An Elevated Threat Alert warns of a credible terrorist threat against the United States.

The Department of Homeland Security, in conjunction with other federal agencies, will decide whether a threat alert of one kind or the other should be issued should credible information be available.

Each alert provides a statement summarizing the potential threat and what, if anything, should be done to ensure public safety.

The NTAS Alerts will be based on the nature of the threat: in some cases, alerts will be sent directly to law enforcement or affected areas of the private sector, while in others, alerts will be issued more broadly to the American people through both official and media channels.

An individual threat alert is issued for a specific time period and then automatically expires. It may be extended if new information becomes available or the threat evolves. The sunset provision contains a specific date when the alert expires as there will not be a constant NTAS Alert or blanket warning that there is an overreaching threat. If threat information changes for an alert, the Secretary of Homeland Security may announce an updated NTAS Alert. All changes, including the announcement that cancels an NTAS Alert, will be distributed the same way as the original alert.

Location and Extent of the Terrorism Hazard

The location and extent of this hazard are unknown. Terrorist attacks can vary greatly in scale and magnitude. Historically, incidents have occurred near abortion facilities, the Louis Armstrong airport, hotels, and law enforcement facilities. Special events and large public gatherings, including Mardi Gras, protests, and sporting events, create potential targets for terrorist attacks.

Severity of the Terrorism hazard

The unpredictable nature of terrorism is such that severity can range from very isolated occurrences of property damage with limited injuries to large scale events with catastrophic impacts to lives and property.

Previous Occurrences of the Terrorism Hazard

The Planning team utilized the Global Terrorism Database, maintained by the University of Maryland and National Consortium for the Study of Terrorism and Responses to Terrorism. This database contains information on terrorist attacks that occurred over the entire world. According to this database, there have been seven terrorist attacks in the planning area from 1970 to 2018. There have been two events reported from 2015 to 2018. Terrorism is ideologically driven, and it is almost certain that some past and current events that were terrorism have not been covered nor counted as such.

Hazard Impacts

Impact on Life and Property

The unpredictable nature of terrorism is such that impacts can range from very isolated occurrences of property damage with limited injuries to large scale events with catastrophic impacts to lives and property.

Vulnerability

For this hazard, we are unable to calculate the probability due to insufficient data and unclear methodologies.

2.14 Infrastructure Failure - Levee Failure

Definition

Levees play a vital role in protecting New Orleans from coastal and riverine floods.

Man-made levees can fail in a number of ways. The most frequent (and dangerous) form of levee failure is a breach. A levee breach is when part of the levee actually breaks away, leaving a large opening for water to flood the land protected by the levee. A breach can be a sudden or gradual failure that is caused either by surface erosion or by a subsurface failure of the levee. Levee breaches are often accompanied by levee boils or sand boils.

A sand boil occurs when the upward pressure of water flowing through soil pores under the levee (under seepage) exceeds the downward pressure from the weight of the soil above it. The under seepage resurfaces on the landside in the form of a volcano-like cone of sand. Boils signal a condition of incipient instability, which may lead to erosion of the levee toe or foundation or result in the sinking of the levee into the liquefied foundation below. Complete breach of the levee may quickly follow.

Levee overtopping occurs when water overtops the crest of the levee. Levee overtopping can be caused when floodwaters simply exceed the lowest crest of the levee system or if high winds begin to generate significant swells in the ocean or river water to bring waves crashing over the levee.

New Orleans Levee System

Some background about how New Orleans was founded and expanded will help explain the City's levee system. New Orleans was founded by the French in 1718 at the natural levee embankment on a tight outer bend of the lower Mississippi River. After the Louisiana Settlement of 1803, the town quickly became the largest U.S. city in the South, expanding its footprint along the flanks of the levees as they followed the meandering river east and west to become the Crescent City. Undeveloped marshland areas remained north of the City.

Developers in the 19th century, interested in expanding the City to the north, recognized that pumps would be required to keep the marshland areas from flooding. In 1928 a 14-foot electricity-powered screw siphon pump was developed by a City of New Orleans engineer to remove floodwater from the City. Increases in pumping capacity at the beginning of the 20th Century saw the city expand across the swamplands right up to the lake's shore. From 1900 through 1930, the population of Orleans Parish grew over 60 percent, to 460,000 people. As described in detail in the Storm Surge subsection (Section xx), a series of drainage canals were also constructed around this time to convey stormwater from the City into Lake Pontchartrain.

The majority of the perimeter floodwall and levee system was designed and constructed after Hurricane Betsy in 1965. The flood protection system was built to withstand an event roughly equivalent to a typical Category 3 hurricane.

Figure 48: Typical Floodwall Construction along the 17th Street Canal in New Orleans

Source: Preliminary Report on the Performance of the New Orleans Levee Systems in Hurricane Katrina on August 29, 2005

The levee system protecting New Orleans consists of over 350 miles of levees, which 133 miles have been newly strengthened after Hurricane Katrina. Much of the system protecting the New Orleans region has been constructed with a combination of earthen and concrete materials, including the following

- **Sheet Pile** – A row of piles driven side-by-side to retain the earth or prevent seepage.
- **Concrete I-Walls** – Concrete floodwalls are mainly "I-walls" with the concrete wall section cast atop a row of sheet piles driven through the crest of an earthen embankment.
- **Concrete T-Walls** – These wall sections also cap a sheet pile curtain, but they get additional rotational and lateral stability by nature of their broad concrete base (which forms an inverted "T").
- **Earthen levee** – A low ridge of an earthen embankment built along the edges of a stream or river channel to prevent flooding of the adjacent land.

The City of New Orleans is currently protected from storm surge flooding by a complex network of levee systems. There are three USACE levee systems in New Orleans and the surrounding area: The Lake Pontchartrain and Vicinity, the West Bank and Vicinity, and the New Orleans to Venice hurricane protection projects, which are collectively known as the Hurricane & Storm Damage Risk Reduction System (HSDRRS).[xxxvi]

The primary system of flood defense in New Orleans is the Lake Pontchartrain and Vicinity project, which covers St. Bernard, Orleans, Jefferson, and St. Charles parishes, generally between Lake Pontchartrain and the Mississippi River. It also includes flood defenses around the 17th Street, Orleans Avenue, London Avenue, and Industrial canals, as well as the Inner Harbor Navigation Canal (IHNC).

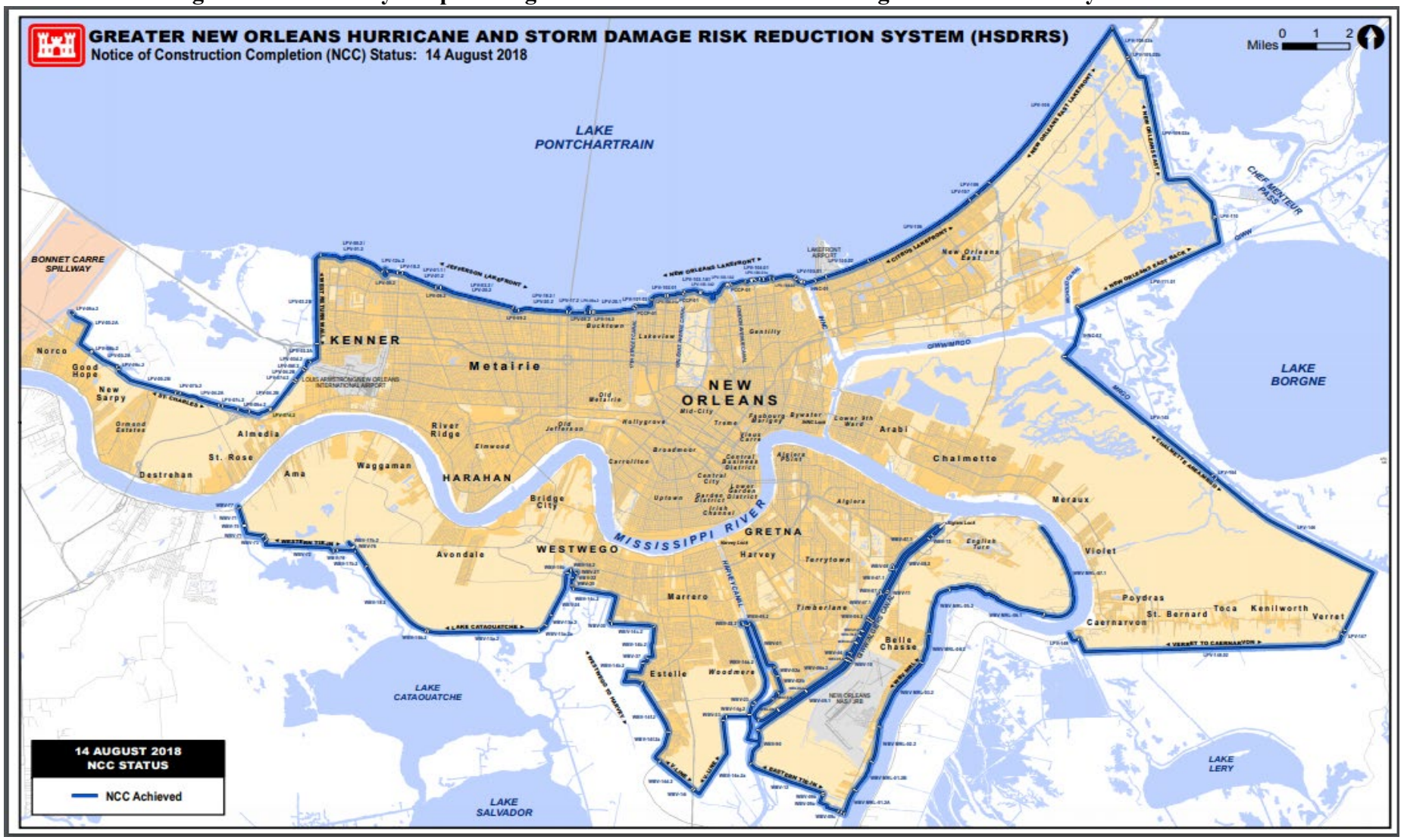
A portion of the Lake Pontchartrain and Vicinity Levee system, also known as the New Orleans Flood Protection System, can be further broken down into a series of protected basins or "polders," each protected by its own perimeter levee system. The New Orleans Flood Protection System is also supported by a series of pumps to remove surface runoff from within the City. There are four main polders (or protected units) that comprise the City of New Orleans flood protection system. The four polders include the following

- Orleans East Bank
- New Orleans East
- St. Bernard Parish - Contains the Lower Ninth Ward and St. Bernard Parish
- Plaquemines Parish Protection Zone

Three of the four polders are described in detail below. The Plaquemines Parish Protection zone contains a thin protected strip along the Mississippi River heading south from St. Bernard Parish to the north of the river at the Gulf of Mexico. This levee system predominately provides protection for communities and infrastructure within the Plaquemines and St. Bernard Parish region and, therefore, is not described in detail as part of the New Orleans HMP update.

The location of the Orleans East Bank protected section encompasses the main downtown area of New Orleans, as well as a number of historic districts, including the French Quarter and the Garden District.

Figure 49: U.S. Army Corps of Engineers Hurricane & Storm Damage Risk Reduction System



Source: U.S. Army Corps of Engineers (USACE)

The region known as New Orleans East is bordered by distinctively different hydraulic boundaries: Lake Pontchartrain borders it to the north and east; the Inner Harbor Navigational Canal (IHNC), also known as the "Industrial Canal," borders it to the west; to the south and southeast is the Intracoastal Waterway (IW)/Mississippi River Gulf Outlet (MRGO) and Lake Borgne, respectively.

The Lower Ninth Ward of New Orleans and neighboring St. Bernard Parish together form an 81 square mile polder located across the IHNC from central New Orleans. Elevations within the polder range from approximately -4 feet to 12 feet, with the higher elevation, reaches situated near its southern edge, which is bordered by the Mississippi River. The Gulf Intracoastal Waterway (GIWW) and MRGO are located north of the polder. The levee system, which includes earthen, I-wall, T-wall, and sheet pile sections, was designed and constructed by the USACE.

Location and Extent of Levee Failure

The complex system of levees is designed to keep the city safe from Lake Pontchartrain, the Mississippi River, and a network of canals that are used for drainage and industrial purposes. A breach of one or more levees would cause massive flooding in the entire polder where the breaches occurred. The entire planning area is subject to the impact of this hazard. Additionally, much of New Orleans is below sea level, and once a breach of a levee occurs, it becomes very difficult, time-consuming, and costly to remove the water from the affected area. Affected structures and infrastructure may remain submerged in floodwaters for lengthy periods of time until the breach can be repaired and the water pumped from flooded areas. A breach in any levee is possible at any time from either natural or manmade causes, and the resulting flooding would be catastrophic to the Parish.

The severity of Levee Failure

The "worst-case" extent of potential flooding as a result of levee failure is best illustrated by the flood depths from Hurricane Katrina in 2005, where 80% of the city flooded with areas under 6 to 20 feet of water.[xxxvii]

Levee failure has the potential to be a catastrophic hazard event for the City. A re-occurrence of this hazard would likely create many of the same consequences as seen after Katrina. Thousands of homes and businesses would be severely damaged or destroyed, and much of the Parish's infrastructure would be devastated. The monetary loss to the Federal, State, and Local government would be staggering. Lives would be disrupted, and some citizens would more than likely die. The economic and tax structure of the Parish would be severely negatively impacted and cause significant damage to Orleans Parish's ability to meet its payroll and other governmental financial obligations. Furthermore, the Parish's vital role as an import and export port for the nation would be affected.

Previous Occurrences of Levee Failure

Since the early 1900s, four significant storm surge flood events (1915, 1947, 1965, and 2005) either overtopped or breached a portion of the levee system in New Orleans. Each of the events prompted an investment in improvements to flood defenses (levees, floodwalls, etc.). On August 29, 2005, Hurricane Katrina, a powerful category three storm at landfall, hit the Gulf Coast near the border of Louisiana and Mississippi. It initiated what has been called the greatest disaster in U.S. history due to a series of catastrophic effects. One effect was that the City of New Orleans flooded as a result of several levee breaks that occurred during or soon after the storm hit. The powerful storm surge, strong winds, and excess water contributed to the levee failures. Additionally, once the water was dumped into the planning area, there was no expeditious way for it to be removed other than by pumping it out. As a result, the floodwaters remained in the City, as well as neighboring parishes, for several weeks, causing catastrophic damage to businesses, residences, vehicles, and infrastructure. Over one thousand persons died in Louisiana as a result of the effects created by Katrina, and a large number of them perished in Orleans Parish as a direct result of rising water from the levee breaks.

As the storm passed through the New Orleans area, the first levee break was reported on the Industrial Canal near the Orleans and St. Bernard Parish Line. This break permitted the waters from the canal to pour into the 9th Ward. Following the report of a break on the Industrial Canal, it was reported that the 17th Street Canal had been compromised and that a levee wall had failed. The 17th Street Canal connects to Lake Pontchartrain and is on the border between Orleans and Jefferson Parishes. The break on this canal was on the Orleans Parish side. Then, in addition to the 9th Ward, water was dumping into Orleans Parish from the west and flooding homes, businesses, vehicles, infrastructure, and endangering the lives of humans and animals. Water from the 17th Street Canal moved into portions of Lakeview, Mid-City, Carrollton, Uptown, the Central Business District, and the French Quarter. There were more than 50 breaches of the levee system, including the London Avenue Canal, and water moved into most parts of the planning area. Generally, only the areas nearest the Mississippi River where some elevated areas near or above sea level were spared.

Hazard Impacts

For the impacts of levee breaches, please see the detailed account under flooding history previously in this plan. There have been no levee failures in Orleans parish within the last five years.

Probability of Levee Failure

For this hazard, we are unable to calculate the probability due to insufficient data.

Vulnerability

We are working to quantify the vulnerability of this hazard. The US Army Corps of Engineers certifies that the levee system is able to provide the design level of protection if given appropriate maintenance.

2.15 Infrastructure Failure - Building Collapse

Definition

A building collapse is the sudden structural failing, partially or entirely, of a building, threatening human life and health. When internal load-bearing structural elements fail, a building will collapse into itself, and exterior walls pulled into the falling structure. This scenario may be caused by construction activity, an earthquake or fire, and may result in a dense debris field with a small footprint. Alternatively, if an explosion or natural forces such as weather cause structural failure, the building may collapse in an outward direction, resulting in a less dense and more scattered debris field.

Location and Extent of the Building Collapse

The potential for this threat exists throughout the City in all settings. Building inspectors and Code Enforcement officials are most familiar with this hazard. The impact of termites city-wide, combined with the very wet climate of New Orleans, creates rot that increases property maintenance costs and can cause structural failures. Building codes and enforcement, as well as the work of the New Orleans Mosquito, Termite, and Rodent Control Board (MRTCB), are part of the mitigation efforts to address this hazard.

Severity of Building Collapse

The scope and size of buildings and the exact cause of the collapse mean that there are varying degrees of severity in this emergency. In the worst-case scenario, a large, multi-story, mixed-use commercial and residential building collapses in a densely populated area of the city, such as the French Quarter. This could be due to the age of the building, impact from other hazards, or manmade action. On a smaller scale, there have been collapses of single-story uninhabited dwellings that were blighted or severely damaged from storm activity.

Previous Occurrences of Building Collapse

Building collapses are frequently the result of another incident or event, such as resulting from a fire or tornadic activity. Partial building collapses are reported several times a year.

September 2013- a house in the 100 block of Mound Avenue was being elevated to mitigate against flood losses. Contractors for the property had lifted the home about six feet in the air when it collapsed, severely injuring two construction workers. Due to the extensive structural damage to the house, it was declared a total loss and demolished.

October 2014- a three-story building in the 800 block of Royal in the French Quarter collapsed. As a result of the deteriorating brick and mortar, the building was over 200 years old. It housed three apartments and commercial space. There were no injuries. The building was a complete loss.

July 2015- a blighted property, slated for demolition, collapsed after a storm. The city was pursuing blight judgment against the property, located at 3516 Delachaise, which had been vacant since Hurricane Katrina. There were no injuries.

On the morning of October 12, 2019, the Hard Rock Hotel collapsed, killing three people. The cost to the City of New Orleans as of December of 2019 was in excess of $11 million. According to WWL, the local CBS affiliate, " most of the city's costs incurred by the collapse are tied to changing RTA routes, making repairs to Rampart Street, and paying crews to work at the site."[xxxviii] This amount is not inclusive of the disruption of business or the broader financial costs. Due to ongoing investigations, demolition, and subsequent legal actions, a full accounting of this event cannot be developed at this time.

Probability

For this hazard, we are unable to calculate the probability due to insufficient data.

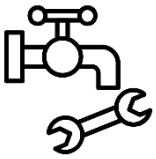
Hazard Impacts

Impact on Life and Property

The monetary loss can be on property owners, the private sector, and/or the public (taxpayers). Estimates can range from insurance deductibles associated with insured losses to millions of dollars that may burden taxpayers if property owners are unable to cover the debris removal and disposal. Monetary losses may or may not be recoverable from insurance or federal disaster resources.

Vulnerability

Given the climate and the prevalence of a number of insects and rodents that compromise the structural integrity of structures, there is a high vulnerability to building collapse in the City. Older structures are generally at higher risk of structural failure.



2.16 Infrastructure Failure - Water Systems

Definition

Water Systems Infrastructure failure is an undesirable or unintended event, occurrence, or situation involving the city's water infrastructure or the discontinuation or significant disruption of water services that could seriously compromise public safety. This infrastructure is public utility infrastructure and, if compromised, would result in a temporary loss of essential function and/or services.

Location and Extent of the Hazard

Miles of water, sewerage, and gas pipes, as well as a vast network of generators, transformers, and treatment and distribution facilities, means that water infrastructure failure can happen virtually anywhere in the City of New Orleans. Often these incidents are not limited to a small localized region but instead affect large areas of the City, with up to tens of thousands of people at a time.

Severity of Infrastructure Failure

The severity of infrastructure failure can range from very isolated occurrences with limited impacts on the City to large-scale events with catastrophic impacts on lives, property, and operations. Since all citizens and businesses are dependent on the public infrastructure, especially the provision of sewerage and water services, these are essential services, and failure is severe. When one or more of these independent, yet interrelated systems fail due to disaster or other cause, even for a short period of time, it can have devastating consequences. When the water or wastewater treatment systems in a community are inoperable, serious public health problems arise that must be addressed immediately to prevent outbreaks of disease. When storm drainage systems fail due to damage or an overload of capacity, serious flooding can occur.

Previous Occurrences

Some recent water utility outages are listed below.

Table 43: Water Utility Infrastructure Failures, 2010 – 2015

Date	Impact Area	Cause
11/20/2010	East Bank	Carrollton power plant shut down
12/22/2010	East Bank	Commercial power failed at Carrollton power plant
3/29/2011	East Bank	Commercial power failed at Carrollton power plant
5/6/2011	East Bank	Thunderstorms knocked out power twice at Carrollton plant
6/9/2011	East Bank	Power failed at Carrollton power plant
6/26/2011	East Bank	Power failed at Carrollton power plant
5/2/2012	Eastern New Orleans	Major water main break
10/8/2012	East Bank	Mechanical failure in boilers at Carrollton power plant
3/3/2013	East Bank	Natural gas flare at the Carrollton power plant
7/23/2013	Uptown	Water main break
12/18/2013	Venetian Isles	Water main break
7/13/2014	Uptown	Major water main break around 5:30 a.m.
6/1/2015	English Turn, Lower Algiers	Water main break
7/24/2015	East Bank	A power surge at the Carrollton power plant
9/24/2015	East Bank	A power surge at the Carrollton power plant

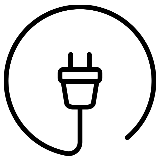
Hazard Impacts

Impact on Life and Property

The direct and indirect effects of water systems failure are difficult to quantify. The loss of water utility, for example, does negatively affect businesses, homes, and critical facilities – with serious consequences from long-term outages. Hotels and restaurants, for example, may have to provide bottled water for guests and diners in the event of a water utility failure, and this can be extremely costly. However, the majority of infrastructure failures are limited in scale and do not present long-term impacts.

Vulnerability

The annual probability of a water infrastructure issue arising in New Orleans is 100%. The vulnerability of this hazard creates challenges for residents and businesses in the form of boil-water advisories in the event of water pressure losses.



2.17 Infrastructure Failure - Power Outage

Definition

A power outage occurs when there is a short or long-term loss of electrical power to an area.

These outages occur when there are damages to distribution or transmission systems and are commonly caused by natural hazards such as hurricanes, thunderstorms, high winds, extreme temperatures, and flooding. Outages are also caused by vehicles crashing into utility lines, animals that come in contact with equipment, excavation and digging, and high power demand, which can overload the local power grid. Since 2005, many generators have been installed at facilities throughout the city.

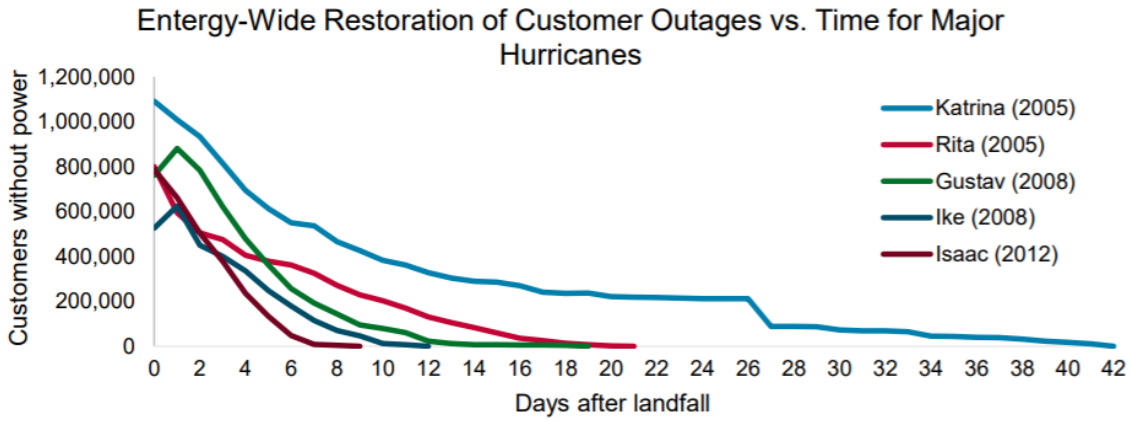
Although there are many causes of power outages, severe weather is the leading cause of outages in the United States. According to a 2013 report, Economic Benefits of Increasing Electric Grid Resilience to Weather Outages by the Executive Office of the President:

> "Outages caused by severe weather such as thunderstorms, hurricanes, and blizzards account for 58 percent of outages observed since 2002 and 87 percent of outages affecting 50,000 or more customers (U.S. DOE, Form OE-417). In all, 679 widespread outages occurred between 2003 and 2012 due to severe weather. Data from the U.S. Energy Information Administration show that weather-related outages have increased significantly since 1992."

Location and Extent of the Power Outage Hazard

The City of New Orleans, in collaboration with Sandia National Laboratories (Sandia), Los Alamos National Laboratories (Los Alamos), and Entergy New Orleans, completed an assessment of the city's electrical grid with the support of the US Department of Energy's Grid Modernization Laboratory Consortium. This assessment found that overall, the energy distribution system is vulnerable to wind, which has the greatest potential to damage distribution lines, which are lower voltage lines that run through neighborhoods. Power transmission lines, higher voltage lines along major corridors, are less vulnerable to wind than the neighborhood distribution lines. Substation upgrades that Entergy made after Hurricane Katrina have reduced the risk of disruption due to inundation. However, there continues to be a risk for underground lines. Based on the assessment of past hurricanes completed by Sandia and Los Alamos, power restoration after a hurricane (a source of wind and flooding), restoration of power in Entergy's service area could take one to three weeks.[xxxix]

Figure 50: Customers Without Power Over Time for Past 5 Hurricanes Across All of Entergy's Service Territory



[1] Re-formatted from: Olivier, P. (2017) Entergy Restoration Curves for Katrina, Rita, Gustav, Ike, Isaac. Entergy Corp.

Power outages occur across Orleans Parish regularly. According to data provided by Entergy New Orleans, outages occur across all areas of the city.

Table 44: Location of Outages by City Council District, New Orleans, June 2019 to November 2019

City Council District	Outages	Percent of Outages
A	381	22.7%
B	295	17.5%
C	276	16.4%
D	393	23.4%
E	336	20.0%
Total	1,681	100.0%

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

Severity of Power Outages

The majority of power outages in New Orleans have isolated impacts on various streets, blocks, and grids. On average, power outages that occurred between June 2019 and November 2019 lasted 242 minutes or approximately 4 hours, according to the most recently available data from Entergy New Orleans.

Table 45: Average Duration of Outages, New Orleans, June 2019 to November 2019

Month	Outages	Average Duration (Minutes)
June	231	163
July	474	194
August	191	180
September	174	147
October	434	414
November	177	217
Total	1,681	242

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

Previous Occurrences of Power Outages

Power outages are a regular occurrence in New Orleans. Although severe weather is the most common cause of power outages on a national level, outages in New Orleans were primarily caused by equipment during the period from June 2019 to November 2019.

Table 46: Cause of Outages, New Orleans, June 2019 to November 2019

Cause	Outages	Percent
Equipment	520	30.9%
Other	361	21.5%
Lightning	212	12.6%
Conductor	207	12.3%
Vegetation	200	11.9%
Animal	74	4.4%
Human Factors	48	2.9%
Summary Missing	46	2.7%
Improper Relaying	6	0.4%
Storm	6	0.4%
Contributing	1	0.1%
Total	1,681	100.0%

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

During the same six-month period, there were 1,681 outages that impacted 345,177 customers across Orleans Parish.

Table 47: Outages, New Orleans, June 2019 to November 2019

Month	Outages	Total Customers Affected
June	231	40,310
July	474	100,978
August	191	32,041
September	174	20,348
October	434	121,542
November	177	38,958
Total	1,681	354,177

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

Of the outages reported, 55 or 3 percent of outages affected more than 2,000 customers.

Table 48: Outages Affecting More Than 2,000 Customers, New Orleans, June 2019 to November 2019

Month	Outages Affecting More Than 2,000 Customers	Total Customers Affected
June	8	19,478
July	15	36,149
August	2	5,531
September	3	7,381
October	19	49,766
November	8	19,246
Total	55	137,551

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

The reporting period covers a six-month period that includes two tropical events, Hurricane Barry in July 2019 and Tropical Storm Olga in October 2019. There were 18 outages that affected 660 customers during these storms, represented by the hurricane weather condition. The majority of outages took place during fair weather (53.4 percent), followed by thunder (32.4 percent).

Table 49: Outage Weather Conditions, June 2019 to November 2019

Weather Condition	Outages	Percentage of Outages	Total Customers Affected	Percentage of Total Customers Affected
Fair	897	53.4%	154,21	43.5%
Thunder	544	32.4%	166,891	47.1%
Heat	98	5.8%	2,020	0.6%
Rain	68	4.0%	11,555	3.3%
Wind	22	1.3%	528	0.1%
Hurricane	18	1.1%	660	0.2%
Cold	30	1.8%	16,901	4.8%
Blank	2	0.1%	1,388	0.4%
Snow and Ice	1	0.1%	17	0.0%
Tornado	1	0.1%	6	0.0%
Total	1,681	100.0%	354,177	100.0%

Source: Entergy New Orleans Reliability Project Status Report to City Council of New Orleans

Hazard Impacts

Impact on Life and Property

Power outages have the potential to disrupt communications, water, and transportation systems; impact businesses by reducing productivity or closing the facility; cause food spoilage and water contamination, and prevent the use of medical devices.[xl] While the direct and indirect effects of power outages are challenging to quantify, the loss of power does negatively affect businesses, homes, and critical facilities – with serious consequences from long-term outages. However, the majority of outages are limited in scale and do not present long-term impacts.

Power outages can exacerbate the impact of other hazards, including extreme heat and winter storms, especially for those living in substandard housing. Populations that are dependent upon access to electricity can also be disproportionately impacted, including people with health problems that depend on caretakers, electric medical devices, and have limited mobility.[xli] Additionally, power outages can lead to cascading events such as the closure of critical facilities and the implementation of boil water orders.

Vulnerability

For this hazard, the annual probability of a power outage is 100%.

2.18 Infectious Disease

Definition

An infectious disease is a viral, bacterial, parasitic, or fungal disorder that can be transmitted between people. An outbreak is an increased number of cases of a particular disease and can include epidemics and pandemics. Infectious Disease Outbreaks require more public health and medical resources than a day to day operations and may include responses such as infection control, contact tracing, quarantine, isolation, prophylaxis, and social distancing.

The Center for Disease Control (CDC) defines a pandemic as,

"*A pandemic is a global outbreak of disease. Pandemics happen when a new virus emerges to infect people and can spread between people sustainably. Because there is little to no pre-existing immunity against the new virus, it spreads worldwide."*[xlii]

Communicable diseases are often of high concern as well. The Center for Disease Control (CDC) defines communicable disease per 42 CFR Part 70 as,

"Communicable diseases means illnesses due to infectious agents or their toxic products, which may be transmitted from a reservoir to a susceptible host either directly as from an infected person or animal or indirectly through the agency of an intermediate plant or animal host, vector, or the inanimate environment."[xliii]

Communicable diseases are typically spread through direct contact. The following are three of the most common ways of direct contact transmission:

Person to person. This involves a direct transfer of bacteria, viruses, or other germs from person to person. This may involve blood transfusion, coughing, kissing, sexual contact, touching, etc.

Animal to person. Infected animals can transfer communicable diseases to humans via biting and scratching. Coming in contact with an infected animal's waste may also transmit diseases.

Mother to the fetus. Infected pregnant women can pass bacteria, germs, and viruses through the placenta, such as HIV. Bacteria, germs, and viruses can also be spread during labor, such as with group B streptococcus.

Communicable diseases are also transmitted indirectly, such as touching a germ infected door handle.

Other ways that communicable diseases are spread is through particle transmission through the air (such as tuberculosis or SARS), through bites and stings from insects (such as West Nile Virus or Lyme Disease), and through food contamination (such as E. Coli).

The following communicable diseases are tracked by the Louisiana Department of Health:

COVID-19 – a novel coronavirus discovered in 2019 and led to a global pandemic infecting millions of people worldwide. In the United States, according to the CDC, as of December 15, 2020, more than 16.52 million total cases with over 302,992 deaths. It will be some time before the fully borne impact of COVID-19 is known.

Chlamydia - A common STD that can infect both men and women. It can cause severe and permanent damage to a woman's reproductive system, making it difficult or impossible for her to get pregnant later on. Chlamydia can also cause a potentially fatal ectopic pregnancy (pregnancy that occurs outside the womb).

Gonorrhea - A sexually transmitted disease (STD) that can infect both men and women. It can cause infections in the genitals, rectum, and throat. It is a very common infection, especially among young people ages 15-24 years.

Primary and Secondary Syphilis - An STD that can cause long-term complications if not treated correctly. Symptoms in adults are divided into stages. These stages are primary, secondary, latent, and late syphilis.

Influenza - There are two main types of influenza (flu) virus: Types A and B. The influenza A and B viruses that routinely spread in people (human influenza viruses) are responsible for seasonal flu epidemics each year. Influenza A viruses can be broken down into sub-types depending on the genes that make up the surface proteins. Over the course of a flu season, different types (A & B) and subtypes (influenza A) of influenza circulate and cause illness.

Viral Meningitis - An inflammation of the tissue that covers the brain and spinal cord. Infants younger than one-month-old and people with weakened immune systems are more likely to have a severe illness related to meningitis.

HIV - A virus spread through body fluids that affect specific cells of the immune system, called CD4 cells, or T cells. Over time, HIV can destroy so many of these cells that the body can't fight off infections and disease. When this happens, HIV infection leads to AIDS.

Acute Hepatitis B - A short term liver infection caused by the Hepatitis B virus. Hepatitis B is transmitted when blood, semen, or another body fluid from a person infected with the Hepatitis B virus enters the body of someone who is not infected. Chronic Hepatitis B - A chronic, long term liver infection caused by the Hepatitis B virus, which can lead to cirrhosis or liver cancer. Hepatitis B is transmitted when blood, semen, or another body fluid from a person infected with the Hepatitis B virus enters the body of someone who is not infected.

It should also be noted that bioterrorism can also involve communicable diseases. The CDC has identified high priority biological agents that have the potential for major public health impact. These include:

- Anthrax (Bacillus anthracis)
- Botulism (Clostridium botulinum toxin)
- Plague (Yersinia pestis)
- Smallpox (variola major)
- Tularemia (Francisella tularensis)
- Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo])

Location and Extent of the Infectious Disease Hazard

The entire United States is considered at risk for disease outbreaks. Within the planning area, the entire population is subject to communicable diseases. Locations with higher population density may be exposed to higher numbers of the aforementioned diseases than less dense areas. In areas of concentrated poverty, especially in communities of color, the negative health impacts of pandemics are disproportionate, including the mortality rates. Other social indicators of vulnerability may include overcrowded housing, lack of health insurance coverage, increased unemployment, and poverty.

Severity of Pandemics

The severity of outbreaks is expected to change annually, depending on variables such as weather patterns and trends in disease outbreaks. While there have been historically severe impacts of a pandemic in Orleans Parish, modern public health and disease prevention are capable of treating most communicable disease outbreaks. Communicable diseases do, however, have the potential to be catastrophic.

As the 2020 Covid-19 pandemic has made clear, pandemics can have major impacts beyond causing sickness and death. The economic shock caused by the pandemic is creating hardship across the country, and the full impacts will certainly be felt for some time, especially food and housing insecurity.

Previous Occurrences of the Hazard

New Orleans has had few communicable disease outbreaks, all of which occurred nearly 100 years ago. The first pandemic reported in New Orleans occurred in the 1830s, in which cholera killed 3,000 people in New Orleans. A subsequent cholera event in New Orleans during the 1870s claimed the lives of thousands more. In 1847 and 1852, over 40,000 people died from yellow fever. The most well-documented pandemic in Orleans parish involved the 1918 flu epidemic, also known as the Spanish Flu, which caused 15,494 cases of influenza statewide in September of 1918, with approximately 7,000 of those cases located in New Orleans. Between October 1918 and April 1919, the city experienced a staggering 54,089 cases of influenza. Of these, 3,489 died – a case

fatality rate of 6.5% and an excess death rate of 734 per 100,000. Only Pittsburgh (806) and Philadelphia (748) - the two cities with the worst epidemics in the nation – had higher death rates. Cases gradually lessened during the winter and spring. By the summer, the disease had disappeared from the state, without the aid of vaccination.

New Orleans also experienced a heightened awareness of communicable/infectious diseases following Hurricane Katrina. This is especially true given the post-disaster context with flooding, a lack of medical care options, limited housing, along with a number of other environmental and social conditions. The CDC was involved in supporting the Department of Health and Human Services response. CDC helped with health issues that involved:

- infectious disease detection, prevention, and outbreak control in shelters and in affected communities,
- injury prevention for displaced people and rescue workers
- environmental health and safety monitoring of homes, water quality, and shelters
- rebuilding public health infrastructure,
- school health, and
- worker and responder safety recommendations and monitoring.

Before 2020, only one known outbreak of communicable disease (norovirus) requiring unusual mobilization of public health resources had been reported as of September 23, 2005. New Orleans has seen 597 deaths and 13,629 cases as of November 3, 2020.

In December of 2018, a Hepatitis A outbreak was declared, and New Orleans has been actively addressing cases since then.

In recent months we have seen first-hand how an infectious disease outbreak can turn into a global pandemic. It has been more than 100 years since this type of event has happened with the Spanish Flu in 1918, which reinforces that the likelihood that these infectious disease outbreaks will lead to large-scale epidemics or pandemics is highly unlikely based on the historical record.

Probability

Based on the historical record, there is a 100% probability that infectious disease outbreaks, such as seasonal influenza, will occur annually**.**

Hazard Impacts

Impact on Life and Property

The severity of outbreaks is likely to change annually, depending on variables such as weather patterns and trends in disease outbreaks. In most infectious disease outbreak, the impact of this hazard is limited, with the majority of illnesses treatable and the likelihood of fatalities low. Large-scale outbreaks like the onset of COVID-19 in the spring of 2020 can strain existing health care facilities.

Vulnerability

There are a number of factors that can contribute to increased vulnerability, including age and underlying health, overcrowded housing, poverty, race, and employment status.

2.19 Economic Shock

Definition

The economic impact on the economic system from a disaster (Natural or Man-Made).

Location and Extent of the Economic Shock Hazard

The scale of economic shocks can range from the individual and household to the nation and the world.

Severity of Economic Shocks

Economic Shocks in New Orleans are generally tied to natural and/or man-made disasters or from broader scale economic shocks on the national and global levels. The severity of a shock is dependent on the scale of the disaster and the vulnerability of the sectors impacted.

Previous Occurrences of Economic Shock

Some recent economic shocks are described below:

- Hurricane Katrina in 2005 – Approximately $161 Billion[xliv]
- BP Oil Spill in 2010 – Approximately $65 billion[xlv]
- COVID-19 Pandemic – The COVID-19 Pandemic has had far-reaching economic repercussions for both the New Orleans region and the United States as a whole. According to the Brookings Institute Metro Recovery Index, most recently updated in September 2020, key economic indicators in New Orleans have been substantially impacted by the pandemic since January 2020. It is estimated that the number of jobs in the New Orleans metropolitan area has decreased 11%, the unemployment rate has increased 4.4% from 4.8% in January to 9.2% in September, and the number of job postings has decreased by 14.3%. Additionally, there has been a 28.9% decrease in small businesses since February.[xlvi] Additionally, New Orleans' top six industries, which account for 80% of local tax revenue, are forecast to see an $81.2 Million reduction in City tax revenue because of the Covid-19 Pandemic. The number one industry in New Orleans, food service and accommodation, has suffered a loss of about 25,000 jobs as of late July 2020.[xlvii]

  While the COVID-19 pandemic has affected communities across the U.S., the economic and public health impacts of the COVID-19 Pandemic have disproportionately affected people of color in New Orleans and across the country. Glaring disparities in access to resources perpetuated by historic and systemic housing, economic, and health care policy discrimination have created conditions that contribute to an increased morbidity and mortality rate in minority-majority communities.[xlviii] These discriminatory social

conditions have been magnified by the COVID-19 Pandemic. In New Orleans, as of June 2020, Black New Orleanians represented 87.5% of all COVID-19-related deaths that were not in Long-Term Care (LTC) facilities, whereas white New Orleanians made up only 9.1% of non-LTC deaths. The overall population of Orleans Parish is 60% Black and 35% White, highlighting the inequitable racial disparities of COVID-19 impacts.[xlix]

Hazard Impacts

Impact on Life and Property

Given the scale of an economic shock, the impact on life and property can vary significantly from the individual to the entirety of the global marketplace. It can be complicated to identify the full effect of any shock given a lack of comprehensive data. The economic shock created by the Covid-19 pandemic has impacted the stability of critical community lifelines, including housing, the food supply chain, and employment.

Vulnerability

For this hazard, we are unable to calculate probability due to a lack of data.

Section 3: The Capability Assessment

This section summarizes the results of the City of New Orleans and other stakeholder efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the parish's infrastructure, as well as highlighting major changes in its capabilities since the last plan update. The City of New Orleans capabilities is unique to the parish, including planning, regulatory, administrative, technical, financial, and education and outreach resources. Through this assessment, New Orleans is able to identify strengths that could be used to reduce losses and reduce risk throughout the community. It also identifies areas where new actions to reduce risk might supplement current capabilities and create a more resilient community before, during, and after a hazard event.

3.1 Policies, Plans, and Programs

There are a number of mitigation-related acts, plans, executive orders, and policies that lay out specific goals, objectives, and policy statements that already support or could support pre-and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation and take an integrated and strategic look holistically at hazard mitigation in New Orleans to propose ways to continually improve it. These tools are valuable instruments in pre-and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework.

3.1.1 Master Plan

The Plan for the 21st Century, commonly referred to as the Master Plan, is a City Charter-mandated planning framework for the core systems that shape New Orleans' physical, social, environmental, and economic future. The Plan for the 21st Century reflects the values and priorities that emerged through a community participation process and is grounded in information assembled for the first time in one place. In 2010, the Plan was unanimously adopted by both the City Planning Commission and the City Council and was signed by Mayor Mitchell Landrieu. The City engaged in a City Charter mandated Master Plan amendment process from 2016 to 2018.

The Master Plan includes specific vision items such as livability, opportunity, sustainability, equity, and resilience. Chapter 12 of the Master Plan is titled "Adapt To Thrive: Environmental Stewardship, Disaster Risk Reduction, And Climate Change." This section includes specific goals and implementation strategies for a host of challenges facing the New Orleans region moving forward and is directly related to many of the topics discussed in the Hazard Mitigation Plan. Topics like coastal protection and restoration, regional government and agency collaboration, urban stormwater management, pre-disaster planning and post-disaster recovery, hazard mitigation planning, community resilience, brownfield remediation, and community outreach and education are defined and discussed in Chapter 12. The Master Plan recommends specific action for each goal and then assigns responsible agencies the proposed timeline and necessary resources to achieve the goals.

The Plan for the 21st Century serves as a valuable tool for the City of New Orleans, its partners, and residents. Significant effort went into the creation of the plan, and the plan is a reflection of

community vision and goals due to the level of public outreach and collaboration that went into the effort.

3.1.2 The Comprehensive Zoning Ordinance (CZO)

The CZO is the law that governs land use throughout the City of New Orleans. The CZO includes lists of permitted land uses for each of the City's zoning districts, in addition to height limits, setback requirements, urban design standards, operational rules, and other regulations. The CZO is broken into a series of Articles that cover citywide standards, individual zoning district regulations, and the processes for variances, conditional use permits, and other land use reviews.

The principal goals of the CZO are to encourage and promote, in accordance with present and future needs, the public health, safety, and welfare of the citizens of the City of New Orleans and to ensure that the policies set forth in City's Master Plan are implemented by the land use regulations and are consistent with the goals set forth in the Master Plan. The CZO includes numerous requirements for topics related to the sustainability and resilience goals of the Hazard Mitigation Plan.

Requirements for minimum permeable open space and maximum impervious surfaces on lots vary throughout the city based on the existing development pattern and uses and are intended to reduce excessive paving and related flooding. Article 23 of the CZO includes landscaping requirements for new development and ensure that sufficient landscaping is provided in order to reduce flooding and improve air quality and public health. Article 22 regulates parking and requires permeable pavement for parking spaces, and sets a maximum number of parking spaces allowed in order to reduce flooding and the overreliance on the automobile as a primary means of transportation. The CZO also includes requirements and incentives for affordable housing so that residents can live safely and comfortably within Orleans Parish in a manner that will afford them and their families the right to be better prepared for potential disasters. Additionally, the CZO defines and regulates Open Space Districts in order to provide residents with access to active and passive recreation areas and preserve national resources within the wetlands and coastal areas.

3.1.3 City Assisted Evacuation Plan (CAEP)

The CAEP provides for the needs of the residents of New Orleans in the event an evacuation is required. This plan includes a Special Needs Registry for those residents that require special assistance during an evacuation.

3.1.4 Other Plans

Resilient NOLA – A plan that sets forth how the city can adapt to face challenges in the wake of Climate Change in an equitable manner.

Climate Action for a Resilient New Orleans – This plan centers on addressing energy use, transportation options, waste reduction, and creating a culture of awareness and action.

Taking Steps Together On Equity & Climate Change: A Report By And For New Orleanians – This report goes a step further to implement and operationalize the climate action plan created by the city of New Orleans while ensuring equity in the face of climate change.

Table 50: City of New Orleans Planning and Regulatory Capabilities

Planning and Regulatory		
	City of New Orleans	**Comments**
Plans	Yes / No	
Comprehensive / Master Plan	Yes	
Capital Improvements Plan	Yes	
Economic Development Plan	No	
Local Emergency Operations Plan	Yes	Includes many event and hazard-specific plans.
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	Yes	
Community Wildfire Protection Plan	No	
Other plans (redevelopment, recovery, coastal zone management)	Yes	
Building Code, Permitting and Inspections	Yes / No	
Building Code	Yes	2015 International Building Code
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	Work in Progress
Fire Department ISO/PIAL rating	Yes	
Site plan review requirements	Yes	
Land Use Planning and Ordinances	Yes / No	
Zoning Ordinance	Yes	
Subdivision Ordinance	Yes	Under Revision: Due Mid-2020
Floodplain Ordinance	Yes	
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	Yes	Stormwater Ordinance
Flood Insurance Rate Maps	Yes	New maps adopted 2016
Acquisition of land for open space and public recreation uses	No	
Other	No	

Source: FEMA Capability Assessment Worksheet 4.1

3.2 Building Codes, Permitting, Land Use Planning and Ordinances

The City of New Orleans provides oversight for building permits and codes, land use planning, and all parish ordinances. The NOHSEP, through this Hazard Mitigation Plan, coordinates between city agencies and external partners to maintain the mitigation plan and implement mitigation actions.

As of the 2020 update, The City of New Orleans and its jurisdictions ensure that all adopted building codes are enforced and in compliance relating to the construction of any structure within the boundaries of the parish. Building permits are required prior to beginning any type of construction or renovation projects, installation of electrical wiring, plumbing or gas piping, moving manufactured/modular or portable buildings, and reroofing or demolitions.
The City of New Orleans Office of Safety and Permits is the agency primarily charged with enforcing the ordinances related to health and safety, property maintenance standards, and condemnation of unsafe structures.

The City's participation in the National Flood Insurance Program and Community Rating System is coordinated through the Office of Safety and Permits. Because of the complexity of these programs and their importance to mitigating flood risk and making affordable flood insurance available to the city's residents, these programs are detailed in a separate section below.

The City of New Orleans Council meets regularly to consider any proposed ordinance changes and to take final actions on proposed changes.

Some programs and policies, such as the above described, might use complimentary tools to achieve a common end but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

3.3 Administration and Technical Capabilities

As a community, New Orleans has administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The ability to access and coordinate these resources is also essential. Table 53 shows examples of resources in place in New Orleans.

Table 51: City of New Orleans Administration and Technical Capabilities

Administration and Technical		
	City of New Orleans	**Comments**
Administration	Yes / No	
Planning Commission	Yes	
Mitigation Planning Committee	Yes	
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	Yes	
Mutual Aid Agreements	Yes	
Staff	Yes / No	
Chief Building Official	Yes	ICC Certified Building Official
Floodplain Administrator	Yes	ASFPM Certified Floodplain Manager
Emergency Manager	Yes	
Community Planner	Yes	Director of City Planning Commission
Civil Engineer	Yes	
GIS Coordinator	Yes	
Grant Writer	Yes	
Other	Yes	VOAD (See Below)
Technical	Yes / No	
Warning Systems / Service (Reverse 911, outdoor warning signals)	Yes	
Hazard Data & Information	Yes	Automated Flood Warning System, installed in 2019
Grant Writing	Yes	
HAZUS Analysis	Yes	
Other		

Source: FEMA Capability Assessment Worksheet 4.1

3.3.1 Automated Flood Warning System (AFWS)

In August 2019 NOHSEP installed a system of sensors and automated alerts at 12 frequently flooded roadway underpasses. The sites measure rainfall and water level and provide on-site warnings to motorists, and also transmit data to city emergency managers. The city has established real-time data sharing with SWBNO and NWS to help coordinate situational awareness and emergency response.

Figure 51: Automated Flood Warning System on Marconi Drive

Source: New Orleans Office of Homeland Security and Emergency Preparedness

3.3.2 Voluntary Organizations Active in Disaster (VOAD)

The New Orleans Office of Homeland Security & Emergency Preparedness hired a staff member in 2019 to be the liaison and coordinator between the voluntary organizations active in disaster (VOAD) and the City of New Orleans. VOADs are critical partners when it comes to disaster recovery, as they often pick up where government response ends and handle a lot of the services and needs that are not covered by local emergency management or federal disaster aid. By investing energy, staff time, and resources into cultivating a highly responsive and effective VOAD, NOHSEP sought to enhance preparedness and coordination around disaster response and recovery and bring more resources to support residents during and following a disaster. Extensive effort was put into outreach and engagement to support the creation of a local New Orleans VOAD and build key relationships with state and national disaster response non-profits able to deploy if needed.

NOHSEP is currently finalizing a VOAD and Donations Plan to add to the Comprehensive Emergency Operations Plan update for 2020.

3.3.3 Some highlights from 2019 and 2020:

- The number and diversity of VOAD groups working directly with the City of New Orleans to offer disaster response and recovery services increased, with coordination calls often having anywhere from 30-50 organizational partners participating. The New Orleans VOAD includes non-profits and faith organizations at the local, state, and national levels.
- Via the VOAD partners, the City was able to access and provide residents with an extensive range of disaster recovery capabilities, such as:
    - Mucking & gutting
    - Debris removal
    - Rebuilding
    - Case Management
    - Legal Aid
    - Feeding Operations
    - Donations Management
    - Volunteer Coordination
    - Functional and Access Needs Support & Advocacy
    - Health
    - Children services

- NOHSEP hosted the first Hurricane Table Top Exercise with over 50 VOAD partners in May 2019
- NOHSEP activated the New Orleans VOAD for 8 emergency activations, including Hurricane Barry, Hard Rock Collapse, COVID19 Pandemic, Hurricane Cristobal, Hurricane Marco/Laura, Hurricane Laura Evacuee Support, Hurricane Sally, and Hurricane Delta.
- NOHSEP hosted regular VOAD coordination calls through emergency activations. These calls have improved information sharing between the City of New Orleans and VOAD partners, allowed for continual assessment of capabilities of organizations to inform response and recovery operations, and improved communication and coordination between VOAD, as well as key functional and access, needs agencies and vulnerable communities.
- In partnership with key VOAD partners, NOHSEP has set up a more formal relationship with both Second Harvest Food Bank and World Central Kitchen to provide feeding support to City-run emergency sheltering operations with water, snacks, and meals. Second Harvest Food Bank and World Central Kitchen have either been on standby or have provided feeding support for City emergency sheltering operations for multiple emergency activations and storm shelters. This is a new development, as previous to VOAD outreach in 2019, the City depended on either MRE's or donations to support smaller-scale feeding operations at the shelters.
- VOAD members assisted in the Hard Rock Hotel Collapse response via volunteering to assist with feeding efforts of First Responders. VOAD organizations like Second Harvest Food Bank and the Salvation Army provided daily meal delivery and donated items to Hard Rock collapse evacuees at different hotels.
- Through NOHSEP coordination, VOAD partners mobilized rapidly and extensively to assist with key food security issues and the feeding of vulnerable populations through the COVID-19 pandemic. This effort later lead to the creation of a Food Security Task-force

with VOAD partners and City agencies. VOAD partners, such as World Central Kitchen and Second Harvest Food Bank, provided millions of meals and food boxes to residents in need throughout the pandemic.

- The engagement of National VOAD partners such as Americares and the GOA Foundation resulted in the donation of hundreds of thousands of critical PPE (N95's, KN95's, surgical masks, face shields, hand sanitizer, etc.) to NOHSEP during the COVID-19 pandemic. This PPE was distributed to public safety agencies, health partners, as well as local VOAD partners. The N95's were also stored for use for residents in the event of a City Assisted evacuation due to a major hurricane.
- Through coordination and strong relationships with VOAD partners, NOHSEP was able to track volunteer hours and donations to support our cost share with FEMA.
- VOAD partners like Air BnB provided free COVID-19 housing to First Responders and Essential Workers who needed to isolate from their families due to their high exposure jobs. VOAD partners like UBER have been helpful in providing free transportation resources to Hard Rock Collapse impacted residents, as well as Hurricane Laura evacuees.
- Extensive VOAD participation assisted in supporting the over 12,000 Hurricane Laura evacuees in New Orleans. VOAD partners such as Catholic Charities, United Way, LA SPCA, the Junior League, Hands On New Orleans, Save the Children, and Southeast Louisiana Legal Services worked with the City to provide donations for evacuees, to receive and sort an extensive donations collection for the City of New Orleans Evacuee Resource Center, and to provide key services and referrals at the Resource Center.
- VOAD members have assisted with the City of New Orleans City Assisted Evacuation program, with some serving as Evacuspot Site Leaders at critical locations in the Lower Ninth ward, Central City, Bywater, New Orleans East, and Lakeview. The ability to use VOAD members as Evacuspot leaders is helpful to NOHSEP as they are volunteers who have leadership skills, know how to coordinate other volunteers, and can be depended on to show up in a hurricane evacuation. NOHSEP also continues to have key conversations with UBER and Lyft on ways their operations can support vulnerable residents to get to their neighborhood Evacuspot in the event of a City Assisted Evacuation.
- VOAD partners have been key players in disseminating NOLA Ready emergency information and supplies to vulnerable communities through their agencies and the communities they serve. VOAD partners have distributed hurricane preparedness brochures and also masks at food distributions, senior centers, churches, and to the undocumented immigrant community. VOAD partners also helped the City of New Orleans promote the COVID19 Meal Assistance Program, share COVID19 testing information, share City Assisted Evacuation information, and much more.
- VOAD partners have both promoted and assisted with NOLA Ready volunteer trainings, taking a particularly active role in CERT trainings. Lighthouse Louisiana has shared a Blind and Deaf Sensitivity training with NOLA Ready CERT volunteers, as well as the Medical Reserve Corps volunteers. NOLA Tree Project gave a Flood Response and Muck & Gut Training for both CERT participants, houses of worship, and NOLA Ready Corp volunteers

3.4 Financial Capabilities

Financial capabilities are the resources that New Orleans has access to or is eligible to use in order to fund mitigation actions. Costs associated with implementing the actions identified by the parish may vary from little to no cost actions, such as outreach efforts, or substantial action costs such as the acquisition of flood-prone properties. The following financial resources are available to fund mitigation actions in New Orleans:

Table 52: City of New Orleans Financial Capabilities

Financial		
	City of New Orleans	**Comments**
Funding Resources	Yes / No	
Capital Improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Stormwater Utility Fee	Yes	
Community Development Block Grant (CDBG)	Yes	
Other Funding Programs	Yes	

Source: FEMA Capability Assessment Worksheet 4.1

3.5 Education and Outreach

A key element in hazard mitigation is promoting a safer, more disaster-resilient community through education and outreach activities and/or programs. Successful outreach programs provide data and information that improves the overall quality and accuracy of important information for citizens to feel better prepared and educated with mitigation activities. These programs enable the individual communities and the parish as a whole to maximize opportunities for the implementation of activities through greater acceptance and consensus of the community.

New Orleans has existing education and outreach programs to implement mitigation activities, as well as communicate risk and hazard-related information to its communities. Specifically, focusing on advising repetitive loss property owners of ways they can reduce their exposure to damage by repetitive flooding remains a priority for the entire parish. The existing programs are as follows:

Table 53: City of New Orleans Education and Outreach Capabilities

Education and Outreach		
	City of New Orleans	**Comments**
Program / Organization	Yes / No	
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access, and functional needs populations, etc.	Yes	VOAD work in the community
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Yes	NOLA Ready for Public Information and emergency warning
Natural Disaster or safety-related school program	Yes	
Storm Ready certification	Yes	
Firewise Communities certification	No	
Public/Private partnership initiatives addressing disaster-related issues	Yes	VOAD
Other	Yes	Sheltering and Evacuation (See Below)

Source: FEMA Capability Assessment Worksheet 4.1

3.5.1 Sheltering

The city is involved in sheltering efforts beyond freeze shelter situations. The city has provided shelter with the use of MCCNO after Hurricane Isaac for an MSNS shelter and the New Orleans East tornado shelter at Joe Brown Park.

3.5.2 Evacuation

City-assisted evacuation and seeks to mitigate the impacts on human health while addressing the lack of transportation or medical/mobility needs within the city via a special needs registry and with Evacuspots, which are designated areas throughout the city for people to gather for evacuations assistance.

The communities within New Orleans rely on the New Orleans Office of Homeland Security and Emergency Preparedness (NOHSEP) and/or City of New Orleans Government agencies for the above-listed planning and regulatory, administrative and technical, financial, and education and outreach capabilities. As reflected in the above existing regulatory mechanisms, programs, and resources within the parish, New Orleans remains committed to expanding and improving on the existing capabilities within the parish. Communities, along with New Orleans, will work together

toward increased participation in funding opportunities and available mitigation programs. Should funding become available, the hiring of additional personnel to dedicate to hazard mitigation initiatives and programs, as well as increasing ordinances within the parish, will all enhance and expand risk reduction for all of Orleans Parish.

3.6 Flood Insurance and Community Rating System

3.6.1 National Flood Insurance Program

Flood insurance data provided by FEMA indicate that New Orleans has 75,653 flood insurance policies with the NFIP, with total annual premiums of $53,614,489. The City of New Orleans will continue to adopt and enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, and will continue to monitor activities, including local requests for new map updates. Flood insurance statistics and additional NFIP participation details for Orleans Parish are provided in the tables to follow.

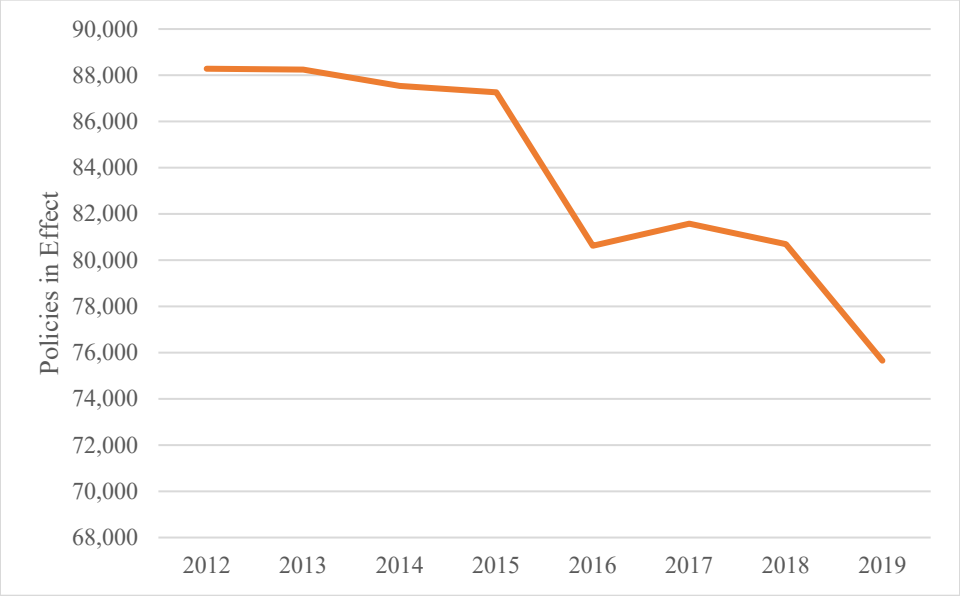
The City of New Orleans will continue active participation in the NFIP through various education and outreach activities. These activities will include community outreach on the availability of flood insurance within the parish, as well as flood safe building initiatives throughout the parish. The Parish Floodplain Manager will continue to work to ensure floodplain management regulations are adopted and enforced. The Parish Floodplain Manager will continue to seek and attend floodplain management and NFIP continuing education.

Table 54: Summary of NFIP Policies for Orleans Parish as of 8/31/2019

Jurisdiction	No. of Insured Structures	Annual Premium Paid	No. of Insurance Claims Filed Since 1978	Total Loss Payments
Orleans Parish	75,653	$53,614,489	124,290	$7,284,016,275

The new FIRM adopted in 2016 reduced the overall extent of special flood hazard areas across the city. As individual properties were removed from the SFHA, they were no longer required to carry flood insurance as a condition of carrying a federally-insured mortgage. Likely as a result, the number of properties with active flood insurance policies shrank in the immediate following years (Figure 51). The continued drop in flood insurance policies likely reflects the increasing cost of insurance premiums and broader economic circumstances that affect the affordability of insurance.

Figure 52: Flood Insurance Coverage, Orleans Parish



Source: City of New Orleans

3.7 Repetitive Loss Properties

Repetitive loss structures are structures covered by a contract for flood insurance made available under the NFIP that:

a. Have incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and

b. At the time of the second incidence of flood-related damage, the contract for flood insurance contains the increased cost of compliance coverage.

Severe repetitive loss (SRL) is defined by the Flood Insurance Reform Act of 2004 and updated in the Biggert Waters Flood Insurance Reform Act of 2012. For a property to be designated SRL, the following criteria must be met:

a. It is covered under a contract for flood insurance made available under the NFIP; and

b. It has incurred flood-related damage –

1) For which four or more separate claims payments have been made under flood insurance coverage with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or

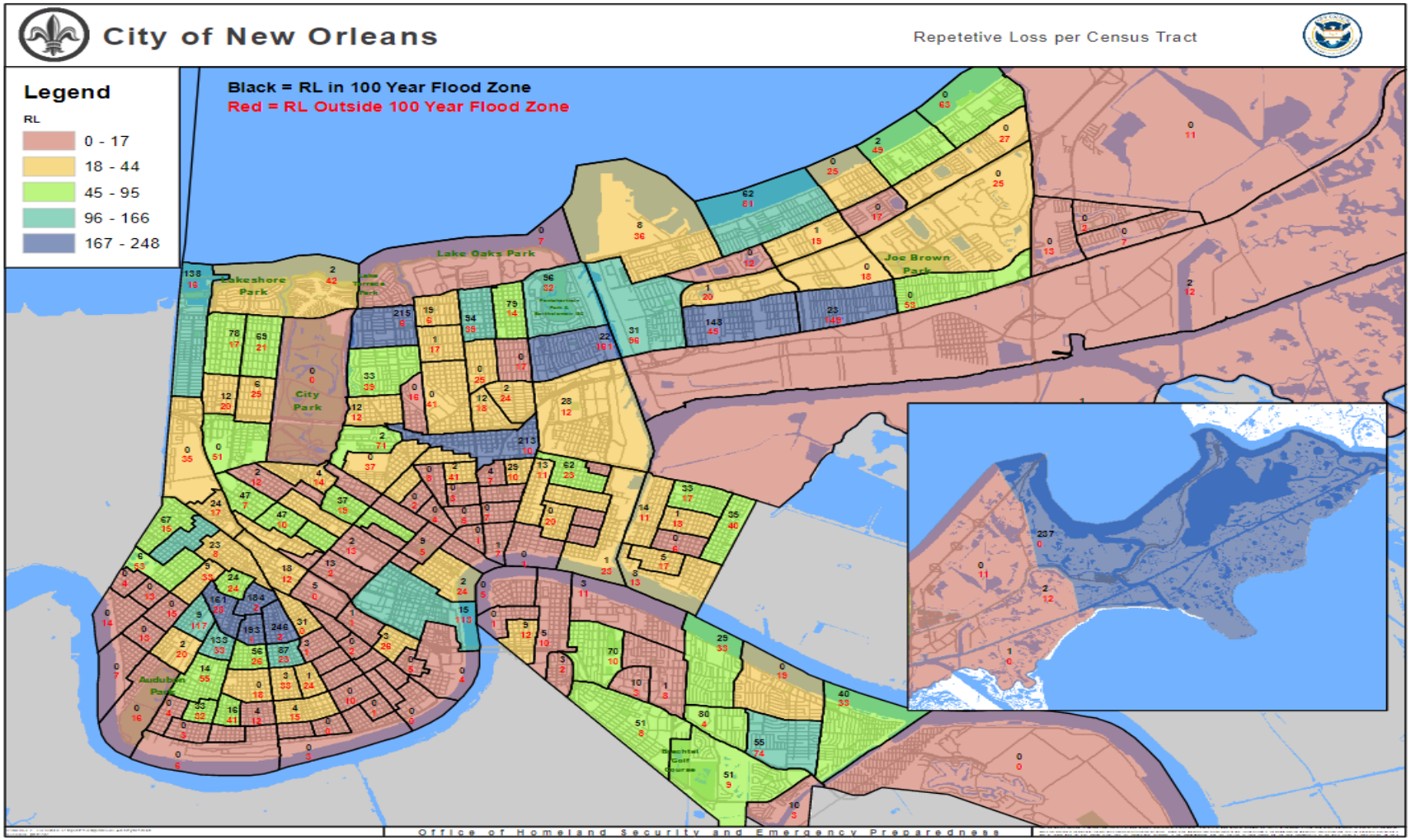
2) For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Figures regarding repetitive loss structures for Orleans Parish are provided in the table below:

Table 55: Repetitive Loss Structures for Orleans Parish

Jurisdiction	Number of Structures	Residential	Commercial	Total Claims	Total Claims Paid	Average Claim Paid
Orleans Parish	8,363	7,619	747	28866	$1,131,207,823	$135,214

Figure 53: Repetitive Loss Property Densities in Orleans Parish



Source: City of New Orleans Repetitive Loss List 8/19

New Orleans is currently participating in the Community Rating System (CRS). Participation in the CRS strengthens local capabilities by lowering flood insurance premiums for jurisdictions that exceed NFIP minimum requirements. If you wish to see a map of NFIP communities around Louisiana, please visit the linked FEMA website in the footnote.[1]

The Federal Emergency Management Agency's National Flood Insurance Program (NFIP) administers the Community Rating System (CRS). Under the CRS, flood insurance premiums for properties in participating communities are reduced to reflect the flood protection activities that are being implemented. This program can have a significant influence on the design and implementation of flood mitigation activities, so a brief summary is provided here.

A community receives a CRS classification based upon the credit points it receives for its activities. It can undertake any mix of activities that reduce flood losses through better mapping, regulations, public information, flood damage reduction, and/or flood warning and preparedness programs.

There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction (see Figure 54). A community that does not apply for the CRS or that does not obtain the minimum number of credit points is a class 10 community.

Figure 54: CRS Premium Discounts by Class

CLASS	DISCOUNT	CLASS	DISCOUNT
1	45%	6	20%
2	40%	7	15%
3	35%	8	10%
4	30%	9	5%
5	25%	10	–

SFHA (Zones A, AE, A1–A30, V, V1–V30, AO, and AH): Discount varies depending on class.

SFHA (Zones A99, AR, AR/A, AR/AE, AR/A1–A30, AR/AH, and AR/AO): 10% discount for Classes 1–6; 5% discount for Classes 7–9.*

Non-SFHA (Zones B, C, X, D): 10% discount for Classes 1–6; 5% discount for Classes 7–9.

* In determining CRS Premium Discounts, all AR and A99 Zones are treated as non-SFHAs.

Source: FEMA

The CRS provides an incentive not just to start new mitigation programs but to keep them going. There are two requirements that "encourage" a community to implement flood mitigation activities. Once the parish has obtained a CRS rating and is a participant, the parish will receive CRS credit for this plan when it is adopted. To retain the credit, the parish must submit an evaluation report on progress toward implementing this plan to FEMA by October 1 of each year. That report must be made available to the media and the public. Second, the parish must annually recertify to FEMA that it is continuing to implement its CRS credited activities. Failure to maintain the same level of involvement in flood protection can result in a loss of CRS credit points and a resulting increase in flood insurance rates to residents.

In 2011[li], the National Flood Insurance Program (NFIP) completed a comprehensive review of the Community Rating System (CRS) that resulted in the release of a new CRS Coordinator's Manual.

The changes to the 2013 CRS Coordinator's Manual are the result of a multi-year program evaluation that included input from a broad group of contributors to evaluate the CRS and refine the program to meet its stated goals. The changes helped to drive new achievements in the following six core flood loss reduction areas important to the NFIP: (1) reduce liabilities to the NFIP Fund; (2) improve disaster resiliency and sustainability of communities; (3) integrate a Whole Community approach to addressing emergency management; (4) promote natural and beneficial functions of floodplains; (5) increase understanding of risk, and; (6) strengthen adoption and enforcement of disaster-resistant building codes.

Since the revision of the 2013 Coordinator's Manual, FEMA released the 2017 CRS Coordinator's Manual, which continued the evolution of the CRS program and its mission to reward communities that prioritize mindful floodplain regulations. As with the 2013 manual, the changes made in the 2017 manual impact each CRS community differently. Some communities see an increase in the points they receive since points for certain activities have increased (e.g., Activity 420 Open Space Preservation). Other communities receive fewer points for specific activities (e.g., Activity 320 Map Information Service). It is likely that some communities with marginal CRS Class 9 programs have to identify new CRS credits in order to remain in the CRS class. Most notably, as it relates to this hazard mitigation plan, more credit was made available for Activity 410 Floodplain Mapping.

Typically, CRS communities do not request credit for all the activities they are currently implementing unless it would earn enough credit to advance the community to a higher CRS Class. A community that finds itself losing CRS credit with the 2017 manual could likely identify activities deserving credit they had not previously received. Due to the changes in both activities and CRS points, community CRS coordinators should speak with their ISO/CRS Specialist to understand how the 2017 manual will impact their community and when.

3.7.1 Inventory of Assets for the Entire Parish

As part of the Risk Assessment, the planning team identified essential facilities throughout the parish. This is done to quantify potential damage to structures and to qualify potential disruption to critical lifelines. For more information on how FEMA defines critical lifelines, please see the footnote below.[lii]

The table below provides the total estimated value for each type of structure by occupancy.

Table 56: Estimated Total of Potential Losses throughout Orleans Parish

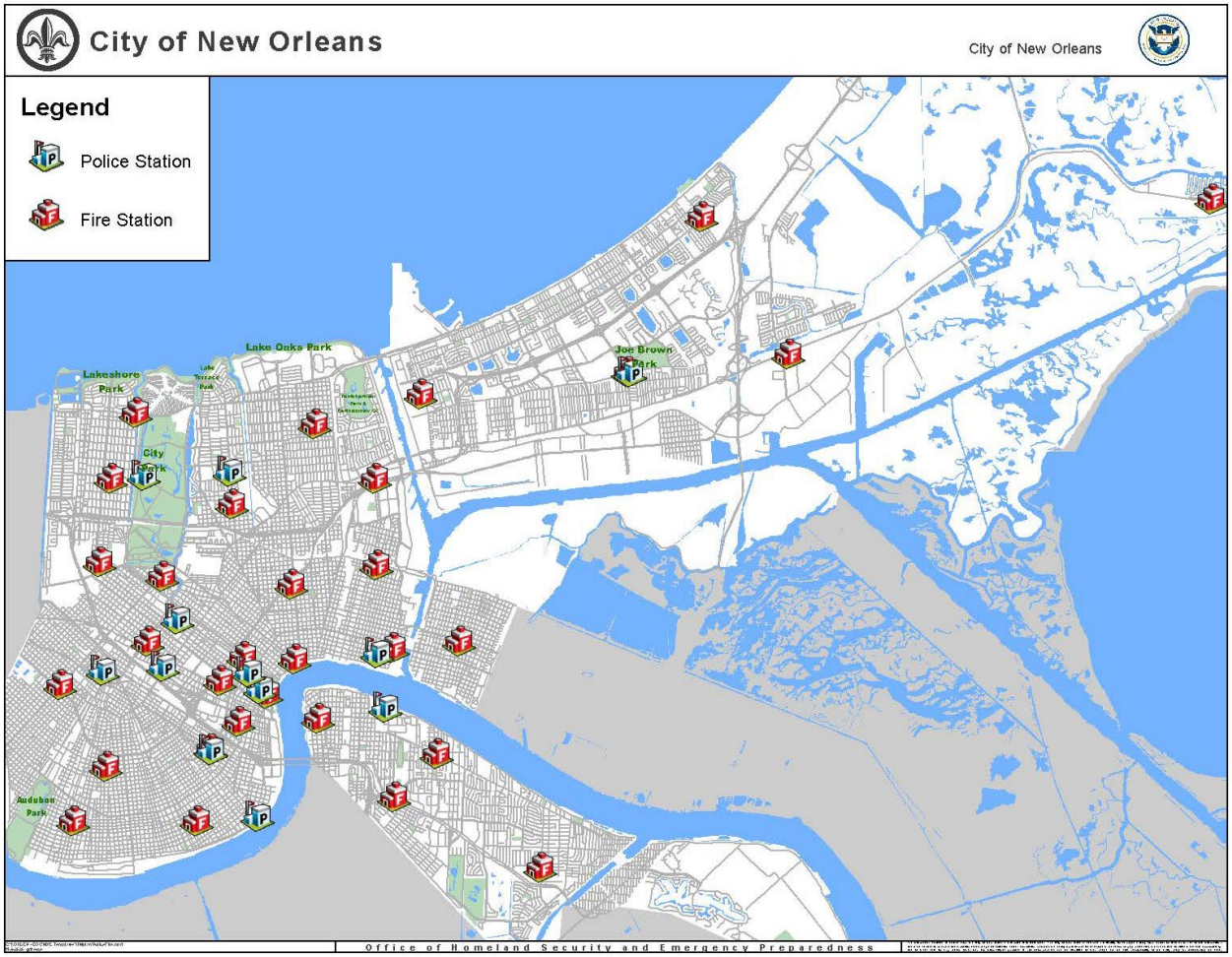
Occupancy	City of New Orleans	Sewerage and Water Board of New Orleans	New Orleans Redevelopment Authority
Agricultural	$40,971,000		
Commercial	$7,422,191,000		
Government	$560,202,000	$2,406,400,000	$1,329,967
Industrial	$1,088,619,000		
Religion	$1,246,887,000		
Residential	$33,606,098,000		
Education	$1,123,532,000		
Total	$45,088,500,000		

Source: HAZUS

Essential Facilities of the Parish

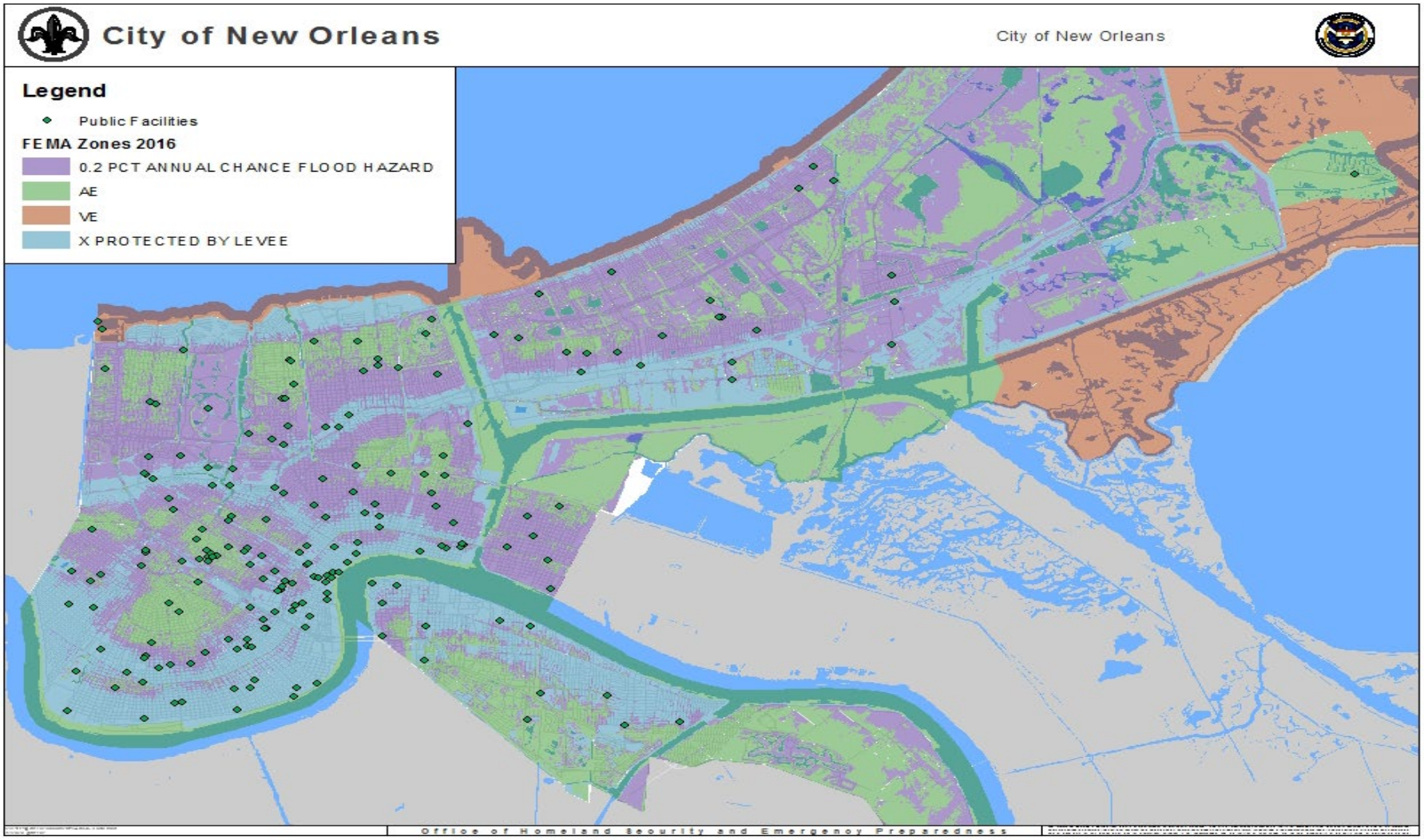
A full list of critical facilities is included in Appendix C.

Figure 55: Fire and Rescue & Law Enforcement and Correction Facilities in Orleans Parish



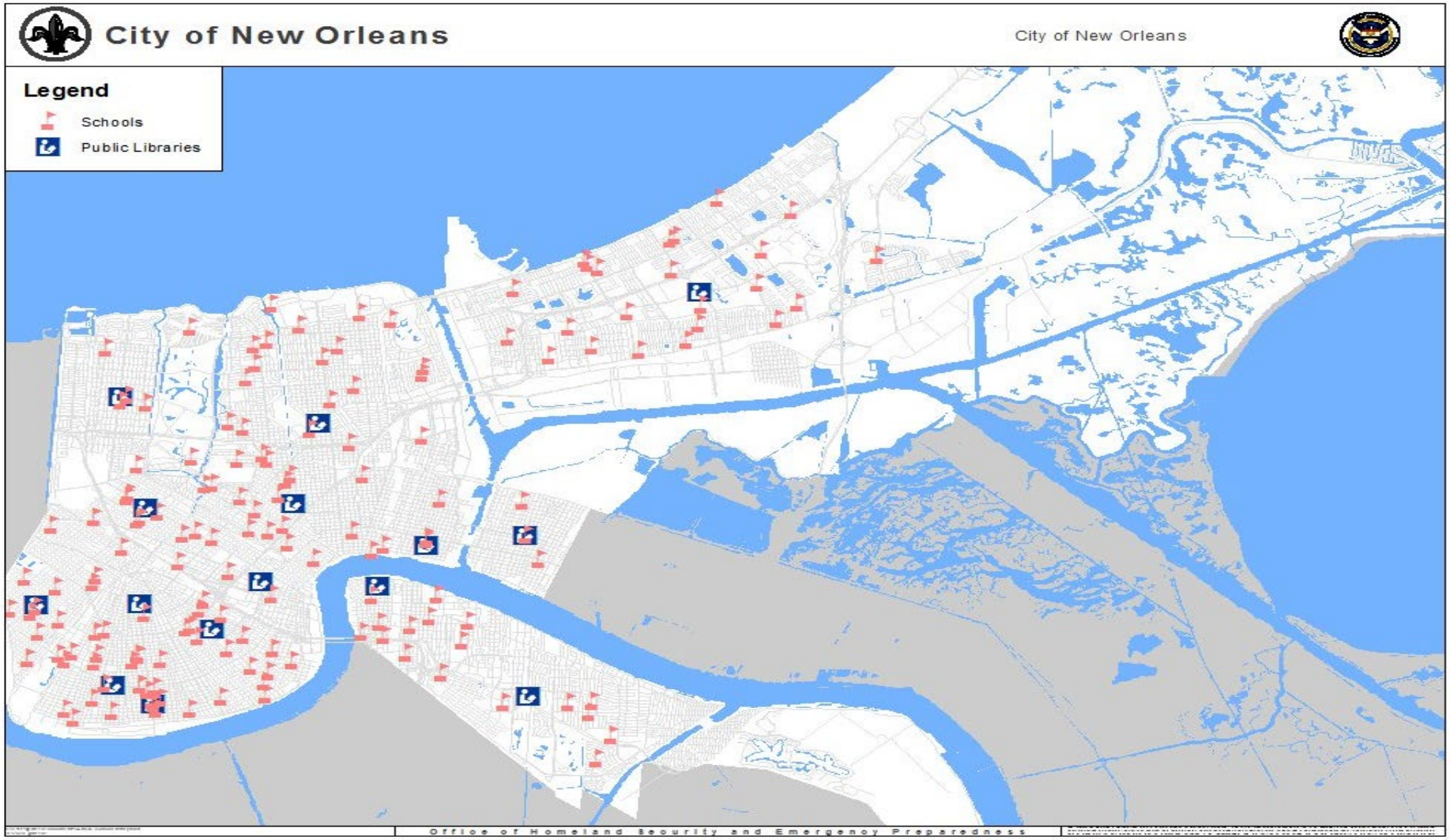
Source: City of New Orleans

Figure 56: Government Facilities in Orleans Parish



Source: City of New Orleans

Figure 57: Educational Facilities in Orleans Parish



Source: City of New Orleans

3.8 New Orleans Floodplain Management Regulations and Enforcement

3.8.1 Introduction

New Orleans' floodplain management is the operation of a community program of corrective and preventative measures for reducing flood damage. These measures take various forms and generally include requirements for zoning, subdivision or building, and special-purpose floodplain ordinances.

The recent City of New Orleans Capability Assessment canvassed relevant City of New Orleans jurisdictions (offices, departments, and commissions) on two questions.

- Are the City's floodplain management measures effective in reducing flood hazard impacts; and
- Are the City's floodplain management measures adequately administered and enforced?
- New Orleans' floodplain management regulations and enforcement are embodied in two divisions:
- Building Codes, Permitting, and Inspections; and
- Land use planning and ordinances.

3.8.2 Building Codes, Permitting, and Inspections

At the time the 2015 HMP was adopted, construction in the City of New Orleans was regulated in accordance with the 2012 edition of the International Building Code (IBC), International Residential Code (IRC), International Mechanical Code (IMC), and International Fuel Gas Code; and electrical work was governed by the 2011 National Electrical Code (NEC). Effective February 1, 2018, the city of New Orleans adopted the following updated building codes: IBC 2015, IRC 2015, IMC 2015, and NEC 2014. The 2015 edition of the International Codes (I-Codes) contains provisions that meet or exceed the minimum flood-resistant design and construction requirements of the National Flood Insurance Program (NFIP) for buildings and structures.

The consensus of the Capability Assessment respondents is that the current New Orleans Building Codes are effective in reducing flood hazard impacts; and that the current New Orleans Building Codes are adequately administered and enforced.

The New Orleans Building Code also has a substantial damage provision that requires properties to be brought up to code and impacts vulnerability to a number of hazards. It also can trigger making ICC funds available for flood mitigation.

The consensus of the Capability Assessment respondents is that site plan review requirements under the current New Orleans Building Codes are effective in reducing flood hazard impacts; and that the current site plan review requirements are adequately administered and enforced.

3.8.3 Building Code Effectiveness Grading Schedule

Data is unavailable as to New Orleans' participation in the Building Code Effectiveness Grading Schedule (BCEGS). BCEGS (performed by Insurance Services Office, ISO) assesses the building codes in effect in a community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. ISO is an organization that collects statistical data, promulgates rating information, develops standard policy forms, and files information with state regulators on behalf of insurance companies that purchase its services. The participant communities receive a rating grade. The BCEGS score for a community can have implications for its Community Rating System score.

The consensus of Capability Assessment respondents is that the BCEGS is not effective in reducing flood hazard impacts in New Orleans, suggesting that the City does not participate, or there are technical or other issues with its participation or grade.

3.9 Land Use Planning and Ordinances

CNO Land-use ordinances fall under four general headings:

- the Comprehensive Zoning Ordinance;
- the Subdivision Ordinance;
- the Floodplain Ordinance; and
- Naturel Hazard -Specific Ordinances, of which the Stormwater Ordinance is the most relevant to floodplain management.

3.9.1 The Comprehensive Zoning Ordinance (CZO)

In 2015, the New Orleans City Council adopted a new Comprehensive Zoning Ordinance (CZO). The full CZO is intended to give legal force to the New Orleans Master Plan, which was adopted in 2010. Article 23 of the CZO, Landscape Stormwater Management and Screening, sought to reduce urban runoff and mitigate the effect of new development, redevelopment, or infill development on the existing drainage system. The Article required a landscape and stormwater management plan for most new development (excluding some residential property) and submission of the plan prior to receiving a permit. Article 23 included several elements that required or strongly encouraged the preservation of permeable surfaces and green infrastructure practices to manage stormwater. Article 23 also required Best Management Practices (BMPs) to minimize runoff, increase infiltration, recharge groundwater, and improve water quality. In March of 2018, The City of New Orleans officially replaced Article 23 of the Comprehensive Zoning Ordinance (CZO) with a new unified Stormwater Code located within Chapter 1, Section 121 of the Building Code (discussed below). The new code contains requirements to protect the City's drainage system during construction, as well as post-construction stormwater management requirements for some projects.

Article 7 of the CZO addresses the protection and preservation of existing natural areas, such as wetlands, to provide stormwater protection and reduce flooding risk.

The consensus of the Capability Assessment respondents is that the provisions of the CZO are effective in reducing flood hazard impacts; and that the CZO is adequately administered and enforced.

3.9.2 Subdivision Ordinance

The City Council adopted the current CNO Subdivision Regulations (Subdivision Ordinance) in May 1999. The regulations contain various provisions to minimize or eliminate flood to subdivision development and to regulate construction to above minimum base flood elevation (BFE) as indicated on the current FEMA Flood Insurance Rate Map (FIRM) for the subdivision.

The consensus of the Capability Assessment respondents is that the provisions of the Subdivision Ordinance are effective in reducing flood hazard impacts; and that the CZO is adequately administered and enforced. However, the City of New Orleans Planning Commission and City of New Orleans Project Delivery Unit are currently (June 2020) revising the 1999 Subdivision Ordinance.

3.9.3 Floodplain Ordinance

The City Council adopted the current CNO Floodplain Ordinance in May 2016, effective 1 June 2016. The ordinance established regulations and requirements for flood damage protection in compliance with the National Flood Insurance Program (NFIP) and the 2016 FIRM. All development in the city, whether constructing a new building, repairing a building substantially damaged by any cause, or substantially improving a building, is required to meet flood protection requirements under the ordinance. In order to provide a higher standard of property protection, all new construction and substantial improvements are required to build to either 3 ft above the highest adjacent curb or at 1ft above the FIRM-provided Base Flood Elevation, whichever is higher. This standard is similar to the ABFE regulations that had been in place for the previous 10 years. Special regulations also apply in Coastal Flood Hazard areas.

- Flood Insurance Rate Maps. As required for participation in the NFIP, the 2016 CNO Floodplain Ordinance adopted the FEMA FIRM dated 16 September 2016, subject to FEMA amendments. Some areas of the City formerly considered SFHAs were reclassified as non-SFHA zones in the 2016 FIRM, allowing properties in those areas reduced flood insurance premiums or to forego flood insurance altogether. In fact, the City has seen a decline in the number of properties carrying flood insurance since the adoption of the 2016 FIRM (although not a decline in the value of insurance in force). Some critics have considered this correlation of reduced numbers of properties carrying flood insurance with flood zone-reclassification to be less than optimal in terms of the City's preparedness for flood hazards.

The consensus of the Capability Assessment respondents is that the provisions of the Floodplain Ordinance are effective in reducing flood hazard impacts; and that the CZO is adequately administered and enforced.

3.9.4 Stormwater Ordinance [Stormwater Code]

In March of 2018, CNO officially replaced Article 23 of the Comprehensive Zoning Ordinance (CZO) with a new unified Stormwater Code located within Chapter 1, Section 121 of the Building Code. The 2018 stormwater ordinance seeks to reduce urban runoff and mitigate the effect of new development and contains requirements to protect the City's drainage system during construction, as well as post-construction stormwater management requirements for some projects. The current Stormwater code requires that all contractors working within the City of New Orleans must provide erosion and sediment control on sites where the ground is disturbed; and provide catch basin protection for any adjacent facilities. Further requirements apply to other onsite protections. These requirements apply to any new development or redevelopment, aside from residential properties with less than six (6) dwelling units, that has 5,000 square feet or more of impervious surface, or a total site area of one acre or more. The ordinance requires that the plan retain (or detain) and filter the first 1.25 inch of stormwater runoff during each rain event and limit the post-development runoff rate.

Most of the Capability Assessment respondents concur that the provisions of the Stormwater Code are effective in reducing flood hazard impacts; and that the CZO is adequately administered and enforced. However, one respondent felt that regulation on development impacts on existing City infrastructure needs to be strengthened still further. In addition, the dissenting respondent recommends the development of a more direct linkage between development and drainage system improvements, including the creation of a drainage impact fee (or stormwater user fee) that would directly fund drainage infrastructure improvement. Such fees have been proposed before but are have not been enacted as policy.

3.9.5 Acquisition of Land for Open Space and Public Recreation Uses

The Plan for the 21st Century, commonly referred to as the Master Plan, is CNO's planning framework. The Master Plan was adopted in 2010, and the City engaged in a Plan amendment process from 2016 to 2018. In the Plan, acquisition of land for open space and public recreation uses is a recommended strategy for the goals of wetland preservation, maintenance of total parkland area, and increasing the area for parks and public recreation. To implement these strategies, the Master Plan recommends partnering with conservation organizations, earmarking proceeds from the sale of public land to park acquisition, and creation of a parks trust fund within the City's Capital Projects Fund. A Parks trust fund could receive a percentage of funds set-aside from major park construction projects for maintenance, sale of any decommissioned parks, developer funds resulting from Community Benefits Agreements, or other donations for the park system. CNO has notable successes in obtaining areas for public use, such as the Lafitte Greenway

and the Mirabeau Water Garden, both of which provide neighborhood resilience features and public recreational opportunities.

However, a majority of the Capability Assessment respondents do not find CNO's efforts to acquire land for open space and public recreation effective in reducing flood hazard impacts. Data is lacking whether the cause of this ineffectiveness is lack of available funding for acquisition, the insufficient scale of land acquisitions for effective impact, lack of political or institutional commitment to acquisition and resilient development, or many other possible factors. One Capability Assessment respondent raised concern for equity of benefits from the acquisition of land for open space and public recreation. Benefits of specific open spaces for public use are inherently not spread across the whole city; some neighborhoods already enjoy greater resilience advantages and access to recreation than do others. Additional public involvement and stakeholder coordination in consideration of the issue of land acquisition for open space and public recreation uses is recommended.

3.10 Summary Conclusion

The offices, departments, and commissions responding to the floodplain management regulations and enforcement survey contained in the City of New Orleans Capabilities Assessment addressed two questions:

- Are the City's floodplain management measures effective in reducing flood hazard impacts; and
- Are the City's floodplain management measures adequately administered and enforced?

The general consensus of the Capability Assessment respondents is that in most (but not all) aspects, the provisions of the Floodplain Ordinance are effective in reducing flood hazard impacts; and that floodplain management regulations are adequately administered and enforced.

Respondents identified several salient areas where the regulations and enforcement might be significantly improved. One was in the structure of the stormwater ordinance, which a respondent felt could be made even more stringent to further reduce impacts of development upon drainage infrastructure, and a recognition that the politically sensitive issue of a drainage impact fee (or stormwater user fee) that would directly fund drainage infrastructure improvement should remain a proposal for consideration. Another finding was a consensus that Acquisition of Land for Open Space and Public Recreation Uses is not effective in reducing flood hazard impacts, although this can be interpreted as not due to technical problems with resilience features so much as to a political process that has not prioritized land acquisition or operated with appropriate sensitivity to equity issues. This last consideration may be addressed by increased public involvement in the planning process.

There was also consensus among Capability Assessment respondents that at present, the Building Code Effectiveness Grading Schedule (BECGS) is not effective in reducing flood hazard impacts in New Orleans. The Capability Assessment states the CNO Department of Safety and Permits is currently working on BCEGS participation for the City.

4.0 Mitigation Strategy

4.1 Introduction

The Mitigation Strategy for the Orleans Parish Multi-Jurisdictional Hazard Mitigation is a long-term plan to reduce potential losses identified in the risk assessment. It includes goals to guide the selection of actions to mitigate and reduce potential losses. The mitigation strategy contains a prioritized list of actions believed to be cost-effective, environmentally sound, and technically feasible. It identifies current and potential funding sources and other resources needed to implement the mitigation actions and integrates the mitigation plan within the City's comprehensive Emergency Preparedness program. Components of the Mitigation Strategy include:

- Goals
- Mitigation Action Plan
- Prioritized Mitigation Actions
- Implementation Strategy

This Mitigation Strategy was developed following a review of the capabilities of the Parish, including its authorities, policies, programs, resources, and ability to use these tools to reduce losses and vulnerabilities from profiled hazards. The mitigation actions are specific projects, policies, and programs that can help to achieve the community's disaster risk reduction goals. A comprehensive range of mitigation actions is included in the updated 2020 Plan that will allow the Parish to reduce losses and vulnerabilities in a variety of ways. For example, the mitigation strategy includes specific capital improvement projects, as well as regulatory changes, public education efforts, and coordination with other entities to improve hazard mitigation planning intended to reduce losses and vulnerabilities. The mitigation strategy includes actions that can be implemented easily with current resources along with others that will require medium to long-range planning and significant local resources.

4.2 Interim Final Rule (IFR) Requirements for Mitigation Strategy

IFR §201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

IFR §201.6(c)(3)(i):[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

IFR §201.6(c)(3)(ii):[The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. [The mitigation strategy] must also address the jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate.

4.3 Goals

The goals identified in the 2020 Orleans Parish Hazard Mitigation Plan update are intended to provide aspirational guidelines for risk reduction efforts in New Orleans over the next five years and beyond. During the planning process, the goals set forth in the 2015 New Orleans Hazard Mitigation Plan were evaluated by the Steering Committee, and the Committee determined that the goals identified in the 2015 Plan are still applicable, and thus will continue to provide guidance for long-term hazard mitigation initiatives in Orleans Parish in this Plan update. These goals are as follows:

1. Reduce risk and vulnerability to the human environment, including cultural resources, homeowners, renters, visitors, and transient populations.
2. Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.
3. Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.
4. Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.
5. To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.
6. To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.

The 2020 Mitigation Plan goals were used to develop the Hazard Mitigation Strategy, as each action in the strategy is supportive of one of these six goals.

4.4 2020 Mitigation Actions and Update on Previous Actions

The Steering Committee reviewed the 2015 Mitigation Strategy and recent annual reports to identify actions that had not been started or were ongoing and still relevant, to be carried forward in the 2020 Plan. The committee developed updates to the action descriptions, lead and supporting agencies, and implementation status for these actions. This process resulted in 35 actions carried over with or without modification from the 2015 Hazard Mitigation Plan.

In order to identify and refine new Mitigation Actions for inclusion in the 2020 Plan, the Planning Team held two rounds of Working Group meetings intended to build out a Mitigation Strategy. Each of the two rounds of Working Group meetings had three meetings focused on different but interrelated topic areas; water management, climate change, and City Hall. Stakeholders representing City and regional agencies, non-profit and community-based organizations, and other local partners were invited to one or more of these meetings based on their area of expertise, incorporating local ecological knowledge and stakeholder input into the Mitigation Action development process.

The first round of Working Group meetings was aimed at developing a new set of Mitigation Actions for the 2020 Hazard Mitigation Strategy. Meeting attendees were asked to brainstorm possible mitigation projects for Orleans Parish, ranging from the lot- and neighborhood-scale interventions to city-wide, regional, or state-level policies. As a follow-up to these meetings, participants were asked to send the City any additional ideas that arose for the new 2020 Mitigation Actions in the week following the meeting. This round of Working Group meetings helped the project team to develop a robust set of Mitigation Actions, which were then shared with the Working Groups in the second round of meetings for additional feedback. For each of the Actions suggested by Working Group members, the Planning Team identified:

- FEMA Mitigation Action category: **In order to facilitate a** systematic review of a wide range of activities to ensure that all possible measures are explored, actions were classified into six categories of mitigation actions described by FEMA. Once the initial list of new and carried over actions was developed, the committee reviewed the six categories and considered additional potential actions within each category.
- The goal met by the Action: Each action in the Plan should address at least one of the risk reduction goals.
- Action description: high-level summary of the action to be taken
- Relevant hazard(s): some actions can address multiple hazards
- Lead and support agencies: Multiple stakeholders may be involved in implementing an action.
- Preliminary costs: if known, what funding may be required
- Funding sources: existing or likely funding to support each action
- Emergency Support Function (ESF): ESFs are a system that groups resources and capabilities into functional areas most frequently needed in emergency response. Organizing the mitigation strategy by ESF helps to integrate the strategy with the City's EOP and the National Response Framework developed by FEMA.
- Timeframe for implementation: general timeline
- Priority ranking (low, medium, high): see the Planning Process section for discussion of how the committee assigned priority rankings to each action.

After the details of the Mitigation Actions were filled in by the Planning Team, another round of Working Group meetings were held. At each of the three topic area meetings, Working Group participants helped to refine the provided Mitigation Actions, including adding agencies and organizations to Actions in lead or support roles for implementation and clarifying Action descriptions. The follow-up to the second round of Working Group meetings included sending the full list of 2020 Mitigation Actions, as well as Actions carried over from 2015 to all Working Group participants and asking for written feedback. Feedback gathered in the second round of meetings and written feedback provided by Working Group members later were then incorporated into the revised Mitigation Strategy. The resulting Mitigation Strategy included:

- 102 Total Actions
- 71 New Actions
- 31 Carried-over Actions

4.5 Summary of the Mitigation Strategy

The 102 recommended actions in this plan include a range of approaches to reducing the impacts of future disasters. While developing this plan, the Steering Committee considered actions that fall within each of six categories of mitigation actions as described by FEMA: Prevention, Property Protection, Structural Projects, Natural Resource Protection, Emergency Service Measures, and Public Education.

4.5.1 Prevention

Preventive activities reduce the potential of hazards to cause damage. The use and development of hazardous areas are limited by planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices. Examples of prevention actions include hazard mapping and data collection and management, open space preservation, planning and zoning, building codes, and stormwater management. 46 of the 102 action items are prevention activities.

Several action items focus on data gathering and management, including hazard mapping and modeling. Comprehensive data are essential for monitoring the level of hazard exposure/risk, learning effective mitigation strategies, and tracking progress. Data collection and management actions include:

- Create a digital database of City infrastructure plans, surveys, and other spatial data to inform project design, stormwater modeling, and other uses.
- Maintain a comprehensive GIS database including data on properties, hazard areas, service districts, public works facilities, transportation infrastructure, and vulnerable populations.
- Maintain a database of all properties that sustain damage as a result of a hazard, including critical facilities.
- Create a citywide data platform of all green infrastructure projects.
- Conduct an Urban Heat Island Study that addresses extreme heat threats on a neighborhood-by-neighborhood level.
- Define standard metrics to measure resilience progress.

These action items call for the use of data, databases, and data management to improve stormwater management, comprehensively record damages from hazards, track green infrastructure projects, inform the city staff on areas that face extreme heat threats, and help better measure and track resilience projects. Through the implementation of these action items, the city can make more informed decisions and track the process.

A variety of planning documents were suggested as action items and require the input not only of the department of planning but several other city departments. Action items call for the drafting and/or implementation of planning documents, including a Parks Master Plan, Comprehensive Reforestation Plan, Pre-Disaster Recovery Plan, the Urban Water Plan, and Climate Action Plan. Some action items call for more regional planning and coordination on watershed management and transportation, especially for evacuation purposes.

Some preventive action items fall under the subcategory of building codes and regulations. Identified action items aim to enforce existing codes and policies and programs to encourage builders to go beyond minimum code requirements. Other action items propose the exploration of codes and policies that will better protect the tree canopy. New Orleans' building codes were updated relatively recently and are consistent with current national standards. For that reason, the mitigation strategy does not include revision of the current building code but focuses instead on implementation of the existing standards. One action item calls for the self-assessment using the Building Code Effectiveness Grading Schedule.

Many prevention action items fall under the subcategory of stormwater management and drainage system maintenance. This includes improving stormwater retention capacity and/or drainage in specific locations around the city. Another stormwater management action item suggests the implementation of a stormwater fee to fund stormwater mitigation projects across the city.

In total, 46 preventative action items were suggested by working groups and the public. Through the process of review, preventative actions that involved developing or implementing plans, improving drainage, and hardening of critical facilities were assigned high priority. Medium-priority items involved the improvement of data management and project tracking. Several suggestions included the exploration of ways to improve codes, ordinances, and policies. These were generally given low-priority status.

Action items that were similar were consolidated. Some items were revised so that they were more actionable. For example, action no. 33 stated, "refocus from coastal habitat to coastal communities." This suggestion was revised to "Study, explore, and identify actions that benefit not only coastal habitats but also preserve and protect coastal communities."

4.5.2 Property Protection

Property protection measures are used to modify structures that are subject to damage. This can be approached in three ways: Modify the structure to prevent the hazard from reaching the building; Modify the structure so it can withstand the impacts of a hazard, and insure the property to provide financial relief after damage occurs. Property protection measures are generally implemented by the property owner, though sometimes technical and financial assistance can be provided by the local, regional, or federal government. Property protection includes measures such as Relocation, Acquisition, Building elevation, Retrofitting, and Insurance.

Building elevation refers to efforts to elevate homes that are at risk of flooding. The plan calls to continue programs to mitigate at-risk structures by physically elevating buildings to or above the Base Flood Elevation. Another action item suggests improving local elevation efforts by creating a digital system for cataloging, managing, and organizing Elevation Certificates acquired through local jurisdictions.

One suggested action item carried over from the 2015 HMP calls for the City to develop an acquisition program wherein property owners could elect to move out of the high-risk area to a lower risk area. The community has historically favored other approaches to property protection,

but the committee felt that this should continue to be explored, as changing conditions may make this more favorable in the future.

The 2020 strategy continues to prioritize retrofitting all existing public facilities and designing future public facilities to be more wind and flood-resistant. Avoiding damages to public facilities will help to maintain continuity of essential services and shorten post-disaster recovery timelines.

Other items address the importance of insurance availability and affordability as a means of reducing disaster vulnerability. An example of this is the City's continuing compliance with the NFIP and coordinating efforts across departments to maximize the city's Community Rating System (CRS) score in order to reduce the cost of flood insurance. Another action item suggests creating a state-level insurance credit to incentivize the installation of roofs adhering to fortified building methods, which are designed to strengthen residential and commercial buildings against high winds and hurricanes.

Of the 14 action items that fell under the category of property protection, only one item was eliminated, "Create a digital system for cataloging, managing, and organizing Elevation Certificates acquired through local jurisdictions. Streamline the process for acquiring elevation permits in Orleans Parish." This item was removed because it was redundant and was consolidated with action no. 2020.5.1, "Create and maintain databases to aid in floodplain management."

4.5.3 Structural Project Protection

These projects involve the construction of manmade structures to control hazards. Structural projects can include dams, reservoirs, levees, seawalls, storm sewers, and elevated roadways. While structural projects are commonly used to mitigate stormwater, they can also mitigate other hazards. They are usually designed by engineers and managed or maintained by public works departments.

The action items suggested are mainly focused on enhancing draining in New Orleans through improvement to drainage infrastructure and implementation of green infrastructure projects. Actions to mitigate heat were also suggested, for example providing cooling stations during extreme heat events. Supporting and promoting voluntary home-mitigation efforts was also suggested as a structural protection action item.

Some items that fell under the category of structural project protection were redundant and thus consolidated. For example, action no. 2020.5.26, "Continue implementing projects from the Urban Water Plan," was consolidated with an action to, "Support a cohesive approach to drainage improvements and other flood mitigation via GNO Urban Water Plan Part 2". This Action is categorized under "prevention."

4.5.4 Natural Resource Protection

Natural resource protection is intended to reduce the intensity of hazard effects as well as improve the quality of the environment and wildlife habitats. Examples of natural resource protection actions include erosion control, natural area restoration, water quality improvement, coastal barrier protection, and the creation of environmental corridors.

Eleven actions, specifically addressing natural resource protection, were suggested. Advocating for funding for various coastal restoration projects was the most common activity suggested. Other suggested actions include the development of nature trails and parks, a methane capture feasibility study, expansion of the city's tree canopy, maintenance of a former landfill, and coordination with regional wetland and watershed management. All suggested actions that fall under the category of natural resource protection were chosen to be included in the action plan, and none were excluded or consolidated.

Natural resource protection provides benefits to the community by providing stormwater retention and alleviates flooding, coastal erosion, and subsidence. The protection of natural resources in the New Orleans area not only helps mitigate hazards but also improves urban greenery and quality of life for residents.

4.5.5 Emergency Service Measures

Emergency services measures are taken during an emergency to minimize its impact. These measures can include creating systems of hazard threat recognition and hazard warning, strengthening hazard response operations, protecting critical facilities, maintaining systems and structures of health and safety, and other mitigation activities. These measures are usually the responsibility of local emergency management staff and the owners or operators of major or critical facilities.

Suggested actions focus mainly on the maintenance of critical facilities, especially facilities that are used during flooding. These actions include upgrading and improving S&WB drainage systems. All suggested actions have been accepted.

4.5.6 Public Education and Awareness

Public information activities advise property owners, potential property owners, and visitors about the hazards and ways to protect people and property from the hazards. Activities and actions could include outreach, providing map information, real estate disclosure, technical assistance, environmental education, or providing topical resources.

Proposed actions include educating the public about green infrastructure, providing employee training on resilience, targeted education, and outreach to realtors, teachers, and city staff. Maintaining and promoting the use of decision-support tools, promoting hazard-resistant building methods.

No suggested action items that fall under the category of public education and awareness were eliminated. Some items were consolidated.

Public information activities enable residents and the city to increase overall hazard preparedness. Hazard mitigation activities identified by working groups and public feedback were focused on the targeted training and education of relevant stakeholders and the use and improvement of decision-making tools.

4.5.7 Analysis of Trends

Major trends run through the 102 suggested action items. These trends include supporting green infrastructure, protecting and expanding tree canopy, improving workforce opportunities, and resilient buildings.

4.5.8 Using Green Infrastructure

The Environmental Protection Agency defines green infrastructure as "a cost-effective, resilient approach to managing wet weather impacts that provide many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits." Green infrastructure can come in the form of rain gardens, bioswales, urban tree canopy, land conservation, rainwater harvesting, and green roofs, parking lots, streets, and alleys. Primary benefits of green infrastructure are an increased capacity of the cityscape to absorb and/or drain floodwater, providing shade during extreme heat, and reducing the urban heat island effect. In some instances, green infrastructure can also reduce long-term energy and maintenance costs, provide recreational spaces, and improve aesthetic values.

At least six suggested actions directly call for the use of green infrastructure to help mitigate hazards, including the following:

- Create a citywide data platform of all green infrastructure projects.
- Complete a study on the economic impacts of green infrastructure and then implement the recommendations of the study.
- Include green infrastructure design into efforts to improve drainage infrastructure.

4.5.9 Expanding the City's Tree Canopy

Several proposed initiatives involve the protection and expansion of the tree canopy as a measure to address stormwater management, extreme heat. The city's trees are a valuable resource and make the city greener. At least seven suggested action items directly address the preservation and expansion of tree canopy, and six of these suggested actions are new, while one has been carried over from the 2015 HMP. The protection and expansion of the tree canopy would require effort from several city departments and non-governmental organizations, including the City Planning Commission (CPC), New Orleans Parks and Parkways, New Orleans Office of Homeland Security and Emergency Preparedness (NOHSEP), Department of Public Works, Department of Safety and

Permits, Sustaining Our Urban Landscape (SOUL), Nola Tree Project, Coalition for Community Connection, Coalition for Coastal Louisiana, and Earth Economics.

The suggested activities fall under a variety of mitigation categories, including prevention, natural resource protection, and public education and awareness. Some actions involve making codes and ordinances that protect trees and make it easier to plant trees in the city. Preventative actions include developing a Comprehensive Reforestation Plan to find and address gaps in the existing tree canopy and researching options for an ordinance that would stipulate that new construction should include native tree planting and should protect existing trees on private property. Outreach and education activities involve the development of a public outreach and education plan to involve residents, businesses, and public officials to promote an equitable and healthy tree canopy. Each of these actions requires the input of different city and non-governmental stakeholders, and the combination of these efforts can help preserve, protect, and expand the New Orleans tree canopy, which in turn cools and greens the city and allows more space for pervious surfaces, which alleviate flooding and subsidence.

4.5.10 Economic Resilience

Many suggested action items called to create working opportunities and training and professional development for the local workforce. As the city secures mitigation funding and implements risk-reduction projects, these resources should increase workforce opportunities. Local resilience and mitigation efforts can be leveraged not only to improve the city's resilience but also to train the local workforce in green jobs in the fields of sustainable construction, green infrastructure, energy and carbon capture and storage, and water quality. At least eleven suggested action items call for the creation of work opportunities, training, and capacity building.

4.5.11 Resilient Buildings

A number of actions in this plan address hazard-resilient buildings and infrastructure through building codes, structural retrofits, and incentive programs. Building codes were recently updated and consistent with national standards, so this strategy does not include actions to revise or strengthen current codes. Having strong building codes is only half the battle; the city must also work to enforce those building codes and even encourage the local construction industry to go beyond minimum requirements. Supporting this effort requires the training and capacity building of city employees and private sector construction practitioners. Action items that directly address this effort include requiring mandatory training in floodplain regulations for all building officials and continuing to educate target audiences on hazard-resistant building methods. In addition to enabling the local public and private construction industry, the city can strengthen its ability to enforce building codes. One action item calls to complete an assessment of the Building Code Effectiveness Grading Schedule, to improve the ability of relevant departments to enforce building codes. Another action item calls for the city to explore incentive programs and financing options for homeowners and builders to build more sustainably and resiliently. A third action item requests higher energy efficiency standards for new developments and using rebates and building codes to encourage these standards to be met.

4.6 National Flood Insurance Program (NFIP) Compliance

FEMA incorporated mitigation planning requirements for the Flood Mitigation Assistance (FMA) program on October 31, 2007, with published amendments to the 44 CFR Part 201. These amendments created a new requirement that all Local Mitigation Plans must address the jurisdiction's participation in the National Flood Insurance Program (NFIP). Orleans Parish participates in the National Flood Insurance Program as indicated below:

Adoption and enforcement of the floodplain management requirements. New Orleans adopted the Floodplain Management Ordinance as part of the City Zoning Ordinance in 2016 to meet and exceed the NFIP minimum standards. The new ordinance includes regulating all new and substantially improved construction in Special Flood Hazard Areas.

Floodplain identification and mapping. The City of New Orleans adopted the new digital Flood Insurance Rate Maps (DFIRMs) in 2016.

City's participation in the NFIP's Community Rating System (CRS). The City also participates in the NFIP's Community Rating System. This program rewards participating communities that go beyond the minimum standard requirements of the NFIP. New Orleans is currently rated as a Class 8 community, which gives policyholders in the Parish a 10% discount on flood insurance premiums. Class 10 is the lowest (no discount), and 1 is the highest, with a 5% discount added at each level. The Department of Safety and Permits administers and enforces the NFIP and coordinates participation in the CRS.

As part of the planning process to update the Orleans Parish Hazard Mitigation Plan, the Hazard Mitigation Planning Team identified, analyzed, and prioritized actions related to continued compliance with the NFIP and participation in the CRS. The updated Orleans Parish 2020 Hazard Mitigation Plan includes the following mitigation actions that will improve the Parish's participation in the NFIP and CRS:

1. Address equity issues within the floodplain management program: provide support for local match requirement.
2. Realtor education on flood risk and a city/state policy on real estate disclosures about flood risk.
3. Scale-up lot-scale green infrastructure, stormwater management, etc. through trainings, funding.
4. Increase water literacy curriculum development, teacher training, the goal of all students receiving 1 hour/year of qualified instruction.
5. Create and Maintain Databases to aid in Flood Plain Management.
6. Explore incorporating repetitive damage provision in the City's floodplain ordinance.
7. Develop in-house custom HAZUS model for risk assessment and decision support.

8. HSDDRS authorized level of protection, MP goal of 500-year protection: assign City team. This is a Congressional Authorization of the levee system that could include a higher level of protection than the ACE have approved.
9. Conduct a study to evaluate the potential impacts of a catastrophic rain event.
10. Coordinate with USACE on recertification on HSDRRS at the 100-year level of protection.
11. Complete study on the economic impact of Green Infrastructure investments and implement policy recommendations.
12. Create a digital database of City infrastructure plans, surveys, and other spatial data to inform project design, stormwater modeling, and other uses.
13. Establish Neighborhood Resilience Hubs Provide to provide hazard mitigation information and resources.

4.7 Actions Prioritization

After developing and refining the 2020 Mitigation Actions from the two rounds of Working Group meetings, the Planning Team created a revised version of the Mitigation Strategy. In order to prioritize the updated Mitigation Actions, the Planning Team asked Steering Committee members to review the full list of Actions and rank each Action as either a low, medium or high priority. Steering Committee members were also encouraged to provide feedback on each Action based on the seven STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria. The average ranking and comments based on STAPLEE criteria for each Action were then used to complete the finalized Mitigation Strategy.

4.8 Implementation Strategy

The Mitigation Actions identified in this Plan will be implemented in a variety of ways and will be overseen by the Hazard Mitigation Office in the New Orleans Office of Homeland Security and Emergency Preparedness (NOHSEP). Some Actions will be implemented through ongoing organization and routine assignments of City staff, while others will be implemented through strengthening City policies, programs, building codes, and other planning tools. Many actions will require coordination between the several agencies identified as playing lead and supporting roles, including city agencies, signatories to this multi-jurisdictional plan, and other partners in the community.

Implementation of the Mitigation Strategy will require a combination of local, federal, and state funds. Many actions may be funded through federal and state programs and will require these external funds before they can be implemented. The information developed for each action includes the necessary detail to begin implementing the action, including:

- Lead agency/support agencies to implement the action
- Preliminary cost estimates (including ongoing maintenance costs)
- Funding sources
- The time frame for implementing action

Before implementing any project, the Hazard Mitigation Office will work with the lead agency to conduct a benefit-cost review. This review will ensure that the City is optimizing the benefits to the community. For actions that require grant funding, a full benefit-cost analysis will be prepared to comply with grant program requirements. Projects with a benefit-cost ratio of greater than one will be considered appropriate for implementation; projects with a benefit-cost ratio of equal to or less than one will not be considered appropriate for implementation.

The Hazard Mitigation Office will be responsible for the general management of the implementation of the mitigation strategies in the Plan. Accordingly, the Hazard Mitigation Office of the NOHSEP will have the authority to divide projects into phases to facilitate implementation. The Hazard Mitigation Office will also continue to build on our partnerships with local universities and colleges for assistance with mitigation activities when appropriate.

In addition, NOHSEP will be responsible for preparing a strategy to implement the mitigation actions in the Plan as part of a disaster recovery process. Frequently, a disaster is followed by a very large infusion of Federal and State development capital for local jurisdictions. Combining mitigation actions with the recovery process can achieve many of a community's mitigation goals; however, communities often have difficulty combining mitigation and recovery actions if they have not prepared to do so in advance. Following final approval of the Plan, NOHSEP will identify the mitigation actions in the Plan that would be most appropriate to implement as part of a disaster recovery process. The organization and processes for integrating this hazard mitigation strategy during the disaster recovery process will be further elaborated in NOHSEP’s Comprehensive Recovery Plan, due to be developed in 2021.

4.8.1 Orleans Parish Previous Mitigation Actions

While many of the Mitigation Actions set forth in the 2015 Orleans Parish Hazard Mitigation Plan were accomplished, there are a number of Actions that are either continuously ongoing or were outstanding at the time of the 2020 Plan update. These Actions are still deemed important to reducing potential losses identified in the risk assessment for Orleans Parish, and thus are being carried forward in the 2020 Mitigation Strategy. A full list of new 2015 carried-over Mitigation Actions is provided on the following pages.

2015 Carried-Over Mitigation Actions Table

New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.2.1	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Improve drainage infrastructure through measures in high flood risk areas including, but not limited to, the upgrade and improvement of culvert design and construction, retention and detention areas	Improve drainage infrastructure through measures including the upgrade and improvement of canals and drainage pipes, installation of retention and detention areas including green infrastructure.	Flooding, Tropical Cyclones, Infrastructure Failure, Coastal Erosion, Subsidence	2015 Carried Over	City of New Orleans, Army Corps of Engineers, FEMA	$2,000,000,000+	FEMA, Army Corps of Engineers, City of New Orleans Capital Improvements	ESF 3	5-10 years	High	High
2015.2.2	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Continue implementing funded drainage improvement projects, including post-construction maintenance and monitoring. These projects will reduce pressure on the existing piping system. The benefits of these projects will include beautification, improved recreational areas, flood mitigation, and social cohesion.	Drainage improvement projects could include St. Roch Streetscape Improvements, Mirabeau Water Park, Mac 35/Hall/Youth Study Center, Pontilly Project green infrastructure interventions, and Hagan Lafitte drainage upgrades.	Flooding, Tropical Cyclones, Infrastructure Failure, Coastal Erosion, Subsidence	2015 Carried Over	City of New Orleans, CNO Parks and Parkways, Army Corps of Engineers, FEMA	4600000	FEMA, Army Corps of Engineers, City of New Orleans Capital Improvements	ESF 3	5-10 years	High	High
2015.2.3	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Install rain gardens and stormwater runoff filtration and water retention systems along streets to reduce subsidence and flooding.	Develop and advocate the necessary site design and landscape standards for streets, neighborhoods, and building sites.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans, CNO Parks and Parkways, Sewerage and Water Board, FEMA	1250000	FEMA, HUD, Private Sector, City of New Orleans Capital Improvements	ESF 5	5-10 years	High	High
2015.2.4	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Property Protection	Harden/Retrofit all critical and non-critical existing public facilities, including City Hall, remote sites, and all distribution points, and construct future public facilities that are resilient to wind and flooding.	Wind hardening projects can include shutters, roof tie-downs, etc. Flood protection projects include switches to turn off the equipment in the event of flooding and floodproofing.	Tropical Cyclones, Coastal Erosion, Winter Weather	2015 Carried Over	City of New Orleans, Sewerage and Water Board	90000000	FEMA	ESF 5	5-10 years	Medium	Medium
2015.2.5	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Promote greater use of pervious concrete	Include pervious concrete in city-contracted road work and other projects, education through NOLA Ready for homeowners	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans, Sewerage and Water Board, NORA	staff time	Staff time	ESF 5	1-5 years	High	High

2015 Carried-Over Mitigation Actions Table

New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.2.6	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Mitigate contamination resulting from illegal dumpsites.	Continue to expand prevention and enforcement of illegal dumpsites. Develop remediation funding sources.	Hazardous Materials	2015 Carried Over	City of New Orleans, State of Louisiana, EPA	Unknown	FEMA, EPA	ESF 10	5-10 years	Low	Low
2015.2.7	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Coordinate with USACE and SLFPAE regarding the levee system improvements and maintenance.	Ensure there is operational coordination between Orleans Parish, the US Army Corps of Engineers, and the Southeast Louisiana Flood Protection Authority-East around levee upgrades and ongoing maintenance.	Flooding, Tropical Cyclones, Infrastructure Failure, Coastal Erosion, Subsidence	2015 Carried Over	City of New Orleans, NORA, Sewerage and Water Board, SLFPAW, CPRA	Staff time	Staff time	ESF 5	1-5 years	Medium	High
2015.3.1	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Engage with regional and statewide efforts for the protection of coastal wetlands – including coordination regarding wetlands policy.	Utilize Regional Coordination as a strategy, within which there are specific actions: Participate in LWI, Coordinate with CPRA, assign ORS staff to participate in SLFPA/USACE strategic partnership meetings, etc.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans, NORA	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	High
2015.3.2	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	The Golden Triangle Marsh Creation Project	The Golden Triangle Marsh Creation Project creates marsh within the boundaries of Bayou Savage, the largest urban wildlife refuge in the United States, leading to an increase in the refuge's wildlife and fish habitat. Monitor progress on construction of the 1st increment, which is funded through RESTORE and will restore 600 acres of marsh. Advocate on state and federal levels for additional funding to complete the full project as identified in the CMP and MRGO restoration plan.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	State of Louisiana (CPRA)	4500000	FEMA, EPA, State Capital Outlay, Private Sector	ESF 11	5-10 years	High	Medium

2015 Carried-Over Mitigation Actions Table

New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.3.3	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	The Biloxi Marsh Living Shoreline Project. The Biloxi Marshes consists of approximately 49,000 hectares of brackish and salt marshes, which provide important storm buffer for New Orleans as well as key habitat and ecosystem services. The marshes have been greatly impacted by shoreline erosion from wind-driven waves.	The proposed Biloxi Marsh Living Shoreline project, if implemented in the future, would create approximately 47,000 feet of bioengineered oyster barrier reef fringing the marshes, which would reduce shoreline erosion and recession, prevent further marsh degradation, promote community resilience, and enhance local fisheries and oyster production. Monitor progress on construction of the 1st increment, which is funded through RESTORE. Advocate on state and federal levels for additional funding to complete the full project as identified in the CMP.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	State of Louisiana (CPRA)	3500000	FEMA, EPA, State Capital Outlay, Private Sector	ESF 11	5-10 years	Medium	Low
2015.3.4	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Coordinate with State and Federal partners to implement the NO East Landbridge restoration project	Work with CPRA to get E&D complete on larger components of the marsh restoration and shoreline protection, as identified in the CMP and MRGO restoration plans. Advocate to support state effort to secure funding (likely NRDA) for construction.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	State of Louisiana (CPRA), City of New Orleans, Sewerage and Water Board	17500000	FEMA, State Capital Outlay, Private Sector, EPA	ESF 11	5-10 years	High	High
2015.4.1	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Educate the public about stormwater management.	Educate the public about their role in keeping drains and culverts clear. Distribute information on lot-scale mitigation strategies like GI; promoting the work of partner NGOs that have programs to assist homeowners with implementing these activities	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans, Sewerage and Water Board	225000	City of New Orleans General Fund	ESF 5	1-5 years	High	Medium
2015.4.2	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Promote the use of building methods that are hazard resistant and built above the code.	Continue to educate the public through NOLA Ready about these methods. Explore incentive programs and financing options for homeowners and builders (w/ GNO Inc, FANO, Insurance commissioner, etc.)	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, NORA	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	Medium	Medium

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New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.4.3	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Develop a small business resilience program	Assist business owners in developing COOP plans and promote the NOLA Ready Business Continuity Guide	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, NORA	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	Low
2015.4.4	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Prevention	Maintain a comprehensive GIS database including data on properties, hazard areas, service districts, public works facilities, transportation infrastructure, and vulnerable populations.	Develop a process and requirements for interdepartmental coordination to keep the database maintained. (e.g., Annual review and updates of SDE, including critical facilities, new hazard data, etc.)	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, NORA, FEMA, LA GOHSEP	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	Medium
2015.4.5	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Require mandatory training in floodplain regulations for all building officials.	Identify available training courses that meet this requirement. Have CAO identify which job positions would be affected. Work with Civil Service to add this to requirements.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans	100000	City of New Orleans, FEMA	ESF 5 and 7	1-5 years	High	Low
2015.4.6	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Property Protection	Evaluate the implementation of voluntary incentive and reward programs	Encourage builders and contractors to go beyond minimum requirements.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans	City staff time	City of New Orleans, FEMA	ESF 5 and 7	1-5 years	Medium	Medium
2015.5.1	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Property Protection	Continue compliance with the NFIP. Coordinate activities across departments to maximize the City's CRS score; pursue other policy initiatives to make flood insurance affordable.	Continue compliance with the NFIP. Coordinate activities across departments to maximize the City's CRS score; pursue other policy initiatives to make flood insurance affordable.	Flooding, Tropical Cyclones, Infrastructure Failure	2015 Carried Over	City of New Orleans	City staff time	City of New Orleans General Fund, NFIP	ESF 5	1-5 years	Medium	High
2015.5.2	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Property Protection	Improve asset management to assist with the documentation of damages.	Continue use of the Survey123 asset management apps; complete annual inspection of all city-owned facilities to support post-event damage assessments.	Flooding, Tropical Cyclones, Infrastructure Failure, Coastal Erosion, Tornadoes, Subsidence	2015 Carried Over	City of New Orleans	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	Medium

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New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.5.3	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Property Protection	Pursue an acquisition/buy-out program wherein property owners could elect to move out of a high-risk area to a lower risk area.	Pursue an acquisition/buy-out program wherein property owners could elect to move out of a high-risk area to a lower risk area. Acquired properties would be rezoned as open space and maintained by Parks and Parkways as passive recreational areas.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans	1090000000	HUD, FEMA, State of Louisiana	ESF 5 and 7	3-5 years	Medium	Medium
2015.5.4	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Property Protection	Pursue programs to mitigate at-risk structures by physically elevating buildings to or above the Base Flood Elevation (BFE), wet flood proofing, and/or dry floodproofing where appropriate.	Continue programs to mitigate at-risk structures by physically elevating buildings to be compliant with the Floodplain Ordinance, wet flood proofing, and/or dry floodproofing where appropriate.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans	4000000000	HUD, FEMA, State of Louisiana, Private Sector	ESF 5 and 7	3-5 years	Medium	High
2015.5.5	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Maintain a database of all properties that sustain damage as a result of a hazard, including critical facilities.	Include this information as part of the City's overall GIS database.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	NOHSEP	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	Medium	Low
2015.5.6	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Explore alternative financing methods to support flood mitigating projects, such as a rebate program	Explore alternative financing methods to support flood mitigating projects, such as a P3s, Environmental Impact bonds, homeowner/builder rebate programs, and others	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	2015 Carried Over	City of New Orleans, Sewerage and Water Board	Staff Time	City of New Orleans General Fund	ESF 5 and 7	1-5 years	High	Medium
2015.5.7	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Engage with regional hazard mitigation planning efforts.	Coordinate with other parishes and local plans to ensure consistency and coordinate actions with neighboring jurisdictions.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, NORA	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	Medium
2015.5.8	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Assist other local agencies with hazard mitigation plans in the implementation of actions from their plans.	Assist local agencies with project scoping, grant management, stakeholder coordination, and other support functions as needed to implement hazard mitigation plan actions.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, NORA	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	Medium	Medium

2015 Carried-Over Mitigation Actions Table

New Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes Available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2015 Priority Ranking	2020 Priority Ranking
2015.6.1	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Structural Projects	Set up cooling shelters or other heat relief measures during extreme heat events	Include cooling shelters along with other active cooling strategies such as misters and splash pads in public spaces.	Extreme Heat	2015 Carried Over	City of New Orleans	$5,000 - $50,000	City Budget	ESF 8	1-5 years	Medium	High
2015.6.2	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Structural Projects	Continue the Southeast Louisiana (SELA) Drainage program to reduce flood damages in the City of New Orleans and surrounding parishes.	The SELA Drainage program will be accomplished by constructing new pumping stations and better drainage canals throughout our city. The program was authorized in 1996 by the United States Congress and administered under a project cooperation agreement between the Sewerage and Water Board of New Orleans and the U.S. Army Corps of Engineers.	Flooding, Tropical Cyclones, Infrastructure Failure, Coastal Erosion, Subsidence	2015 Carried Over	City of New Orleans, Army Corps of Engineers, FEMA	$2,000,000,000+	FEMA, Army Corps of Engineers, City of New Orleans Capital Improvements	ESF 3	5-10 years	High	Medium
2015.6.3	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Prevention	Develop pre-disaster Disaster Recovery Plans	Develop a New Orleans pre-disaster Recovery Plan	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	NOHSEP	City staff time	City of New Orleans General Fund	ESF 5	1-5 years	High	High
2015.6.4	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Emergency Services Measures	Install emergency generators at all emergency shelters and critical facilities.	Ensure emergency generators are running properly at all existing critical facilities and emergency shelters.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans	$250,000- $800,000 per site	City of New Orleans Capital Improvements, FEMA, Sewage and Water Board, Private Sector	ESF 12	1-5 years	High	High
2015.6.5	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Emergency Services Measures	Map the interior of critical facilities to assist first responders in the event of an incident.	Mapping of the interior facilities for all schools has been completed, continue to expand to other public facilities. Establish criteria for which buildings should provide floorplans to NOHSEP.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure, Tornadoes	2015 Carried Over	City of New Orleans, Private Partners	250000	City of New Orleans, FEMA	ESF 5	1-5 years	Low	Medium
2015.6.6	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Prevention	Harden utility services to be resilient to wind hurricane wind speeds, including transmission line upgrades, establishing microgrids	Harden utility services and street infrastructure. Harden all flood protection infrastructure, including pump support with alternative energy sources. Establish an implementation plan giving priority to emergency evacuation routes and primary arterials.	Tropical Cyclones, Tornadoes	2015 Carried Over	City of New Orleans, Entergy, Critical Infrastructure Partners, FEMA, LA GOHSEP	Unknown	FEMA, DHS, HUD, Private Sector, City of New Orleans Capital Improvements	ESF 12	5-10 years	High	High

4.8.2 Orleans Parish New Mitigation Actions

New 2020 Mitigation Actions were developed in close coordination with stakeholders representing City and regional agencies, non-profit and community-based organizations, and other local partners through two rounds of Working Group meetings. A full list of new 2020 Mitigation Actions is provided on the following pages.

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.1.1	Goal 1: Reduce risk and vulnerability to the human environment, including cultural resources, homeowners, renters, visitors, and transient populations.	Prevention	Advocate for state and national policy supporting a Green New Deal for Housing. Along with local policy creation and implementation.	Incorporate recommendations from the national proposed Green New Deal for Public Housing Act into local public housing policies, such as converting buildings to electric energy, adding solar panels, and securing renewable energy sources.	Extreme Heat, Winter Weather	New	HANO, OCD, FANO, NORA, GNOHA, Gulf South for a New Green Deal	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants, Private Financing	ESF 6	1-5 years	Medium
2020.1.2	Goal 1: Reduce risk and vulnerability to the human environment, including cultural resources, homeowners, renters, visitors, and transient populations.	Prevention	Actively plan for shifting risks, population movement, and changing development patterns in response to Climate Change	Create local and regional plans for climate change-related threats, including the intensification of weather events, changing development patterns and methods, and population relocation due to environmental risk.	Flooding, Extreme Heat, Subsidence, Coastal Erosion, Infectious Disease Outbreak	New	NOHD, NOHSEP, ORS	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 14	1-3 years	Medium
2020.1.4	Goal 1: Reduce risk and vulnerability to the human environment, including cultural resources, homeowners, renters, visitors, and transient populations.	Prevention	Address equity issues within the floodplain management program: provide support for local match requirement	Buildout and implement an equity strategy for the flood plain management program	Flooding	New	NOHSEP, Water Collaborative of Greater New Orleans	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-3 years	Medium
2020.2.1	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Complete BCEGS assessment	Work to address the Building Code Effectiveness Grading Schedule	Flooding, Tropical Cyclones, Severe Thunderstorms, Tornadoes	New	City of New Orleans (Safety and Permits)	City Staff Time	CNO General Fund	ESF 14	1-2 years	High

2020 New Mitigation Actions Table

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2020.2.2	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Duncan Plaza Drainage Improvement	Address Storm Water Retention Needs with Improvements to the stormwater infrastructure in Duncan Plaza.	Flooding	New	DPW, ORS, SWBNO, Downtown Development Authority, Safety, and Permits, SOUL, GNOF, DDD	City Staff Time, Contractor Labor	CNO General Fund, State and Federal Grants	ESF 3	3-5 years	Medium
2020.2.3	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Audubon Golf Course Drainage Improvement	Address Storm Water Retention Needs with Improvements to the stormwater infrastructure in the Audubon Park Golf Course.	Flooding	New	DPW, ORS, SWBNO, Safety and Permits, Audubon Institute, Water Collaborative of Greater New Orleans, Tulane University	City Staff Time, Contractor Labor	Audubon Institute Funds, CNO General Fund, State and Federal Grants	ESF 3	3-5 years	High
2020.2.4	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Parks Master Plan - Drainage Project Scoping	Scope potential drainage projects for inclusion in the Parks Master Plan for implementation. Make sure that there are not duplicate plans for the same area.	Flooding	New	DPW, ORS, NORDC, SWBNO, French Market Corporation, Parks for All, Water Collaborative of Greater New Orleans, City Park, Flood Protection Authority-East	City Staff Time	CNO General Fund	ESF 3	3-5 years	High
2020.2.5	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Higher energy efficiency standards for new developments utilizing an incentive rebate and/or building code requirement	Create a higher set of energy efficiency standards for building performance to reduce energy consumption and greenhouse gas emissions in new construction.	Extreme heat, Winter Weather	New	DPW, ORS, Safety and Permits, CPC, SWBNO	City Staff Time	CNO General Fund	ESF 12	3-5 years	Medium

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2020.2.6	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	N Claiborne GI	Implement recommended green infrastructure improvements along the North Claiborne corridor that could include tree planting, bioswales, stormwater parks, and pervious pavement on public and private property.	Flooding, Extreme Heat	New	PPW, DPW, ORS, CID, SOUL, Claiborne Avenue Alliance, local Neighborhood Associations, Merchants and Business Association, GNOF	City Staff Time, Contract Labor, Community Partner Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11 and 14	1-5 years	High
2020.2.7	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	2043-47 Felicity GI	Implement recommended green infrastructure improvements along 2043-47 Felicity Street.	Flooding, Extreme Heat	New	ORS, DPW, PPW, SOUL	City Staff Time, Contract Labor, Community Partner Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11 and 14	1-5 years	Low
2020.2.8	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Lafitte Blue Way	Implement recommended green infrastructure improvements along the Lafitte Greenway.	Flooding, Extreme Heat	New	ORS, DPW, PPW, Friends of the Lafitte Greenway, NORDC, SWBNO, SOUL	City Staff Time, Contract Labor, Community Partner Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11 and 14	1-5 years	Medium
2020.2.9	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Public Education & Awareness	Provide shade structures, and seating at all RTA stops and evacuation pick-up sites	Work with the RTA to protect riders from the elements at RTA stops and evacuation sites	Extreme Heat	New	Safety and Permits, RTA, City Council, Mayor's Office of Transportation, DPW, RIDE New Orleans, RTA Rider's Advisory Committee	City Staff Time, Partner Agency Time, Contract Labor	CNO General Fund, State and Federal Grants	ESF 1	1-2 years	High

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2020.2.10	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Prevention	Solar for All	Make solar power a realistic and viable option for residential and commercial property owners and city-owned properties in Orleans Parish to increase energy security, reduce energy costs, and reduce dependence on fossil fuels.	Extreme Heat, Winter Weather, Infrastructure Failure	New	ORS, Community Development, Finance New Orleans, NORA, GNOHA	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants, Private Financing	ESF 12	1-5 years	High
2020.2.11	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Property Protection	Integrate design solutions into community stormwater behaviors (e.g., designate parking areas in neutral grounds to avoid damage to trees and underground infrastructure)	Implement citywide urban design standards intended to guide the community's response to stormwater management. Ensure the design guidelines and solutions consider the location of utilities and green infrastructure to prevent accidental and unintended damage to City facilities and improve safety and mobility.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Winter Weather, Active Threats, Infrastructure Failure	New	ORS, DPW, SWBNO	City Staff Time, Contract Labor	Homeland Security, FEMA, Health and Human Services	ESF 2, 4, 6, 8, 10	2-5 years	Medium
2020.2.12	Goal 2: Reduce risk and vulnerability to the built environment, including current and future structures; critical facilities; historic structures; and infrastructure, including communications infrastructure.	Structural Projects	Encourage voluntary installation of residential sprinkler systems. Create an incentive program for the voluntary installation of residential sprinklers in key areas	Consider incentives for residential sprinklers for existing structures, renovated structures, and new construction.	Winter Weather, Infrastructure Failure	New	New Orleans Fire Department, CPC			ESF 5		Low
2020.3.1	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Complete a Methane Capture Feasibility Study at SWBNO WWTP	Explore opportunities to capture and reuse methane as an energy source rather than allowing it to be released as a harmful pollutant.	Tornadoes, Tropical Cyclones, Severe Thunderstorms	New	SWBNO		CNO General Fund, State and Federal Grants	ESF 12	3-5 years	Medium

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2020.3.2	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Sankofa Wetlands Enhancement	Develop a nature trail and wetland park on 40 acres of space in the Lower Ninth Ward to help with stormwater management and reduction of land subsidence. Utilize this project as an educational opportunity for youth in the area.	Coastal Erosion	New	ORS, DPW, Sankofa Community Development Corporation, GroundWorks, L9 Homeowners Association, Center for Sustainable Development, City Council, SOUL	City Staff Time, Community Partner Time	Received an Environmental Justice Small Grant from the US EPA	ESF 11	1-2 years	Medium
2020.3.3	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	NO East Landbridge Restoration: Advocate for NRDA funding	Advocate for NRDA Funding of the NOE Land Bridge Project at State and Federal Levels.	Flooding, Coastal Erosion, Tropical Cyclones	New	ORS, DPW, NOHSEP, Restore the Delta Gulf Program for National Wildlife Restoration, Pontchartrain Conservancy, Food Protection Authority-East	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11	3-5 years	Medium
2020.3.4	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	MRGO Restoration:	Advocate for Funding of the continued restoration of the MRGO at State and Federal Levels.	Flooding, Coastal Erosion, Tropical Cyclones	New	ORS, NOHSEP, DPW, Orleans Land Bridge, Pontchartrain Conservancy, MRGO Coalition, Mississippi Restore Coalition, St. Bernard Parish, Regional Planning Commission, Flood Protection Authority-East	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11	3-5 years	Medium

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2020.3.5	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Bayou Bienvenue/Central Wetlands Restoration	Advocate for Funding of the restoration of Bayou Bienvenue at State and Federal Levels.	Flooding, Coastal Erosion, Tropical Cyclones	New	ORS, Sankofa Community Development Corporation, Center for Sustainable Engagement, MRGO Must Go, Flood Protection Authority-East, St. Bernard Parish	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11	3-5 years	Medium
2020.3.6	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Scale-up tree planting to the neighborhood level, opt-out approach, contiguous planting grids	Promote tree clustering strategy, which will allow plantings to have a more impactful scale. It is a proven strategy that produces numerous environmental benefits, which has been implemented in numerous major cities, including Atlanta. Explore an opt-out planting strategy where the community pre-selects streets for plantings; property owners can "opt-out" of the project if they desire.	Flooding, Extreme Heat	New	NOHSEP, CPC, Parks and Parkways, Sustaining Our Urban Landscape (SOUL), NOLA Tree Project	City Staff Time	CNO General Fund	ESF 11 and 14	1 to 3 years	High
2020.3.7	Goal 3: Reduce risk and vulnerability to the natural environment, including wetland restoration and recognition of New Orleans as a coastal city.	Natural Resource Protection	Former Recovery 1 Landfill maintenance and environmental protection of Bayou Sauvage	Ensure the former Recovery 1 landfill site located adjacent to Bayou Sauvage, a National Wildlife Refuge, is properly and safely maintained over time to prevent contamination of Bayou Sauvage.	Infrastructure Failure	New	Sanitation and DPW, ORS	City Staff Time, Contract Labor	CNO General Fund, EPA Grants, other State, and Federal Grants	ESF 3 and 11	1-2 years	High

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2020.4.1	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Complete a job study to institutionalize floodplain management training as a requirement for key positions. Provide training in floodplain management principles for local officials and increase the number of Certified Floodplain Managers on City staff.	Work with the Civil Service Commission to require building officials employed at the city to become Certified Floodplain Managers (CFM) through ASFPM. Work with SHMO to schedule trainings in Orleans Parish. Explore adding CFM as a requirement for resilience officers, others.	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Infrastructure Failure	New	Civil Service, Safety and Permits, Water Collaborative of Greater New Orleans	City Staff Time	CNO General Fund, State and Federal Grants	ESF 5	1-2 years	Low
2020.4.2	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Realtor education on flood risk and a city/state policy on real estate disclosures about flood risk.	Work with the Metropolitan Realtors Association and Louisiana Realtors Association to understand this issue from their point of view. Also, hold meetings for public comment on this issue to fully inform the policy. Develop and Implement a policy at the State and Local level	Flooding	New	Orleans Parish Civil Clerk of Court, Urban Conservancy, Water Collaborative of Greater New Orleans	City Staff Time	CNO General Fund	ESF 6	1-3 years	Medium
2020.4.3	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Leverage Resilience work to create workforce development opportunities	Work with the WIB and JOB1 to build out a strategy for workforce development in the field of resiliency. Leverage local resilience and mitigation efforts as opportunities to train the local workforce in 'green' jobs, such as sustainable construction, green infrastructure, adaptive reuse of demolition materials, energy and carbon capture and storage, and water quality technicians. Make sure all angles of workforce development are being addressed.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Subsidence, Winter Weather, Coastal Erosion, Infectious Disease Outbreak, Active Threats, Infrastructure Failure, Hazardous Materials, Economic Shock	New	Job1, Workforce Investment Board, ORS, DPW, GNOF, Schools and Universities, Job1, CCC OCD, Sankofa Community Development Corporation, LA Green Jobs Corps	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 15	1-5 years	High

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2020.4.4	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Scale-up lot-scale green infrastructure, stormwater management, etc. through trainings, funding	Institutionalize the inclusion of lot-scale green infrastructure components, stormwater management, and green energy initiatives to the neighborhood scale and beyond to create a robust green infrastructure network. Educate citizens on how to best integrate lot-scale interventions into the larger network. Numerous NGOs in the city are working on such efforts presently.	Flooding, Extreme Heat	New	NORA, DPW, SWBNO, NOHSEP, Water Wise Gulf South	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-2 years	High
2020.4.5	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Update and Maintain the Climate Adaptation decision support tool and encourage the use of the tool	Update and Maintain the Climate Adaptation decision support tool and encourage the use of the tool	Flooding, Tropical Cyclones, Coastal Erosion, Subsidence, Severe Thunderstorms, Extreme Heat, Winter Weather	New	ORS, SWBNO, NOHSEP, CPC, Trust for Public Land	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-5 years	Medium
2020.4.6	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Increase water literacy curriculum development, teacher training, the goal of all students receiving 1 hour/year of qualified instruction	Work with Orleans Parish School Board and other charter schools in the Parish to develop a curriculum for water ecology, rain gardens, best management practices for stormwater management (catch basin debris collection, etc.)	Flooding, Subsidence	New	New Orleans Public School Board, DPW, ORS, Ripple Effect, Flood Protection Authority-East, Green Light New Orleans, Water Collaborative of Greater New Orleans, Pontchartrain Conservancy, Water Institute	City Staff Time	Philanthropy, School Board	ESF 15	3 to 5 years	Medium

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2020.4.7	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Louisiana Watershed Initiative - City engagement in Region 6 and Region 8 planning and policy	Continue coordination with Regional Planning Commission (RPC) and other parishes in Region 6 and Region 8 to implement the planning and policy development for watershed management in the region. Evaluation of flood risks and identification of projects in the region to minimize the flood risk in accordance with Louisiana Water Initiative launched by the State of Louisiana in 2018 based on the following principles: 1) Using scientific tools and data; 2) Enabling transparent, objective decision-making; 3) Maximizing the natural function of floodplains; 4) Establishing regional, watershed-based management of flood risk.	Flooding	New	CPC, RPC, ORS, Water Collaborative of Greater New Orleans, DPW, Greater New Orleans Water Collaborative	City Staff Time	CNO General Fund	ESF 15	On-going (1 year)	High
2020.4.8	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Reforestation community outreach plan	Develop a public outreach and education plan to involve residents, businesses, and public officials to promote an equitable and healthy tree canopy. This public outreach program will facilitate the ongoing city's reforestation initiative to restore and expand the urban forest to a 50 percent tree canopy coverage by 2030 as specified in the city master plan—link reforestation to complete streets elements like desirable walking conditions and traffic calming.	Flooding	New	NOHSEP, CPC, Parks and Parkways, Sustaining Our Urban Landscape (SOUL), NOLA Tree Project	City Staff Time	CNO General Fund	ESF 15	1 to 3 years	Medium

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2020.4.9	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Provide financial incentives to make mitigation accessible to all	Provide financial incentives at the City, Parish, or State level to make hazard mitigation improvements to private property accessible to all residents. Examples of incentives include offering low loan insurance rates for renovations, insurance discounts, home interest rate reductions, and SBA loan guarantee programs.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Subsidence, Winter Weather, Coastal Erosion, Infectious Disease Outbreak, Active Threats, Infrastructure Failure, Hazardous Materials, Economic Shock	New	NOHSEP, OCD, ORS	City Staff Time	State and Federal Grants	ESF 5 and 7	1-5 years	Medium
2020.4.10	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Develop a tool with City monitoring data (AFWS) similar to the education/data monitoring tools that federal agencies use	Create an online, interactive tool utilizing City monitoring data around hazard mitigation initiatives for public use and education. This tool can be modeled after federal agency data monitoring tools. Ensure the tool is accessible to all, including K-12 audiences.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Subsidence, Winter Weather, Coastal Erosion, Infectious Disease Outbreak, Active Threats, Infrastructure Failure, Hazardous Materials, Economic Shock	New	NOHSEP, DPW, PPW, ITI	City Staff Time, Contract Labor	City capital bond funds, GOMESA, CDBG, CDBG-NDR, Sewerage and Water Board, State capital outlay, FHWA, FEMA-HMGP, US Army Corps of Engineers, FEMA	ESF 1 and 3	3-5 years	Medium

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2020.4.11	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Improve access to green jobs from a young age as a means to greater social equity	Integrate green jobs education and skill-building into K-12 school and after school curriculums. Coordinate with education-focused organizations in the greater New Orleans area to offer additional educational opportunities pertaining to green jobs as a means to high-paying careers.	Flooding, Tornadoes, Tropical Cyclones Severe Thunderstorms, Extreme Heat, Winter Weather, Coastal Erosion, Subsidence	New	WIB, Job1, ORS, DPW, Louisiana Department of Education, CCC, Thrive NOLA, City Council, New Orleans School Board, Charter schools, Delgado Horticultural Tech, Edible Schoolyards, STEM Nola	City Staff Time, Contract Labor	GOMESA, CPRA, CWPPRA, Sewerage and Water Board	ESF 1 and 3	4-5 years	Medium
2020.4.12	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Household Hazard Waste drop-off days: involve volunteers, scale-up material recovery, and landfill diversion	Advertise and coordinate household hazardous waste drop-off days with local jurisdictions. Recruit volunteers to assist with expanding City efforts to scale up material recovery and landfill diversion. Improve public education to Orleans Parish residents about household hazardous waste Materials Collection Day and related efforts.	Hazardous Materials	New	New Orleans Department of Sanitation, Keep New Orleans Beautiful	City Staff Time and Disposal	CNO General Fund, State and Federal Grants	ESF 10 and 8 .1	1-2 years	Medium
2020.4.13	Goal 4: Maximize the involvement of individuals, businesses, and groups in risk reduction measures through education/outreach on hazard mitigation appropriate to all groups, particularly vulnerable populations.	Public Education & Awareness	Green Infrastructure maintenance manual	Create a comprehensive green infrastructure maintenance manual for Orleans Parish that details procedures such as who is the party responsible for maintenance, what are the steps and needed equipment and materials to maintain the green infrastructure, how these efforts can be sustainably funded over time, and how maintenance will be properly inspected and enforced.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Winter Weather, Coastal Erosion, Subsidence	New	ORS, DPW, NOHSEP, PPW, SWBNO, Water Wise Gulf South	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 3 and 5	1-2 years	High
2020.5.1	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Create and Maintain Databases to aid in Flood Plain Management	Create an Elevation Certificate database and FFE estimation tool to augment the RLAA findings and aid floodplain management planning. Train building officials to enter data from new ECs in order to maintain the database.	Flooding	New	City of New Orleans (Safety and Permits, ITI), GNO Inc.	City Staff Time	CNO General Fund	ESF 5	1-5 years	High

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2020.5.2	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Stormwater Fee	Draft a citywide policy to levy and administer a stormwater fee to fund stormwater mitigation projects across the city. Study how this would impact and interact with other fees (e.g., how this will impact non-profits).	Flooding	New	ORS, NOHSEP, SWBNO, Urban Conservancy, DPW, Safety and Permits, Green Light New Orleans, Water Collaborative of Greater New Orleans, Housing	City Staff Time	CNO General Fund	ESF 5	1-2 years	High
2020.5.3	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Property Protection	Insurance credit for fortified roofs to incentivize builders to use resilient materials and methods	Create a state-level insurance credit to incentivize the installation of roofs adhering to fortified building methods, which are designed to strengthen residential and commercial buildings against high winds and hurricanes. Promote community education opportunities around this incentive for new and existing homeowners.	Tropical Cyclones, Severe Thunderstorms, Tornadoes	New	OCD, IGA, Finance New Orleans	City Staff Time	State Revenue	ESF 5	1-5 years	Medium
2020.5.4	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	"Green" Specifications to promote the use of resilient building materials in City projects	Develop a set of standards aimed at promoting the use of resilient building materials in government-owned, commercial, and residential projects.	Flooding, Extreme Heat, Winter Weather	New	City of New Orleans (PDU-SI), DPW, Safety and Permits	City Staff Time	CNO General Fund	ESF 5	1-3 years	Low
2020.5.5	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Develop a Comprehensive Reforestation Plan	Conduct a Tree Canopy Study to understand gaps in the existing tree canopy inventory. Identify and allocate city budget to plant trees in order to address the identified gaps in the tree canopy network.	Extreme Heat, Tornadoes, Tropical Cyclones, Severe Thunderstorms	New	City of New Orleans PPW, ITI, ORS, CPC, SOUL, Nola Tree Project, Coalition for Community Connection, Coalition for Coastal Louisiana, Earth Economics	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants, and Private Funds	ESF 5	1-3 years	High
2020.5.6	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Urban Heat Island Study	Conduct an Urban Heat Island Study that addresses extreme heat threats on a neighborhood-by-neighborhood level. Identify areas most in need of interventions to prevent extreme heat threats and prioritize project implementation in those places.	Extreme Heat	New	NOHD, NOHSEP, NACCHO, Growing Gardens, Earth Economics	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-3 years	Medium

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.7	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Advocate for NFIP reforms	Advocate for National Flood Insurance Program (NFIP) reforms, including increasing the cap on Increased Cost of Compliance (ICC) coverage and freezing premiums for properties enrolled in Hazard Mitigation Assistance (HMA) programs.	Flooding	New	NOHSEP, Mayors Office, City Council, Regional Planning Commission, Housing Nola, Urban Conservancy, Flood Protection Authority-East and West	City Staff Time	CNO General Fund	ESF 14	1-5 years	High
2020.5.8	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Explore incorporating repetitive damage provision in the City's floodplain ordinance	Including a Repetitive Loss provision would increase access to ICC funds for repetitive loss property owners. This would help fund residential mitigation projects. CPC to investigate adding a repetitive loss mechanism to the CZO that would enable ICC to be triggered for repetitive loss of residential properties. This would help some homeowners meet their non-federal match for mitigation grant projects. IGA to advocate at the federal level with support from Hazard Mitigation Office and ORS to raise the ICC funding cap.	Flooding, Tropical Cyclones, Tornadoes	New	NOHSEP, Safety and Permits, ORS, Housing Nola, Urban Conservancy, Flood Protection Authority-East and West, Water Collaborative of Greater New Orleans	City Staff Time	CNO General Fund	ESF 5	1-3 years	Medium
2020.5.9	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Public Education & Awareness	Develop in-house custom HAZUS model for risk assessment and decision support	Create an in-house HAZUS model, a nationally standardized methodology from FEMA for estimating potential losses from natural disasters, designed to support risk-informed decision-making efforts specific to Orleans Parish.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Winter Weather	New	NOHSEP	City Staff Time	CNO General Fund, State and Federal Grants	ESF 5	1-2 years	Medium

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.10	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Complete update to Climate Action Plan Update	Perform an update of the Climate Action Plan and incorporate relevant actions into the HM plan	Flooding, Coastal Erosion, Tropical Cyclones	New	ORS, NOHSEP, Climate Action Equity Advisory Group, C40	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1 year	High
2020.5.11	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Financing for State and Local adaptation	Examine the financing mechanism from other states and municipalities for funding adaptation beyond FEMA recovery dollars. Advocate for federal authorization and ACE implementation for levees that can protect up to the 500-year level.	Flooding, Coastal Erosion, Tropical Cyclones	New	NOHSEP, Economic Development, Finance Authority, Regional Planning Commission, Sankofa Community Development Corporation, Urban Conservancy	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 11	3-5 years	High
2020.5.12	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	HSDDRS authorized level of protection, MP goal of 500-year protection: assign City team. This is a Congressional Authorization of the levee system that could include a higher level of protection than the ACE have approved.	Utilize City Team to address 500-year flood protection.	Flooding, Coastal Erosion, Tropical Cyclones	New	ORS, Tulane Center for Environmental Law, Flood Protection Authority-East	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 3	1-3 years	High
2020.5.13	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Conduct a study to evaluate the potential impacts of a catastrophic rain event	Conduct a study to better understand and evaluate the potential impacts of catastrophic rain events. Incorporate the outcomes of this study into recommendations for regional emergency preparedness planning.	Flooding	New	NOHSEP, NOHD, DPW, SWBNO	City Staff Time, Contract Labor, Imagine Water Works, Urban Conservancy, IC Change	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-2 years	Medium

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.14	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Investigate HSDDRS authorization to make a case for nonstructural investment	Study how non-structural investments could be implemented from the HSDDRS authorization.	Flooding	New	DPW, ORS, Tulane Center for Environmental Law, New Orleans City Council Governmental Affairs Committee, Flood Protection Authority-East	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-2 years	Medium
2020.5.15	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Develop a policy for the adaptive re-use and recycling of demolition materials.	Develop a city-wide policy regarding re-use of materials from structure demolitions, other ways to reduce the greenhouse gas footprint of new construction or retrofits.	Hazardous Materials	New	Sanitation, ORS, CPC	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5 and 11	1-2 years	Medium
2020.5.16	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Explore code/policy models related to canopy preservation on private property	Look at Houston Tree Ordinance as a potential guide for such a policy.	Flooding, Extreme Heat	New	CPC, Parks and Parkways, ORS, SOUL	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 5	1-2 years	Medium
2020.5.17	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Coordinate with USACE on recertification on HSDRRS at the 100-year level of protection	Work with USACE to update the HSDRRS risk assessment (conducted in 2013) to obtain NFIP recertification (due in 2023) for 100-year flood protection from FEMA.	Flooding	New	SLFPA-E, SLFPA-W, ORS, CPRA	City Staff Time	CNO General Fund	ESF 5 and 14	1 to 2 years	High
2020.5.18	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Complete study on the economic impact of Green Infrastructure investments and implement policy recommendations	Work with GNOF and partners to implement the recommendations of the 2020 Green Infrastructure economic impact study.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms	New	GNOF, OCD, Water Collaborative of Greater New Orleans, Healthy Community Services, Nola BA, GNO Inc., Finance Authority, Upper Alliance Energy	City Staff Time	CNO General Fund	ESF 5	3 to 5 years	High

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.19	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Explore new ordinance for new construction to include native tree planting, protection of existing canopy including on private property	Evaluate the options for amending the building code and zoning ordinance to require/promote the preservation of existing native trees and planting of new native trees in the development of new properties.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms	New	CPC, Parks, and Parkways	City Staff Time	CNO General Fund	ESF 5 and 14	3 to 5 years	Low
2020.5.20	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	List the permitting process for tree planting and some types of concrete removal as Green Infrastructure rather than a Construction project	Reclassify the tree planting activities under green infrastructure projects instead of construction projects.	Flooding, Extreme Heat	New	CPC, DPW, Safety and Permits, SOUL, Nola Tree Project	City Staff Time	CNO General Fund	ESF 11	1 to 3 years	Low
2020.5.21	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Create a citywide data platform for all green infrastructure projects	Coordinate between the City of New Orleans, local jurisdictions, Orleans Parish, neighboring Parishes, regional planning organizations, environmental organizations, and any other relevant stakeholder groups to compile a user-friendly, interactive data platform displaying green infrastructure projects and initiatives.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Winter Weather, Coastal Erosion, Subsidence	New	IT, Love Your City	City Staff Time, Contract Labor	EPA, US Army Corps of Engineers, FEMA-HMGP	ESF 8	4-5 years	Medium
2020.5.22	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Link cross-parish projects to LWI and DOTD priorities, including Claiborne Ave, N Broad St, and Tulane Ave	Coordinate Orleans Parish mitigation initiatives with neighboring parishes to meet regional goals around safety and mobility, including those outlined by the Louisiana Watershed Initiative and the Louisiana Department of Transportation and Development. Cross-jurisdictional project examples focused on major thoroughfares include Claiborne Avenue, Broad Street, and Tulane Avenue.	Flooding	New	Regional Planning Commission, NOHSEP, DPW, Jefferson Parish, St. Bernard Parish, RIDE	City Staff Time, Contract Labor	EPA, Health and Human Services, Port of New Orleans	ESF 10 and 8	1 year	Medium

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.23	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Define common metrics to measure resilience progress	Develop a set of metrics that can be used to track and measure the progress of various resiliency projects and initiatives in Orleans Parish. Ensure these data-informed metrics can be measured consistently over time to clearly communicate the impact of projects and programs on regional resiliency and mitigation.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Winter Weather, Coastal Erosion, Subsidence	New	OIG, ORD, Universities, Love Your City	City Staff Time, Contract Labor	Health and Human Services, CDC, EPA	ESF 8 and 6	1-2 years	Medium
2020.5.24	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Create a digital database of City infrastructure plans, surveys, and other spatial data to inform project design, stormwater modeling, and other uses	Digitize hard copies of historical plans and create a standard operating procedure for new projects. Create a comprehensive citywide digital database of existing City infrastructure plans, utility plans, surveys, GIS, and other spatial data to inform project design, stormwater modeling, and other hazard mitigation initiatives.	Flooding	New	DPW, ITI, Geotech Information	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 1	1-3 years	High
2020.5.25	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Identify mitigation opportunities related to MS4 permit	Identify hazard mitigation provisions that can be included in the Municipal Separate Storm Sewer Systems (MS4) permitting process in order to promote a comprehensive and innovative urban water management approach throughout Orleans Parish. Focus on identifying actions that address both water quality and flooding.	Flooding	New	ORS, DPW, SWBNO	City Staff Time, Contract Labor	CNO General Fund, State and Federal Grants	ESF 3	1-2 years	Medium

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.5.26	Goal 5: To promote, implement, and sustain mitigation measures in Orleans Parish in order to reduce and manage risks to human life, the environment, and property.	Prevention	Take a cohesive approach to drainage improvements and other flood mitigation via GNO Urban Water Plan Part 2	The Urban Water Plan provides a roadmap for better management of flood and subsidence threats while creating economic value and enhancing the quality of life. This plan seeks to work in tandem and create multiple lines of defense with the region's levee system and Louisiana's 2012 Coastal Master Plan. (ref: GNO Urban Water Plan). Implement projects from the Urban Water Strategy, including but not limited to the Monticello Canal, 40 Arpent Canal, I-610 Corridor/Desire/Florida Canal, expanding the Blue Green Corridor Network, Interceptor Streets and Urban Parks, and the New Orleans East Water Walk	Flooding, Subsidence	New	NOHSEP, DPW, S&WBNO, NORA, GNO, Inc., Water Collaborative of Greater New Orleans, Flood Protection Authority-East, Green Light New Orleans, GNOF	City Staff Time	CNO General Fund, HMGP	ESF 5 and 14	1 to 3 years	High
2020.6.1	Goal 6: To protect Orleans Parish and the surrounding region from the effects of natural and manmade hazards, ensuring community continuity in the event of such hazards.	Prevention	Establish Neighborhood Resilience Hubs Provide to provide hazard mitigation information and resources	Create neighborhood resilience hubs that are focused on community-serving initiatives. Resilience hubs provide an opportunity to build local community power and leadership, can support neighborhood residents before, during, or after a natural or manmade hazard event, and can ensure timely resource and service distribution during disasters. Include information on types of disasters, family disaster plans, business continuity plans, and basic mitigation projects. Give presentations to civic groups, church groups, business groups, etc.	Flooding, Tornadoes, Tropical Cyclones, Severe Thunderstorms, Extreme Heat, Subsidence, Winter Weather, Coastal Erosion, Infectious Disease Outbreak, Active Threats, Infrastructure Failure, Hazardous Materials, Economic Shock	New	NEO, ORS, NOHD	City Staff Time	CNO General Fund, State and Federal Grants, Philanthropic Grants	ESF 7 and 14	3-5 years	Medium
2020.SWBNO.1	1,2,3	Emergency Services Measures, Property Protection, Structural Projects	Generators and Transfer Switch at SPS	See 6.8 Sewage & Water Board Master Plan	Flooding, Tropical Cyclone, Infrastructure Failure	SWBNO Actions	S&WB Operations	25,000,000	PDM/S&WB	ESF 12	TBD	High

2020 New Mitigation Actions Table

Action No.	Goal	Action Type	Action Item	Description	Hazards	Status	Lead Agency/Support Agencies that will Implement Action	Preliminary Costs (including ongoing maintenance costs) – to be refined as more data becomes available	Funding Sources (Specify specific entity that could potentially fund this action	Emergency Support Function	Time Frame for Implementing Action	2020 Priority Ranking
2020.SWBNO.2	1,2,3	Emergency Services Measures, Property Protection	Safe House and Resiliency center	See 6.5.2 Sewage & Water Board Master Plan	All	SWBNO Actions	S&WB Emergency Mgmt	21,000,000	PDM/S&WB	ESF 6	TBD	Medium
2020.SWBNO.3	1,2,3,6	Emergency Services Measures, Property Protection, Structural Projects	Water Hammer Mitigation	See 6.6.1 Sewage & Water Board Master Plan	Flooding, Tropical Cyclone, Severe Thunderstorms	SWBNO Actions	S&WB Operations	90,000,000	PW	ESF 3	12/30/2023	Medium
2020.SWBNO.4	1,2,3,6	Emergency Services Measures, Property Protection, Structural Projects	Power House	See 6.7 Sewage & Water Board Master Plan	Flooding, Tropical Cyclone, Infrastructure Failure	SWBNO Actions	S&WB Operations	213,000,000	HMGP/S&WB	ESF 12	12/30/2021	High
2020.SWBNO.5	1,2,4,5,6	Prevention, Public Education & Awareness	Soil Sampling/Analysis	See 6.63 Sewage & Water Board Master Plan	Flooding	SWBNO Actions	City of NO Eustis Engineering EPA ORD	97,795	S&WB	ESF 11	12/31/2019	Low
2020.SWBNO.6	1,2,4,5,6	Prevention, Public Education & Awareness	Flood Risk Analysis	See 6.6.4 Sewage & Water Board Master Plan	Flooding	SWBNO Actions	NOHSEP, S&WB, UNO		UNO Grant	ESF 5	TBD	Medium
2020.SWBNO.7	1,3	Emergency Services Measures, Property Protection	Upgrades and Improvements to the S&WB Drainage System. Including Canals Upgrades, Pump Station Rehabilitation, Pump Upgrades, and Power Controls	See 6.6.6 Sewage & Water Board Master Plan	Flooding, Tropical Cyclone, Infrastructure Failure	SWBNO Actions	S&WB Operations, USACE	1,000,000,000	USACE	ESF 3	On Going	High

Appendix A. The Orleans Parish Multi-Jurisdictional Mitigation 2020 Update Planning Process

A.1 Overview of the Planning Process

Hazard mitigation planning is intended to understand the risks and vulnerabilities associated with natural and manmade disasters. The planning process also identifies actions and long-term strategies that can reduce risks and potential impacts. Hazard Mitigation Plans are a federal requirement under the Disaster Mitigation Act of 2000 with the goal of reducing the impact and cost of disasters. Hazard Mitigation Plans must be updated every five years, and the last New Orleans Hazard Mitigation Plan was completed in 2015.

The 2020 Hazard Mitigation Plan Update identifies mitigation measures that the City of New Orleans and its planning partners can put into place that may reduce the impact or severity of future hazard events. The Plan is a requirement to access certain types of disaster assistance through the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Programs. The Plan also informs floodplain management planning under the Community Rating System (CRS) to improve CRS score and increase flood insurance discounts under the National Flood Insurance Program (NFIP). The Orleans Parish Multi-Jurisdictional Mitigation Plan is maintained through quarterly meetings of the Hazard Mitigation Committee, which is a subset of the Local Emergency Planning Committee. The overall process to create the 2020 Mitigation Plan update included:

- A review of existing plans, data, and studies
- Identifying hazards and completing a Risk Assessment
- Developing a Mitigation Strategy
- Community and stakeholder engagement

A.2 Existing Plans and Studies Review

The Orleans Parish Multi-Jurisdictional Mitigation Plan was developed, utilizing the most recent and relevant research, data, and existing plans. Key plans, studies, and guides that were reviewed include:

- 2010 and 2015 New Orleans Hazard Mitigation Plans
- FEMA guides, including the 2013 Local Mitigation Planning Handbook
- Local jurisdiction plans, including:
    - Resilient NOLA
    - Climate Action for a Resilient New Orleans Plan
    - Taking Steps Together on Equity & Climate Change: A Report by and for New Orleanians
    - 2010 New Orleans Master Plan
    - New Orleans Comprehensive Zoning Ordinance (CZO)
    - New Orleans City Assisted Evacuation Plan (CAEP)
- Climate change guidance documents and related studies
- Local, state, and federal plans, ordinances, and regulations related to hazard mitigation and resilience

A full list of the existing plans, studies, and data used in the Orleans Parish Multi-Jurisdictional Mitigation Plan can be found in the Bibliography.

A.3 Hazard Identification and Risk Assessment

During the hazard identification process, the Planning Team held focus group meetings and surveyed the public about their priorities and concerns related to the risks that affect the City. Using the feedback gained through these outreach efforts, the Steering Committee developed a proposed list of hazards to be addressed in this plan:

- Flooding
- Tropical Cyclones
- Coastal Erosion
- Tornadoes
- Subsidence
- Winter Weather
- Extreme Heat
- Severe Thunderstorms
- Hazardous Materials
- Active Threats
- Infrastructure Failure
- Infectious Disease Outbreak
- Economic Shock

For each identified hazard, the Planning Team created a profile that provides a definition, explains how it is measured, describes its geographic extent, surveys any previous occurrence, and evaluates the likelihood and potential impacts of future occurrence.

A.4 Mitigation Strategy

The Mitigation Strategy for the Orleans Parish Multi-Jurisdictional Hazard Mitigation is a long-term plan to reduce potential losses identified in the risk assessment. Components of the Mitigation Strategy include:

- Goals
- Mitigation Action Plan
- Prioritized Mitigation Actions
- Implementation Strategy

A.4.1 Identifying New 2020 Actions & Updating 2015 Actions

In order to develop a set of Mitigation Actions for the 2020 Orleans Parish Hazard Mitigation Plan, the Planning Team formed three subcommittees, or Working Groups, to focus on the topics of climate change, water management, and City operations. Stakeholders representing City and regional agencies, non-profit and community-based organizations, and other local partners were invited to participate in one or more of these sub-committees based on their area of expertise. Each of the Working Groups met twice during the Fall of 2020.

The first round of Working Group meetings aimed to develop a new set of Mitigation Actions for the 2020 Hazard Mitigation Strategy. Meeting attendees were asked to brainstorm possible mitigation projects for Orleans Parish, ranging from the lot- and neighborhood-scale interventions to city-wide, regional, or state-level policies. As a follow-up to these meetings, participants were asked to send the City any additional ideas for the new 2020 Mitigation Actions in the week following the meeting. This round of Working Group meetings helped the project team to develop a set of Mitigation Actions, which were then shared with the Working Groups in the second round of meetings for additional feedback. For each of the Actions suggested by Working Group members, the Planning Team identified:

- FEMA Mitigation Action category
- The goal met by the Action
- Action description
- Relevant hazard(s)
- Lead and support agencies
- Preliminary costs
- Funding sources
- Emergency Support Function (ESF)
- Timeframe for implementation

After the Mitigation Actions were filled in by the Planning Team, another round of Working Group meetings were held. At each of the meetings, Working Group participants helped to refine the provided Mitigation Actions, including adding City agencies and organizations to Actions in lead or support roles for implementation and clarifying Action descriptions. The follow-up to the second round of Working Group meetings included sending the full list of 2020 Mitigation Actions, as well as Actions carried over from 2015 to all Working Group participants and asking for written feedback.

The Steering Committee brainstormed a diverse range of activity types, including preventative activities, property protection, natural resource protection, emergency services measures, structural projects, and public information activities. More specific definitions and examples of each activity time are provided:

Prevention activities keep hazards from causing more damage that is unavoidable. The use and development in hazardous areas is limited through planning, land acquisition, or regulation. They are usually administered by building, zoning, planning, and/or code enforcement offices. Activities include:

- Hazard mapping and data
- Open space preservation
- Regulations
- Erosion setbacks
- Planning and zoning
- Stormwater management

- Drainage system maintenance
- Building codes

Property protection measures are used to modify structures that are subject to damage. This can be approach in three ways: Modify the structure to prevent the hazard from reaching the building; Modify the structure so it can withstand the impacts of a hazard; and insure the property to provide financial relief after damage occurs. Property protection measures are generally implemented by the property owner, though sometimes technical and financial assistance can be provide by the local, regional, or federal government. Subcategories of property protection include:

- Relocation
- Acquisition
- Building elevation
- Retrofitting
- Sewer backup protection
- Insurance

Natural resource protection activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies, primarily parks, recreation, or conservation agencies or organizations. Activities include:

- Wetlands protection
- Erosion and sediment control
- Natural area restoration
- Water quality improvement
- Coastal barrier protection
- Environmental corridors
- Natural functions protection

Emergency services measures are taken during an emergency to minimize its impact. These measures are usually the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities. Activities include:

- Hazard threat recognition
- Hazard warning
- Hazard response operations
- Critical facilities protection
- Health and safety maintenance
- Post-disaster mitigation activities

Structural projects keep flood waters away from an area with a levee, reservoir, or other flood control measure. They can also mitigate for other hazards, like extreme heat, through the construction of cooling stations, etc. Structural projects are usually designed by engineers and managed or maintained by public works staff. Activities and actions could include:

- Reservoirs
- Levees/floodwalls
- Diversions
- Channel modifications
- Storm drain improvements
- Cooling stations

Public information and awareness activities advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains. They are usually implemented by a public information office. Activities and actions could include:

- Map information
- Outreach projects
- Real estate disclosure
- Libraries
- Technical assistance
- Environmental education

Feedback gathered in the second round of meetings and written feedback provided by Working Group members were then incorporated into the revised Mitigation Strategy. The resulting draft Mitigation Strategy included:

- 103 Total Actions
- 71 New Actions
- 32 Carried-over 2015 Action

A.4.2 Finalizing and Prioritizing Mitigation Actions

After developing and refining the 2020 Mitigation Actions from the two rounds of Working Group meetings, the Planning Team created a revised version of the Mitigation Strategy.

In order to prioritize the updated Mitigation Actions, the Planning Team asked Steering Committee members to review the full list of Actions and rank each Action as either a low, medium, or high priority. Steering Committee members were also encouraged to provide feedback on each Action based on the seven STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria. The average ranking and comments based on STAPLEE criteria for each Action were then used to complete the draft Mitigation Strategy.

A.5 Community and Stakeholder Engagement in the Planning Process

The City of New Orleans established a mitigation planning organization that encourages input and involvement of the many agencies and organizations responsible for implementing the Update's action items and/or have information to support the implementation of the mitigation strategy.

Planning Team: The development of the Orleans Parish Multi-Jurisdictional Mitigation Plan was led by a Hazard Mitigation Planning Team. The Planning Team facilitated the planning process to:

- Ensure that the updated HMP met the requirements of the Disaster Mitigation Act of 2000
- Organize and manage steering committee meetings
- Develop and implement the stakeholder engagement process
- Develop the web-based plan interface and integrate the hazard maps and data tables created for this plan with the City's data management system

The City of New Orleans Planning Team included:

- Hazard Mitigation Office staff
- New Orleans Office of Homeland Security & Emergency Preparedness Planners and Geographic Information Specialist
- NOLA Ready Public Engagement Manager
- Department of Information Technology and Innovation GIS Manager and Director of Enterprise Information

Planning Steering Committee: The Planning Steering Committee includes representatives of all the agencies and organizations involved in the planning process. There are three main categories of members:

- representatives of City departments and offices,
- representatives of other jurisdictions who will adopt the Update as their own mitigation plan, and
- representatives of stakeholder organizations who will provide public input during the process and will implement or provide support for the implementation of some action items.

Some of the individuals participate in the Local Emergency Planning Committee (LEPC) Hazard Mitigation Sub-Committee and are familiar with many of the issues addressed in the Update. The participants in the Steering Committee are listed below.

This plan was developed as a multijurisdictional plan. The City of New Orleans invited eligible entities to participate as co-signatories to this plan. Each agency or organization signed a letter of intent to participate in the plan development by assigning staff to serve as liaisons to the steering committee, share data and participate actively in all steps of the planning process.

A.5.1 List of Steering Committee Members

Agency/Organization	**Primary Representative**
Southeast Louisiana Flood Protection Authority-East	Derek Boese
Governor's Office of Homeland Security and Emergency Preparedness	Jeffrey Giering

Southern University at New Orleans	Igwe Udeh
University of New Orleans	Monica Teets Farris
Finance New Orleans	Damon Burns
Port of New Orleans	Amelia Pellegrin
CNO – Office of Resilience and Sustainability	Anne Coglianese
CNO – Office of Safety and Permits	Brad Klamer
CNO – Department of Public Works	Meagan Williams
CNO – Office of Homeland Security and Emergency Preparedness	Cara Rodrigue
CNO – City Planning Commission	Brooke Perry
New Orleans Regional Planning Commission	Chris Laborde
Committee for a Better New Orleans	Keith Twitchell
Greater New Orleans Foundation	Ella D'Ellio
Foundation for Louisiana	Liz Williams Russell
GNO Inc	Robin Barnes
NOLA Business Alliance	Quinton Messer
Lake Pontchartrain Conservancy	John Lopez
Propeller	Allison DeJong
Tulane School of Public Health	Stephen Murphy
Tulane ByWater Institute	Mark Davis
Greater New Orleans Housing Alliance	Andreanecia Morris
Business Council of New Orleans	Tamara Agins
Entergy New Orleans	Steve Molnar
LA Office of Community Development	Matt Sanders
New Orleans Metropolitan Association of Realtors	Grasshopper Mendoza
Sewerage and Water Board of New Orleans	Jason Higginbotham
Housing Authority of New Orleans	Shelly Smith
New Orleans Redevelopment Authority	Seth Knudsen
Orleans Parish School Board	Tiffany Delcour
Tulane University	Lauren Jardell
Dillard University	Nick Harris
Loyola University	Tommy Screen
Regional Transit Authority	Lona Edwards Hankins
CNO – Parks and Parkways	Daniel McElmurray
CNO – Capital Projects Administration	Vincent Smith

CNO – EMS	Shayna Goldfine
CNO – Health Department	Meredith McInturff
CNO – Department of Sanitation	Cynthia Sylvain Lear
CNO – Office of Transportation	Laura Bryan
CNO – Police Department	Louis Faust
CNO – Fire Department	Matt Spector
CNO – Department of Property Management	Martha Griset
CNO – Chief Administrative Office	Courtney Story
CNO – Mosquito Rodent and Termite Control Board	Claudia Riegel
CNO – Economic Development	Ellen Lee

The Steering Committee met on a quarterly basis from June 2019 through November 2020. The meeting dates and attendance are included here below.

Sub-committees: Because mitigation planning needs to review the details of a wide range of programs and activities, subcommittees were created to allow the Planning Steering Committee to focus on overall policy issues and review the findings and recommendations of the experts on the subcommittees.

The first subcommittee is the City Staff Working Group. Its primary duty was to review proposals that would be implemented by the City to ensure that they were appropriate and feasible given the City's authorities and resources.

The other subcommittees were formed around the topics of Climate Change and Flood Risk. These topics were identified by the Steering Committee as meriting focused discussion due to the complexity and intersecting nature of these issues and their impacts on the community. These subject matter subcommittees allowed a cross-section of public and private experts to review issues and draft findings and recommendations.

Public Involvement: In addition to the formal Planning Steering Committee and subcommittee work, the City made efforts to obtain input from the public. Because many of the action items, such as purchasing flood insurance and getting building permits, depend on individual involvement, the outreach effort helped educate people on these actions and helped the planners design more appropriate and more effective measures.

The Plan outreach process began in October 2019 with a series of focus group meetings. In November-December 2019, the planning team surveyed the community to get insight into the stakeholder priorities.

The original outreach strategy for the Mitigation Plan utilized in-person Steering Committee, Working Group, and public meetings. In early March, the strategy was shifted to an online process in the wake of the COVID-19 Pandemic. The remainder of the meetings were held virtually, leading up to the public comment period on the draft Mitigation Plan in December 2020-2021 and presenting the final plan to the New Orleans City Council.

Full documentation for each meeting in the community outreach process is provided in this section, including meeting dates, meeting locations, a summary of meeting purpose, meeting invitees, and meeting attendees.

A.5.2 Meetings Summary

Meeting #1	Hazard Mitigation Plan Update Kick-Off	January 14, 2020
Meeting #2	City Hall Working Group 1	February 19, 2020
Meeting #3	Steering Committee Meeting 1	April 1, 2020
Meeting #4	Public Meeting 1	April 7, 2020
Meeting #5	Steering Committee Meeting 2	July 22, 2020
Meeting #6	Public Meeting 2	July 29, 2020
Meeting #7	Public Meeting 3	September 17, 2020
Meeting #8	Climate Change Working Group Meeting 1	September 28, 2020
Meeting #9	Water Management Working Group Meeting 1	September 29, 2020
Meeting #10	City Hall Working Group 2	October 2, 2020
Meeting #11	City Hall Working Group 3	October 20, 2020
Meeting #12	Climate Change Working Group Meeting 2	October 21, 2020
Meeting #13	Water Management Working Group Meeting 2	October 22, 2020
Meeting #14	Public Meeting 4	November 19, 2020

A.5.3 Neighboring Community, Local and Regional Planning Process Involvement

The public sector emergency leaders from neighboring parishes were invited to join Orleans Parish Hazard Mitigation Steering Committee. These included Jefferson, St. Bernard, Plaquemines, and St. Tammany Parishes. The Regional Planning Commission and Southeast Louisiana Flood Protection Authorities were active members of the steering committee. Throughout the planning process, new plans from other agencies and groups were integrated into the broader Orleans Parish Hazard Mitigation Plan.

A.5.4 Program Integration

The Hazard Mitigation Plan is incorporated by reference in the City of New Orleans Master Plan. The HMP sets priorities and identifies actions that occur across many local organizations and individual programs. Through the work of the Steering Committee and community engagement efforts, the updated mitigation strategy attempts to capture the priorities and ongoing efforts of the many organizations working to build resilience in our community. The ongoing meetings of the HMP Steering Committee provide a platform for coordinating efforts, and annual reporting as part of plan maintenance provides a mechanism for monitoring progress towards the community's risk reduction goals.

A.5.5 Detailed Meeting Documentation and Public Outreach Activities

The following pages contain the meetings and public outreach activities conducted during this hazard mitigation plan update for Orleans Parish.

Meeting #1: Hazard Mitigation Plan Update Kick-Off

Date: January 14, 2020

Location: Online

Purpose: Discuss the expectations and requirements of the hazard mitigation plan update process and establish an initial project timeline with the Parish's OHSEP Director and any additional personnel. Components of the hazard mitigation plan update process discussed in this meeting included project organization and functional teams, upcoming meetings such as public meetings, committee meetings, subcommittee meetings, and individual jurisdiction and stakeholder meetings, data requests, initial project objectives, and project logistics.

Public Invitation: No

Meeting Invitees:

Organization	Department	Name	Alternate
Tulane University		Meredith Beers	Lauren Jardell
Loyola University		Tommy Screen	
Xavier		Patrice Mercadel	
Dillard		Nick Harris	Adonis Woods
SWBNO		Timothy Forstall	Jason Higgonbotham
HANO		Andreanecia Morris	Shelly Smith
OPSB		Tiffany Delcour	Paul Lucius
NORA		Seth Knudsen	
CNO	NOHSEP	Austin Feldbaum	
	City Planning Commission	Brooke Perry	
	Dept. of Health	Juliette Frazier	Meredith McInturff
	Safety and Permits	Brad Klamer	
	Parks and Parkways	Daniel McElmurray	Ann MacDonald
	Property Management	Martha Griset	
	Sustainable Infrastructure	Mary Kincaid	

Meeting #2: Steering Committee Meeting 1

Date: April 1, 2020

Location: Online

Purpose: To discuss the expectations and requirements of the hazard mitigation plan update process with the Steering Committee, including outreach and engagement, plan development, floodplain management, and engineering, and project next steps. Outreach and engagement topics discussed included the public information strategy for the process, the first public meeting, and outreach to neighboring jurisdictions. The components of the plan development process that were discussed were the hazards summary, capability assessment, data inventory, and website update.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Allison DeJong	Planner	Water Institute
Amber Beezley	Interim Assistant Vice President	Tulane - University Planning Office
Amelia Pellegrin	Director of Sustainable Development	Port NOLA
Andreanecia Morris	Executive Director	HousingNOLA
Ann E. Macdonald	Director	CNO-Parks and Parkways
Anne Coglianese	Coastal Resilience Program Manager	CNO-ORS
Avi Becher	Closeout Specialist	CNO-NOHSEP
Brad Klamer	CRS Manager	CNO-Safety and Permits
Brittany Jack	Hazard Mitigation Intern	NOHSEP
Brooke Perry	Assistant Director	CNO Planning Commission
Chris Laborde	Senior Transportation Planner	Regional Planning Commission
Claudia Riegel	Director	CNO-NMTRCB
Collin Arnold	Director	CNO-NOHSEP
Courtney W. Story	Innovation Manager	CNO
Cynthia Sylvain-Lear	Director	CNO-Sanitation
Damon Burns	Executive Director	Finance Authority of New Orleans
Daniel W. McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
David W. Morris	Deputy Chief Resilience Officer	CNO-NOHSEP
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Dr. Igwe Udeh	Dean	Southern University at New Orleans
Dr. Reynold Verret	President	Xavier University New Orleans
Elissa Hunter	Planning Coordinator	SWBNO-OEM
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Ellen M. Lee	Director of Community and Economic Development	CNO-Economic Development

Emily F. Wolff	Director of the Mayor's Office of Youth & Families	CNO
Eric P. Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Frank Revitt	Warning Coordination Meteorologist	National Weather Service New Orleans
Grasshopper Mendoza	Senior Real Estate Specialist	NAI Latter & Blum
Greg R. Nichols	Deputy Director	CNO-Property Management
James Logan	Program Officer	Greater New Orleans Foundation
Jason Higginbotham	Director of Emergency	Tulane University
Jeffrey E. Schwartz	Director of Economic Development	CNO-Economic Development
Jeffrey Giering	Assistant Section Chief	Hazard Mitigation at State of Louisiana
Jeffrey J. Entwisle	Chief Financial Officer	Archdiocese of New Orleans
Jenerio C. Sanders	Police Lieutenant	New Orleans Police Development
Jennifer E. Ruley	Mobility and Safety Program Lead	CNO-DPW
Jerome A. Landry	Coastal Zone Manager	CNO-Safety and Permits
Jim Austin	Maintenance & Facilities Director	NORD Commission
John Lopez	Director	Lake Pontchartrain Basin Foundation
Jonathan T. Wisbey	Chief Technology Officer	CNO
Josh W. Hartley	Construction Project Manager	CNO-DPW
Joshua Lewis	Research Associate Professor	Tulane ByWater Institute
Joshua O. Cox	Director of Strategic Initiatives	CNO
Juliette E. Frazier	Healthy Environments Coordinator	CNOHD
Keith J. LaGrange	Director	CNO-DPW
Keith Twitchell	President	Committee for a Better New Orleans
Kelli Walker Starrett	Senior Vice President & Governmental Relations	New Orleans Metropolitan Association of Realtors
Kenette Lewis	Human Resources Technician	Delgado Community College
Kenisha Green-Ross	Special Assistant to the Executive Director	Housing Authority of New Orleans
Kevin Williams	Detective	New Orleans Police Department
Kristi Trail	Executive Director	Lake Pontchartrain Basin Foundation
Lacy McManus	Vice President of Strategic Initiatives	Greater New Orleans Foundation
Lamar Gardere	Executive Director	The Data Center
Laura B. Bryan	Director	CNO-Department of Transportation
Laura Mellem	Public Engagement Officer	CNO-NOHSEP

Lauren Jardell	Director of Local Government and Community Relations	Tulane University
Leslie Alley	Agent	French Market Corporation
Liz Russell	Climate Justice Program Director	Foundation for Louisiana
Liz Williams	Coastal Communities Resiliency Program Officer	Foundation for Louisiana
Lona Edwards Hankins	Deputy Chief Executive Officer	New Orleans Regional Transit Authority
Louis Faust	Liaison Officer	New Orleans Police Department
Marion Pearson	State Hazard Mitigation Grant Program	GOHSEP
Marjorianna B. Willman	Director	CNO Housing Policy and Community Development
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Martha Griset	Director	CNO-Property Management
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Mathew Sanders	OCD-DRU policy advisor	State of Louisiana
Matt R. Torri	Deputy Director	City of New Orleans, Inc.
Matthew M. Spector	Liaison Officer	NOFD-NOHSEP
Meagan Williams	Stormwater Program Manager	CNO-DPW
Meredith C. McInturff	Emergency Preparedness Lead	NOHD
Michael Antoine	Deputy Director	CNO-NOHSEP
Monica Farris	Director	UNO CHART
Nicholas W. Satterfield	Enterprise Rose Architectural Fellow	New Orleans Redevelopment Authority
Nick Harris	Director of Community and Church Relations	Dillard University
Oliver R. Zakrzewski	Operations Section Chief	CNO-NOHSEP
Patrice A. Bell	Vice President of Administration/ Chief of Staff	Xavier University New Orleans
Paul Lucius	Executive Director of Facilities	Orleans Parish School Board
Quentin Messer	President & CEO	New Orleans Business Alliance
Rayne E. Pestello	Special Assistant to the Mayor	CNO
Robin Barnes	Interim Executive Director	GNO, Inc
Roman Nelson	Deputy Superintendent	New Orleans Fire Department
Scott St. Pierre	Safety and Risk Manager	Delgado Community College
Sean Wyatt	Assistant Deputy Director of Hazard Mitigation	State of Louisiana HSEP
Seth C. Knudsen	Director of Real Estate Development & Planning	New Orleans Redevelopment Authority
Shayna E. Goldfine	NOEMS Liaison	CNO-NOSHEP
Shelley Smith	Deputy Executive Director	Housing Authority of New Orleans
Stephen Murphy	Assistant Professor	Tulane University

Steve Cochran	Associate Vice President, Coastal Resilience	Environmental Defense Fund
Steve Molnar	Project Manager	Entergy
Theodore Callier	Asst. Vice President for Research and Sponsored Programs	Dillard University
Tiffany Delcour	Chief Operations Officer	Orleans Parish
Vincent A. Smith	Director of Capital Projects	CNO
Vincenzo Pasquantonio	Director	Mayors Office of Equity
William T. Salmeron	Coordinator of Special Events & Planning	New Orleans EMS
Tamara Agins	Executive Director	Emerge Louisiana

Meeting Attendees:

Name	**Title**	**Agency**
Amber Beezley	Interim Assistant Vice President	Tulane - University Planning Office
Amelia Pellegrin	Director of Sustainable Development	Port of New Orleans
Austin Feldbaum	Senior Hazard Mitigation Specialist	CNO-NOHSEP
Avi Becher	Closeout Specialist	CNO-NOHSEP
Benjamin Billings	Vice President	Civix
Brad Klamer	CRS Manager	CNO-Safety and Permits
Brooke Perry	Assistant Director	CNO Planning Commission
Chris Laborde	Senior Transportation Planner	Regional Planning Commission
Chris Rippetoe	GIS Analyst	SDMI - LSU
Danny McElmurray	Chief Landscape Architect	CNO - Parkways
Elissa Hunter	Planning Coordinator	SWBNO-OEM
Ella Aglipay Delio	Program Officer	Greater New Orleans Foundation
French Wetmore	President	French & Associates
Gaige Hargrave	Program Coordinator	GNOHA
Grasshopper Mendoza		New Orleans Metropolitan Association of Realtors
Jackie Woodward	Planning and Permitting Coordinator	Port of New Orleans
James Logan	Program Officer	100 Black Men of Metro New Orleans
Jeffrey Giering	Section Chief	GOHSEP
Jennifer Day	Senior Planner	Civix
Jerome Landry	Floodplain Manager	CNO - Safety and Permits
John Lopez	Director	Pontchartrain Conservancy
Kirk Burrell	Emergency Manager	SWBNO
Leslie Alley	Agent	French Market Corporation
Lona Edwards Hankins	Deputy Chief Executive Officer	New Orleans Regional Transit Authority
Marion Pearson	State Hazard Mitigation Grant Program	GOHSEP

Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Meagan Williams	Stormwater Program Manager	CNO-DPW
Monica Farris	Director	UNO-CHART
Paul Lucius	Executive Director of Facilities	Orleans Parish School Board
Reddy Nandipati	Principal	Accu-Environmental
Robin Barnes	Interim Executive Director	GNO, Inc
Ryan Albright	Senior Planner	Civix
Ted Guillot	Vice President	Civix
Theodore Callier	Assistant Vice President	Dillard University

Meeting #3: Steering Committee Meeting 2

Date: July 28, 2020

Location: Online

Purpose: Provide Steering Committee members with an update on the plan development process, a review and finalization of hazard classifications, definitions, and profiles, a discussion of plan goals and objectives, and a review of the next steps in the process.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Allison DeJong	Planner	Water Institute
Amber Beezley	Interim Assistant Vice President	Tulane - University Planning Office
Amelia Pellegrin	Director of Sustainable Development	Port NOLA
Andreanecia Morris	Executive Director	HousingNOLA
Ann E. Macdonald	Director	CNO-Parks and Parkways
Anne Coglianese	Coastal Resilience Program Manager	CNO-ORS
Avi Becher	Closeout Specialist	CNO-NOHSEP
Brad Klamer	CRS Manager	CNO-Safety and Permits
Brittany Jack		
Brooke Perry	Assistant Director	CNO Planning Commission
Chris Laborde	Senior Transportation Planner	Regional Planning Commission
Claudia Riegel	Director	CNO-NMTRCB
Collin Arnold	Director	CNO-NOHSEP
Courtney W. Story	Innovation Manager	CNO
Cynthia Sylvain-Lear	Director	CNO-Sanitation
Damon Burns	Executive Director	Finance Authority of New Orleans
Daniel W. McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
David W. Morris	Deputy Chief Resilience Officer	CNO-NOHSEP
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Dr. Igwe Udeh	Dean	Southern University at New Orleans
Dr. Reynold Verret	President	Xavier University New Orleans
Elissa Hunter		SWBNO
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Ellen M. Lee	Director of Community and Economic Development	CNO-Economic Development
Emily F. Wolff	Director of the Mayor's Office of Youth & Families	CNO

Eric P. Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Frank Revitt	Warning Coordination Meteorologist	National Weather Service New Orleans
Grasshopper Mendoza	Senior Real Estate Specialist	NAI Latter & Blum
Greg R. Nichols	Deputy Director	CNO-Property Management
James Logan	Program Officer	Greater New Orleans Foundation
Jason Higginbotham	Director of Emergency	Tulane University
Jeffrey E. Schwartz	Director of Economic Development	CNO-Economic Development
Jeffrey Giering	Assistant Section Chief	Hazard Mitigation at State of Louisiana
Jeffrey J. Entwisle	Chief Financial Officer	Archdiocese of New Orleans
Jenerio C. Sanders	Police Lieutenant	New Orleans Police Development
Jennifer E. Ruley	Mobility and Safety Program Lead	CNO-DPW
Jerome A. Landry	Coastal Zone Manager	CNO-Safety and Permits
Jim Austin	Maintenance & Facilities Director	NORD Commission
John Lopez	Director	Lake Pontchartrain Basin Foundation
Jonathan T. Wisbey	Chief Technology Officer	CNO
Josh W. Hartley	Construction Project Manager	CNO-DPW
Joshua Lewis	Research Associate Professor	Tulane ByWater Institute
Joshua O. Cox	Director of Strategic Initiatives	CNO
Juliette E. Frazier	Healthy Environments Coordinator	CNOHD
Keith J. LaGrange	Director	CNO-DPW
Keith Twitchell	President	Committee for a Better New Orleans
Kelli Walker Starrett	Senior Vice President & Governmental Relations	New Orleans Metropolitan Association of Realtors
Kenette Lewis	Human Resources Technician	Delgado Community College
Kenisha Green-Ross	Special Assistant to the Executive Director	Housing Authority of New Orleans
Kevin Williams	Detective	New Orleans Police Department
Kristi Trail	Executive Director	Lake Pontchartrain Basin Foundation
Lacy McManus	Vice President of Strategic Initiatives	Greater New Orleans Foundation
Lamar Gardere	Executive Director	The Data Center
Laura B. Bryan	Director	CNO-Department of Transportation
Laura Mellem	Public Engagement Officer	CNO-NOHSEP
Lauren Jardell	Director of Local Government and Community Relations	Tulane University

Leslie Alley	Agent	French Market Corporation
Liz Russell	Climate Justice Program Director	Foundation for Louisiana
Liz Williams	Coastal Communities Resiliency Program Officer	Foundation for Louisiana
Lona Edwards Hankins	Deputy Chief Executive Officer	New Orleans Regional Transit Authority
Louis Faust	Liaison Officer	New Orleans Police Department
Marion Pearson	State Hazard Mitigation Grant Program	GOHSEP
Marjorianna B. Willman	Director	CNO Housing Policy and Community Development
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Martha Griset	Director	CNO-Property Management
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Mathew Sanders	OCD-DRU policy advisor	State of Louisiana
Matt R. Torri	Deputy Director	City of New Orleans, Inc.
Matthew M. Spector	Liaison Officer	CNO-NOHSEP
Meagan Williams	Stormwater Program Manager	CNO-DPW
Meredith C. McInturff	Emergency Preparedness Lead	NOHD
Michael Antoine	Deputy Director	CNO-NOHSEP
Monica Farris	Director	UNO CHART
Nicholas W. Satterfield	Enterprise Rose Architectural Fellow	New Orleans Redevelopment Authority
Nick Harris	Director of Community and Church Relations	Dillard University
Oliver R. Zakrzewski	Operations Section Chief	CNO-NOHSEP
Patrice A. Bell	Vice President of Administration/ Chief of Staff	Xavier University New Orleans
Paul Lucius	Executive Director of Facilities	Orleans Parish School Board
Quentin Messer	President & CEO	New Orleans Business Alliance
Rayne E. Pestello	Special Assistant to the Mayor	CNO
Robin Barnes	Interim Executive Director	GNO, Inc
Roman Nelson	Deputy Superintendent	New Orleans Fire Department
Scott St. Pierre	Safety and Risk Manager	Delgado Community College
Sean Wyatt	Assistant Deputy Director of Hazard Mitigation	State of Louisiana HSEP
Seth C. Knudsen	Director of Real Estate Development & Planning	New Orleans Redevelopment Authority
Shayna E. Goldfine	NOEMS Liaison	CNO-NOSHEP
Shelley Smith	Deputy Executive Director	Housing Authority of New Orleans
Stephen Murphy	Assistant Professor	Tulane University
Steve Cochran	Associate Vice President, Coastal Resilience	Environmental Defense Fund
Steve Molnar	Project Manager	Entergy

Theodore Callier	Asst. Vice President for Research and Sponsored Programs	Dillard University
Tiffany Delcour	Chief Operations Officer	Orleans Parish
Vincent A. Smith	Director of Capital Projects	CNO
Vincenzo Pasquantonio	Public Policy Fellow	Disability Rights Louisiana
William T. Salmeron	Coordinator of Special Events & Planning	New Orleans EMS
Tamara Agins	Executive Director	Emerge Louisiana

Meeting Attendees:

Name	**Title**	**Agency**
Ann Wilson	Chief of Environmental Affairs	SWBNO
Austin Feldbaum	Senior Hazard Mitigation Specialist	CNO-NOHSEP
Benjamin Billings	Vice President	Civix
Brad Klamer	CRS Manager	CNO-Safety and Permits
Claudia Riegel	Director	CNO-NMTRCB
Daniel McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Elissa Hunter	Emergency Planner	SWBNO
Ella Aglipay Delio	Program Officer	Greater New Orleans Foundation
Grasshopper Mendoza	Chief Executive	Adaptation Strategies
Jaleesa Jackson	Program Coordinator	GNOHA
James Logan	Program Officer	GNOHA
Jennifer Day	Senior Planner	Civix
Jerome Landry	Floodplain Manager	CNO - Safety, and Permits
Jessica Knox	Senior Strategic Specialist	Housing Authority of New Orleans
John Lopez	Director	Pontchartrain Conservancy
Keith LaGrange	Director	CNO-DPW
Kirk Burrell		SWBNO
Laura Mellem	Public Engagement Manager	CNO-NOHSEP
Maggie Talley	Director	Jefferson Parish Floodplain Management & Hazard Mitigation
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Martha Griset	Director	CNO-Property Management
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Matt Torri	Deputy Director	CNO-Sanitation
Matthew Spector	Fire Department Liaison Officer	CNO-NOHSEP
Meagan Williams	Stormwater Program Manager	CNO-DPW
Meredith McInturff	Emergency Preparedness Lead	NOHD
Monica Farris	Director	UNO-CHART
Ryan Albright	Senior Planner	Civix
Shayna Goldfine	NOEMS Liaison	CNO-NOHSEP

Meeting #4: Climate Change Working Group Meeting 1

Date: September 28, 2020

Location: Online

Purpose: Review and provide an update on the Hazard Mitigation Plan process. Develop a new set of Mitigation Actions for the 2020 Hazard Mitigation Strategy with actions ranging from the lot- and neighborhood-scale interventions to city-wide, regional, or state-wide mitigation policies.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Natalie Snider	Senior Director	Restore the Coast
Anne Rolfes	Director	Louisiana Bucket Brigade
Website Defunct		Green Army
René Pastorek	Director	LA Chapter of the American Planning Association
Steve Cochran	Associate Vice President of Coastal Resilience	Environmental Defense Fund
Maggie Rose	AmeriCorps Vista	Global Green Community & Climate Action Center
Raoul Chauvin	Chapter President	New Orleans Chapter of the Louisiana Engineering Society
Andreanecia Morris	Executive Director	HousingNOLA
Leo Laventhal	Senior Organizing Representative	Sierra Club
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Liz Russell	Climate Justice Program Director	Foundation for Louisiana
David Muth	Director of Gulf Restoration	National Wildlife Federation
John Lopez	Director	Lake Pontchartrain Basin Foundation
Kimberly Reyher	Executive Director	Coalition to Restore Coastal Louisiana

Meeting Attendees:

Name	Title	Agency
Amanda Moore	Deputy Director	Gulf Program for National Wildlife Restoration
Andreanecia Morris	Executive Director	Housing Nola
Camille Pollan	Community Sustainability Manager	CNO-NOHSEP
Darryl Malek-Wiley	Senior Organizing Representative	Sierra Club
Ella Aglipay Delio	Program Officer	Greater New Orleans Foundation

John Lopez	Director	Lake Pontchartrain Basin Foundation
Liz Russell	Climate Justice Program Director	Foundation for Louisiana
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute

Meeting #5: Climate Change Working Group Meeting 2

Date: October 21, 2020

Location: Online

Purpose: Review and provide an update on the Hazard Mitigation Plan process. Develop a new set of Mitigation Actions to address climate change-related challenges faced by the City of New Orleans and its residents for the 2020 Hazard Mitigation Strategy. The actions developed in this meeting range from the lot- and neighborhood-scale interventions to city-wide, regional, or state-wide mitigation policies.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Natalie Snider	Senior Director	Restore the Coast
Anne Rolfes	Director	Louisiana Bucket Brigade
Website Defunct		Green Army
René Pastorek	Director	LA Chapter of the American Planning Association
Steve Cochran	Associate Vice President of Coastal Resilience	Environmental Defense Fund
Maggie Rose	AmeriCorps Vista	Global Green Community & Climate Action Center
Raoul Chauvin	Chapter President	New Orleans Chapter of the Louisiana Engineering Society
Andreanecia Morris	Executive Director	HousingNOLA
Leo Laventhal	Senior Organizing Representative	Sierra Club
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Liz Russell	Climate Justice Program Director	Foundation for Louisiana
David Muth	Director of Gulf Restoration	National Wildlife Federation
John Lopez	Director	Lake Pontchartrain Basin Foundation
Kimberly Reyher	Executive Director	Coalition to Restore Coastal Louisiana

Meeting Attendees:

Name	Title	Agency
Amanda Moore	Deputy Director	Gulf Program for National Wildlife Restoration
Andreanecia Morris	Executive Director	Housing Nola
Ella Aglipay Delio	Program Officer	Greater New Orleans Foundation
Kimberly Reyher	Executive Director	Coalition to Restore Coastal Louisiana
John Lopez	Director	Pontchartrain Conservancy

Liz Russell	Climate Justice Program Director	Foundation for Louisiana
Rashida Ferdinand	Executive Director	Sankofa Community Development Corporation
Reedy Brooks	Founder	Glory Gardens

Meeting #6: Water Management Working Group Meeting 1

Date: September 29, 2020

Location: Online

Purpose: Review and provide an update on the Hazard Mitigation Plan process. Develop a new set of Mitigation Actions for the 2020 Hazard Mitigation Strategy with actions ranging from the lot- and neighborhood-scale interventions to city-wide, regional, or state-wide mitigation policies.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Andreanecia Morris	Executive Director	HousingNOLA
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Meagan Williams	Stormwater Program Manager	CNO-DPW
Tyler Antrup	Director of Planning and Strategy	SWBNO
Jason Higginbotham	Chief of Security	SWBNO
John Lopez	Director	Lake Pontchartrain Basin Foundation
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Mark Wingate	Deputy District Engineer	US Army Corps of Engineers
Katie Donaghue		CNO-ORS
David Morris	Deputy Chief Resilience Officer	CNO-ORS
Jessica Dandridge	Executive Director	Water Collaborative of Greater New Orleans
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Jerome Landry	Coastal Zone Manager	CNO-Safety and Permits
Monica Farris	Director	UNO CHART

Meeting Attendees:

Name	Title	Agency
Dana Eness	Executive Director	Urban Conservancy
Angela Chalk	Executive Director	Healthy Community Services
Andreanecia Morris	Executive Director	HousingNOLA
Andreas Hoffman	Executive Director	Greenlight New Orleans
Claire Anderson	Executive Director	Ripple Effect
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Ella Aglipay Delio	Program Officer	Greater New Orleans Foundation
Jessica Dandridge	Executive Director	Water Collaborative of Greater New Orleans

Meagan Williams	Stormwater Program Manager	CNO-DPW
Ramiro Diaz	Architect & Planner	Waggonner and Ball
Scott Hemmerling	Director of Human Dimensions	Water Institute
Susannah Burley	Executive Director	SOUL

Meeting #7: Water Management Working Group Meeting 2

Date: October 22, 2020

Location: Online

Purpose: Review and provide an update on the Hazard Mitigation Plan process. Develop a new set of Mitigation Actions to address water management-related challenges faced by the City of New Orleans and its residents for the 2020 Hazard Mitigation Strategy. The actions developed in this meeting range from the lot- and neighborhood-scale interventions to city-wide, regional, or state-wide mitigation policies.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Andreanecia Morris	Executive Director	HousingNOLA
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Meagan Williams	Stormwater Program Manager	CNO-DPW
Tyler Antrup	Director of Planning and Strategy	SWBNO
Jason Higginbotham	Chief of Security	SWBNO
John Lopez	Director	Lake Pontchartrain Basin Foundation
Mark Davis	Center of Environmental Law Director	Tulane ByWater Institute
Mark Wingate	Deputy District Engineer	US Army Corps of Engineers
Katie Donaghue		CNO-ORS
David Morris	Deputy Chief Resilience Officer	CNO-ORS
Jessica Dandridge	Executive Director	Water Collaborative of Greater New Orleans
Ella D'Ellio	Program Officer	Greater New Orleans Foundation
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
Jerome Landry	Coastal Zone Manager	CNO-Safety and Permits
Monica Farris	Director	UNO CHART

Meeting Attendees:

Name	Title	Agency
Andreanecia Morris	Executive Director	HousingNOLA
Andreas Hoffman	Executive Director	Greenlight New Orleans
Dana Enness	Executive Director	Urban Conservancy
Derek Boese	Chief Administrative Officer	Flood Protection Authority-East
James Logan	Program Officer	Greater New Orleans Foundation
Jessica Dandridge	Executive Director	Water Collaborative of Greater New Orleans

Meagan Williams	Stormwater Program Manager	CNO-DPW
Ramiro Diaz	Architect & Planner	Waggonner and Ball
Scott Hemmerling	Director of Human Dimensions	Water Institute
Susannah Burley	Executive Director	SOUL (Sustaining Our Urban Landscape)

Meeting #8: City Hall Working Group Meeting 1

Date: October 2, 2020

Location: Online

Purpose: Review and provide an update on the Hazard Mitigation Plan process. Develop a new set of Mitigation Actions to address challenges faced by the City of New Orleans and its residents for the 2020 Hazard Mitigation Strategy. The actions developed in this meeting range from the lot- and neighborhood-scale interventions to city-wide, regional, or state-wide mitigation policies.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Tom Schrilla	Planner	CNO-NOHSEP
Michael Antoine	Deputy Director	CNO-NOHSEP
Courtney W. Story	Innovation Manager	CNO
Meredith C. McInturff	Emergency Preparedness Lead	NOHD
Oliver R. Zakrzewski	Operations Section Chief	CNO-NOHSEP
David Morris	Deputy Chief Resilience Officer	CNO-ORS
Katrina Porter-Dean	Program Coordinator	CNO-NOHSEP
Cynthia Sylvain-Lear	Director	CNO-Sanitation
Collin Arnold	Director	CNO-NOHSEP
Avi Becher	Closeout Specialist	CNO-NOHSEP
Daniel McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
Jennifer A. Breaux	Research Entomologist	CNO-NMTRCB
Claudia Riegel	Director	CNO-NMTRCB
Ross Bourgeois	Real-Time Crime Center Administrator	CNO-NOHSEP
Louis Faust	Liaison Officer	New Orleans Police Department
William T. Salmeron	Deputy Director/Chief	CNO-EMS
Brad Klamer	CRS Manager	CNO-Safety and Permits
Cara Rodrigue	Operations Program Manager	NOHD
Eric Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Shayna Goldfine	NOEMS Liaison	CNO-NOSHEP
Randi Jones	Capital Projects Program Administrator	CNO-Capital Projects
Robert Eiserloh	Deputy Superintendent of Operations	CNO-Fire Department

Meeting Attendees:

Name	Title	Agency
Avi Becher	Closeout Specialist	CNO-NOHSEP
Brad Klamer	CRS Manager	CNO-Safety and Permits
Cara Rodrigue	Operations Program Manager	NOHD

David Morris	Deputy Chief Resilience Officer	CNO-NOHSEP
Jennifer Breaux	Research Entomologist	CNO-NMTRCB
Laura Mellem	Public Engagement Officer	CNO-NOHSEP
Shayna Goldfine	NOEMS Liaison	CNO-NOSHEP
Cynthia Sylvain-Lear	Director	CNO-Sanitation
Daniel McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
Merideth McInturff	Emergency Preparedness Lead	NOHD
Mary Kincaid	Sustainable Infrastructure Program Manager	CNO-Project Delivery
Tom Schrilla	Planner	CNO-NOHSEP
Kelly Jefferies	Planner	CNO-NOHSEP
Randi Jones	Capital Projects Program Administrator	CNO-Capital Projects
Michael Antoine	Deputy Director	CNO-NOHSEP
Claudia Riegel	Director	CNO-NMTRCB
Eric Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Roman Nelson	Deputy Superintendent	CNO-NOFD

Meeting #9: City Hall Working Group Meeting 2

Date: October 20, 2020

Location: Online

Purpose: Provide an update on the Hazard Mitigation Plan process. Discuss the full draft set of Mitigation Actions to address challenges faced by the City of New Orleans and its residents that were developed from the first round of Working Group meetings. Prioritize the Mitigation Actions for the 2020 Hazard Mitigation Plan (HMP) and identify gaps in the existing set of Actions.

Public Invitation: No

Meeting Invitees:

Name	Title	Agency
Tom Schrilla	Planner	CNO-NOHSEP
Michael Antoine	Deputy Director	CNO-NOHSEP
Courtney W. Story	Innovation Manager	CNO
Meredith C. McInturff	Emergency Preparedness Lead	NOHD
Oliver R. Zakrzewski	Operations Section Chief	CNO-NOHSEP
David Morris	Deputy Chief Resilience Officer	CNO-ORS
Katrina Porter-Dean	Program Coordinator	CNO-NOHSEP
Cynthia Sylvain-Lear	Director	CNO-Sanitation
Collin Arnold	Director	CNO-NOHSEP
Avi Becher	Closeout Specialist	CNO-NOHSEP
Daniel McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
Jennifer A. Breaux	Research Entomologist	CNO-NMTRCB
Claudia Riegel	Director	CNO-NMTRCB
Ross Bourgeois	Real-Time Crime Center Administrator	CNO-NOHSEP
Louis Faust	Liaison Officer	New Orleans Police Department
William T. Salmeron	Deputy Director/Chief	CNO-EMS
Brad Klamer	CRS Manager	CNO-Safety and Permits
Cara Rodrigue	Operations Program Manager	NOHD
Eric Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Shayna Goldfine	NOEMS Liaison	CNO-NOSHEP
Randi Jones	Capital Projects Program Administrator	CNO-Capital Projects
Robert Eiserloh	Deputy Superintendent of Operations	CNO-Fire Department

Meeting Attendees:

Name	Title	Agency
Austin Feldbaum	Senior Hazard Mitigation Specialist	CNO-NOHSEP
Meagan Williams	Stormwater Program Manager	CNO-DPW
Matthew Spector	Fire Department Liaison Officer	CNO-NOHSEP

Collin Arnold	Director	CNO-NOHSEP
Avi Becher	Closeout Specialist	CNO-NOHSEP
Brad Klamer	CRS Manager	CNO-Safety and Permits
Shayna Goldfine	NOEMS Liaison	CNO-NOHSEP
Tom Schrilla	Planner	CNO-NOHSEP
Eric Ogburn	Director of Enterprise Information	CNO IT Web Data & GIS
Cara Rodrigue	Operations Program Manager	CNO-NOHSEP
Laura Mellem	Public Engagement Manager	CNO-NOHSEP
Gregory Reece	Public Safety GIS Officer	CNO-NOHSEP
Oliver Zakrzewski	Deputy Operations Section Chief	CNO-NOHSEP
Daniel McElmurray	Chief Landscape Architect	CNO-Parks and Parkways
Ross Bourgeois	Real-Time Crime Center Administrator	CNO-NOHSEP
Juliette Frazier	Healthy Environment Coordinator	NOHD

Meeting #10: Public Meeting 1

Date: April 7, 2020

Location: Online

Purpose: To introduce the public to the hazard mitigation planning process. The agenda included a Project Timeline, Identifying Hazards, and a Polling Activity to better understand the views of the public on the hazards under examination.

Public Invitation: Yes

Meeting Invitees: General Public and Community Stakeholders

Meeting Attendees: 95 People Attended

First Name	Last Name
Sheila	
Wendy	King
Carl	K
jeffrey	eaton
Clarence	Lymon
Taylor	Fehmel
Ed	trapido
Addy	m
Ryan	jeansonne
Debby	Pigman
Felix	Jones
Jacquelle	
Jwaxman1	
Claire	Romaine
Hoang	Tao
Reddy	Nandipati
user	
Lyneisha	Jackson
Mike	Biros
Andrew	Doyle
Elane	Burleigh
Valerie	Wheatley
Paul	Meyer
Jennifer	Day
Camellia	Okpodu
Jessica	L
S.M.	
Taylor	Fehmel
Lucy	Bulmahn

Lucy	Bulmahn
Nicole	Coleman
Policemonitor	policemonitor
Joseph	
Matthew	
wboudre	
Don	H
Andy	Kowalczyk
Adam	Robins
Sarah	ripp
Kielee	Clement
Austin	Feldbaum
Will	Thinnes
Benjamin	Billings
tmartin	
Stephanie	Dreher
Molly	Blair
Sarah	
achal	
courtlyn	
courtlyn	
courtlyn	
courtlyn	
Lucy	Bulmahn
Yaye	sarr
Xeddy	
Keith	Bartlett
ltalley	
Tracy	Garrett-Numa
Nina	
Paul	B
Nicole	Morales
Hexing	
Bayley	Romig
Bayley	Romig
Hoang	Tao
Cammi	O
Monica	Farris
lavondra	
Jim	Goodwin
Ryan	Albright
Kévin	Byrne
Kévin	Byrne

S	Armstrong
S	Armstrong
Grasshopper	Mendoza
Harry	Lowenburg
Amy	
Matt	Stanley
French	
lstevens	
Annalee	Jackson
S	Armstrong
Maryann	
Michelle	Simon
Aron	
Benjamin	Quimby
Dana	Eness
Lisa	Fritscher
Indred’s	PC
Dell	
Ellie	Pectol
Liz	Maxwell
Taylor	Johnson
Hannah	Perkins
Chelsea	
Ted	Guillot

Meeting #11: Public Meeting 2

Date: July 29, 2020

Location: Online

Purpose: Provide an Overview of Hazard Mitigation Plan and Planning Process, Project Timeline, Hazard Identification and Risk Assessment Summary, and Polling Activity about Hazard Awareness.

Public Invitation: Yes

Meeting Invitees: General Public and Community Stakeholders

Meeting Attendees:

Name
Chris Cameron
achal
afeldbaum
lisa kutyreff
Felice Lavergne
Chuck Morse
Benjamin Quimby
French
Hoang Tao
Jennifer Day
George Haddow
zulnun awadallah
.
Leslie Alley
Brenda Lomax-Brown
Brenda Lomax-Brown
Gaige
Jason Doyle
Adrienne
Stephen
James Logan
James C Goodwin
Joe LaRochelle
samara
samara
Mike Biros
Monica Charlton
Brooke Randolph
David Culpepper

Katharine Ercole Poole
Walterine & Dennis Griffin
Alahna Moore
Alahna Moore
Taylor Johnson
Ryan Albright
Nicholas Phillips
Bonnie Canal
Aron
Ana Edwards
Andreas Hoffmann
Evann Whitt
Yvonne Gray
Louis
Monica Farris
Laura Mellem
san
Grasshopper Mendoza
Felice
YB Gray
Brooke Morris
Wendy King
Emily May
Tara Tolford
Ann Maier
Sarah
Evan
ltalley
Nichelle Taylor
Charlie Barnes
Charlie Barnes
joanna
Ana Edwards
lisa kutyreff
Kirk Paxson
giovanni lopez
Devin Wright
Clayton Smith
Wesley Gillen
Wesley Gillen
Debby Pigman
Debby Pigman

Meeting #12: Public Meeting 3

Date: September 17, 2020

Location: Online

Purpose: The agenda included the project timeline, mitigation strategy framework, review of the current actions, a description of how to propose new actions, and next steps in the process.

Public Invitation: Yes

Meeting Invitees: General Public and Community Stakeholders

Meeting Attendees:

Name
Ryan Albright
Nathan Cataline
afeldbaum
Billie Johnson
Clayton Smith
Debby Pigman
Benjamin Quimby
French
Hoang Tao
J&G
Julie Pfeffer
Katharine Ercole Poole
Katie Donahoue
Laura Mellem
lhankins
lstevens
Madeline Solomon
MarkSchexnayder
Nichelle Taylor
Reddy Nandipati
Tara Tolford
Call in Users (16)

Meeting #13: Public Meeting 4

Date: November 19, 2020

Location: Online

Purpose: The agenda included an Overview of Hazard Mitigation Plan Process, Updated 2020 Mitigation Actions and concluded with Questions and Comments

Public Invitation: Yes

Meeting Invitees: General Public and Community Stakeholders

Meeting Attendees:

Name
Ann Wilson
Maggie Talley
Sage Teasley
Monica Farris
Abrina Williams
Lauren Jardell
Kirk Burrell
Laura Mellem
Ben Quimby
Grasshopper Mendoza
Mike Biros
Reddy Nandipati
Danielle Curtis
Scott Finney
French Wetmore
Erika Boer
Austin Feldbaum
Ryan Albright
Amanda Kannard
Hoang Tao
Call-In Users (5)

Appendix B: Plan Maintenance

B.1 Purpose

This section details the method and system for plan maintenance, following the CFR's guidelines that the Plan Update must include (1) "a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle" (2) "a process by which local governments incorporated the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans" and (3) "discussion on how the community will continue public participation in the plan maintenance process." Once the Plan has been approved by GOHSEP and FEMA and adopted by the City Council, the Plan must be maintained to continue be effective and relevant. This section describes the process that the City will use to update the plan and keep the community informed of progress in implementing the mitigation strategy.

B.2 Interim Final Rule (IFR) Requirements for Plan Maintenance

IFR §201.6(c)(4)(i): The plan maintenance process shall include a) section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

IFR §201.6(c)(4)(ii): The plan shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, where appropriate.

IFR §201.6(c)(4)(iii): The plan shall include a discussion on how the community will continue public participation in the plan maintenance process.

B.3 Monitoring, Evaluating, and Updating the Plan

The NOHSEP Hazard Mitigation Office will be responsible for monitoring implementation of the mitigation strategy and coordinating regular updates to the Plan to ensure it remains an effective tool. The Hazard Mitigation Office will continue to facilitate meetings of the Hazard Mitigation Committee on a quarterly basis, and will produce an annual report that includes updates on the implementation status of Plan, updates to the risk assessment and capability assessment to incorporate new data and developments, and new mitigation action items.

The Hazard Mitigation Subcommittee of the Local Emergency Preparedness Committee will continue to be the primary mechanism for interagency coordination and public involvement during the implementation and monitoring phase of this Plan. The Hazard Mitigation Office will continue to facilitate quarterly meetings of the Committee.

The lead agency responsible for implementing each mitigation action in this Plan will submit annual progress reports to the Hazard Mitigation Office. The Director of the NOHSEP Hazard Mitigation Office, or their designated representative, will be responsible for ensuring that the progress reports are completed and that relevant updates are included in the Hazard Mitigation Annual Report.

During these annual reviews, the Planning Committee will also evaluate the Plan to ensure that the Risk Assessment and Capability Assessment sections of the Plan are current. Any major changes to the hazards that threaten New Orleans or to the vulnerability of persons or property in New Orleans will be noted. The Plan review will consider issues such as, changes in vulnerability due to the completion of mitigation projects, new information about hazards, and changes in the community's capability to implement projects. The NOHSEP Hazard Mitigation Office and the Committee will review changes in regulations, funding, socioeconomic conditions of the community, and political support for the Mitigation Strategy. When needed, the goals, objectives, mitigation actions, and priorities will be changed to reflect the changing needs of the community.

The NOHSEP Hazard Mitigation Office will be responsible for updating the plan with assistance from the Planning Team. The plan will be reviewed, revised, and updated every five years from the date of FEMA's approval. If a disaster occurs or as action items are met, the plan will be reviewed, revised, and updated sooner than the required five years, via the process outlined above. With adoption in 2021, the Plan will enter the review and update cycle in 2025, with the adoption of the revisions in 2026. The Plan will be sent back to FEMA for re-approval within the five-year cycle.

B.4 Incorporation into Existing Planning Programs

The Orleans Parish Hazard Mitigation Plan will serve as the main statement of disaster risk reduction policy for the City of New Orleans. The 2020 plan will play an important role in the City's Resilience Strategy, which outlines the need to consider environmental shocks and stresses together and integrate overall approaches to them. Aligning the Hazard Mitigation Plan with the Resilience Strategy vision will guide the City's risk reduction plans for natural and man-made disasters.

The NOHSEP Hazard Mitigation Office, with support from the committee, will review the findings from the Capability Assessment and work with the City's Chief Administrative Officer (CAO) to find effective ways to integrate the mitigation actions into day-to-day operations within the City departments. The Hazard Mitigation staff will begin with the following:

- Work with the CAO to obtain proper authority to require cooperation and participation from departments and agencies to implement the Hazard Mitigation Action Plan.
- Include mitigation project funding in the City's capital and operating budgets.
- Issue a letter to department heads to solicit their support and explore opportunities to integrate hazard mitigation actions into day-to-day operations.
- Examine administrative functions that have a bearing on reducing risks from hazards identified in the Mitigation Plan. Where needed, work plans, policies, and procedures will be changed to integrate mitigation planning efforts into these administrative functions.
- Work with department heads to review job descriptions and identify day-to-day work assignments that can be broadened to effectively integrate mitigation planning activities throughout city government.

The NOHSEP Hazard Mitigation Office will also work with the following departments to integrate the implementation of the Hazard Mitigation Action Plan into the enforcement and

implementation of other planning tools, codes, and ordinances. Examples of these efforts include the following:

- Coordinate with Safety and Permits and other appropriate departments to ensure that the minimum standards established in the International Building Code are being enforced. Coordinate with Safety and Permits and other appropriate departments to enforce the Floodplain Management Ordinance, to participate in the National Flood Insurance Program, and to implement improvements for the Community Rating System (CRS).
- Coordinate with the City Planning Commission and other appropriate departments to ensure that the adopted Hazard Mitigation Plan is added as an Appendix to the New Orleans Master Plan.
- Coordinate with the City Planning Commission and other appropriate departments to educate citizens, boards, and commissions on the Hazard Mitigation Plan and how planning and zoning can reduce hazard risks for the community.
- Coordinate with the NOHSEP Office to ensure that appropriate sections of the Hazard Mitigation Plan are integrated into the New Orleans Comprehensive Emergency Operations Plan (CEOP). The CEOP addresses mitigation of, preparation for, and recovery from a wide variety of emergencies and disasters. Once the Hazard Mitigation Plan has been adopted, it will become part of the CEOP and be included as an appendix to that document.
- The NOHSEP Hazard Mitigation Office will report on efforts to integrate the Mitigation Action Plan into other planning mechanisms at each quarterly committee meeting and discuss new opportunities to build on what has already been accomplished.

B.5 Public Participation in Plan Maintenance Process

The public will be given opportunities to comment on progress in implementing the Hazard Mitigation Action Plan and on any proposed plan revisions through community surveys and during periodic public workshops/meetings.

- A community survey will be distributed to the public periodically to solicit information regarding 1) understanding of the identified hazards, mitigation actions, and implementation strategy, and plan maintenance process; 2) recommendations for keeping the community informed about implementation progress of the Plan; and 3) comments regarding progress in implementing specific mitigation projects or any proposed plan revisions.
- Appropriate public workshops will be held to review the status of implementing the mitigation strategy, and to receive a summary report of the annual reports' findings and recommendations.
- Public comments can be submitted to the NOHSEP Hazard Mitigation Office through the website (www.ready.nola.gov/hazard-mitigation), email or mail. The Hazard Mitigation Office will maintain records of the comments submitted and their resolution.
- Numerous partners inside of and external to the City government will be involved in implementing the actions recommended by this plan. Small group meetings will be held as needed throughout the life of the Plan to coordinate implementation of specific actions.
- The community will be notified and included in any public hearing process conducted by the City Council to adopt any Plan revisions.

The NOHSEP Hazard Mitigation Office will use the following means to keep the community informed regarding the implementation of the Hazard Mitigation Plan, the plan maintenance process, and any proposed changes to the Hazard Mitigation Plan:

- Information updates on the Hazard Mitigation website www.ready.nola.gov/hazard-mitigation);
- Emails to neighborhood associations; community, business, and non-profit organizations; churches, etc. as included in the Stakeholder Email Database developed during the 2020 Plan Update;
- Press releases and public service announcements (PSA's);
- Annual progress reports.

The NOHSEP Hazard Mitigation Office will accept public feedback on the Plan on an ongoing basis. The chief method of soliciting feedback will be the Hazard Mitigation website (www.ready.nola.gov/hazard-mitigation). Once the Hazard Mitigation Plan is approved, it will be posted on the website, and hard copies of the plan will be distributed to all branches of the New Orleans Public Library. Any updates to the Plan will also be posted on the Hazard Mitigation website.

The NOHSEP Hazard Mitigation Office will use press releases, public service announcements, the Hazard mitigation website, and emails to inform the community regarding where to send comments and how to view a copy of the Plan or any Plan revisions. Information on where to send comments will also be noted in the press releases, public service announcements, on the Hazard Mitigation website and, in emails to Stakeholders.

All comments will be directed to:

New Orleans Office of Homeland Security and Emergency Preparedness (NOHSEP)
Hazard Mitigation Office
City Hall Room 9W03
1300 Perdido St
New Orleans, LA 70112
hazardmitigation@nola.gov

Appendix C: Critical Facilities

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Fire and Rescue	Fire Station 1	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 4	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 6	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 7	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 8	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 10	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 12	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 13	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 14	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 15	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 16	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 17	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 18	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 20	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 21	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 24	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 25	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 27	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 29	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 31	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 33	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 35	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 36	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 37	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 38	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 40	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Fire and Rescue	Fire Station 39	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 9	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 2	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station 26	x	x	x	x	x	x	x	x
Fire and Rescue	Fire Station IT	x	x	x	x	x	x	x	x
Government	City Hall	x	x	x	x	x	x	x	x
Government	Algiers Regional Branch	x	x	x	x	x	x	x	x
Government	Alvar Library	x	x	x	x	x	x	x	x
Government	Main Library	x	x	x	x	x	x	x	x
Government	Children's Resource Center	x	x	x	x	x	x	x	x
Government	Cita Dennis Hubbell Library	x	x	x	x	x	x	x	x
Government	East New Orleans Regional Library	x	x	x	x	x	x	x	x
Government	Norman Mayer Library	x	x	x	x	x	x	x	x
Government	Milton H. Latter Memorial Library	x	x	x	x	x	x	x	x
Government	Nix Library	x	x	x	x	x	x	x	x
Government	Robert E. Smith Library	x	x	x	x	x	x	x	x
Government	Rosa F. Keller Library & Community Center	x	x	x	x	x	x	x	x
Government	Mid-City Branch	x	x	x	x	x	x	x	x
Government	Central City Library	x	x	x	x	x	x	x	x
Government	Martin Luther King Library	x	x	x	x	x	x	x	x
Government	Nora Navra Library	x	x	x	x	x	x	x	x
Schools	Akili Academy of New Orleans	x	x	x	x	x	x	x	x
Schools	Alice M. Harte Elementary School	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Andrew Wilson Charter School	x	x	x	x	x	x	x	x
Schools	ARISE Academy	x	x	x	x	x	x	x	x
Schools	Audubon Charter School: Gentilly	x	x	x	x	x	x	x	x
Schools	Audubon Charter School French	x	x	x	x	x	x	x	x
Schools	Audubon Charter School French	x	x	x	x	x	x	x	x
Schools	Benjamin Franklin Elementary Mathematics and Science School	x	x	x	x	x	x	x	x
Schools	Benjamin Franklin High School	x	x	x	x	x	x	x	x
Schools	Bricolage Academy	x	x	x	x	x	x	x	x
Schools	Abramson Sci Academy	x	x	x	x	x	x	x	x
Schools	G.W. Carver High School	x	x	x	x	x	x	x	x
Schools	Livingston Collegiate Academy	x	x	x	x	x	x	x	x
Schools	Dr. Martin Luther King Jr. Charter School For Science and Technology	x	x	x	x	x	x	x	x
Schools	Dwight D. Eisenhower Academy of Global Studies	x	x	x	x	x	x	x	x
Schools	Edna Karr High School	x	x	x	x	x	x	x	x
Schools	Edward Hynes Charter School - Lakeview Campus	x	x	x	x	x	x	x	x
Schools	Einstein Charter High School at Sarah Towles Reed	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Einstein Charter Middle School at Sarah Towles Reed	x	x	x	x	x	x	x	x
Schools	Einstein Charter School at Sherwood Forest	x	x	x	x	x	x	x	x
Schools	Einstein Charter School at Village De L'est	x	x	x	x	x	x	x	x
Schools	Elan Academy	x	x	x	x	x	x	x	x
Schools	Eleanor McMain Secondary School	x	x	x	x	x	x	x	x
Schools	ENCORE Academy	x	x	x	x	x	x	x	x
Schools	Esperanza Charter School	x	x	x	x	x	x	x	x
Schools	Fannie C. Williams Charter School	x	x	x	x	x	x	x	x
Schools	FirstLine Schools: Arthur Ashe	x	x	x	x	x	x	x	x
Schools	FirstLine Schools: Langston Hughes Academy	x	x	x	x	x	x	x	x
Schools	FirstLine Schools: Live Oak	x	x	x	x	x	x	x	x
Schools	FirstLine Schools: Phillis Wheatley Community School	x	x	x	x	x	x	x	x
Schools	FirstLine Schools: Samuel J Green Charter School	x	x	x	x	x	x	x	x
Schools	Homer A. Plessy Community School	x	x	x	x	x	x	x	x
Schools	International School of Louisiana: Dixon Campus (Spanish)	x	x	x	x	x	x	x	x
Schools	International School of Louisiana: Olivier Street Campus (Spanish)	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	International School of Louisiana: Camp Street Campus (French)	x	x	x	x	x	x	x	x
Schools	James M. Singleton Charter School	x	x	x	x	x	x	x	x
Schools	JCFA - Algiers Campus	x	x	x	x	x	x	x	x
Schools	John F. Kennedy High School (KIPP)	x	x	x	x	x	x	x	x
Schools	Joseph A. Craig Charter School	x	x	x	x	x	x	x	x
Schools	KIPP Central City	x	x	x	x	x	x	x	x
Schools	KIPP East	x	x	x	x	x	x	x	x
Schools	KIPP Leadership	x	x	x	x	x	x	x	x
Schools	KIPP Morial	x	x	x	x	x	x	x	x
Schools	L. B. Landry – O. Perry Walker College and Career Preparatory High School	x	x	x	x	x	x	x	x
Schools	Lake Forest Elementary Charter School	x	x	x	x	x	x	x	x
Schools	Lawrence D. Crocker College Prep: A School for the Arts and Technology	x	x	x	x	x	x	x	x
Schools	Lusher Charter Elementary School	x	x	x	x	x	x	x	x
Schools	Lusher Middle and High Charter School	x	x	x	x	x	x	x	x
Schools	Lycée Français de la Nouvelle-Orléans	x	x	x	x	x	x	x	x
Schools	Lycée Français de la Nouvelle-Orléans	x	x	x	x	x	x	x	x
Schools	Mary D. Coghill Elementary School	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Mary McLeod Bethune Elementary Charter School	x	x	x	x	x	x	x	x
Schools	McDonogh #32 Literacy Charter School	x	x	x	x	x	x	x	x
Schools	McDonogh #35 College Preparatory High School	x	x	x	x	x	x	x	x
Schools	McDonogh #42 Elementary Charter School	x	x	x	x	x	x	x	x
Schools	Mildred Osborne Charter School	x	x	x	x	x	x	x	x
Schools	New Orleans Center for Creative Arts	x	x	x	x	x	x	x	x
Schools	New Orleans Charter Science and Math High School (Sci High)	x	x	x	x	x	x	x	x
Schools	New Orleans Military and Maritime Academy (NOMMA)	x	x	x	x	x	x	x	x
Schools	Noble Minds Institute for Whole Child Learning	x	x	x	x	x	x	x	x
Schools	Paul Habans Charter School	x	x	x	x	x	x	x	x
Schools	Pierre A. Capdau Charter School at Avery Alexander Elementary	x	x	x	x	x	x	x	x
Schools	Accelerated High School	x	x	x	x	x	x	x	x
Schools	ReNEW Dolores T. Aaron Academy	x	x	x	x	x	x	x	x
Schools	ReNEW SciTech Academy	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Robert Russa Moton Charter School	x	x	x	x	x	x	x	x
Schools	Rooted School	x	x	x	x	x	x	x	x
Schools	Sophie B. Wright High School	x	x	x	x	x	x	x	x
Schools	Success at Thurgood Marshall	x	x	x	x	x	x	x	x
Schools	The Net Charter High School: Cental City	x	x	x	x	x	x	x	x
Schools	The NET Charter High School: Gentilly	x	x	x	x	x	x	x	x
Schools	Travis Hill School: Orleans Justice Center	x	x	x	x	x	x	x	x
Schools	Warren Easton High School	x	x	x	x	x	x	x	x
Schools	Kipp Central City	x	x	x	x	x	x	x	x
Schools	International School of Louisiana: Camp Street Campus (Spanish)	x	x	x	x	x	x	x	x
Schools	International School of Louisiana: Dixon Campus (French)	x	x	x	x	x	x	x	x
Schools	Walter L. Cohen Academy of Career and Community Education (ACCE)	x	x	x	x	x	x	x	x
Schools	Walter L. Cohen College Prep	x	x	x	x	x	x	x	x
Schools	ReNEW Schaumburg Elementary	x	x	x	x	x	x	x	x
Schools	Opportunities Academy	x	x	x	x	x	x	x	x
Schools	New Harmony High	x	x	x	x	x	x	x	x
Schools	Morris Jeff Community School	x	x	x	x	x	x	x	x
Schools	Morris Jeff Community School	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Martin Behrman Charter School Academy of Creative Arts and Sciences	x	x	x	x	x	x	x	x
Schools	Lafayette Academy Charter School	x	x	x	x	x	x	x	x
Schools	Lafayette Academy Charter School	x	x	x	x	x	x	x	x
Schools	KIPP Believe	x	x	x	x	x	x	x	x
Schools	Harriet Tubman Charter School	x	x	x	x	x	x	x	x
Schools	Harriet Tubman Charter School	x	x	x	x	x	x	x	x
Schools	Foundation Preparatory Charter	x	x	x	x	x	x	x	x
Schools	Dr. Martin Luther King Jr. Charter School For Science and Technology	x	x	x	x	x	x	x	x
Schools	Benjamin Franklin Elementary Mathematics and Science School	x	x	x	x	x	x	x	x
Schools	Edward Hynes Charter School - Lakeview Campus	x	x	x	x	x	x	x	x
Schools	Edward Hynes Charter School - UNO	x	x	x	x	x	x	x	x
Schools	Edward Hynes Charter School - UNO (French)	x	x	x	x	x	x	x	x
Schools	Waldorf School of New Orleans	x	x	x	x	x	x	x	x
Schools	Audubon Charter School Montessori	x	x	x	x	x	x	x	x
Schools	Booker T. Washington High School (KIPP)	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Rosenwald Collegiate Academy	x	x	x	x	x	x	x	x
Schools	Ecole Bilingue De La Nouvelle-Orleans	x	x	x	x	x	x	x	x
Schools	Frederick A. Douglass High School (KIPP Renaissance)	x	x	x	x	x	x	x	x
Schools	Hype Academy	x	x	x	x	x	x	x	x
Schools	IDEA Oscar Dunn	x	x	x	x	x	x	x	x
Schools	Living School	x	x	x	x	x	x	x	x
Schools	ReNEW Early Childhood Center @ Gilda's Academy	x	x	x	x	x	x	x	x
Schools	Academy Of The Sacred Heart High School	x	x	x	x	x	x	x	x
Schools	Academy Of The Sacred Heart Lower School	x	x	x	x	x	x	x	x
Schools	Brother Martin High School	x	x	x	x	x	x	x	x
Schools	Cabrini High School	x	x	x	x	x	x	x	x
Schools	Christian Brothers School	x	x	x	x	x	x	x	x
Schools	De La Salle High School	x	x	x	x	x	x	x	x
Schools	Holy Cross Middle and High School	x	x	x	x	x	x	x	x
Schools	Holy Name Of Jesus Elementary School	x	x	x	x	x	x	x	x
Schools	Holy Rosary Academy and High School	x	x	x	x	x	x	x	x
Schools	Jesuit High School	x	x	x	x	x	x	x	x
Schools	Lake Castle Private School	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Mount Carmel Academy High School	x	x	x	x	x	x	x	x
Schools	Resurrection Of Our Lord Elementary School	x	x	x	x	x	x	x	x
Schools	St. Andrew The Apostle Elementary School	x	x	x	x	x	x	x	x
Schools	St. Mary's Academy	x	x	x	x	x	x	x	x
Schools	St. Marys Dominican High School	x	x	x	x	x	x	x	x
Schools	St. Michael Special School	x	x	x	x	x	x	x	x
Schools	St. Peter Claver School	x	x	x	x	x	x	x	x
Schools	St. Pius X School	x	x	x	x	x	x	x	x
Schools	St. Stephen School	x	x	x	x	x	x	x	x
Schools	St. Alphonsus Elementary School	x	x	x	x	x	x	x	x
Schools	St. Anthony Of Padua School	x	x	x	x	x	x	x	x
Schools	St. Augustine Senior High School	x	x	x	x	x	x	x	x
Schools	St. Benedict The Moor Elementary School	x	x	x	x	x	x	x	x
Schools	St. Joan Of Arc School	x	x	x	x	x	x	x	x
Schools	St. Katharine Drexel	x	x	x	x	x	x	x	x
Schools	St. Rita School	x	x	x	x	x	x	x	x
Schools	Stuart Hall	x	x	x	x	x	x	x	x
Schools	Good Shepherd Nativity Mission Elementary School	x	x	x	x	x	x	x	x
Schools	Ursuline Academy	x	x	x	x	x	x	x	x
Schools	Ursuline Academy Elementary School	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Christian Brothers School	x	x	x	x	x	x	x	x
Schools	St. Leo the Great	x	x	x	x	x	x	x	x
Schools	St. Dominic School	x	x	x	x	x	x	x	x
Schools	Holy Cross Priimary School	x	x	x	x	x	x	x	x
Schools	Calvary Baptist School	x	x	x	x	x	x	x	x
Schools	Bishop McManus Academy	x	x	x	x	x	x	x	x
Schools	Life Of Christ Christian Academy	x	x	x	x	x	x	x	x
Schools	Light City Christian Academy	x	x	x	x	x	x	x	x
Schools	The Upperroom Bible Church Academy	x	x	x	x	x	x	x	x
Schools	St. George's Episcopal School	x	x	x	x	x	x	x	x
Schools	St. Paul's Episcopal School	x	x	x	x	x	x	x	x
Schools	St. Andrew's Episcopal School	x	x	x	x	x	x	x	x
Schools	Trinity Episcopal School	x	x	x	x	x	x	x	x
Schools	St. John Lutheran School	x	x	x	x	x	x	x	x
Schools	University Montessori School	x	x	x	x	x	x	x	x
Schools	New Orleans Adventist Academy	x	x	x	x	x	x	x	x
Schools	The University of New Orelans	x	x	x	x	x	x	x	x
Schools	Tulane University	x	x	x	x	x	x	x	x
Schools	Loyal University New Orleans	x	x	x	x	x	x	x	x
Schools	Xavier University of Louisiana	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Schools	Dillard University	x	x	x	x	x	x	x	x
Schools	University of Holy Cross	x	x	x	x	x	x	x	x
Schools	Southern University at New Orleans	x	x	x	x	x	x	x	x
Schools	Louisiana State University Health Sciences Center New Orleans	x	x	x	x	x	x	x	x
Schools	Delagado Community College	x	x	x	x	x	x	x	x
Schools	Crescent School Gaming and Bartending	x	x	x	x	x	x	x	x
Schools	Tech Talent South - NOLA Campus	x	x	x	x	x	x	x	x
Schools	Saint Agatha Career School	x	x	x	x	x	x	x	x
Schools	Nursing Assistant Network Association	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Children's Hospital of New Orleans	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Medical Center of Louisiana at New Orleans	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Ochsner Baptist Medical Center	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Ochsner Medical Center	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Touro Infirmary	x	x	x	x	x	x	x	x
Public Health (Hospitals)	Tulane Medical Center	x	x	x	x	x	x	x	x
Public Health (Hospitals)	University Hospital, Ne w Orleans	x	x	x	x	x	x	x	x
Public Health (Hospitals)	New Orleans VA Medical Center	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
Police Stations and Orleans Parish Prison	2nd District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	4th District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	6th District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	8th District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	1st District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	Headquarters	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	3rd District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	7th District	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	SOD	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	Mounted / K-9	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	Traffic	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	Facility Support	x	x	x	x	x	x	x	x
Police Stations and Orleans Parish Prison	5th District	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Sewer Operation***								
SWBNO Pump Stations and Facilities	West Bank STP	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	East Bank STP	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Sta A SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Sat B SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Sta C SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	01 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	03 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	04 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	05 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	06 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	08 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	09 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	14 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	15 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	16 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	17 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	18 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	19 SPS	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	20 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	21 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	22 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	23 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	24 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	25 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	26 SPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Alcee Fortier	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	America	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	America Marine	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Amid	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Aurora	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Berge	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Blvd X	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Bariarwood	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Bridge Plaza	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Bullard	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Burke	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Castle Manor	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Cerise	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Chickasaw	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	City Park	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Crowder	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Dodt	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Eastover	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	English turn I	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	English Turn II	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	English Turn III	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Eton	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Folgers	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Forest Isle	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	France And Fla	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Garden Oaks	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Gentilly Oaks	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Holiday	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Horace	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Huntlee	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Industrial Park	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Kmart	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Lake Forest	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	LakeLand Terrace	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Lakewood South	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Lamb	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Lawrence	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Liggett	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Lower Coast	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Mccoy	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Mech Equip (Meco)	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Memorial	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Michoud	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Oak Island	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Paris Road	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Park Timbers	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Pines Village	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Plum Orchard	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Shorewood	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Southern Scrap	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Tall Timbers	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Venetian Isles No.2	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Victoria	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Village De Lest	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Webber	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Willowbrook	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Wilson	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Woodland	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Wright rd	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Drainage Stations***								
SWBNO Pump Stations and Facilities	01 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	02 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	03 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	04 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	05 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	06 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	07 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	10 (Citrus)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	11 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	12 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	13 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	14 (Jancke)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	15 DPS	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	16 (St.Charles)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	17 (Station D)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Pritchard	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	18 (Maxent)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	19 DPS	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	20 (Amid)	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Dwyer	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Elaine	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Grant	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Oleander	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Carrolton Freq Changer	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Underpass DPS***								
SWBNO Pump Stations and Facilities	Bay Street	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Broad	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Canal Blvd	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Franklin Ave	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Hospital	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Marconni Dr	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	New Carrollton	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Old Carrollton	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Paris Ave.	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Ponchartrain	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Press Dr.	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	St.Bernard Ave	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	I-10 Mounds	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Support Facilities***								
SWBNO Pump Stations and Facilities	St Joesph HQ	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Central, Yard Complex	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Water Facilities***								
SWBNO Pump Stations and Facilities	Carrollton Water Plant	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Algiers Water Plant	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Michoud Water Tank	x	x	x	x	x	x	x	x

Facility Type	Facility Name	Flooding	Tropical Cyclones	Coastal Erosion	Tornadoes	Subsidence	Winter Weather	Extreme Heat	Severe Thunderstorms
SWBNO Pump Stations and Facilities	Algiers Water Tank	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Carrollton Intake 1	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Carrollton Intake 2	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Algiers Intake 1	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Algiers Intake 2	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	***Sewer Discharge***								
SWBNO Pump Stations and Facilities	EBSTP Discharge at DelerySt	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	WBSTP Dischrage at Rivier Rd and William St.	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Discharge at Holiday Place	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Discharge at Huntlee Dr.	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Discharge at Eton St	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Discharge at Woodland PI	x	x	x	x	x	x	x	x
SWBNO Pump Stations and Facilities	Discharge at Blair St.	x	x	x	x	x	x	x	x

Appendix D: State Required Worksheets

Appendix E: Sources

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