

2025 PLAQUEMINES PARISH HAZARD MITIGATION PLAN



PLAQUEMINES PARISH HAZARD MITIGATION PLAN UPDATE

Prepared for:

Plaquemines Parish



Prepared by:

Stephenson Disaster Management Institute

**Mr. Brant Mitchell, CEM
Mrs. Lauren Morgan, MEPP
Mr. Chris Rippetoe, CFM
Dr. Joseph B. Harris, PhD
Mr. Jason Martin**

Louisiana State University – Louisiana Digital Media Center
Baton Rouge, LA 70803



*****THIS PAGE LEFT INTENTIONALLY BLANK*****

ACKNOWLEDGMENTS

This 2025 Plaquemines Parish Hazard Mitigation Plan Update was coordinated by the Plaquemines Parish Hazard Mitigation Plan Update Planning Committee, in collaboration with community stakeholders and the general public.

Special thanks is directed to all of those who assisted in contributing their expertise and feedback on this document, especially the Plaquemines Parish Office of Homeland Security and Emergency Management. These combined efforts have made this project possible. The Plaquemines Parish Planning Committee consists of the following individuals, who are credited in the creation of this document:

Patrick Harvey	Plaquemines Parish OHSEP
Keith Hinkley	Plaquemines Parish Government
Shannta Carter	Plaquemines Parish Government
Jeff Dimarco	Plaquemines Parish Government
Ken Dugas	Plaquemines Parish Government
Jonah Arceneaux	Plaquemines Parish Government
Paula Dove	Plaquemines Parish Government
Ametra Rose	Plaquemines Parish Planning & Zoning
John Rahaim	St. Bernard Parish OHSEP
John Gardner	GOHSEP
Margaret Dejean	GOHSEP
Jonathan Butcher	Plaquemines Parish Fire
Brad Breuhl	Plaquemines Parish Government

The 2025 Plaquemines Parish Hazard Mitigation Plan Update was written by the Stephenson Disaster Management Institute, Louisiana State University. Further comments should be directed to the Plaquemines Parish Office of Homeland Security and Emergency Preparedness: 8056 HWY 23 Suite 308, Belle Chasse, LA 70037.



Contents

1. Introduction	1-1
Geography, Population and Economy	1-2
Geography.....	1-2
Population	1-3
Economy.....	1-3
Hazard Mitigation	1-4
General Strategy	1-5
2025 Plan Update.....	1-6
2. Hazard Identification and Parish-Wide Risk Assessment	2-1
Overview	2-1
Data Limitations	2-1
Identifying Hazards	2-2
Historical Context and Previous Occurrences.....	2-2
Probability of Future Threats and Hazards	2-4
Assessing Vulnerability Overview	2-4
Vulnerability Analysis Methodology	2-4
Quantitative Methodology	2-5
Qualitative Methodology	2-7
Priority Risk Index and Hazard Risk.....	2-7
Inventory of Assets for the Entire Parish	2-8
Critical Facilities of the Parish	2-11
Population and Development Trends	2-17
Land Use.....	2-18
Vulnerability Analysis (NRI & PRI)	2-8
Hazard Profile, Risk Assessment, and Vulnerability Analysis.....	2-19
Coastal Hazards.....	2-19
Flooding.....	2-24
Levee Failure	2-34
Sinkholes	2-37
Thunderstorms (Hail, Lightning, & Thunderstorm Wind)	2-43
Tornadoes	2-55
Tropical Cyclones	2-61
3. Capability Assessment	3-1
Policies, Plans and Programs	3-1

Building Codes, Permitting, Land Use Planning and Ordinances	3-2
Administration, Technical, and Financial	3-2
Education and Outreach	3-3
Flood Insurance and Community Rating System	3-4
NFIP Worksheets.....	3-6
4. Mitigation Strategy.....	4-1
Introduction	4-1
Goals	4-3
2025 Mitigation Actions and Update on Previous Plan Actions	4-4
Plaquemines Parish Mitigation Actions	4-5
Action Prioritization	4-26
Appendix A: Planning Process.....	A-1
Purpose	A-1
The Plaquemines Parish Hazard Mitigation Plan Update	A-1
Planning	A-2
Coordination	A-2
Neighboring Community, Local and Regional Planning Process Involvement	A-3
Program Integration.....	A-4
Meeting Documentation and Public Outreach Activities	A-5
Meeting #1: Hazard Mitigation Plan Update Kick-Off.....	A-5
Meeting #2: Hazard Mitigation Plan Update Initial Planning Committee Meeting.....	A-5
Meeting #3: Hazard Mitigation Plan Update Mitigation Action Workshop.....	A-6
Meeting #4: Hazard Mitigation Plan Update Planning Committee Risk Assessment Review	A-7
Meeting #5: Hazard Mitigation Plan Update Public Meeting	A-8
Outreach Activity #1: Public Opinion Survey	A-10
Outreach Activity #2: Public Meeting Activity - Incident Questionnaire	A-10
Outreach Activity #3: 2025 Plaquemines Parish Hazard Mitigation Plan Public Review	A-10
Appendix B: Plan Maintenance.....	B-1
Purpose	B-1
Implementing, Monitoring, Evaluating, and Updating the Plan	B-1
Responsible Parties	B-1
Methods for Monitoring and Evaluating the Plan and Plan Evaluation Criteria.....	B-1
2025 Plan Version Plan Method and Schedule Evaluation	B-3
Incorporation into Existing Planning Programs	B-3
Continued Public Participation	B-4

Appendix C: Critical Facilities.....	C-1
Critical Facilities within the Plaquemines Parish Planning Area	C-1
Appendix D: Plan Adoption	D-1
FEMA Approval Letter	D-1
GOHSEP Approval Letter	D-2
Plaquemines Parish.....	D-3
Appendix E: State Required Worksheets.....	E-1
Mitigation Planning Team	E-1
Capability Assessment	E-2
Building Inventory.....	E-5
Vulnerable Populations.....	E-9
National Flood Insurance Program (NFIP)	E-10

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, mitigation goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented.

In that regard, this plan (a) documents the Plaquemines Parish Hazard Mitigation Plan Update (HMPU) process; (b) identifies natural hazards and risks within the parish; and (c) identifies the parish's hazard mitigation strategy to make Plaquemines Parish less vulnerable and more disaster resilient. It also includes mitigation project scoping to further identify scopes of work, funding sources, and implementation timing requirements of proposed selected mitigation projects. The information in the plan will be used to help guide and coordinate mitigation and local policy decisions affecting future land use.

The Federal Emergency Management Agency (FEMA), now 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, measures, and policies are the primary means to achieving these goals. Mitigation planning and project implementation has become even more significant in a post-Katrina/Rita, Gustav/Ike, and Laura/Delta environment in south Louisiana.

This Hazard Mitigation Plan is a comprehensive plan for disaster resiliency in Plaquemines Parish. The parish is subject to natural hazards that threaten life and health and have caused extensive property damage. To better understand these hazards and their impact on people and property, and to identify ways to reduce those impacts, the parish's Office of Homeland Security and Emergency Preparedness undertook this Natural Hazards Mitigation Plan. "Hazard mitigation" does not mean that all hazards are stopped or prevented. It does not suggest the complete elimination of the damage or disruption caused by such incidents. Natural forces are powerful, and most natural hazards are well beyond our ability to control. Mitigation does not mean quick fixes. It is a long-term approach to reduce hazard vulnerability. As defined by FEMA, "hazard mitigation" means any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event.

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 for managing or mitigating their effects. Planning is one of the best ways to correct these shortcomings and produce a program of activities that will best mitigate 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.

Under the Disaster Mitigation Act of 2000 (42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a 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 (CRS), a program that reduces flood insurance premiums in participating communities. This program is further described in Section Three: Capability Assessment.

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 hazards. It fulfills the Federal mitigation planning requirements, qualifies for CRS credit, and provides Plaquemines Parish and its communities with a blueprint for reducing the impacts of these natural hazards on people and property.

Geography, Population and Economy

Geography

Plaquemines Parish is located in the southeast portion of Louisiana along the state's Gulf of America coastline. Essentially bisected from the northwest to the southeast by the Mississippi River, Plaquemines Parish is bordered to the northeast by St. Bernard Parish, to the north by Orleans Parish, and to the west by Jefferson Parish. According to the U.S. Geological Survey, Plaquemines Parish includes a surface area of approximately 2567 square miles (or 1,642,977 acres), of which 68% (1,110,107 acres) is water and a mere 1% (19,527 acres) is urban development. The figure below shows the geographical location of Plaquemines Parish.



Figure 1-1: Location of Plaquemines Parish in the State of Louisiana

The geography of Plaquemines Parish mainly consists of relatively flat floodplains and bodies of water. The largest concentration of urban development is found in the northwestern part of the parish. Coincidentally, this is also the area with the highest natural elevation in the parish. Plaquemines Parish is bisected by the Mississippi River, resulting in two separate portions that are only commutable by ferry. The bulk of the land within the parish can be found on the west bank of the Mississippi River, although this is a bit misleading as the majority of the parish acreage consists of wetlands and open water. Most of the actual land found in Plaquemines Parish is located along the levees of the Mississippi River, particularly along the west bank.

Approximately 90% of the total land area of Plaquemines Parish is located within FEMA's 100-year floodplain. The only significant area outside the 100-year floodplain is the land in the northern portion of the parish in the Belle Chasse community along Hwy 23, which is in the 500-year floodplain.

Plaquemines Parish weather is typically warm and humid. Variations in daily temperature are determined by distance from the Gulf of America and, to a much lesser degree, by differences in elevation. According to the NCEI Data Tools service, the average annual temperature for the state as a whole is 68°F. January is typically the coldest month for Louisiana, averaging approximately 54°F, while July is typically the warmest at an average of 83°F. Winter months are usually mild with cold spells of short duration. For Plaquemines Parish in particular, the summer months are usually quite warm, with an average daily maximum temperature in July and August of 92°F. Winters are typically mild. Snowfall averages less than one inch per year. Average annual rainfall for the area is 60.5 inches. Plaquemines Parish is susceptible to the normal weather dangers, such as thunderstorms and flooding, but due to its location within the state and its proximity to the Gulf of America, the parish is highly susceptible to tropical cyclones. Hurricane season lasts from June 1st to November 30th, with most hurricanes forming in August, September, and October.

Plaquemines Parish is located in Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) Region 1 (*Figure 1-3*).

As noted above, Plaquemines Parish is located in the far south-eastern region of Louisiana.

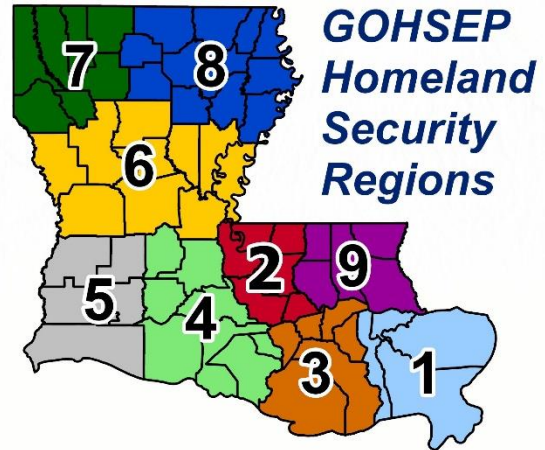


Figure 1-2: Louisiana Homeland Security Regions

Population

The population of Plaquemines Parish is estimated at 22,386 (2024 estimate) with a population percent change from April 1, 2010 – July 1, 2024 of -2.85%.

*Table 1-1: Plaquemines Parish Population
(Source: US Census)*

	2010 Census	2020 Census	2024 Estimate	Percent Change 2010 -2024
Total Population	23,042	23,515	22,386	-2.85%
Population Density (Pop/Sq. Mi.)	29.5	30.1	28.6	-3.05%
Total Housing Units	9,560	9,447	9,839	2.92%
Persons Per Household	2.41	2.49	2.27	-5.81%

Economy

Plaquemines is Louisiana's southernmost parish where the great Mississippi River meets the Gulf of America. It is home to some of the best commercial and sportsman fishing areas in the world. Plaquemines Parish produces millions of pounds of shrimp, oysters, crabs and fish annually contributing to the state's seafood industry; one of the leading sources of income and largest employers in Louisiana. Plaquemines Parish is the operational center for the offshore oil and gas industry. From the oil field to the marine industry, farming, commercial fishing, shipping and construction, all different types of business and industry thrive in Plaquemines Parish. (Louisiana Economic Development)

Table 1-2: *Plaquemines Parish Business Patterns*
(Source: US Census, CBP)

Business Description	Number of Establishments	Number of Employees	Annual Payroll (\$1,000)
Agriculture, forestry, fishing and hunting	9	19	590
Mining, quarrying, and oil and gas extraction	20	465	37,334
Utilities	10	72	4,675
Construction	62	461	25,934
Manufacturing	29	1,612	194,827
Wholesale trade	59	763	49,278
Retail trade	60	479	12,701
Transportation and warehousing	89	1,384	95,432
Information	6	10	328
Finance and insurance	21	92	5,613
Real estate and rental and leasing	25	220	15,068
Professional, scientific, and technical services	53	411	41,217
Administrative and support and waste management and remediation services	32	268	15,809
Educational services	6	287	11,290
Health care and social assistance	22	322	11,615
Arts, entertainment, and recreation	18	180	3,032
Accommodation and food services	54	721	15,640
Other services (except public administration)	48	419	22,215

Hazard Mitigation

To fully understand hazard mitigation efforts in Plaquemines Parish and throughout Louisiana, it is first crucial to understand how hazard mitigation relates to the broader concept of emergency management. 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 which 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 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., flood proofing homes through elevation, or acquisition or relocation away from floodplains).
- **Emergency Preparedness**—includes plans and preparations made to save lives and property and to facilitate response operations in advance of a disaster event.
- **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 1-4 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.

As *Figure 1-4* demonstrates, mitigation relies on updating in the wake of disaster. This can give the appearance that mitigation is only reactive rather than proactive. In reality, post-disaster revision is a vital component of improving mitigation. Each hazardous event affords an opportunity to reduce the consequences of future occurrences.

Unfortunately, this cycle can be painful for a community. For instance, the risks of disasters that could create catastrophic incidents in Louisiana were thought to be relatively well-understood prior to 2005. However, the impact of the 2005 hurricane season on the Gulf Coast region of the United States prompted a new level of planning and engagement related to disaster response, recovery, and hazard mitigation. Hurricanes Katrina and Rita hit three weeks apart and together caused astonishing damage to human life and to property. The two storms highlighted a hurricane season that spawned 28 storms—unparalleled in American history. The 2005 hurricane season confirmed Louisiana’s extreme exposure to natural disasters and both the positive effects and the concerns resulting from engineered flood-protection solutions. More recently, the historically impactful 2020 hurricane season reinforced the need for proper planning and mitigation strategies.



Figure 1-3: The Four Phases of Emergency Management and their Relation to Future Hazard Mitigation
(Source: Louisiana State Hazard Mitigation Plan 2019)

The catastrophic tropical events of 2005 and 2020, coupled with the unprecedented flooding events of 2016 have had profound impacts on emergency management and hazard mitigation throughout Louisiana. As detailed later in this document, significant funding has been made available to the State of Louisiana and its parishes for the purpose of hazard mitigation planning. 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.

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 key 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 agencies within the state, the SHMT has worked to incorporate this information into the decision process.

Part of the ongoing integration process is that the Louisiana Governor’s Office of Homeland Security and Emergency Preparedness (GOHSEP) encourages the parishes and the local communities 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 2025 Plaquemines Parish Hazard Mitigation Plan (HMP) maintains much of the information from the 2020 plan version, but it now incorporates the order and methodologies of the 2024 Louisiana State Hazard Mitigation Plan.

The sections in the 2020 Plaquemines Parish HMP were 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 Essential Facilities
- Appendix D Plan Adoption
- Appendix E State Required Worksheets

This 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. Nevertheless, the Plaquemines Parish Hazard Mitigation Planning Committee recognized the benefits from the successful analysis and mitigation planning executed in previous plan updates, as well as improvements to be made in the 2025 update. This plan update remains coherent with those documents, retaining language and content when needed, deleting it when appropriate, and augmenting it when constructive.

2025 Plan Update

This 2025 plan update proceeds with the previous goals of the Plaquemines Parish Hazard Mitigation Plan. The current goals are as follows:

1. Reduce losses to existing and future property due to hazards
2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
3. Ensure the abilities of emergency services providers to continue operating during hazardous events
4. Protect existing public and private infrastructure from damage

This plan update makes a number of textual changes throughout, but the most obvious changes are data related and structural edits. First, the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information's (NCEI) Storm Events Database was used in the analysis, which provides historical hazard data from 1950 to 2024. The planning committee was also instrumental in providing detailed data where appropriate to more accurately reflect hazard impacts on the parish. Furthermore, all of the sections were updated to reflect the most current information and the most current vision of the plan update. The most significant changes are the newly developed hazard profiles and risk assessments, as well as the removal of much repetition between sections from the previous plan updates.

The 2025 plan update is organized in the same format as the 2020 update, with one minor change to this 2025 update as outlined below. The decision to change the title of Appendix C from Essential Facilities to Critical Facilities was made to better align with FEMA preferred terminology.

- Section One Introduction
- Section Two Hazard Identification and Parish-Wide Risk Assessment
- Section Three Capability Assessment
- Section Four Mitigation Strategies
- Appendix A Planning Process
- Appendix B Plan Maintenance
- Appendix C Critical Facilities
- Appendix D Plan Adoption
- Appendix E State Required Worksheets
- Appendix F Floodplain Management Activity 510

Table 1-3: 2025 Plan Update Crosswalk

Plan Update Crosswalk	
2020 Update	2025 Update
Section 1: Introduction	Section 1: Introduction
Section 2: Hazard Identification and Parish-Wide Risk Assessment	Section 2: Hazard Identification and Parish-Wide Risk Assessment
Section 3: Capability Assessment	Section 3: Capability Assessment
Section 4: Mitigation Strategy	Section 4: Mitigation Strategy
Appendix A: Planning Process	Appendix A: Planning Process
Appendix B: Plan Maintenance	Appendix B: Plan Maintenance
Appendix C: Essential Facilities	Appendix C: Critical Facilities
Appendix D: Plan Adoptions	Appendix D: Plan Adoptions
Appendix E: State Required Worksheets	Appendix E: State Required Worksheets

Despite numerous changes in this plan update, the plan remains consistent in its emphasis on the types of hazards that pose the most risk to loss of life, injury, and property in Plaquemines Parish and its communities. The extent of this risk is dictated primarily by its geographic location. Most significantly, Plaquemines Parish remains at high risk of water inundation from various sources, including flooding and tropical cyclone activity. The entire parish is also at high risk of damages from high winds and wind-borne debris. The 2016 flooding events, along with the 2020 hurricane season were both felt heavily in all parts of Plaquemines Parish. Other hazards threaten the parish and/or its communities, 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) prepare for and respond to disasters.

Mitigation efforts related to particular hazards are highly individualized by the parish planning area. Flexibility in response and planning is essential. The most important step forward to improve hazard management capability is to improve coordination and information sharing between the various levels of government regarding hazards.

*****THIS PAGE LEFT INTENTIONALLY BLANK*****

2. Hazard Identification and Parish-Wide Risk Assessment

Overview

The risk assessment identifies and assesses a large variety of threats and hazards that impact the parish to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section describes the risks associated with each identified hazard of concern. Each section (1) defines the hazard, (2) explains how each hazard is measured, (3) provides the hazard's geographic extent, (4) analyzes the previous occurrences, (5) evaluates each hazard's future likelihood of occurrence, and (6) identifies the worst-case scenario for each hazard.

The following steps were used to define the risk of each hazard:

- Profile and describe each hazard
 - Geographic areas most affected by the hazard
 - Previous occurrences and detailed description of events occurring in the last five years
 - Occurrence probability/frequency estimates
 - Worst-case scenarios
- Determine exposure to each hazard
 - Exposure was determined by overlaying hazard maps with an inventory of structures, facilities, and systems to determine which of them would be exposed to each hazard
 - Vulnerability analysis for people and infrastructure

The primary source for historical data used throughout the risk assessment is the National Centers for Environmental Information (NCEI) Storm Events Database, which provides natural hazard event data from 1950 to the present. In staying consistent with climatological studies, the NCEI Storm Events Database was evaluated for the past 31 years (1993 – 2024) to determine the future probability and frequency of a hazard occurring when data was available.

Data Limitations

Throughout the planning process, every effort was made to use the best available data. Much of the historic natural-hazard occurrence information was obtained through the National Oceanic and Atmospheric Administration's (NOAA) NCEI. The NCEI Storm Events Database contains data from January 1950 to the present (i.e., within the past few months); however, there are some issues with events recorded prior to 1996. From the years 1950 to 1954, the NCEI Storm Events Database only contain information on tornado events, until thunderstorm wind and hail events were added to the database for the time period between 1955 and 1992. All event types identified in the National Weather Service (NWS) Directive 10-1605 (48 in total) are recorded from 1996 to the present. For these hazards, only 29 years (1996 – 2024) worth of data was evaluated to determine the future probability and frequency of a hazard occurring. Additionally, property damage and crop damage estimates from the NCEI Storm Events Database are a "best guess" based on all available data at the time of the event publication.

The NCEI Storm Events Database does not record all events, only occurrences that have sufficient intensity to cause loss of life, injuries, significant property damage, and/or disruption to commerce. Even then, there are events that may not be covered due to changes in data collection and processing procedures over time. Also, events such as tornadoes or hailstorms rely heavily on eye-witness accounts which creates a reporting bias in urban areas. The inception of Doppler radar in 1980 significantly decreased this bias, especially for tornado events, but records prior to 1980 are not as detailed or complete as post 1980-records.

The Storm Prediction Center (SPC) National Severe Weather Database browser examines convective/thunderstorm-related winds only and does not include wind data from hurricane or non-thunderstorm wind damage. This data contains measured and estimated wind gusts including wind damage without estimated wind speeds. For many observations, this results in several thunderstorm wind events with no estimated or actual wind speed estimates.

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied result in an approximation of risk. These estimates may be used to understand the relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment, as well as approximations and simplifications that are necessary for a comprehensive analysis.

Identifying Hazards

Several emergency management and hazard mitigation documents at the state and local levels were reviewed to identify a comprehensive list of hazards that may impact the parish. These documents addressed a wide range of hazards including natural, technological, and human-caused. The two main documents referenced in finalizing the parish's comprehensive hazard list were the 2020 Hazard Mitigation Plan for the parish and the state of Louisiana's 2019 Hazard Mitigation Plan. Typically, unless otherwise noted in the plan, all hazards previously identified in the parish's 2020 Hazard Mitigation Plan and all hazards in the state of Louisiana's 2019 Hazard Mitigation Plan identified as medium or high risk by the state are profiled in the risk assessment. The table below provides a comprehensive list of the hazards selected based on the above criteria.

Table 2-1: Hazard Profile Summary.

Hazard	Profiled in 2020 Plan	Considered Medium or High Risk in the State's HM Plan	Profiled in the 2025 Update
Coastal Hazards	X		X
Flooding	X	X	X
Levee Failure	X		X
Saltwater Intrusion			X
Sinkholes	X		X
Thunderstorms (Hail, Lightning, & Thunderstorm Wind)	X	X	X
Tornadoes	X	X	X
Tropical Cyclones	X	X	X

Historical Context and Previous Occurrences

The following table and figures display past Presidential Declaration occurrences and provides background on the type of natural disasters that have affected the parish in the past.

Table 2-2: Presidential Disaster Declarations in Plaquemines Parish.

Disaster Number	Year	Declaration
208	1965	Hurricane Betsy
272	1969	Hurricane Camille
374	1973	Severe Storms & Flooding
448	1974	Hurricane Carmen
752	1985	Hurricane Juan
956	1992	Hurricane Andrew
1246	1998	Hurricane Georges/TS Frances
1435	2002	Tropical Storm Isidore
1437	2002	Hurricane Lili

Disaster Number	Year	Declaration
1548	2004	Hurricane Ivan
1601	2005	Tropical Storm Cindy
1603/3212	2005	Hurricane Katrina
1607/3260	2005	Hurricane Rita
1786/3289	2008	Hurricane Gustav
1792	2008	Hurricane Ike
4041	2011	Tropical Storm Lee
4080	2012	Hurricane Isaac
4345	2017	Tropical Storm Harvey
4458	2019	Hurricane Barry
4484	2019	COVID-19
4559	2020	Hurricane Laura
4570	2020	Hurricane Delta
4577	2021	Hurricane Zeta
4590	2021	Severe Ice Storm
4611	2021	Hurricane Ida
4817	2024	Hurricane Francine

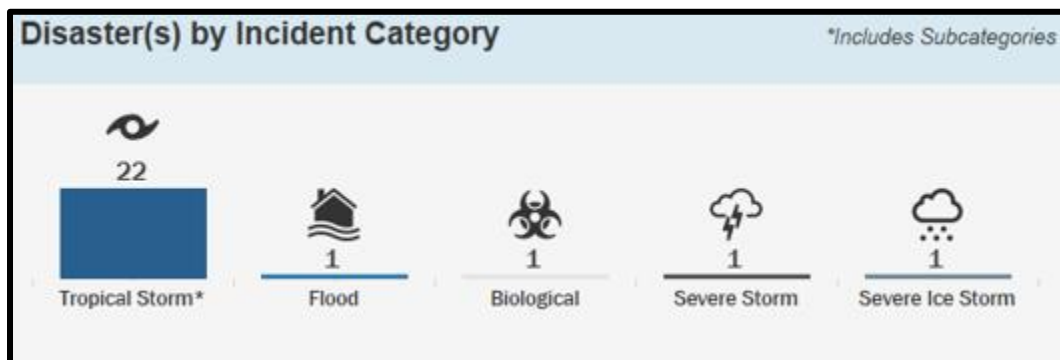


Figure 2-1: Presidential Disaster Declarations for the Parish by Disaster Type Since 1950
(Source: FEMA Disaster Declarations Summary: Open Government Dataset)

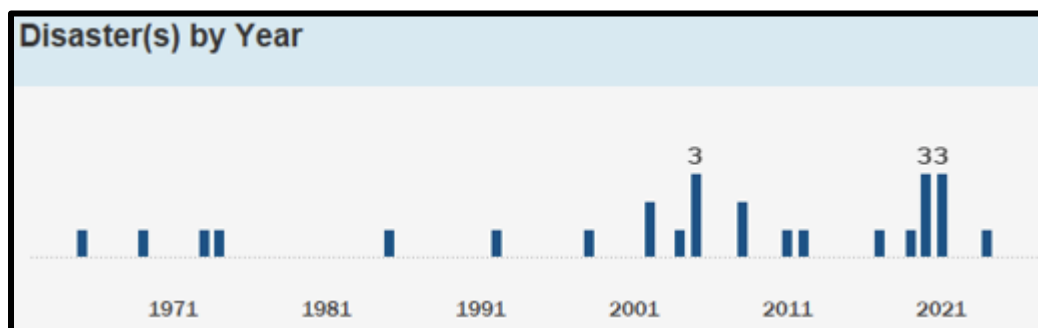


Figure 2-2: Total Presidential Disaster Declarations Yearly Totals for Plaquemines Parish from 1950 to 2024
(Source: FEMA Disaster Declarations Summary: Open Government Dataset)

Probability of Future Threats and Hazards

The probability of each hazard occurring in the parish is estimated in the following table:

Table 2-3: Probability of Future Hazard Reoccurrence.

Hazard	Probability
	Plaquemines Parish
Coastal Hazards	100%
Flooding	38%
Levee Failure	< 1%
Saltwater Intrusion	100%
Sinkholes	< 1%
Thunderstorm Hail	62%
Thunderstorm Lightning	7%
Thunderstorm Winds	100%
Tornadoes	48%
Tropical Cyclones	100%

Assessing Vulnerability Overview

The purpose of assessing vulnerability is to quantify and/or qualify exposure and determine how various threats and hazards impact life, property, the environment, and critical operations of the parish. Vulnerability can be defined as the manifestation of the inherent states of the system (e.g., physical, technical, organizational, cultural) that can be exploited to adversely affect (cause harm or damage to) that system. For example, identifying areas within the parish that suffer disproportional damage compared to other areas, or overall exposure of the entire parish to flooding. Identifying and understanding vulnerability to each threat and hazard provides a strong foundation for developing and pursuing mitigation actions.

The vulnerability analysis builds upon the information provided in the risk assessment by assessing the potential impact and amount of damage that each hazard has on the parish. To complete the analysis, the best available data were collected from a variety of sources, including local, state, and federal agencies and multiple analyses were performed qualitatively and quantitatively. The estimates provided in the vulnerability analysis should be used to understand the relative risk from each hazard and the potential losses that may be incurred; however, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning specific hazards and their effects on the built environment, as well as incomplete datasets and from approximations and simplifications that are necessary to provide a meaningful and complete analysis. Further, most datasets used in this assessment contain relatively short periods of records, which increases the uncertainty of any statistically based analysis.

Vulnerability Analysis Methodology

To direct the vulnerability analysis effort for the parish, two distinct methodologies were applied. The first includes a quantitative analysis that relies upon the best available data and technology, while the second methodology includes a qualitative analysis that relies more on local knowledge and rational decision-making. Upon completion, the methodologies are combined to create a vulnerability analysis that allows for some degree of quality control and assurance. The quantitative assessment focuses on potential hazard loss estimates, while the qualitative assessment is comprised of a scoring system built around values assigned by the Planning Team as to the likelihood of occurrence, spatial extent, and potential impact of each hazard.

Quantitative Methodology

The quantitative methodology consists of utilizing Hazus, a geographic information system (GIS)-based loss estimation software available from the Federal Emergency Management Agency (FEMA), as well as a detailed GIS-based approach independent of the Hazus software. These two GIS-based studies together help form a quantitative vulnerability analysis. GIS technology allows for the identification and analysis of potentially at-risk community assets such as people and infrastructure. This analysis was completed for hazards that can be spatially defined in a meaningful manner (i.e., hazards with an official and scientifically determined geographic extent) and for which GIS data were readily available.

Additionally, the National Risk Index developed by FEMA was utilized to determine the composite risk to 18 natural hazards to include avalanche, coastal flooding, cold wave, drought, earthquake, hail, heat wave, hurricane, ice storm, landslide, lightning, riverine flooding, strong wind, tornado, tsunami, volcanic activity, wildfire, and winter weather. Historic loss ratio, expected annual loss, and overall risk factor for any of the above hazards which are profiled in this plan are provided in the vulnerability analysis to provide further context on the risk associated to the hazard. Expected annual loss and the risk factor are calculated using the following formulas:

$$\text{Expected Annual Loss} = \text{Exposure} * \text{Annualized Frequency} * \text{Historic Loss Ratio}$$

$$\text{Risk Index} = \text{Expected Annual Loss} * \text{Social Vulnerability} / \text{Community Resilience}$$

According to FEMA, Plaquemines Parish has a Community Risk Index Rating of “Relatively Low,” when compared to the rest of the US. The parish has a community risk index score of **82.69/100.00**. When compared to the state of Louisiana, the parish has a risk index score of **56.30/100.00**. The natural hazards that contributed to a higher overall risk index score include Coastal Flooding, Hurricanes, and Riverine Flooding.

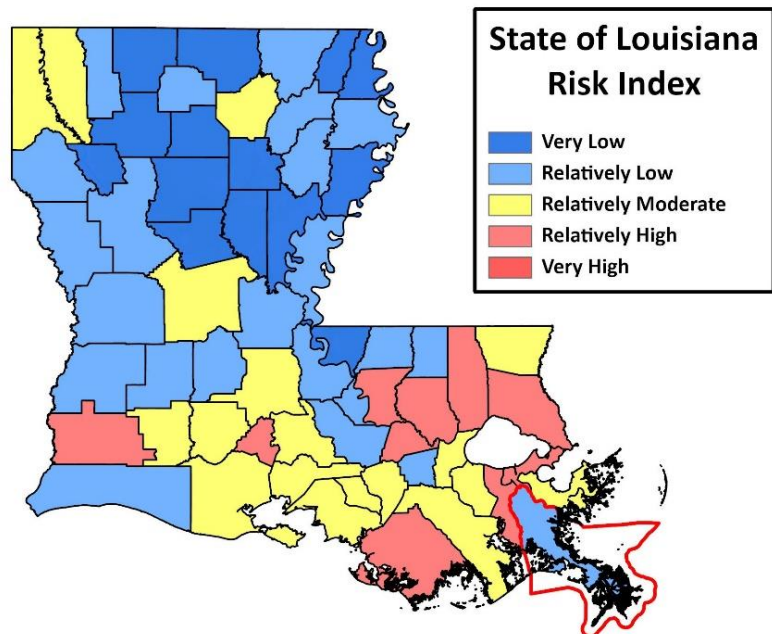


Figure 2-3: Risk Index Ratings for Louisiana

Plaquemines Parish has an Expected Annual Loss rating, in relation to natural hazards, of “Relatively Low” when compared to the rest of the US. The parish has an Expected Annual Loss rating of **81.71/100.00**. When compared to the state of Louisiana, the parish has a risk index score of **59.40/100.00**. Again, the natural hazards that account for the most expected annual loss are Coastal Flooding, Excessive Heat/Heat Waves, Hurricanes, and Riverine Flooding.

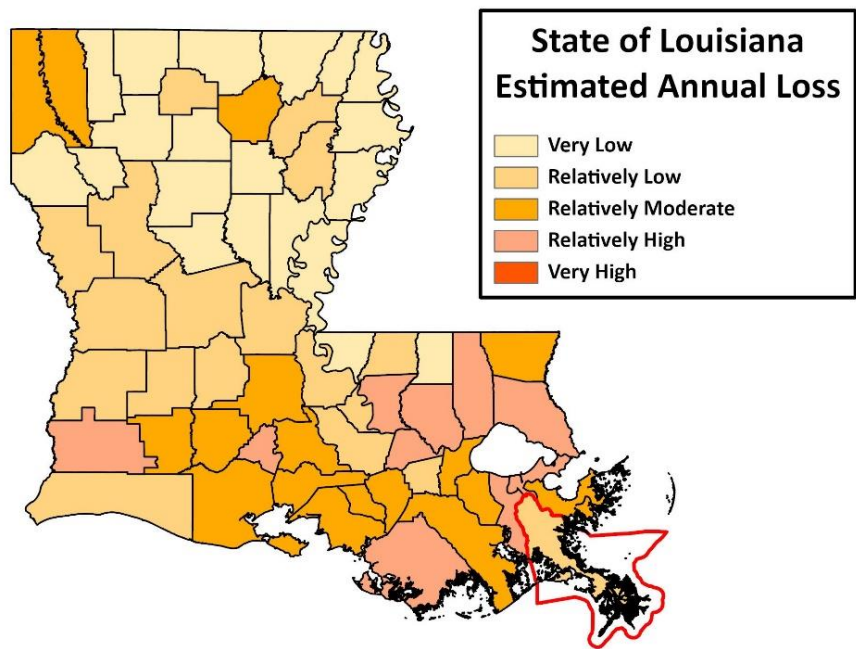


Figure 2-4: Estimated Annual Loss for Louisiana

Plaquemines Parish has a Social Vulnerability Rating of “Relatively High” when compared to the rest of the US. When communities have a Relatively High Social Vulnerability rating, the area may be susceptible to adverse impacts brought about by natural hazards. Factors regarding social vulnerability include poverty, lack of transportation, persons per household, etc. For a more in depth look into social vulnerability statistics on Plaquemines Parish, refer to the [Socially Vulnerable Populations](#) section. The parish has a Social Vulnerability rating of **65.28/100.00** when compared to the US. When compared to the state of Louisiana, the parish has a Social Vulnerability rating of **20.30/100.00**.

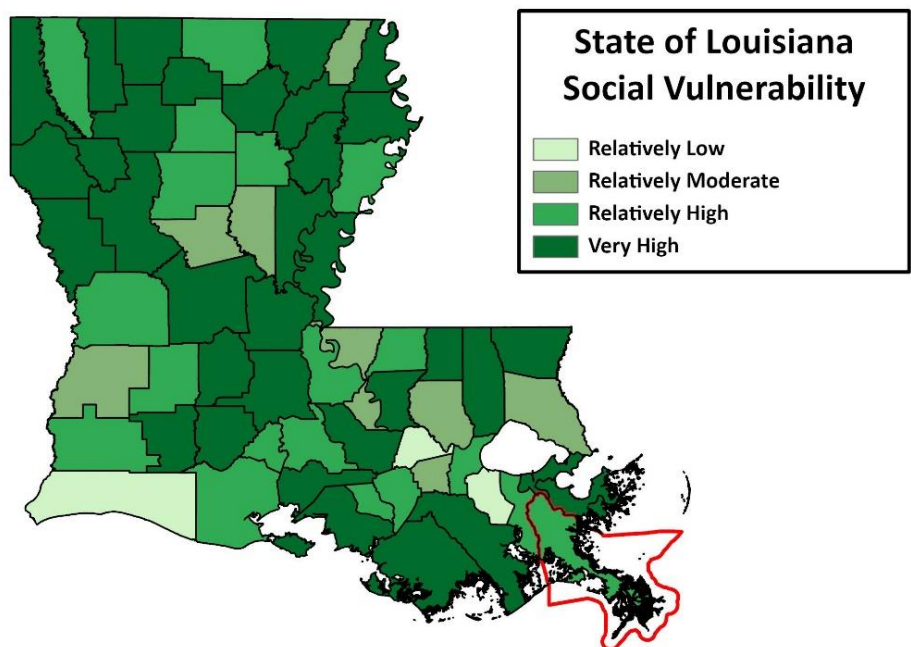


Figure 2-5: Social Vulnerability Ratings for Louisiana

Plaquemines Parish has a Community Resilience rating of “Very High” when compared to the rest of the US. A “Very High” Community Resilience Rating indicates that Plaquemines Parish has an advanced ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from “disruptions” when compared to the rest of the US. These Community Resilience values are measured via the *University of South Carolina’s Hazard and Vulnerability Research Institute Baseline Resilience Indicators for Communities (HVRI BRIC)*. Some indicators include human well-being, economic/financial assets, infrastructure, governance,

community capacity, natural resources, and overall environmental conditions. Based on all the above factors and characteristics, Plaquemines Parish has a Community Resilience rating of **94.33/100.00** when compared to the entire US. When compared to the state of Louisiana, Plaquemines has a Community Resilience rating of **89.10/100.00**.

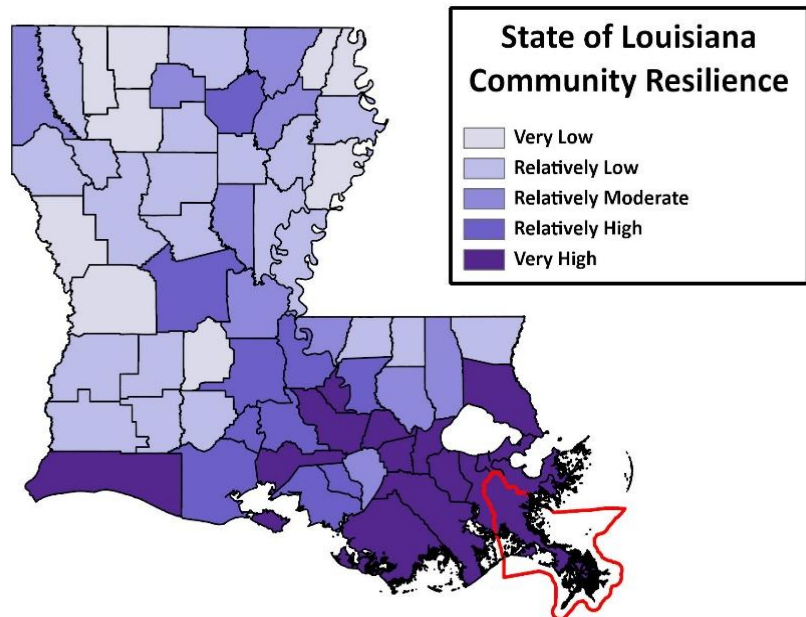


Figure 2-6: Community Resilience Ratings for Louisiana

Qualitative Methodology

The qualitative assessment relies less on technology, but more on historical and anecdotal data regarding expected hazard impacts. The qualitative assessment completed for the parish is based on the Priority Risk Index (PRI). The purpose of the PRI is to prioritize all potential hazards, and then group them into three categories of high, moderate, or low risk to identify and prioritize mitigation opportunities.

The PRI is a good practice to use when prioritizing hazards because it provides a standardized numerical value for hazards to be compared. Adapted PRI scores were calculated using five categories:

- Probability
- Impact
- Spatial Extent
- Warning Time
- Duration

Each degree of risk is assigned a value (1-4) and a weighting factor. To calculate the Risk Factor for a given hazard, the assigned risk value for each category is multiplied by the weighted factor, and the sum of all five categories is totaled together for a final score. The highest possible Risk Factor is a 4.0.

$$\text{Risk Factor} = [(\text{Probability} * 0.25) + (\text{Impact} * 0.25) + (\text{Spatial Extent} * 0.20) + (\text{Warning Time} * 0.15) + (\text{Duration} * 0.15)]$$

Priority Risk Index and Hazard Risk

Hazard risk is determined by calculating the Risk Factor for each hazard impacting the parish. A summary of the PRI is found in the table on the following page. The conclusions drawn from the qualitative and quantitative assessments are fitted into three categories based on High, Moderate, or Low designations. Hazards identified as high risk have a risk factor of 2.5 or greater. Risk factors ranging from 2.0 to 2.4 are deemed moderate risk hazards while hazards with risk factors less than 2.0 are considered low risk.

Table 2-4: Summary of the Priority Risk Index.

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	25%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	25%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than a week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self-explanatory	1	15%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	15%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

Table 2-5: Associated Risk Factor with PRI Value Range.

Risk Factor	PRI Range
High Risk	2.5 to 4.0
Moderate Risk	2.0 to 2.4
Low Risk	0 to 1.9

Vulnerability Analysis (NRI & PRI)

The first table is the overall risk associated with each threat and hazard with 2.5 or above deemed high risk, 2.0 to 2.4 deemed medium risk, and less than 2.0 deemed low risk. The final table summarizes the composite risk of 18

natural hazards outlined previously on the parish by expected annual loss, social vulnerability, community resilience, and overall risk rating.

Table 2-6: PRI Vulnerability Analysis for Plaquemines Parish.

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Overall Risk
Coastal Hazards	4	2	4	2	3	3.05
Flooding	3	4	3	4	3	3.4
Levee Failure	1	3	4	1	3	2.4
Sinkholes	1	2	2	1	4	1.9
Thunderstorm Hail	3	2	3	3	1	2.45
Thunderstorm Lightning	2	2	2	3	1	2
Thunderstorm Winds	4	2	3	3	1	2.7
Tornadoes	3	3	2	4	3	2.95
Tropical Cyclones	4	4	4	1	4	3.55

Table 2-7: National Risk Index (NRI) Summarization of Risk to Eighteen Natural Hazards for Plaquemines Parish.

(Source: National Risk Index)

Expected Annual Loss	Social Vulnerability	Community Resilience	Overall Risk Rating
Relatively Low	Relatively High	Very High	Relatively Low

Socially Vulnerable Populations

The tables on the next page illustrate at risk populations in Plaquemines Parish compared to the United States as a whole. The data displayed below was taken directly from Headwater Economics, via a social vulnerability tool titled *Neighborhoods at Risk*. This tool was created to help communities identify specific areas that may be adversely impacted by ongoing climate change.

Based on the parish, reliability of the information presented becomes a factor. To combat misinformation and skewed values when dealing with socially vulnerable populations, the U.S. Census Bureau along with Headwater Economics, has denoted values by color and given them a reliability denotation. Any values in **black** are denoted as “high reliability”. This means that error in data based off of the sampling size for that specific population is relatively small and should not be cause for concern. Any values in **orange** are denoted as “medium reliability”. This means that values could be skewed based off of the sampling size being inaccurately examined. Populations and values in orange should be interpreted with caution. Any values in **red** are denoted as “low reliability”. This means that population values and data taken from the census are very unreliable as the sample size included for this data incorporation were very small or insufficient. An emphasis has been placed on values in red in that anyone using them for studies, local plans and regulatory measures, or projects, should consult the respective community for a more comprehensive evaluation of said population(s). *Neighborhoods at Risk* also cites a data limitation to any community with less than 1,000 people residing in it. (US Census Beau 2022, Headwater Economics)

Additionally, there are some limitations to the data that is provided below. Families in poverty are based upon the amount families within the identifiable area. Rental units, mobile homes, and households with no car are based upon the amount of housing units within the identifiable area. People who do not speak English well is based upon the population of the identifiable area who are five years of age or older. People without a high school degree are based upon the population of the identifiable area who are 25 years of age or older. All other indicators used to identify neighborhoods at risk are based upon the identifiable area’s total population. For reference to populations with specific limitations, the table below illustrates the population sample size used to evaluate their respective areas, not the total number of people a specific indicator applies to.

Table 2-8: Limiting Factors in Neighborhoods at Risk Study for Plaquemines Parish

Limiting Factors in Neighborhoods at Risk – Population Sample Size		
Indicators 2023*	Plaquemines Parish	United States
Families in poverty	6,127	82,220,165
Rental units, mobile homes, households with no car	8,200	127,482,865
People who do not speak English well	21,614	313,447,641
People without a high school degree	15,433	228,434,661
Total Population	23,070	332,387,540

*The American Community Survey Office (ACS) estimates values over a 5-year period. 2023 indicators represent average statistics from 2019-2023.

Table 2-9: Neighborhoods at Risk – Socially Vulnerable Populations in Plaquemines Parish

Neighborhoods at Risk – Plaquemines Parish			
Indicators 2023*	Plaquemines Parish Population	Plaquemines Parish Percentage	U.S. Percentage
People under 5 years	1,456	6.3%	5.7%
People over 65 years	3,214	13.3%	16.8%
People of color (including Hispanic)	9,175	39.8%	41.8%
People who do not speak English well	324	1.5%	4.2%
People without a high school degree	2,216	14.4%	10.6%
Families in poverty	623	10.2%	8.7%
Housing units that are rentals	2,143	26.1%	35.0%
Housing units that are mobile homes	2,082	25.4%	5.1%
Households with no cars	270	3.3%	8.3%
People with disabilities	3,381	15.4%	13.0%
People without health insurance	1,244	5.6%	8.5%
Population of Plaquemines Parish: 23,070			

Inventory of Assets for the Entire Parish

As part of the Risk Assessment, the planning team identified essential facilities throughout the parish. Within the entire planning area, there is an estimated value of \$2,477,371,000 in structures throughout the parish. The table below provides the total estimated value for each type of structure by occupancy.

Table 2-10: Estimated Total of Potential Losses throughout Plaquemines Parish.

Occupancy	Plaquemines Parish
Agricultural	\$10,487,000
Commercial	\$398,785,000
Government	\$32,058,000
Industrial	\$158,698,000
Religion	\$61,059,000
Residential	\$1,789,963,000
Education	\$26,321,000
Total	\$2,477,371,000

Critical Facilities of the Parish

The following figures show the locations and names of the essential facilities within the parish:

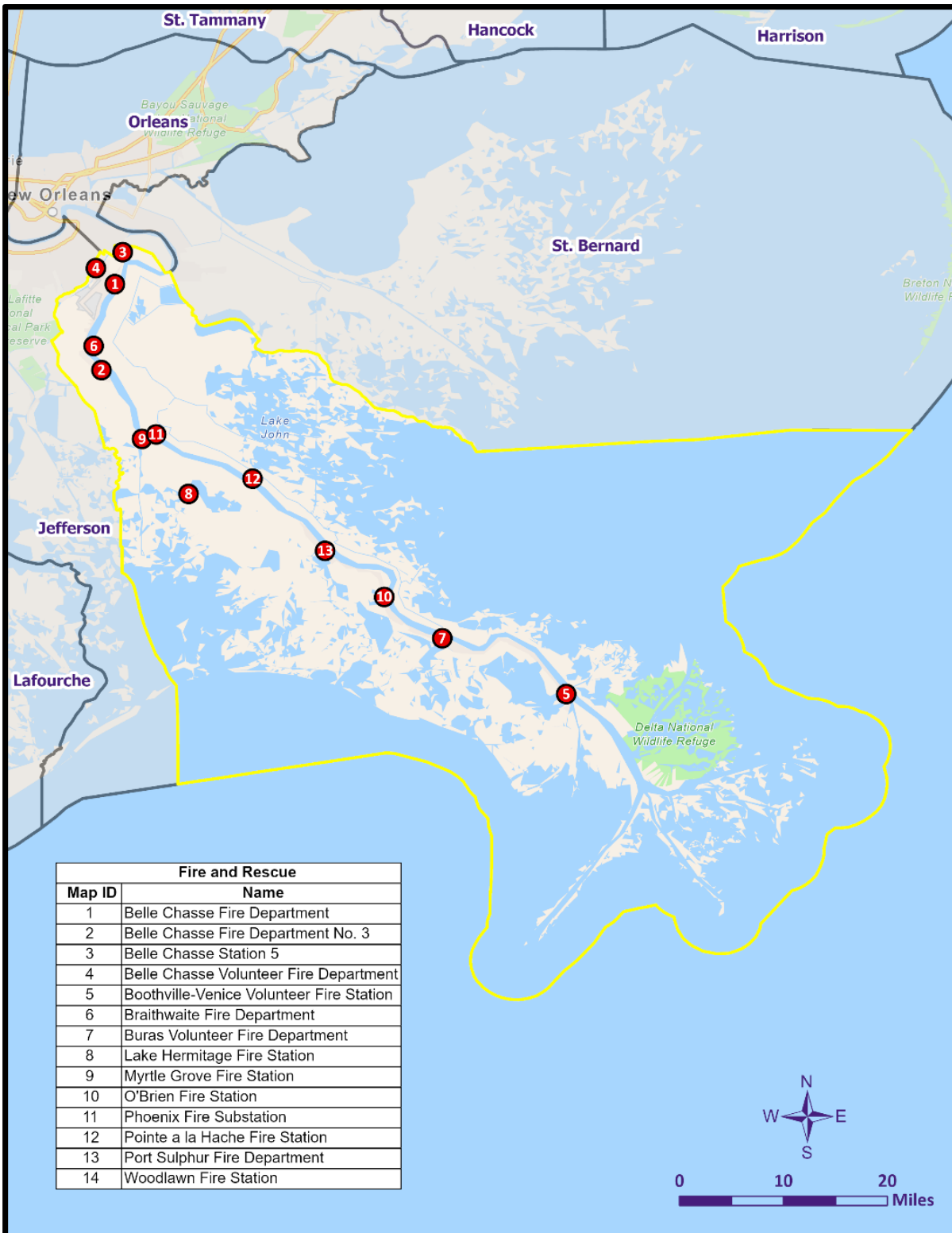


Figure 2-7: Fire and Rescue Facilities in Plaquemines Parish.

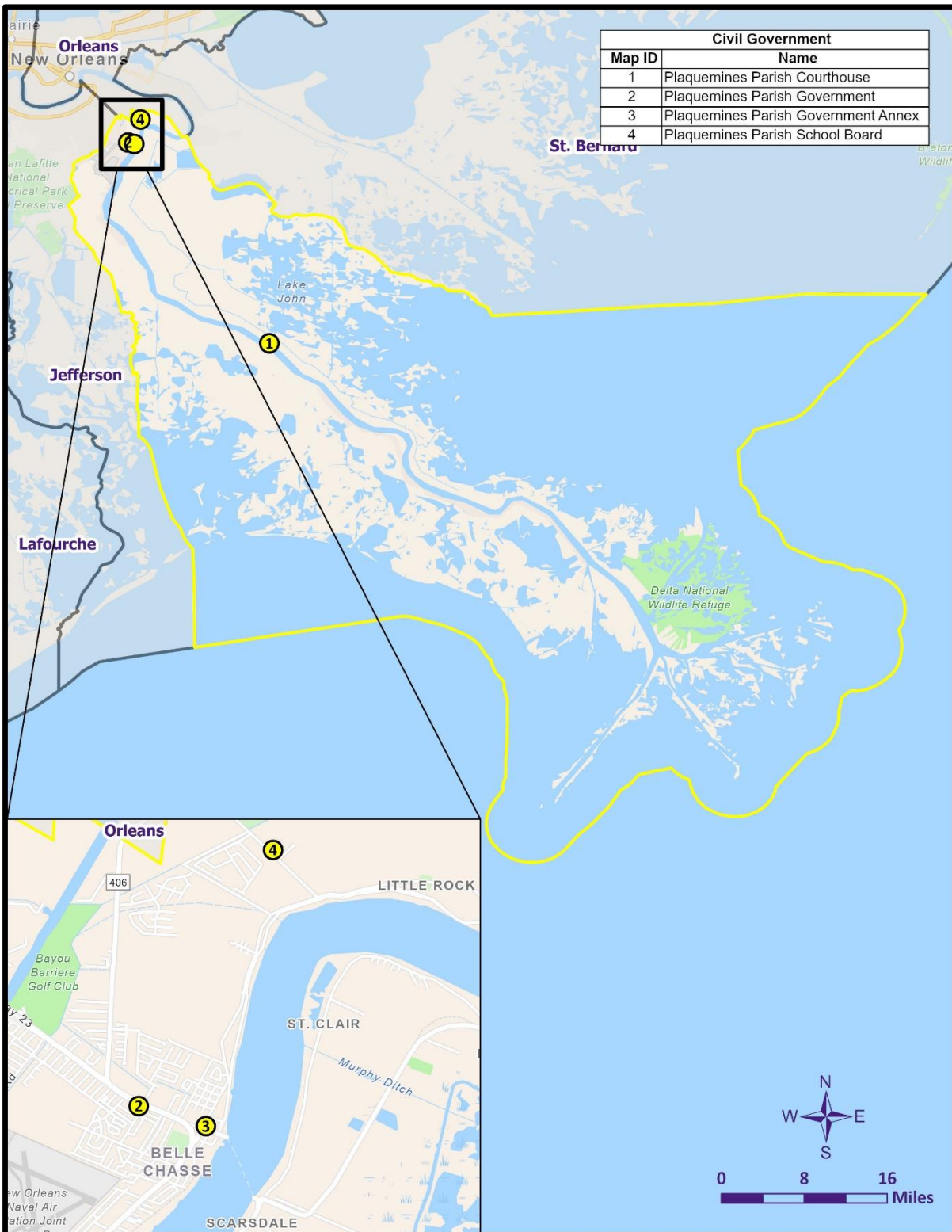


Figure 2-8: Government Buildings in Plaquemines Parish.

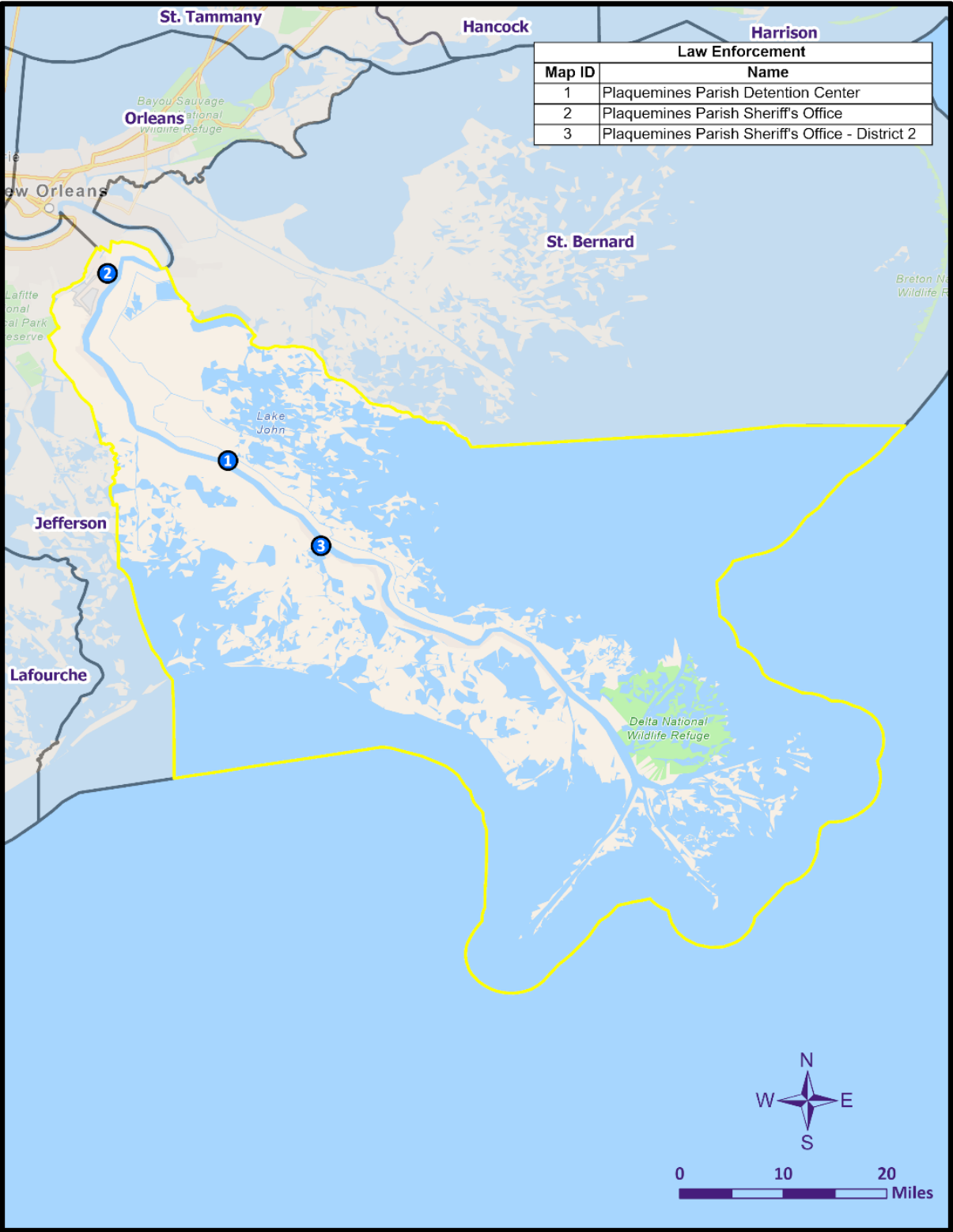


Figure 2-9: Law Enforcement in Plaquemines Parish.

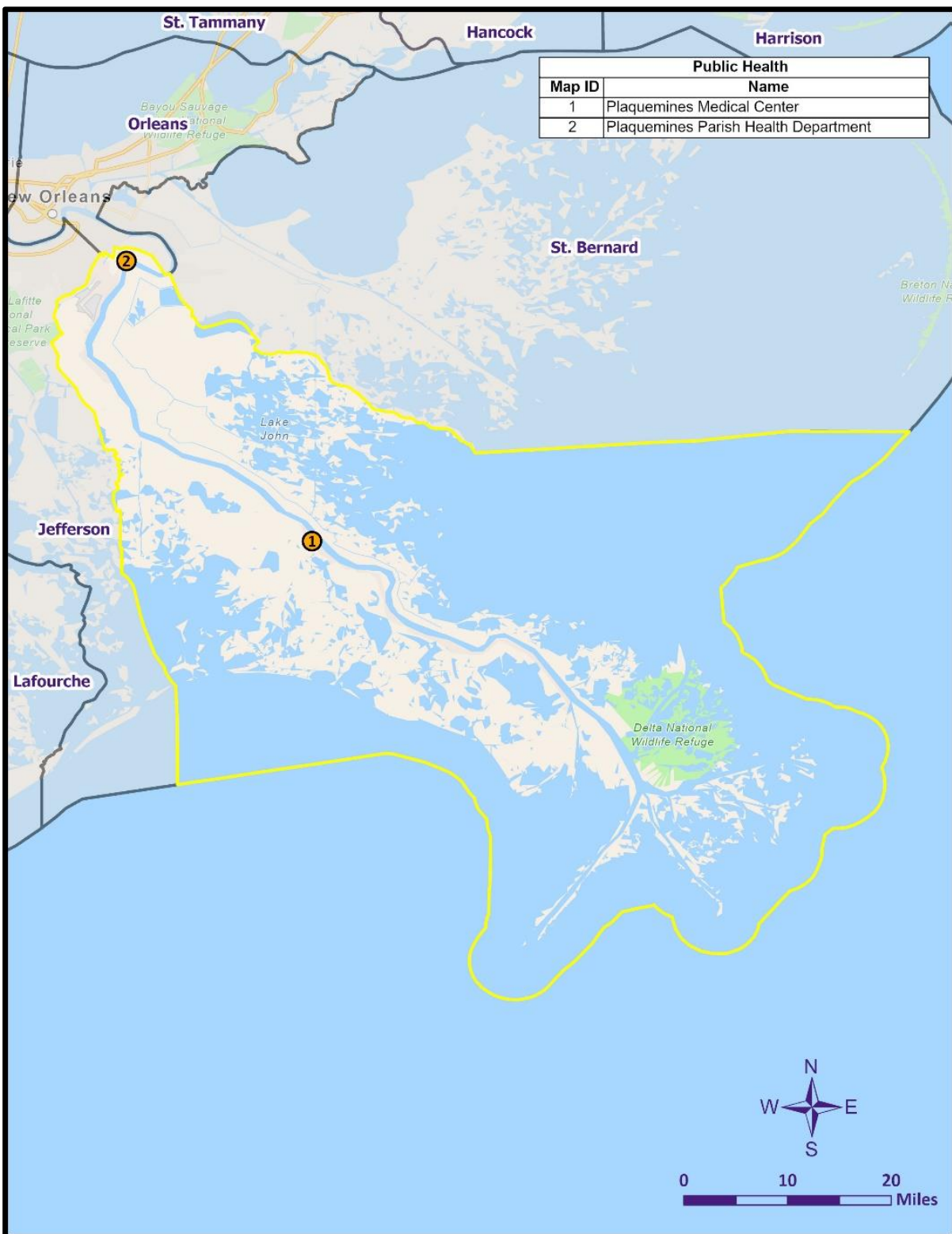


Figure 2-10: Public Health Facilities in Plaquemines Parish.

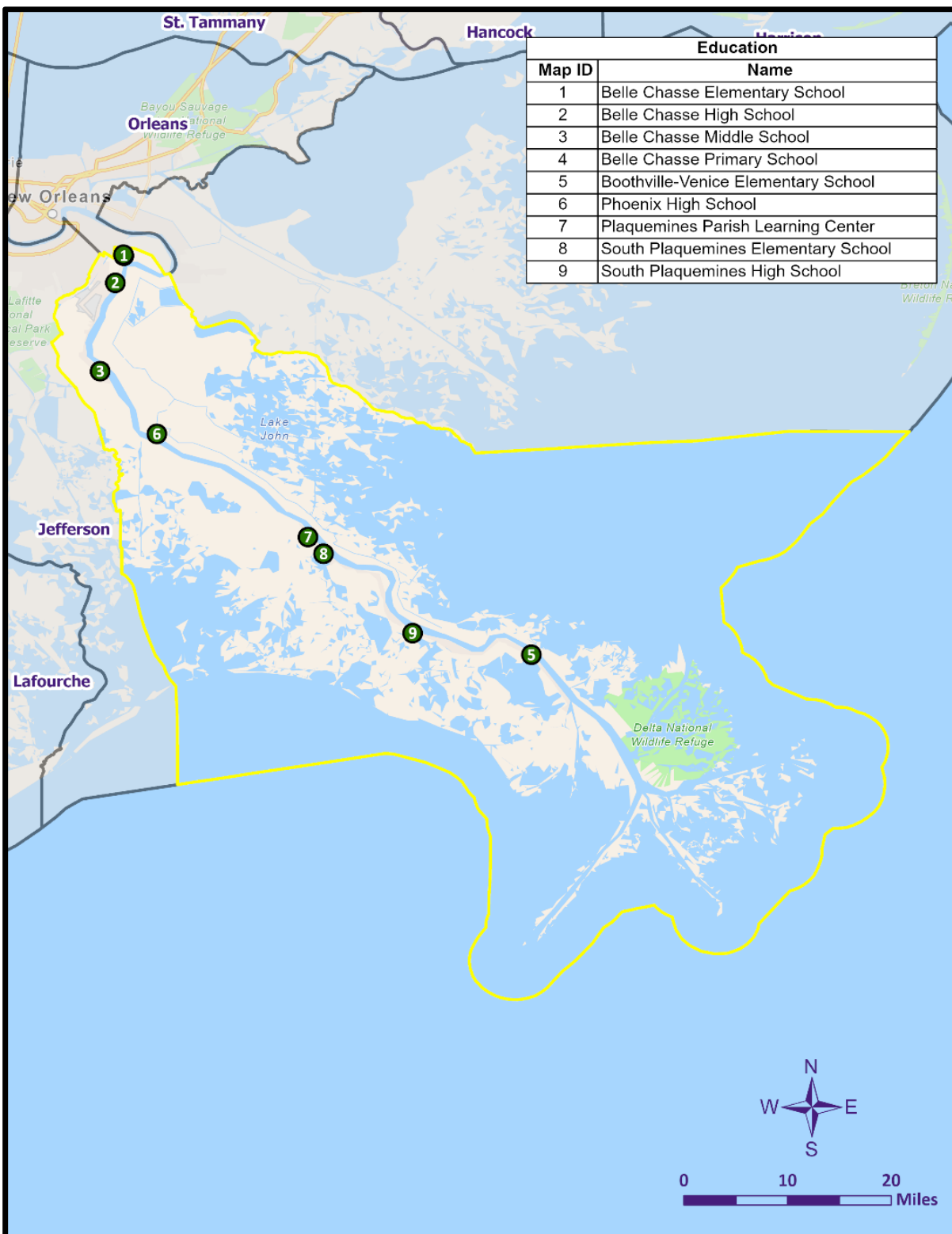


Figure 2-11: Educational Facilities in Plaquemines Parish.

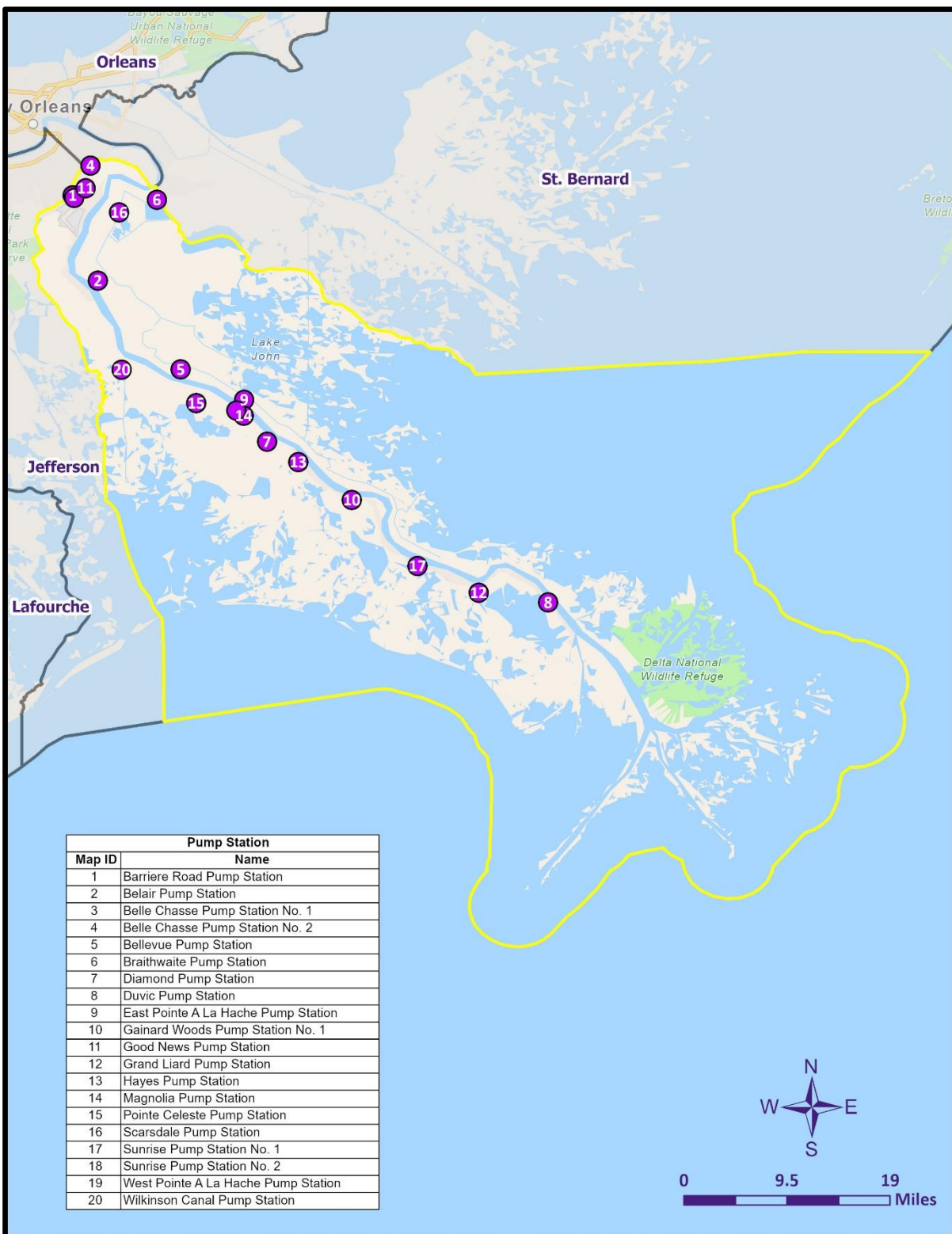


Figure 2-12: Pump Stations in Plaquemines Parish.

Population and Development Trends

The future population and number of buildings can be estimated using U.S. Census Bureau housing and population data. The following tables show population and housing unit estimates from 2010 to 2023:

Table 2-11: Population Growth Rate for Plaquemines Parish.

Total Population	Plaquemines Parish
1-Apr-10	23,042
1-Apr-20	23,515
1-Apr-23	22,386
Population Growth between 2010 – 2020	2.1%
Average Annual Growth Rate between 2010 – 2020	0.2%
Population Growth between 2020 – 2023	-4.8%
Average Annual Growth Rate between 2020 – 2023	-1.2%

Table 2-12: Housing Growth Rate for Plaquemines Parish.

Total Population	Plaquemines Parish
1-Apr-10	9,696
1-Apr-20	9,780
1-Apr-23	9,839
Housing Growth between 2010 – 2020	0.9%
Average Annual Growth Rate between 2010 – 2020	0.1%
Housing Growth between 2020 – 2023	1.01%
Average Annual Growth Rate between 2020 – 2023	0.25%

Since the previous plan update in 2020, the population has decreased while housing development has increased. Plaquemines Parish will continue to be vigilant in offsetting any new development around the parish with appropriate mitigative actions. Initiatives such as active floodplain management have regulated the development of flood prone areas to continue supporting and encouraging safer communities within Plaquemines Parish. The development that has occurred since 2020 has not in any knowing way altered the parish's vulnerability to natural hazards. Plaquemines Parish will continue to monitor the rise of development and ensure that any new planning project is within the limitations of this hazard mitigation plan and for the best interest of the public, especially socially vulnerable populations.

Land Use

The Parish Land Use table is provided on the following page. Residential, commercial, and industrial areas account for only 1% of the parish's land use. Water areas is the largest category, accounting for 1,110,107 acres (68%) of parish land. At 368,276 acres, wetlands account for 22% of parish lands, while 141,514 acres of agricultural areas account for 9% of parish lands. The parish also consists of 3,553 acres of forested areas, accounting for less than 1% of all parish lands.

Table 2-13: Plaquemines Parish Land Use.

(Source: USGS Land Use Map)

Land Use	Acres	Percentage
Agricultural Land, Cropland, and Pasture	141,514	9%
Wetlands	368,276	22%
Forest Land (Not including forested wetlands)	3,553	< 1%
Urban/Development	19,527	1%
Water	1,110,107	68%

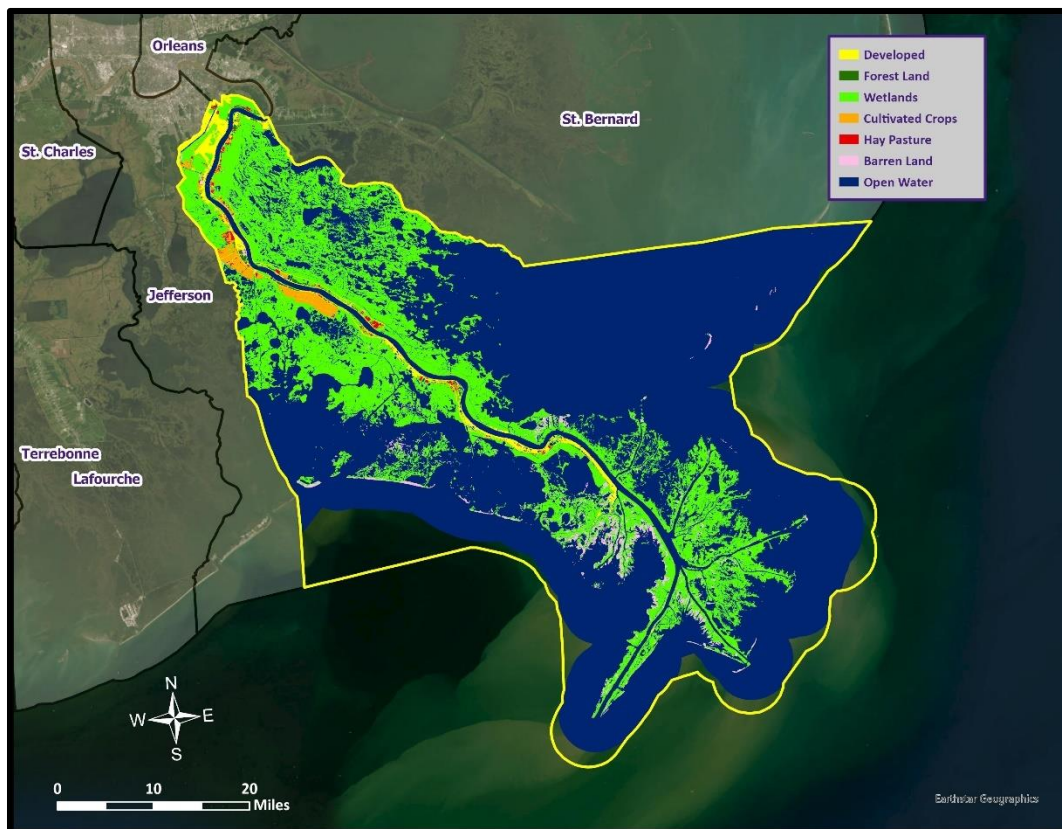


Figure 2-13: Plaquemines Parish Land Use Map.

(Source: USGS Land Use Map)

Hazard Profile, Risk Assessment, and Vulnerability Analysis

Coastal Hazards

Profile

Coastal land loss is the loss of land (especially beach, shoreline, or dune material) by natural and/or human influences. Coastal land loss occurs through various means, including erosion, subsidence (the sinking of land over time as a result of natural and/or human-caused actions), saltwater intrusion, coastal storms, littoral drift, changing currents, manmade canals, rates of accretion, and sea level rise. The effects of these processes are difficult to differentiate because of their complexity and because they often occur simultaneously, with one influencing each of the others.

Some of the worst recent contributors to coastal land loss in the state are the tropical cyclones of the past decade. Two storms that stand out in this regard are Hurricanes Katrina and Rita. These powerful cyclones completely covered large tracts of land in a very brief period, permanently altering the landscape. The disastrous legacy of these storms concentrated already ongoing efforts to combat coastal land loss. Consistent with the 2019 State Hazard Mitigation Plan Update, coastal land loss is considered in terms of two of the most dominant factors: sea level rise and subsidence.

Sea level rise and subsidence impact Louisiana in a similar manner—again making it difficult to separate impacts. Together, rising sea level and subsidence—known together as relative sea level rise—can accelerate coastal erosion and wetland loss, exacerbate flooding, and increase the extent and frequency of storm impacts. According to NOAA, global sea level rise refers to the upward trend currently observed in the average global sea level. Local sea level rise is the level that the sea rises relative to a specific location (or, benchmark) at the coastline. The most prominent causes of sea level rise are thermal expansion, tectonic actions (such as sea floor spreading), and the melting of the Earth's glacial ice caps.

The current U.S. Environmental Protection Agency (EPA) estimate of global sea level rise is 10–12 in. per century, while future sea level rise could be within the range of 1–4 ft. by 2100. According to the U.S. Geological Survey (USGS), the Mississippi Delta plain is subject to the highest rate of relative sea level rise of any region in the nation largely due to rapid geologic subsidence.

Subsidence results from a number of factors including:

- Compaction/consolidation of shallow strata caused by the weight of sediment deposits, soil oxidation, and aquifer draw-down (shallow component)
- Gas/oil/resource extraction (shallow & intermediate component)
- Consolidation of deeper strata (intermediate components)
- Tectonic effects (deep component)

For the most part, subsidence is a slow-acting process with effects that are not as evident as hazards associated with discrete events. Although the impacts of subsidence can be readily seen in coastal parishes over the course of decades, subsidence is a “creeping” hazard. The highest rate of subsidence is occurring at the Mississippi River Delta (estimated at greater than 3.5 ft./century). Subsidence rates tend to decrease inland, and they also vary across the coast.

Overall, subsidence creates three distinct problems in Louisiana:

- By lowering elevations in coastal Louisiana, subsidence accelerates the effects of saltwater intrusion and other factors that contribute to land loss.
- By lowering elevations, subsidence may make structures more vulnerable to flooding.
- By destabilizing elevations, subsidence undermines the accuracy of surveying benchmarks (including those affecting levee heights, coastal restoration programs, surge modeling, BFEs, and other engineering inputs),

which can contribute to additional flooding problems if construction occurs at lower elevations than anticipated or planned.

Risk Assessment

Geographic Extent

Historic areas of coastal land loss and gain and subsidence rates have been quantified for the parish using data from the U.S. Geologic Survey and Louisiana Coastal Protection and Restoration Authority (CPRA). Since 1932, the average annual land loss in Louisiana is 35 square miles, while the average annual land gain has been 3 square miles for a net loss of 32 square miles per year. Land loss is occurring throughout the entire area of the Parish. Subsidence is also occurring throughout the parish further exacerbating land loss.

Previous Occurrences

Coastal land loss is an ongoing process, including discrete (hurricanes) and continuous (subsidence, sea level rise) processes. While historic flood loss data undoubtedly includes the effects of coastal land loss, specific previous occurrences have not been identified as a source of direct disaster damage in Louisiana. Rather, the effects of the underlying flood or hurricane storm surge hazard are recorded. Land loss is a significant hazard, however, and assessment of the added flood impacts caused by land loss is quantified in the following sections. The southern portion of Plaquemines Parish can expect to experience subsidence rates of approximately 35 mm annually. The western portions of Plaquemines Parish can expect subsidence rates upwards of 25 mm annually, while the eastern portions of the parish can expect subsidence rates of approximately 10 mm annually.

Probability

Subsidence, sea level rise, and coastal land loss are ongoing hazards. Based on historical subsidence rates and land loss/gain trends, the probability of future land loss in the parish is 100% certain, but actual rates of subsidence and land loss/gain vary along the coast based on various meteorological, geological, and human-influenced dynamics (e.g., water/resource extraction, canal dredging, saltwater intrusion, marsh restoration projects, etc.).

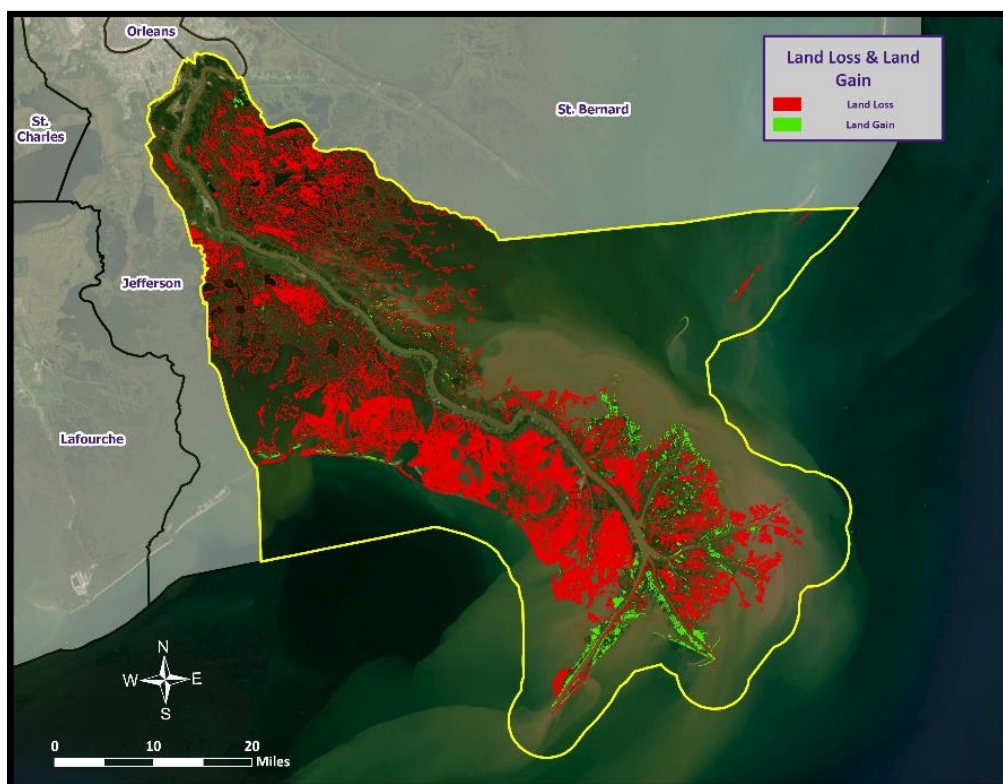


Figure 2-14: Historical Areas of Land Loss and Gain Between 1950 and 2020

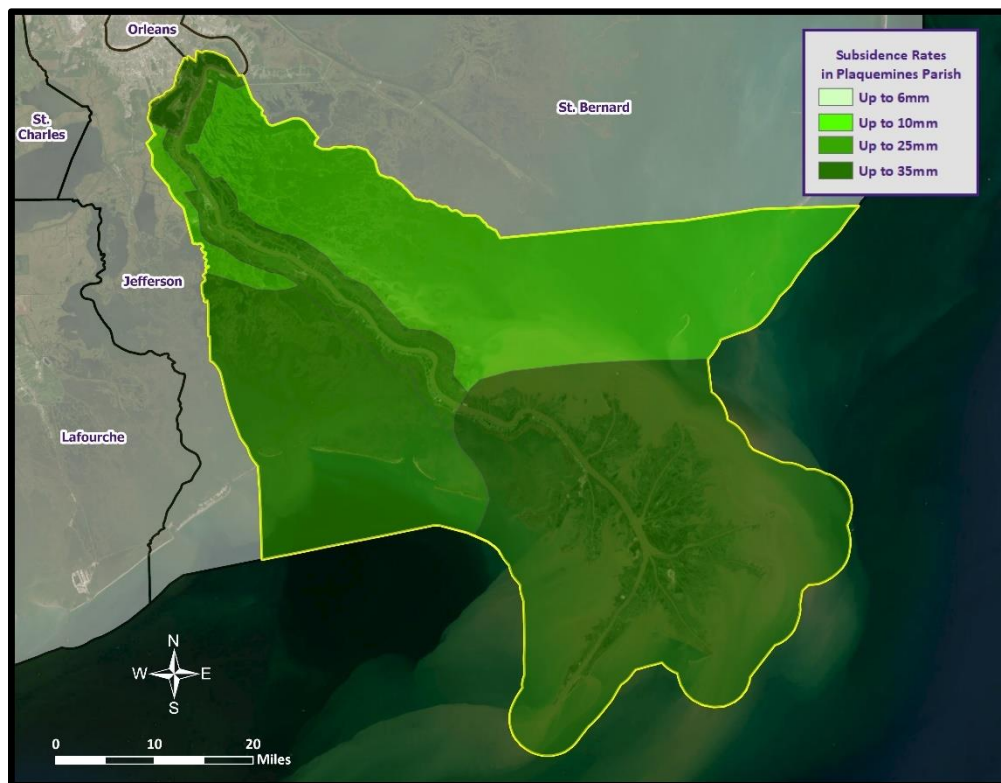


Figure 2-15: Maximum Annual Subsidence Rates Based on Subsidence Zones in Coastal Louisiana

Climate Change Impacts

Climate change has a significant impact on coastal hazards, especially the state of Louisiana as increased coastal erosion due to sea level rise will increase as higher sea levels push against the shoreline of Louisiana. Loss of land will occur in low-lying areas and areas below sea level. Saltwater intrusion into freshwater aquifers will occur as sea levels rise, impacting drinking water supplies and agriculture in the state and parish.

Future Hazard Impacts

Future development in coastal areas can exacerbate existing hazards such as sea level rise and storm surges by increasing vulnerability through urbanization disrupting natural coastal buffers and altering sediment processes. Population growth in coastal areas can also intensify coastal hazards due to increased urbanization, infrastructure demands, and land-use changes.

Vulnerability Analysis

Estimated Impact and Potential Loss

To determine the estimated potential losses, the methodology implemented in the 2014 Louisiana State Plan Update was used. In the state plan, two parameters were considered to estimate the projected increase in coastal flood losses from storm surge scenarios – global sea level rise and subsidence. A timeframe of 10 years was used for evaluation of future effects of sea level rise and subsidence for comparison with current conditions. The NOAA Sea, Lake and Overland Surges from Hurricanes (SLOSH) model was used to estimate the maximum of maximum (MOM) storm surge elevations for a Category 1 hurricane at mean tide along the coast of Louisiana. The MOM scenario is not designed to describe the storm surge that would result from a particular event, but rather evaluates the impacts of multiple hurricane scenarios with varying forward speeds and storm track trajectories to create the maximum storm surge elevation surface that would occur given the simultaneous occurrence of all hurricane events for a given category.

There are many global sea level rise scenarios from which to select; however, within a 10-year timeframe, methods that predict accelerating sea level rise rates do not deviate significantly from straight line methods. Therefore, a

linear sea level rise projection for the sea level rise occurring in 10 years (SLR₂₀₂₄) using a linear global sea level rise rate of 3.1 mm/year was used (IPCC, 2007), which is also in accordance with the CPRA Coastal Master Plan. This resulted in an increase of 0.1 feet, which was applied to the NOAA MOM storm surge elevation results over the model output domain.

$$SLR_{2024} = 0.0031 \frac{m}{year} \times 10 \text{ years}$$

$$SLR_{2024} = 0.031 \text{ meters} = 0.10 \text{ ft in 2024}$$

To estimate the effects of subsidence, the elevation profile for southern Louisiana was separated into sections based on subsidence zones. The 20th percentile values for subsidence were used, in accordance with the CPRA Master Plan, and subtracted from the digital elevation model (DEM) for each zone and re-joined to create a final subsided ground elevation layer.



Figure 2-16: Total Impact of Subsidence in Plaquemines Parish

The following table shows the current and future exposure potential based on the Hazus inventory database.

Table 2-14: Estimated Annual Losses for Coastal Land Loss in Plaquemines Parish.
(Source: Hazus)

Estimated Annual Potential Losses
Plaquemines Parish
\$9,227

Vulnerable Population

Coastal land loss can impact all demographics and age groups. Buildings located within highly vulnerable coastal land loss areas could be eventually permanently shut down and forced to re-locate. Long-term sheltering and permanent relocation could be a concern for communities that are at the highest risk for future coastal land loss. The total population within the parish that is susceptible to the effects of coastal land loss are shown in the following table.

Table 2-15: Number of People Susceptible to Coastal Land Loss in the Parish.

Number of People Exposed to Hurricane Hazards			
Location	# in Community	# in Hazard Area	% in Hazard Area
Plaquemines Parish	23,515	23,515	100%

The Hazus Flood Model was used to identify populations vulnerable to coastal land loss throughout the parish in the tables below:

Table 2-16: Population Vulnerable to Coastal Land Loss in the Parish.

Plaquemines Parish		
Category	Total Numbers	Percentage of People in Hazard Area
Number in Hazard Area	23,515	100.0%
Persons Under 5 years	1,481	6.3%
Persons Under 18 years	5,879	25.0%
Persons 65 Years and Over	3,269	13.9%
White	14,532	61.8%
Minority	8,983	38.2%

Vulnerability Score

Table 2-17: Vulnerability Score for Coastal Hazards in Plaquemines Parish.

Coastal Hazards Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	4	2	4	2	3	3.05

Flooding

Profile

A flood is the overflow of water onto land that is usually not inundated. The National Flood Insurance Program 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 overflow of inland or tidal waves, 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 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 such as precipitation, topography, vegetation, soil texture, and seasonality, as well as anthropogenic factors such as urbanization (extent of impervious surfaces), land use (agricultural and forestry tend to remove native vegetation and accelerate soil erosion), and the presence of flood-control structures such as levees and dams.

Extreme precipitation, produced from mid-latitude cyclones, thunderstorms, or hurricanes, is often the major initiating condition for flooding. During the cooler months, slow-moving frontal weather systems produce heavy rainfalls, while the summer and autumn seasons produce major precipitation in isolated thunderstorm occurrences (often on warm afternoons) that may lead to localized flooding. During these warmer seasons, floods are overwhelmingly of the flash flood variety, as opposed to the slower-developing river floods caused by heavy stream flow during the cooler months.

Six specific types of flooding 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. The speed with which riverine flood levels rise and fall depends not only on the amount of rainfall, but even more on the capacity of the river itself, as well as the shape and land cover of its drainage basin. The smaller the river, the faster that water levels rise and fall. For example, the Mississippi River levels rise and fall slowly due to its large capacity. Generally, elongated and intensely developed drainage basins will reach faster peak discharges and faster falls than circular-shaped and forested basins of the same area.
- **Flash flooding** occurs when locally intense precipitation inundates an area in a short amount of time, resulting in local stream flow 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.
- **Urban flooding** is similar to flash flooding but is specific to urbanized areas. It takes place when storm water 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 sea water). Coastal flooding is typically caused by storm surge, tsunamis, or gradual sea level rise.

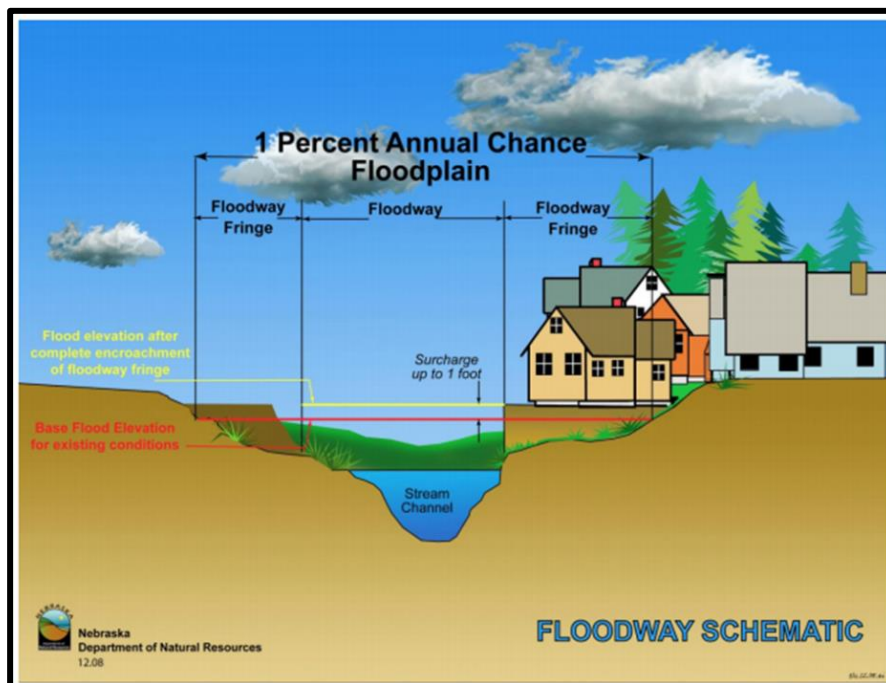
Based on stream gauge levels and precipitation forecasts, the NWS posts flood statements, watches, and warnings. The NWS issues the following weather statements with regard to flooding:

- Flood Categories
 - 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.

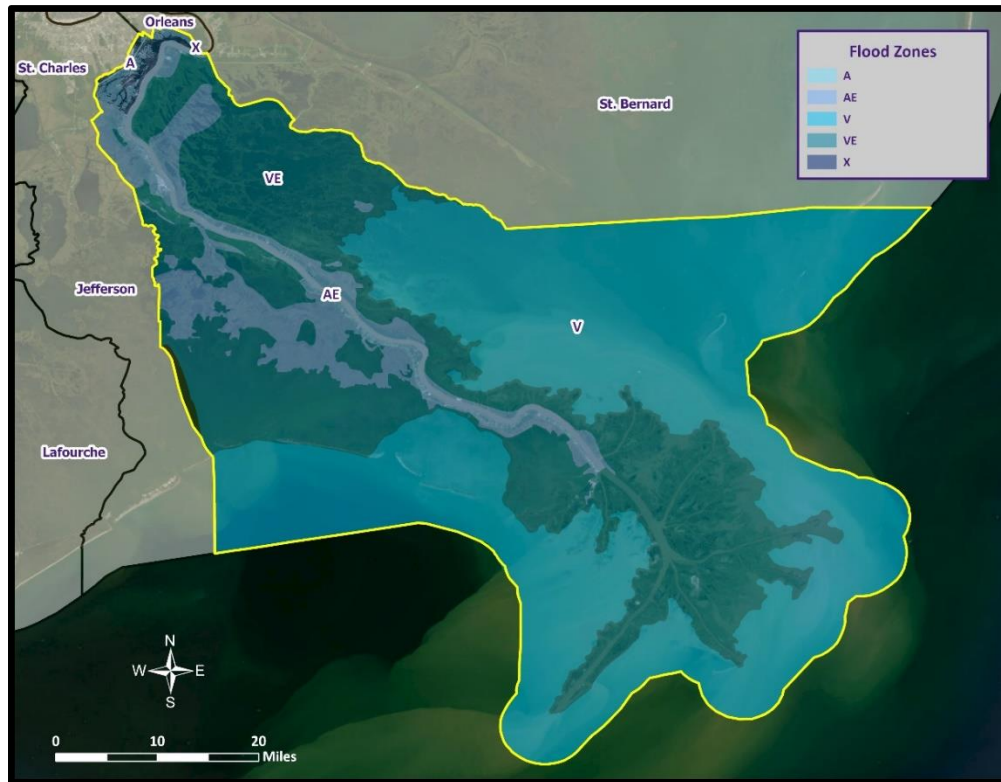
Floods are measured mainly by probability of occurrence. A 10-year flood occurrence, for example, is an occurrence of small magnitude (in terms of stream flow or precipitation) but with a relatively high annual probability of recurrence (10%). A 100-year flood occurrence is larger in magnitude, but it has a smaller chance of recurrence (1%). A 500-year flood is significantly larger than both a 100-year occurrence and a 10-year occurrence, but 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 occurrence does not mean an occurrence of that magnitude occurs only once in X years. Instead, it means that on average, we can expect a flood occurrence of that magnitude to occur once every X years. Given that such statistical probability terms are inherently difficult for the general population to understand, the Association of State Floodplain Managers (ASFPM) promotes the use of more tangible expressions of flood probability. As such, the ASFPM also expresses the 100-year flood occurrence as having a 25% chance of occurring over the life of a 30-year mortgage.

The 100-year flood occurrence 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 Program (NFIP) Rate Maps. The NFIP and FEMA suggest insurance rates based on Special Flood Hazard Areas (SFHAs), as diagrammed in the following figure.



*Figure 2-17: Schematic of 100-Year Floodplain.
The Special Flood Hazard Area (SFHA) extends to the end of the floodway fringe
(Source: Nebraska Department of Natural Resources)*

A SFHA is the land area covered by the floodwaters of the base flood (red line in the above figure), where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. Flood zones for the parish are shown in the following figure.



*Figure 2-18:Plaquemines Parish Areas within the Flood Zones
(Source: Hazus)*

Property Damage

The depth and velocity of flood waters 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 gypsum wallboard can deteriorate if it is bumped before it has time to completely dry. 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 usually are 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 flood waters may look sound and unharmed after a flood, but 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.

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 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 claim's 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 the parish are provided in the table below:

Table 2-18: Repetitive Loss Structures for Plaquemines Parish.

Jurisdiction	Number of Structures	Residential	Commercial	Government	Total Claims	Total Claims Paid	Average Claim Paid
Plaquemines Parish	530	465	65	0	1,356	\$125,151,755	\$92,295

The 530 repetitive loss structures were geocoded in order to provide an overview of where the repetitive loss structures are located throughout the parish. The figures on the following page show the approximate locations of the structures and where the highest concentration of repetitive loss structures is located. Through the repetitive loss maps, it is clear the primary concentration of repetitive loss structures is focused around the Northwestern portion of the parish.



Figure 2-19: Repetitive Loss Properties in Plaquemines Parish.

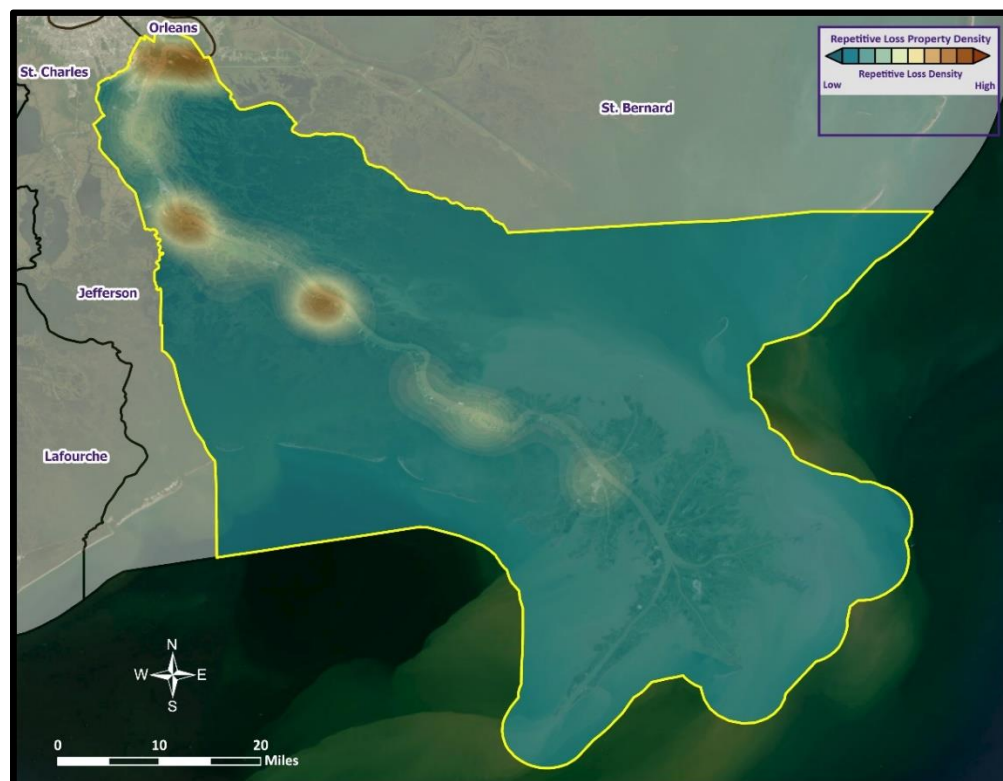


Figure 2-20: Repetitive Loss Property Densities in Plaquemines Parish.

National Flood Insurance Program

Flood insurance statistics indicate that the Parish has 4,824 flood insurance policies with the NFIP, with total annual premiums of \$6,205,362. The parish participants in the NFIP. The parish will continue to adopt and enforce floodplain management requirements, including regulating new construction Special Flood Hazard Areas, making substantial improvement and/or damage determinations, or determining the necessary permits required of owners to bring a substantially improved/damaged structure back into compliance. The parish will continue to monitor activities including local requests for new map updates. Flood insurance statistics and additional NFIP participation details for the parish are provided in the tables to follow.

Table 2-19: Summary of NFIP Policies for Plaquemines Parish.

No. of Insured Structures	Total Insurance Coverage Value	Annual Premiums Paid	No. of Insurance Claims Filed Since 1978	Total Loss Payments
4,824	\$1,492,709,000	\$6,205,362	6,156	\$382,194,304

Table 2-20: Summary of Community Flood Maps for Plaquemines Parish.

CID	Date Joined the NFIP	Tribal	Initial FHBM Identified	Initial FIRM Identified	Adopted Date	Current Effective Map Date
220160	5/1/85	No	1/17/1985	5/1/1985	1/15/2021	1/15/21

According to the Community Rating System (CRS) list of eligible communities, Plaquemines Parish does not participate in the CRS program.

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 flood waters 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. Victims of floods have often put themselves in perilous situations by entering flood waters that they believe to be safe, or by ignoring travel advisories.

Major health concerns are also associated with floods. Floodwater 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. Flood water can also infiltrate sewer lines and inundate wastewater treatment plants, causing sewage to back up and creating a breeding ground for dangerous bacteria. This infiltration may also cause water supplies to become contaminated and undrinkable.

Elevations in the Parish

On the following page, the digital elevation model (DEM) for the parish is instructive in visualizing where the low-lying and high-risk areas are for the parish. Elevations in the parish range from just above sea level to 20 feet. The higher elevations in the parish are just over 10 feet (NAVD88) with the highest elevation located in the vicinity of Belle Chasse of approximately 20 feet (NAVD88). These higher elevations are mainly concentrated along the banks of the Mississippi River and are not common for the majority of the area.

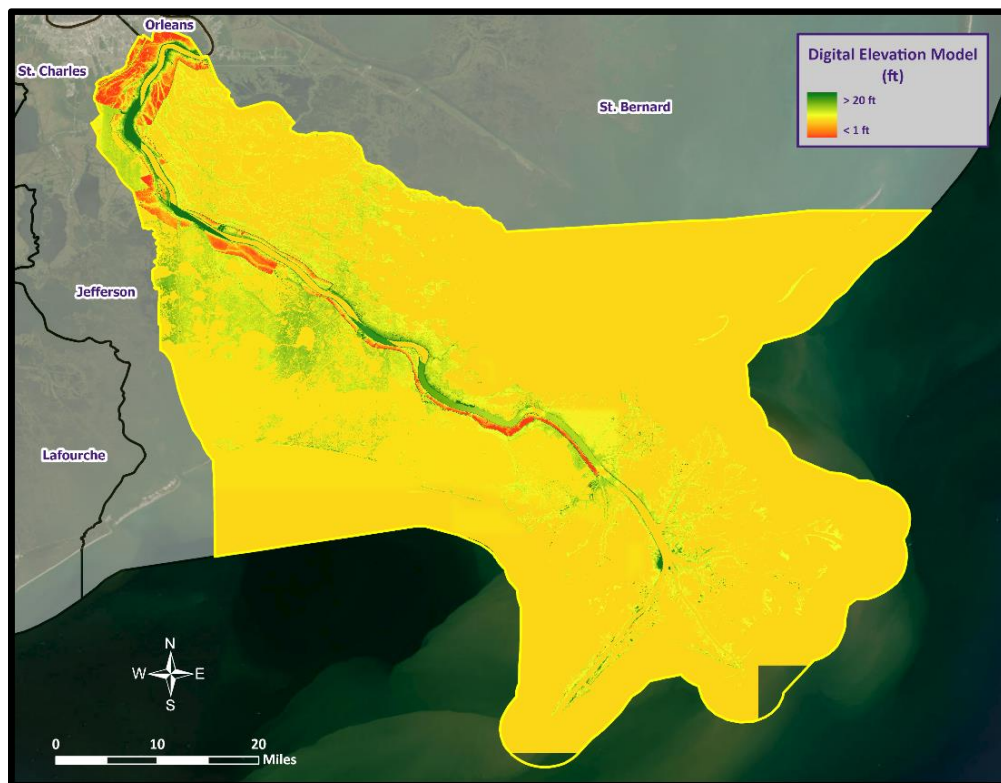


Figure 2-21: Elevation throughout Plaquemines Parish.

Risk Assessment

Geographic Extent

The parish has experienced significant flooding in its history and can expect more in the future. Stormwater excesses caused by large amounts of rainfall in a short period of time occur frequently in the parish. Topography, poor drainage, and an extensive levee system mean that storm water cannot flow out of many areas of the parish. Generally, the most damaging storm water events are a function of a tropical storm or hurricane.

The worst-case scenarios are based on several different types of flooding events. Storm water excesses and riverine flooding primarily affect the low-lying areas of the parish, and flood depths of up to six feet can be expected in Plaquemines Parish.

Previous Occurrences

The parish experienced 11 flooding occurrences between the years 1996 and 2024. Since the last update, there has been one flood occurrence within the boundaries of the parish.

Table 2-21: Historical Flooding Events in Plaquemines Parish since the Last Update.

Date	Area	Type of Flood	Property Damage	Fatalities	Injuries
5/19/2021	Parish Wide	Coastal	\$0	0	0

Probability

The annual return rate (frequency) for periods of flooding in the parish is 0.38 (38% annual probability) or approximately one flood occurrence every 2 to 3 years. The table on the next page shows the probability and return frequency for the parish.

Table 2-22: Annual Flood Probabilities for Plaquemines Parish.

Annual Probability	Return Frequency
38%	1 occurrence every 2 to 3 years

Climate Change Impacts

Atmospheric moisture, precipitation, and atmospheric circulation can be affected by climate change, since radiative forcing alters heating which affects evaporation and sensible heating at the Earth's surface. This process alters the amount, frequency, intensity, duration, and type of precipitation which is part of the hydrological cycle. The Intergovernmental Panel on Climate Change reports that over 105-year period (1901 – 2005) precipitation has increased 5 to 10%. Additionally, water resource managers observed the following:

- Historical hydrological patterns can no longer be solely relied upon to forecast the water future.
- Precipitation and runoff patterns are changing, increasing the uncertainty for water supply quality, flood management, and ecosystem functions.
- Extreme climatic events will become more frequent, necessitating improvement in flood protection and emergency response.

Climate change poses significant threats to both infrastructure and vulnerable populations in the context of flooding. Rising global temperatures have led to the intensification of extreme weather events, such as heavy rainfall and storms, which increase the frequency and severity of floods. Infrastructure, such as roads, bridges, and buildings, designed to withstand historical weather patterns, is now facing greater stress and damage due to the increased volume and intensity of floodwaters.

One of the most pressing impacts of climate change on infrastructure is the increased risk of damage and disruption to critical lifeline systems, such as water supply networks, energy grids, and transportation systems. Floods can compromise the integrity of these systems, leading to widespread power outages, disrupted water access, and road closures, hindering emergency response and recovery efforts. As floods become more frequent and severe, the cost of repairing and reinforcing infrastructure becomes a significant burden on governments and communities.

Furthermore, climate change disproportionately affects vulnerable populations, including low-income communities, the elderly, and those with limited mobility or access to resources. These communities often reside in flood-prone areas with inadequate infrastructure and limited capacity to adapt to changing conditions. Floods can exacerbate existing social inequalities, displacing vulnerable populations and exposing them to health risks, property loss, and economic hardship. Lack of access to timely information and limited evacuation resources can further endanger their lives during extreme flooding events.

Additionally, climate change can disrupt local economies in flood-affected regions. Agricultural lands can be damaged, leading to reduced crop yields and affecting livelihoods. Businesses, particularly those without insurance or financial resilience, may face bankruptcy due to flood-related losses. The overall economic impacts ripple beyond immediate flood-affected regions, affecting supply chains and markets globally.

Addressing the impacts of climate change on infrastructure and vulnerable populations requires a comprehensive approach. Building more resilient infrastructure, incorporating climate adaptation measures, and enforcing zoning regulations to prevent development in flood-prone areas are essential steps. Additionally, governments must prioritize support and resources for vulnerable communities, providing them with better access to early warning systems, evacuation plans, and social safety nets to cope with flood-related challenges. Long-term climate change mitigation efforts are also necessary to reduce the severity and frequency of floods, ultimately safeguarding both infrastructure and vulnerable populations from the detrimental effects of flooding.

Future Hazard Impacts

Hazard impacts for flooding were estimated for the years 2025 and 2030. Yearly population and housing rates were applied to parish inventory assets for composite floods. Based on a review of available information, it is assumed

that population and housing units will increase within the parish from the present until 2030. A summary of estimated future impacts is shown in the table below. Dollar values are expressed in future costs and assume an annual rate of inflation of 1.02%

*Table 2-23: Estimated Future Impacts, 2020 - 2030.
(Source: Hazus, US Census Bureau)*

Hazard / Impact	Total in Parish (2020)	Hazard Area (2020)	Hazard Area (2025)	Hazard Area (2030)
Flood Damage				
Structures	9,625	3,853	3,880	3,899
Value of Structures	\$2,477,371,000	\$991,685,870	\$1,072,171,396	\$1,133,630,247
# of People	23,070	9,235	9,901	10,406

Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the parish level for flooding.

*Table 2-24: National Risk Index (NRI) Summarization of Riverine Flood Occurrences for the Parish.
(Source: National Risk Index)*

Expected Annual Losses	Overall Risk Rating
Relatively Moderate	Relatively Moderate

Estimated Impact and Potential Loss

Using the Hazus Flood Model, the 100-year flood scenario was analyzed to determine losses from this scenario. The following table shows the total economic losses that would result from a 100-year flood occurrence.

*Table 2-25: Estimated Losses in the Parish from a 100-Year Flood Event.
(Source: Hazus)*

Jurisdiction	Estimated Loss
Plaquemines Parish	\$878,445,000

The Hazus Flood Model also provides a breakdown by jurisdiction for seven primary categories (Hazus occupancy) throughout the parish. The losses for the parish by sector are listed in the following table:

*Table 2-26: Estimated 100-year Flood Losses for Plaquemines Parish by Sector.
(Source: Hazus)*

Plaquemines Parish	Estimated Total Losses from 100-Year Flood Event
Agricultural	\$444,000
Commercial	\$175,211,000
Government	\$726,000
Industrial	\$102,321,000
Religious / Non-Profit	\$1,219,000
Residential	\$598,298,000
Schools	\$226,000
Total	\$878,445,000

Vulnerable Population

The total population within the parish that is susceptible to a flood hazard is shown in the table below:

*Table 2-27: Vulnerable Populations Susceptible to a 100-year Flood Event.
(Source: Hazus)*

Number of People Exposed to Flood Hazards			
Location	# in Community	# in Hazard Area	% in Hazard Area
Plaquemines Parish	23,515	9,413	40.0%

The Hazus Flood model was also extrapolated to provide an overview of the vulnerable populations throughout the parish in the following table:

*Table 2-28: Vulnerable Populations Susceptible to a 100-year Flood Event in Plaquemines Parish.
(Source: Hazus)*

Plaquemines Parish		
Category	Total Numbers	Percentage of People in Hazard Area
Number in Hazard Area	9,413	40.0%
Persons Under 5 Years	593	6.3%
Persons Under 18 Years	2,353	25.0%
Persons 65 Years and Over	1,308	13.9%
White	5,817	61.8%
Minority	3,596	38.2%

Vulnerability Score

Table 2-29: Vulnerability Score for Flooding in Plaquemines Parish.

Flood Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	3	4	3	4	3	3.4

Levee Failure

Profile

Levees and floodwalls are flood control barriers constructed of earth, concrete, or other materials. For the purposes of this plan, levees are distinguished from smaller flood barriers (such as berms) by their size and extent. Berms are barriers that only protect a small number of structures, or at times only a single structure. Levees and floodwalls are barriers that protect significant areas of residential, commercial, or industrial development; at a minimum, they protect a neighborhood or small community. Levee failure involves the overtopping, breach, or collapse of the levee. Levee failure is especially destructive to nearby development during flood and hurricane events.

The northern half of Louisiana is protected by levees on the Ouachita River, under the authority of the Vicksburg District of the United States Army Corp of Engineers (USACE). The Vicksburg District encompasses 68,000 mi² in the states of Arkansas, Mississippi and Louisiana. They manage seven drainage basins, including the Yazoo, Pearl, Big Black, Red, Ouachita, and Mississippi Rivers; 12 locks and dams on the Pearl, Red, and Ouachita Rivers; 1,808 miles of levees, including 468 miles along the Mississippi River; and multiple lakes with 1,709 miles of shoreline.

Coastal and southern Louisiana are protected by an extensive levee system under the authority of the New Orleans District of the USACE. This system includes 30,000 mi² of Louisiana south of Alexandria, including 961 miles of river levees in the Mississippi River and Tributaries Project, 449 miles of river levees in the Atchafalaya Basin, and 340 miles of hurricane-protection levees. Other levees have been built along stretches of rivers throughout Louisiana by local levee districts and private citizens. The data regarding these non-federal levees are managed by the individual entity responsible for construction and subsequent maintenance and are not kept in a consistent format for comprehensive hazard analysis.

The effects of a levee failure on property is similar to that of a flood, as discussed in the flooding section. One major difference is that the velocity of the water is increased in the area of the breach, so the potential for property damage is higher in these areas.

A levee failure occurs during high water events, so the populace is normally alerted to the potential danger. Levees are normally monitored during these events and the population in danger is alerted to a possible levee failure. However, if people consider themselves safe once a levee has been breached and do not evacuate, the results could be deadly.

The Mississippi River levee system is constantly monitored during high water events by federal, state, and parish officials. Any potential failure of the Mississippi River levee would be observed long before a failure took place. Once observed, it would be mitigated to prevent any failure in the levee. As a slowly developing hazard, there is significant lead time to warn and evacuate the population in the event of a potential failure. The more likely scenario involving a potential level failure would be an overtopping event for a major precipitation event taking place during a tropical cyclone, similar to Tropical Storm Allison in 2001. An event of this nature is less likely to produce an early warning and most likely to subject more people to flooding.

Risk Assessment

Geographic Extent

Per the National Inventory of Levees, there are 10 levee systems located within the parish. The following figure displays the levee systems located in the parish:

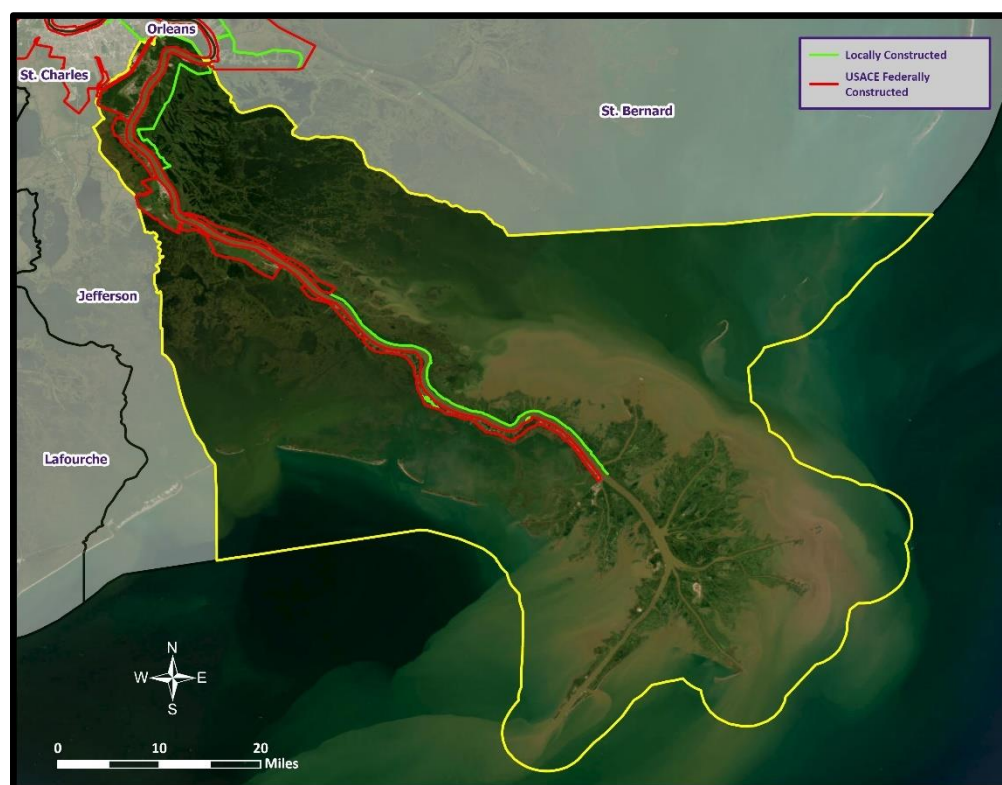


Figure 2-22: Levee Systems in Plaquemines Parish.

Previous Occurrences

There have been no reported levee failure occurrences within Plaquemines Parish.

Probability

It is nearly impossible to predict and model levee failure and its impact on the parish. Due to the unpredictability of levee failures, it is calculated that the probability of a levee failure is less than 1% annually for the unincorporated areas of the parish.

Climate Change Impacts

Extreme precipitation, primarily the type that contributes to flash flooding and not widespread areal flooding, is expected to increase due to climate change. While this may not contribute to the traditional definition of a levee failure, it could increase the chances of a levee overtopping.

Future Hazard Impacts

Population growth and urban development exert significant pressure on levees, as more people and infrastructure depend on their protection from floods. Rapid development often leads to alterations in natural drainage patterns and increased impermeable surfaces, exacerbating flood risks. Expanding urban areas may also encroach upon floodplains and wetlands, reducing natural buffers against floodwaters.

Vulnerability Analysis

Estimated Impact and Potential Loss

Determining the annualized loss as a result of a levee failure is difficult in the parish due to the availability of data on past levee failure events. The National Inventory of Levees was utilized to determine the levees within the parish, the risk level, and the height of the levee. The following table provides an extensive list of the levees in the parish with the risks associated with each system.

Table 2-30: Levees in Plaquemines Parish.

(Source: National Inventory of Levees)

System	Length (miles)	Height (ft)
Caernarvon to Phoenix Polder	21.615	20
Donner Canal West Bank Sub System	4.416	N/A
Fort Jackson Protection System	0.761	N/A
Lower Donner Canal	5.119	N/A
Mississippi River (Plaquemines-1 Left Side)	17.849	N/A
New Orleans East Bank	179.259	22
New Orleans West Bank	110.122	17
Oakville to St. Jude Polder	55.468	17
Phoenix to Bohemia Polder	30.887	16
St. Jude to Venice Polder	73.316	15

Table 2-31: Risks and Vulnerabilities associated with levees in Plaquemines Parish

(Source: National Inventory of Levees)

System	Population	Buildings	Property Value
Caernarvon to Phoenix Polder	1,009	487	\$120,000,000
Donner Canal West Bank Sub System	27,067	7,055	\$4,000,000,000
Fort Jackson Protection System	0	0	\$0
Lower Donner Canal	1,055	15	\$90,000,000
Mississippi River (Plaquemines-1 Left Side)	970	377	\$240,000,000
New Orleans East Bank	849,393	323,422	\$74,000,000,000
New Orleans West Bank	248,334	90,436	\$19,000,000,000
Oakville to St. Jude Polder	2,752	1,052	\$330,000,000
Phoenix to Bohemia Polder	890	424	\$85,000,000
St. Jude to Venice Polder	4,895	2,319	\$420,000,000

Vulnerable Population

There have been no reported fatalities or injuries due to levee failure in Plaquemines Parish.

Vulnerability Score

Table 2-32: Vulnerability Score for Levee Failure in Plaquemines Parish.

Levee Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	1	3	4	1	3	2.4

Saltwater Intrusion

Profile

Saltwater intrusion occurs when seawater infiltrates freshwater aquifers or surface water bodies, posing significant risks to natural ecosystems and human activities. In coastal areas where freshwater and saltwater meet, excessive extraction of groundwater for agriculture, industry, or municipal use can lower freshwater levels enabling seawater to encroach inland. This intrusion threatens the availability of drinking water essential for agriculture, local economies, and communities dependent on freshwater resources. Ecologically, it disrupts habitats vital for freshwater species, endangering biodiversity. The infiltration of saltwater can degrade soil quality by increasing salinity, compromising crop yields and agricultural sustainability.

Saltwater intrusion presents a formidable challenge to Louisiana, primarily due to its expansive coastline and low-lying terrain factors that heighten susceptibility to rising sea levels and coastal erosion. Louisiana's vital coastal wetlands play a crucial role in mitigating storm surges and sustaining diverse ecosystems, yet they are particularly vulnerable to the encroachment of saltwater. The southeastern region of Louisiana, including the Mississippi River Delta, faces significant threats from saltwater intrusion. This area is home to essential freshwater marshes and swamps that provide critical habitats for numerous plant and animal species. The intrusion of saltwater into these ecosystems disrupts the delicate ecological balance required for the survival of native species adapted to specific freshwater conditions, posing risks of biodiversity loss.

The state's reliance on groundwater from underground aquifers for agriculture, industry, and municipal water supplies exacerbates the issue. Excessive pumping of groundwater can deplete freshwater levels, creating a gradient that draws seawater into the aquifers. This phenomenon jeopardizes the quality and quantity of available freshwater resources, impacting local communities, agricultural productivity, and industrial operations alike.

Louisiana has responded to these challenges with various mitigation strategies. These efforts include initiatives focused on coastal restoration, aimed at rebuilding and maintaining natural defenses such as barrier islands and marshlands that serve as buffers against saltwater intrusion. The state has enhanced monitoring and regulation of groundwater use to promote sustainable management practices and preserve freshwater resources for future generations.

Despite these proactive measures, Louisiana continues to confront persistent challenges exacerbated by saltwater intrusion and exacerbated by climate change. Anticipated increases in sea levels and storm intensity associated with climate change are expected to escalate the impacts of saltwater intrusion, underscoring the critical need for ongoing adaptation and resilience-building efforts. These efforts are essential to safeguarding both the natural ecosystems and the communities reliant on Louisiana's coastal resources.

Risk Assessment

Geographic Extent

Saltwater intrusion in the parish primarily affects areas along its southern boundary adjacent to the Gulf of America and areas along the Mississippi River. The parish is susceptible to saltwater intrusion due to its low-lying coastal geography and proximity to both saline water bodies. The extent of intrusion can vary depending on factors such as sea level rise, groundwater extraction rates, and hydrological conditions.

Previous Occurrences

Saltwater intrusion has been a recurring issue in the parish. Historically, the parish has experienced instances of saltwater encroachment into freshwater aquifers due to a combination of factors including sea level rise, hydrological changes, and land subsidence.

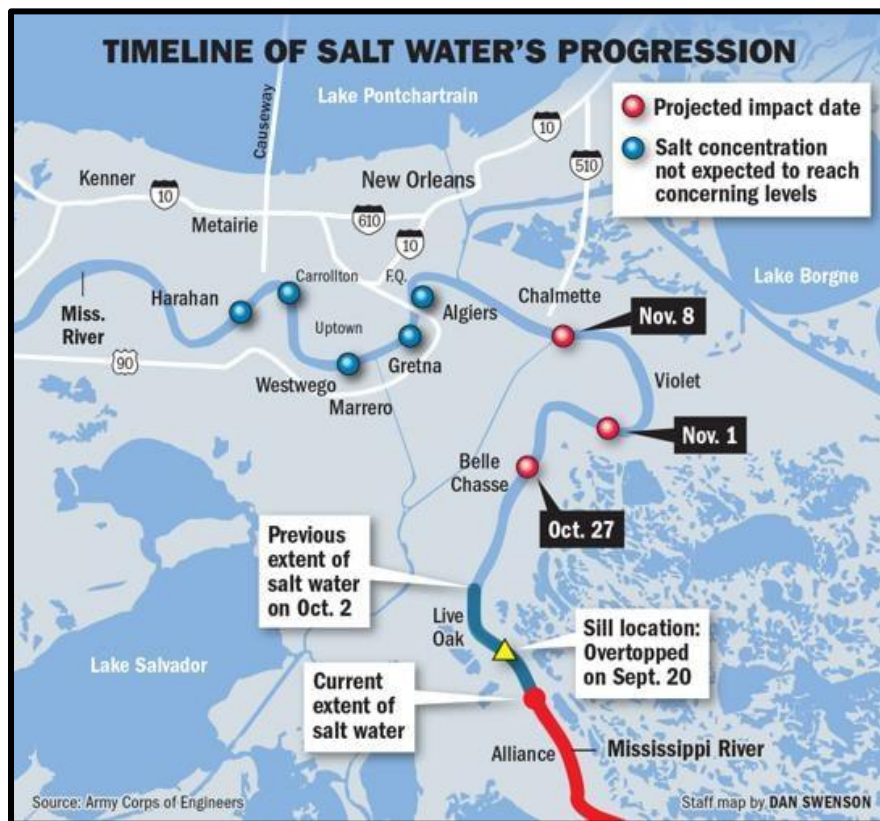


Figure 2-23: Saltwater Intrusion Wedge in the Mississippi River October 10, 2023
(Source: NOLA.com)

Probability

Due to the parish's geographical location, it is calculated that the probability of saltwater intrusion is 100% annually for the unincorporated areas of the parish.

Climate Change Impacts

Climate change intensifies saltwater intrusion by raising sea levels, which increases pressure on coastal aquifers and pushes saltwater further inland. Changes in precipitation patterns and increased evaporation rates due to higher temperatures also reduce freshwater recharge into aquifers, exacerbating the problem.

Future Hazard Impacts

Population growth and urban development can exacerbate saltwater intrusion into freshwater aquifers in several ways. Increased water demand from growing populations often leads to excessive groundwater extraction, lowering water tables and allowing seawater to intrude into coastal aquifers. Additionally, urbanization often involves the construction of impermeable surfaces like roads and buildings, which reduce natural recharge of aquifers and further exacerbate saltwater intrusion. Climate change, which can lead to sea level rise and altered precipitation patterns may also intensify these impacts.

Vulnerability Analysis

Estimated Impact and Potential Loss

Determining the annualized loss as a result of a saltwater intrusion is difficult in the parish due to availability of data on past events. However, saltwater intrusion has the potential to corrode infrastructure such as wells, pipes, and pumps necessitating costly repairs and replacements. Saltwater intrusion can contaminate freshwater aquifers reducing the availability of potable water for drinking and agriculture. The Mississippi River is a vital resource for Plaquemines Parish and plays a crucial role in the region's water supply through its connection to aquifers. The health of the river is essential to the community as saltwater intrusion poses a significant threat to drinking water. Maintaining the health of the Mississippi River is not only essential for sustaining local ecosystems but also for

ensuring the continued safety and reliability of the water supply for Plaquemines Parish. Agriculture could also be adversely affected leading to decreased crop yields and economic losses for farmers.

Plaquemines Parish is highly susceptible to saltwater intrusion due to its unique location along the Louisiana coast and at the mouth of the Mississippi River. As one of the state's most low-lying and vulnerable regions, it is directly exposed to rising sea levels, coastal erosion, and storm surges that push saltwater further inland. Additionally, during periods of low water levels in the Mississippi River, saltwater from the Gulf of America can travel upriver, further threatening freshwater resources. This intrusion endangers freshwater ecosystems, agriculture, industrial facilities and drinking water supplies, making it a critical issue for the region's environmental and economic sustainability.

Vulnerable Population

There have been no reported fatalities or injuries due to saltwater intrusion in the parish. Residents and businesses will face disruptions in daily life and economic activities due to water shortages and quality issues. This could drastically impact tourism, real estate values, and the overall community well-being.

Vulnerability Score

Table 2-33: Vulnerability Score for Saltwater Intrusion in Plaquemines Parish.

Saltwater Intrusion Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	4	3	2	1	4	2.9

Sinkholes

Profile

Sinkholes are areas of ground—varying in size from a few square feet to hundreds of acres and reaching in depth from 1 to more than 100 ft.—with no natural external surface drainage. Sinkholes are usually found in karst terrain—that is, areas where limestone, carbonate rock, salt beds, and other water-soluble rocks lie below the Earth’s surface. Karst terrain is marked by the presence of other uncommon geologic features such as springs, caves, and dry streambeds that lose water into the ground. In general, sinkholes form gradually (in the case of cover subsidence sinkholes), but they can also occur suddenly (in the case of cover-collapse sinkholes).

Sinkhole formation is a very simple process. Whenever water is absorbed through soil, encounters water-soluble bedrock, and then begins to dissolve it, sinkholes start to form. The karst rock dissolves along cracks; as the fissures grow, soil and other particles fill the gaps, loosening the soil above the bedrock. Figure 1 illustrates the development of a cover subsidence sinkhole. As the soil sinks from the surface, a depression forms, which draws in more water, funneling it down to the water-soluble rock. The increase of water and soil in the rock pushes open the cracks, again drawing more soil and water into it. This positive feedback loop continues, unless clay plugs into the cracks in the bedrock, at which time a pond may form. A sudden cover-collapse sinkhole occurs when the topsoil above dissolving bedrock does not sink, but forms a bridge over the soil that is sinking beneath it. Underground soil continues to fill the bedrock fissures, until finally the soil bridge collapses and fills the void beneath it.

Both kinds of sinkholes can occur naturally or through human influence. While sinkholes tend to form naturally in karst areas, sinkholes can form in other geological areas that have been altered by humans such as mining, sewers, hydraulic fracture drilling, groundwater pumping, irrigation, or storage ponds. In all of these cases, and others, the cause for the sinkhole is that support for surface soil has been weakened or substantially removed.

In the United States, 20% of land in the United States is susceptible to sinkholes. Most of this area lies in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. In Louisiana, most of the sinkholes are precipitated by the human-influenced collapse of salt dome caverns. The collapse of a salt dome is usually a slow process; however, it may occur suddenly and without any advance warning.

Risk Assessment

Geographic Extent

Currently, there are 11 identifiable salt dome locations in the parish. The figure on the following page displays the location of salt domes with their relative location. As depicted in the figure, the salt domes are dispersed throughout Plaquemines Parish and affect the entire planning area.

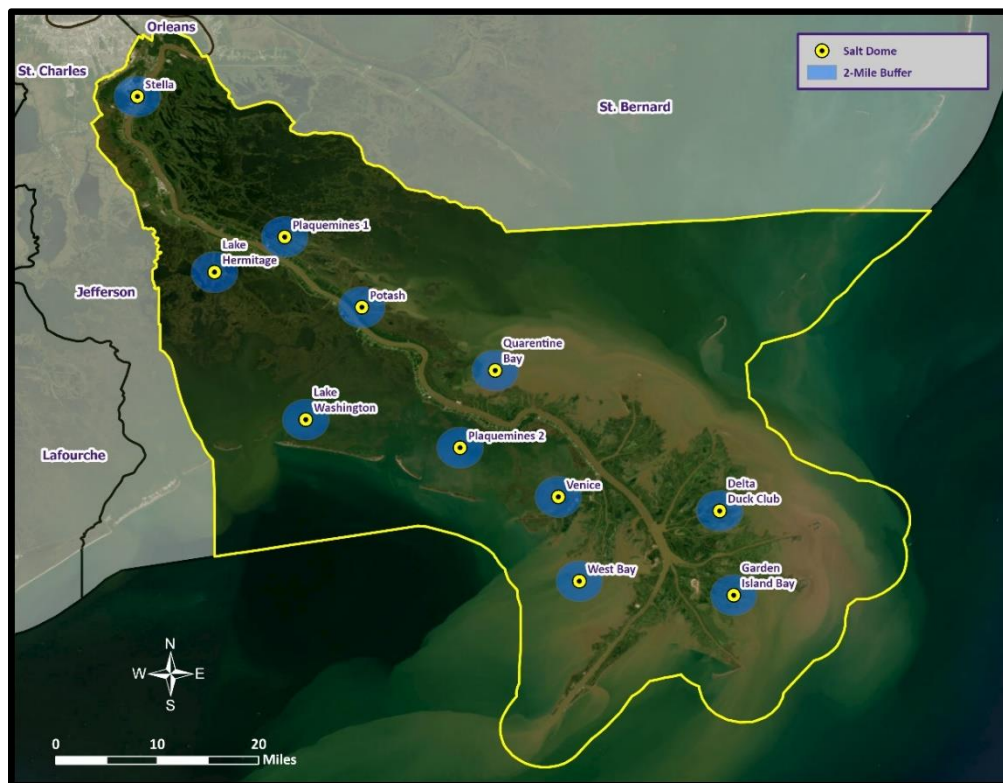


Figure 2-24: Salt Dome Locations in Plaquemines Parish.

Previous Occurrences

There have been no recorded incidents of sinkholes or salt dome collapses in the parish to date.

Probability

Based on historical data for the past 29-years, there has been no incident of a sinkhole formation or salt dome collapse in the Parish. The annual chance of occurrence is calculated at less than 1%.

Climate Change Impacts

Climate change is exerting significant impacts on the occurrence and behavior of sinkholes, geological formations characterized by ground collapse. Altered precipitation patterns, intensified by climate change, result in increased infiltration of water into the ground, eroding underground rock layers and forming voids that can lead to sinkhole formation. Rising sea levels, another consequence of climate change, contribute to the intrusion of saltwater into coastal aquifers, accelerating the dissolution of underground rocks and enhancing the likelihood of sinkhole development. Furthermore, shifting hydrological patterns and extreme weather events, both exacerbated by climate change, disrupt natural water movement and contribute to the instability of soil and rock formations, increasing the susceptibility of sinkhole formation. As climate change continues to reshape ecosystems and exacerbate these processes, adequate mitigation strategies, including improved urban planning, infrastructure design, and geological assessments, become essential to curbing the escalating impacts of sinkholes on both natural landscapes and human settlements.

Vulnerability Analysis

Sinkholes can have profound and wide-ranging impacts on both natural environments and human communities. These sudden depressions in the Earth's surface can pose serious risks to infrastructure, causing damage to roads, buildings, and utility lines. The resulting economic losses can be substantial, affecting businesses, disrupting local economies, and straining resources for repairs and recovery. Human populations can be directly affected through displacement due to sinkhole-related damage, leading to temporary or permanent evacuations and upending lives.

Public safety concerns also arise as sinkholes can appear with little warning, endangering individuals and vehicles. The environmental consequences are also significant, altering local hydrology, groundwater flow, and potentially causing groundwater contamination if hazardous materials are exposed. As urbanization and climate change further interact with sinkhole dynamics, understanding and managing these impacts becomes increasingly crucial for sustainable development and community resilience.

Estimated Impact and Potential Loss

The 11 salt dome locations were analyzed to determine the number of people and homes that are potentially susceptible to losses from a sinkhole materializing from the salt domes. The following table is based on conducting a two-mile buffer around the center of the salt domes. The values were determined by querying the 2020 U.S. Census block data to determine the number of houses and people located within two miles of the salt domes and sinkholes. Critical facilities were also analyzed to determine if they fell within the two-mile buffer of the salt domes and sinkholes. Total value for all occupancy groups from Hazus was used to estimate a total loss of all facilities that were within two miles of the salt domes and sinkholes.

*Table 2-34: Estimated Potential Losses from a Sinkhole Formation.
(Source: U.S. 2020 Census Data and Hazus)*

Salt Dome Name	Total Building Exposure	Critical Infrastructure Exposure	Number of People Exposed	Number of Houses Exposed
Delta Duck Club	\$135,000	0	0	0
Garden Islands Bay	\$0	0	0	0
Lake Hermitage	\$6,652,000	0	41	7
Lake Washington	\$0	0	0	0
Plaquemines 1	\$0	0	0	0
Plaquemines 2	\$0	0	0	0
Potash	\$42,981,000	0	563	251
Quarantine Bay	\$0	0	0	0
Stella	\$226,182,000	0	4,121	1,219
Venice	\$415,000	0	0	0
West Bay	\$0	0	0	0

Vulnerable Population

Per the NCEI Storm Events Database, there have been no reported fatalities or injuries as a result of sinkholes. However, sinkholes pose particularly severe and disproportionate impacts on vulnerable populations, exacerbating existing social disparities. Low-income communities often lack the resources to adequately prepare for and recover from sinkhole-related events. These populations may reside in areas prone to sinkhole formation due to limited housing options or historical settlement patterns. When sinkholes occur, they can destroy homes, disrupt essential services, and force displacement, leaving vulnerable individuals without stable housing and access to necessary amenities. Additionally, marginalized communities might face barriers in receiving timely assistance and information, compounding the challenges they face in the aftermath of sinkhole incidents. Limited financial means can hinder the ability to rebuild or relocate, trapping vulnerable populations in unsafe environments.

Vulnerability Score

Table 2-35: Vulnerability Score for Sinkholes in Plaquemines Parish.

Sinkholes Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	1	2	2	1	4	1.9

Thunderstorms (Hail, Lightning, & Thunderstorm Wind)

Overview

The term “thunderstorm” is usually used as a catch-all term for several kinds of storms. Here “thunderstorm” is defined to include any precipitation occurrence in which thunder is heard or lightning is seen. Thunderstorms are often accompanied by heavy rain and strong winds, and occasionally, depending on conditions, by hail or snow. Thunderstorms form when humid air masses are heated, which causes them to become convectively unstable. Consequently, the air masses rise. Upon rising, the air masses’ water vapor condenses into liquid water and/or deposits directly into ice when they rise sufficiently to cool to the dew-point temperature.

Thunderstorms are classified into four main types (single-cell, multi-cell, squall line, and supercell) depending on the degree of atmospheric instability, the change in wind speed with height (called wind shear), and the degree to which the storm’s internal dynamics are coordinated with those of adjacent storms. There is no such interaction for single-cell thunderstorms, but there is significant interaction with clusters of adjacent thunderstorms in multi-cell thunderstorms, and with a linear “chain” of adjacent storms in squall line thunderstorms. Though supercell storms have no significant interactions with other storms, they have very well-organized and self-sustaining internal dynamics, which allows them to be the longest-lived and most severe of all thunderstorms.

The life of a thunderstorm proceeds through three stages: the developing (or cumulus) stage, the mature stage, and the dissipation stage. During the developing stage, the unstable air mass is lifted as an updraft into the atmosphere. This sudden lift rapidly cools the moisture in the air mass, releasing latent heat as condensation and/or deposition occurs, which warms the surrounding environment, thus making it less dense than the surrounding air. This process intensifies the updraft and creates a localized lateral rush of air from all directions into the area beneath the thunderstorm to feed continued updrafts. At the mature stage, the rising air is accompanied by downdrafts caused by the shear of falling rain (if melted completely), or hail, freezing rain, sleet, or snow (if not melted completely). The dissipation stage is characterized by the dominating presence of the downdraft as the hot surface that gave the updrafts their buoyancy is cooled by precipitation. During the dissipation stage, the moisture in the air mass largely empties out.

The Storm Prediction Center, in conjunction with 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:

- **Severe Thunderstorm Watch:** Issued to alert people to the possibility of a severe thunderstorm developing in the area. Expected time frame for these storms is three to six hours.
- **Severe Thunderstorm Warning:** Issued when severe thunderstorms are imminent. This warning is highly localized and covers parts of one to several counties.

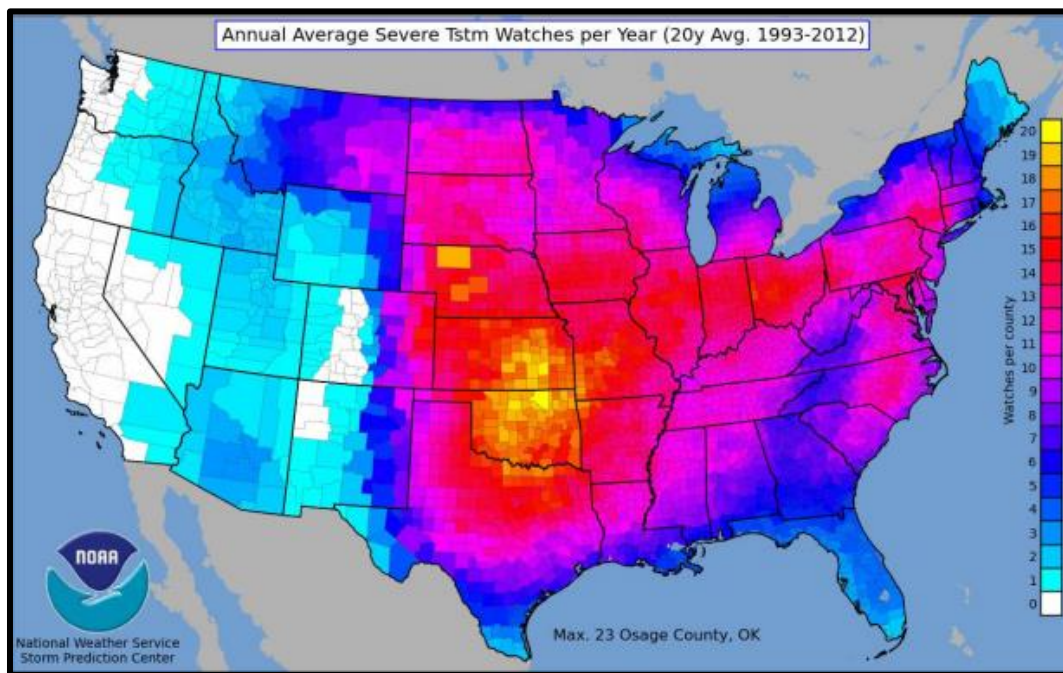


Figure 2-25: County-Level Severe Thunderstorm Watches Issued Per Year on Average.

A variety of hazards might be produced by thunderstorms, including lightning, hail, tornadoes or waterspouts, flash flooding, and high-speed winds called downbursts. Nevertheless, given the criteria, the National Oceanic and Atmospheric Administration (NOAA) characterize a thunderstorm as severe when it produces one or more of the following:

- Hail of one inch in diameter or larger
- Wind gusts to 58 mph or greater
- One or more tornadoes

Tornadoes and flooding hazards have been profiled individually within this report; therefore, for the purpose of thunderstorms, the sub-hazards of hail, high winds, and lightning will be profiled.

Thunderstorms occur throughout the United States at all times of the year, although the types and severity of these storms vary greatly depending on a wide variety of atmospheric conditions. Severe thunderstorms occur more frequently during the late spring and early summer and late summer and early fall when extreme variations exist between ground surface temperatures and upper atmospheric temperatures.

Climate Change Impacts

The impact of climate change on thunderstorms is not well understood at this time. However, thunderstorms are complex, dynamic systems fueled by heat and moisture which can be measured with CAPE (convective available potential energy). It is predicted that CAPE will increase across the Eastern United States by the second half of the 21st century, meaning there is more energy to fuel severe thunderstorms. In this same time frame, there would be a small decrease in vertical wind shear, which helps produce long-lived severe storms. However, the increase in energy outweighs the decreasing shear to produce a net increase in environmental favorability for severe thunderstorms by the end of the century. Some climate models maintained by the Goddard Institute for Space Studies indicate that the number of severe thunderstorms will not change much, but the severe storms that do occur would have stronger winds and more intense precipitation.

Climate change is influencing the frequency and severity of thunderstorms, resulting in significant impacts on infrastructure and vulnerable populations. As global temperatures rise, the atmosphere becomes more energized, leading to an increase in the intensity of thunderstorm activity. Thunderstorms bring heavy rainfall, strong winds, hail, and lightning, all of which can cause substantial damage to various types of infrastructure.

One of the most significant impacts of thunderstorms on infrastructure is the damage to power and communication lines. Strong winds and lightning strikes can lead to power outages, disrupting essential services and communication networks. This can have severe consequences for communities that rely on electricity for medical equipment, communication, and daily living. Additionally, damage to power infrastructure can result in economic losses due to business interruptions and increased repair costs.

Furthermore, heavy rainfall associated with thunderstorms can lead to flash flooding, overwhelming stormwater drainage systems and causing road and bridge damage. This not only disrupts transportation networks but also poses a safety hazard for motorists and pedestrians. Flooded roads can isolate communities and hinder emergency response efforts, leaving vulnerable populations at higher risk during and after thunderstorm events.

Vulnerable populations, such as low-income communities and the elderly, often lack access to resources and live in areas with inadequate infrastructure. They are disproportionately affected by the impacts of thunderstorms. For instance, substandard housing in flood-prone regions can suffer severe damage during storms, displacing already marginalized individuals and families. The elderly and people with limited mobility may face difficulties evacuating during severe weather events, putting their lives at risk.

Moreover, thunderstorms can lead to an increase in lightning-related accidents and wildfires. Lightning strikes can cause fires that spread rapidly, threatening communities and posing additional risks to vulnerable populations living in areas prone to wildfires. These events not only endanger lives but also strain emergency response resources and increase the financial burden on affected communities.

To address the impacts of climate change on infrastructure and vulnerable populations concerning thunderstorms, several measures are crucial. Investment in resilient infrastructure, such as strengthening power grids and stormwater drainage systems, can help mitigate damage and improve response capabilities. Additionally, raising awareness and providing resources to vulnerable communities can enhance preparedness and evacuation plans. Climate change mitigation efforts to reduce greenhouse gas emissions are also essential in curbing the intensification of thunderstorms, ultimately safeguarding both infrastructure and vulnerable populations from the adverse effects of these severe weather events.

Future Hazard Impacts

Population growth and development trends can influence thunderstorm dynamics in several ways. Urban heat islands generated by increased development can enhance local convection and thunderstorm activity. Urbanization can alter land cover, increasing impermeable surfaces that reduce natural drainage and potentially exacerbate localized flooding during thunderstorms. Increased human activity can also introduce aerosols and pollutants into the atmosphere which may influence cloud formation and precipitation patterns, possibly intensifying thunderstorm characteristics.

Hail Profile

Hailstorms are severe thunderstorms in which balls or chunks of ice fall along with rain. Hailstorm densities and reports vary spatially across Louisiana. Hail initially develops in the upper atmosphere as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface. They then fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, and then get caught in another updraft whereupon re-freezing and deposition grows another concentric layer of ice. After several trips up and down the cloud, they develop enough weight to fall. The size of hailstones varies depending on the severity and size of the thunderstorm. Higher surface temperatures generally mean stronger updrafts, which allow more massive hailstones to be supported by updrafts, leaving them suspended longer. This longer suspension time results in larger hailstone sizes. The tables on the next page display the TORRO Hailstorm Intensity Scale, along with a spectrum of hailstone diameters and their everyday equivalents.

Table 2-36: TORRO Hailstorm Intensity Scale.

Intensity Category		Hail Diameter (mm)	Probable Kinetic Energy	Typical Damage Impacts
H0	Hard Hail	5	0 - 20	No damage
H1	Potentially Damaging	5 - 15	>20	Slight general damage to plant, crops
H2	Significant	10 - 20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20 - 30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25 - 40	>500	Widespread glass damage, vehicle body work
H5	Destructive	30 - 50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40 - 60		Bodywork of grounded aircraft dented; brick walls pitted
H7	Destructive	50 - 75		Severe roof damage, risk of serious injuries
H8	Destructive	60 - 90		Severe damage to aircraft bodywork
H9	Super Hailstorms	75 - 100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Table 2-37: Spectrum of Hailstone Diameters and their Everyday Description.

(Source: National Weather Service)

Spectrum of Hailstone Diameters	
Hail Diameter Size	Description
1/4"	Pea
1/2"	Plain M&M
3/4"	Penny
7/8"	Nickle
1" (severe)	Quarter
1 1/4"	Half Dollar
1 1/2"	Ping Pong Ball / Walnut
1 3/4"	Golf Ball
2"	Hen Egg / Lime
2 1/2"	Tennis Ball
2 3/4"	Baseball
3"	Teacup / Large Apple
4"	Softball
4 1/2"	Grapefruit
4 3/4" – 5"	Computer CD-DVD

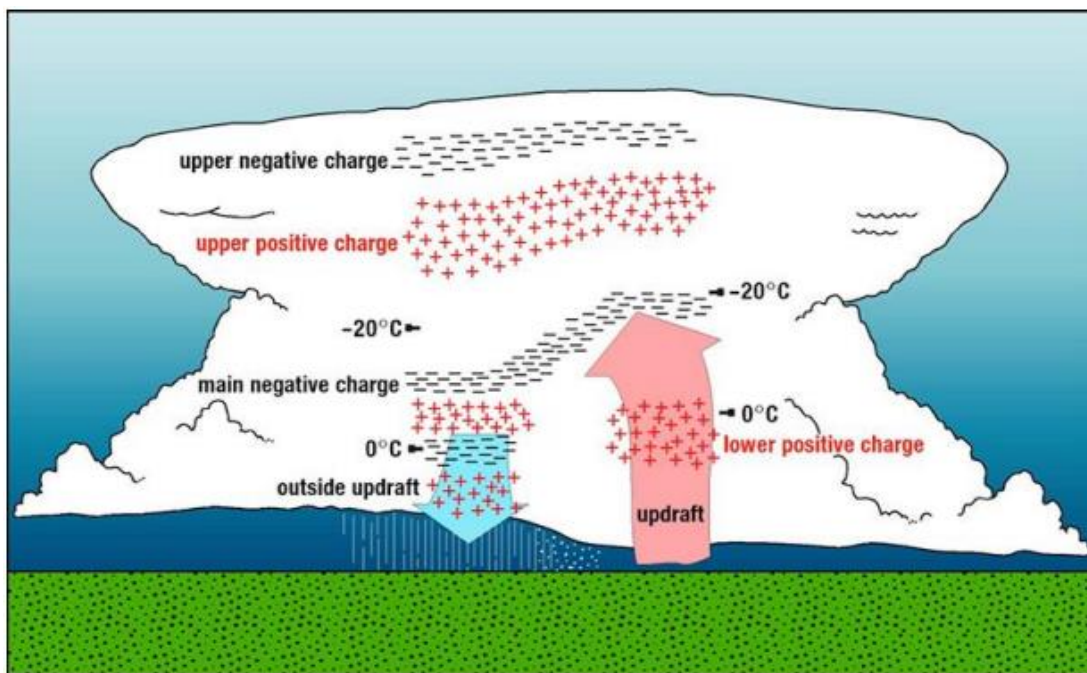
Hailstorms can cause widespread damage to homes and other structures, automobiles, and crops. While the damage to individual structures or vehicles is often minor, the cumulative cost to communities, especially across large metropolitan areas, can be quite significant. Hailstorms can also be devastating to crops. Thus, the severity of hailstorms depends on the size of the hailstones, the length of time the storm lasts, and where it occurs. Hail rarely causes loss of life, although large hailstones can cause bodily injury.

Lightning Profile

Lightning is defined by the National Weather Service as any and all of the various forms of visible electrical discharge caused by thunderstorms. Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Damage may also be indirect which occurs when the current passes through or near an object.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it transpires inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charged center and deliver negative charge to the earth. However, a large minority of flashes carry a positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike five to ten miles from the storm in areas that most people do not consider a threat. Positive lightning also has a longer duration, so fires are more easily ignited. When positive lightning strikes, it usually carries a high peak electrical current, which can potentially result in greater damage.



*Figure 2-26: Charge Distribution in a Typical Storm Cloud
(Source: The National Severe Storms Laboratory)*

Lightning continues to be one of the top three storm-related killers in the United States per FEMA, but if not fatal it also has the ability to cause negative long-term health effects to the individual that is struck. The table on the following page outlines the lightning activity level and intensity scale:

Table 2-38: 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 reaches 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	

Thunderstorm Wind Profile

In general, high winds occur in a number of different ways, with and without thunderstorms. Similar to hailstorms (and often associated with the same storm), high wind damage densities and reports resulting from severe thunderstorms vary spatially across Louisiana. The only high winds of present concern from the following table 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 Louisiana. Nor'easters are cyclonic low-pressure systems that have a minimal impact if any on Louisiana while hurricane winds have a significant impact on the state due to its location.

Table 2-39: High Winds Categorized by Source.
(Source: Making Critical Facilities Safe from High Wind, FEMA)

High Wind Type	Description
Straight-Line Winds	Wind blowing in straight line; usually associated with intense low-pressure area
Downslope Winds	Wind blowing down the slope of a mountain; associated with temperature and pressure gradients
Thunderstorm Winds	Wind blowing due to thunderstorms, and thus associated with temperature and pressure gradients
Downbursts	Sudden wind blowing down due to downdraft in a thunderstorm; spreads out horizontally at the ground, possible forming horizontal vortex rings around the downdraft.
Northeast (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 Ocean and land
Hurricane Winds	Wind blowing in spirals, converging with increasing speed toward eye; associated with temperature and pressure gradients between the Atlantic Ocean, Gulf of America, and land
Tornado Winds	Violently rotating column of air from base of thunderstorm to the ground with rapidly decreasing winds at greater distances from center; associated with extreme temperature gradient

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 increased tendency for traffic accidents, increased vulnerability to fire, food spoilage, and other

losses that might be sustained by a loss of power. The following table presents the Beaufort Wind Scale, first developed in 1805 by Sir Francis Beaufort, which aids in determining relative force and wind speed based on the appearance of wind effects:

Table 2-40: Beaufort Wind Scale.

(Source: NOAA's SPC)

Beaufort Wind Scale			
Force	Wind (MPH)	WMO Classification	Appearance of Wind Effects on Land
			Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-17	Moderate Breeze	Dust, leaves, and loose paper lifted; small tree branches move
5	18-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-30	Strong Breeze	Larger tree branches moving, whistling in wires
7	31-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Twigs breaking off trees, generally impedes progress
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	54-73	Violent Storm	N/A
12	74+	Hurricane	N/A

Hail Risk Assessment

Geographic Extent

Because hailstorms are a climatological based occurrence that can occur anywhere, the entire planning area is at risk from hailstorms. The worst-case scenario for hailstorms is hail up to 2.0 inches in diameter.

Previous Occurrences

The parish experienced 18 hail occurrences between the years 1996 and 2024. Since the last update, there have been 10 hail occurrences within the boundaries of the parish.

Table 2-41: Historical Hail Occurrences in Plaquemines Parish since the Last Update.

Date	Location	Magnitude (inches)	Property Damage	Fatalities	Injuries
5/15/2022	Naval Air Base	1	\$0	0	0
5/15/2022	Augusta	1.75	\$0	0	0
5/15/2022	Port Nickel	2	\$0	0	0
5/15/2022	Sone Chasse	2	\$0	0	0
5/15/2022	Naval Air Base	1.25	\$0	0	0
5/15/2022	Belle Chasse	1.5	\$0	0	0
5/15/2022	Augusta	1.5	\$0	0	0
5/15/2022	Naval Air Base	1.25	\$0	0	0
5/15/2022	Sone Chasse	1	\$0	0	0
6/20/2023	Noami	1	\$0	0	0

Probability

The annual return rate (frequency) for hail occurrences in the parish is 0.62 (62% annual probability) or approximately 1 hail occurrence every 1 to 2 years. The following figures display the density of hailstorm events and an overview of hailstorm size based on location.

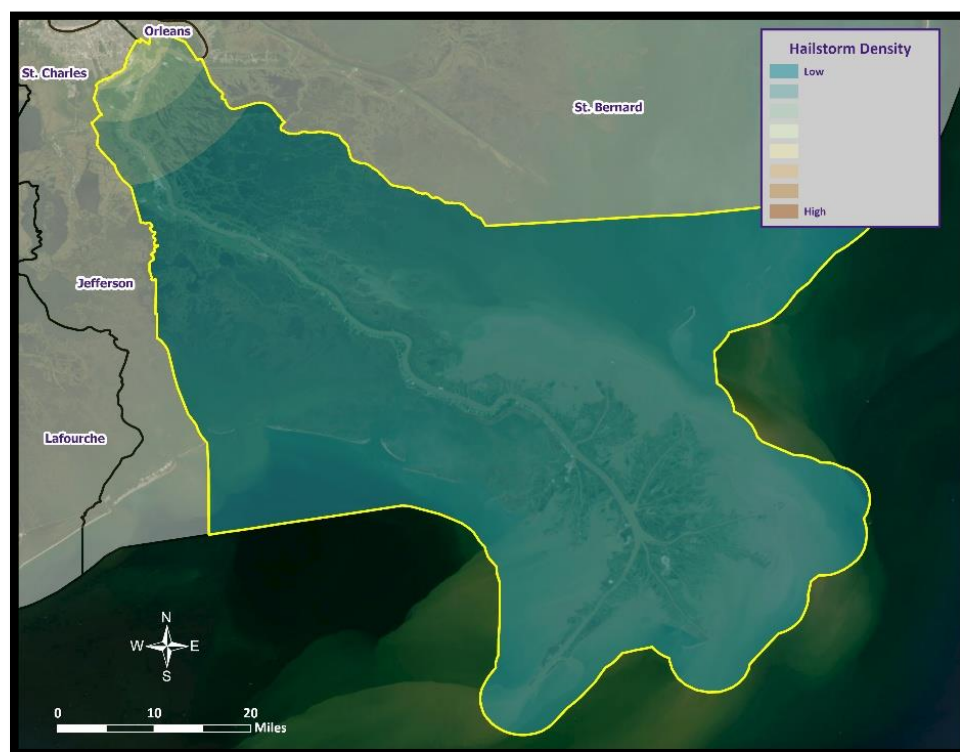


Figure 2-27: Density of Hailstorms by Diameter from 1950-2024.

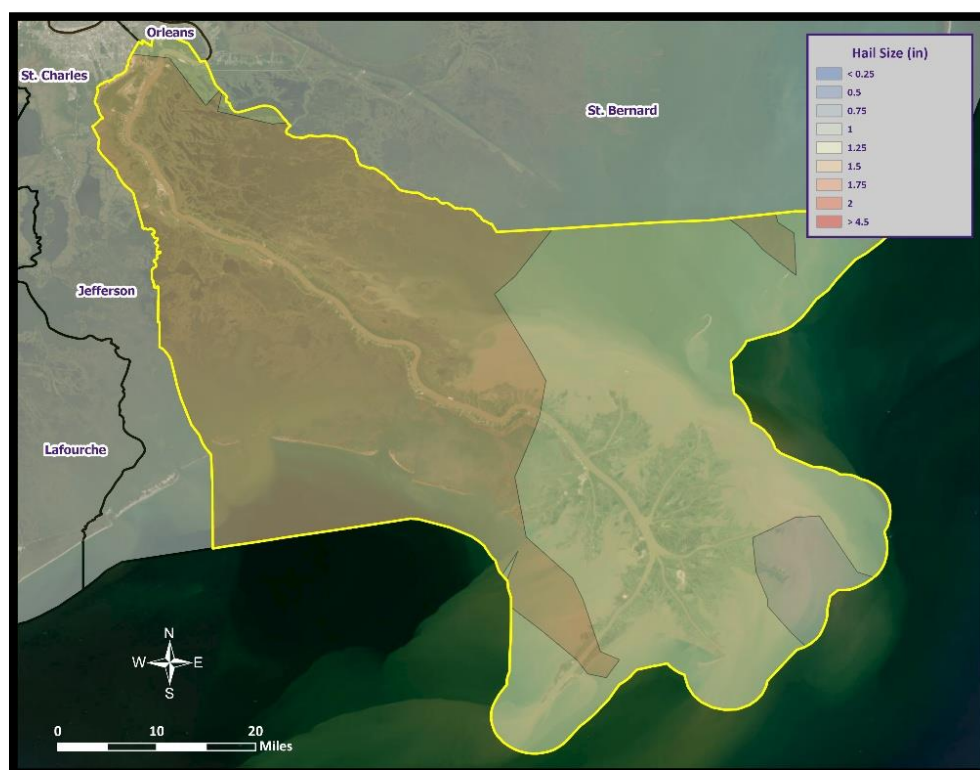


Figure 2-28: Hail Size Probability in Inches for Plaquemines Parish.

Lightning Risk Assessment

Geographic Extent

Because lightning strikes are a climatological based occurrence that can occur anywhere, the entire planning area is at risk from lightning strikes. The worst-case scenario for lightning incidents is a lightning activity level of 4 which is approximately 16 to 25 lightning strikes every 15 minutes.

Previous Occurrences

The parish experienced two lightning occurrences between the years 1996 and 2024. Since the last update, there have been no significant lightning occurrences within the boundaries of the parish.

Probability

The annual return rate (frequency) for lightning occurrences in the parish is 0.07 (7% annual probability) or approximately 1 lightning occurrence every 14 to 15 years.

Thunderstorm Wind Risk Assessment

Geographic Extent

Because thunderstorm winds are a climatological-based occurrence that can occur anywhere, the entire planning area is at risk from thunderstorm wind. The worst-case scenario for thunderstorm wind occurrences is hail wind speeds of approximately 87 knots.

Previous Occurrences

The parish experienced 42 thunderstorm wind occurrences between the years 1996 and 2024. Since the last update, there have been two thunderstorm wind occurrences within the boundaries of the parish.

Table 2-42: Historical Thunderstorm Wind Occurrences in Plaquemines Parish since the Last Update.

Date	Magnitude (knots)	Property Damage	Crop Damage	Fatalities	Injuries
10/27/2021	50	\$0	\$0	0	0
5/17/2024	56	\$0	\$0	0	0

Probability

The annual return rate (frequency) for thunderstorm wind occurrences in the parish is 1.44 (100% annual probability) or approximately 1 to 2 thunderstorm wind occurrences every year. The figure on the following page displays the thunderstorm wind speed probability for the parish.

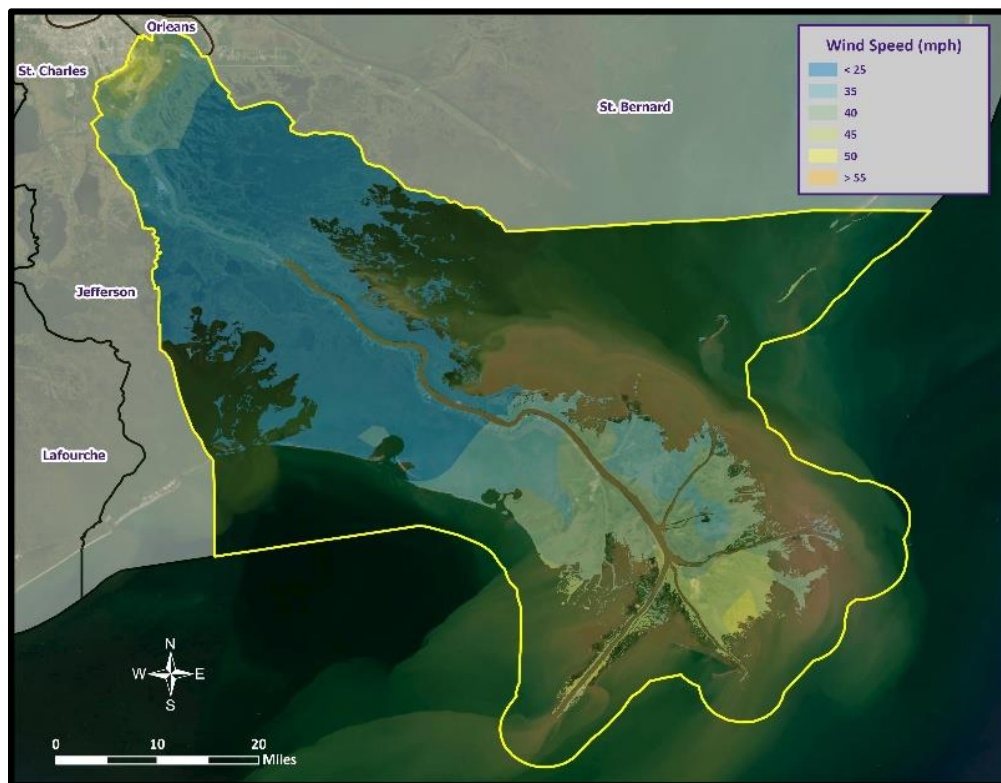


Figure 2-29: Thunderstorm High Wind Speed Probability in Miles Per Hour for Plaquemines Parish.

Hail Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the county level for hail.

Table 2-43: National Risk Index (NRI) Summarization of Hail Occurrences for the Parish
(Source: National Risk Index)

Expected Annual Losses	Overall Risk Rating
Very Low	Very Low

Estimated Impact and Potential Loss

Since 1996, there have been 18 significant hail occurrences per the NCEI Storm Events Database. The total property damage associated with these storms totaled approximately \$5,000. To estimate the potential losses on an annual basis, the total damages recorded were divided by the total number of years of available data in the NCEI Storm Events Database (1996 – 2024). This provides an annual estimated potential loss of \$172 and \$278 per event. The following table provides an estimate of potential property losses for the Parish:

Table 2-44: Estimated Annual Property Losses in the Parish resulting from Hail Damage.

Estimated Annual Potential Losses
Plaquemines Parish
\$172

Vulnerable Population

Per the NCEI Storm Events Database, there have been no reported injuries or fatalities as a result of hail.

Vulnerability Score

Table 2-45: Vulnerability Score for Hailstorms in Plaquemines Parish.

Hail Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	3	2	3	3	1	2.45

Lightning Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the county level for lightning.

*Table 2-46: National Risk Index (NRI) Summarization of Lightning Occurrences for the Parish
(Source: National Risk Index)*

Expected Annual Losses	Overall Risk Rating
Relatively Low	Relatively Low

Estimated Impact and Potential Loss

Since 1996, there have been two significant lightning occurrence per the NCEI Storm Events Database. The total property damage associated with this storm totaled approximately \$20,000. To estimate the potential losses on an annual basis, the total damages recorded were divided by the total number of years of available data in the NCEI Storm Events Database (1996 – 2024). This provides an annual estimated potential loss of \$690 and \$10,000 per event. The following table provides an estimate of potential property losses for the Parish:

Table 2-47: Estimated Annual Property Losses in Plaquemines Parish resulting from Lightning Damage.

Estimated Annual Potential Losses
Plaquemines Parish
\$690

Vulnerable Population

Per the NCEI Storm Events Database, there have been no reported fatalities or injuries as a result of lightning.

Vulnerability Score

Table 2-48: Vulnerability Score for Lightning in Plaquemines Parish.

Lightning Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	2	2	2	3	1	2

Thunderstorm Wind Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the county level for thunderstorm wind.

Table 2-49: National Risk Index (NRI) Summarization of Thunderstorm Wind Occurrences for Plaquemines Parish
(Source: National Risk Index)

Expected Annual Losses	Overall Risk Rating
Very Low	Very Low

Estimated Impact and Potential Loss

Since 1996, there have been 42 significant thunderstorm wind occurrences per the NCEI Storm Events Database. The total property damage associated with these storms totaled approximately \$166,500. To estimate the potential losses on an annual basis, the total damages recorded were divided by the total number of years of available data in the NCEI Storm Events Database (1996 – 2024). This provides an annual estimated potential loss of \$5,741 and \$3,964 per event. The following table provides an estimate of potential property losses for the Parish:

Table 2-50: Estimated Annual Property Losses in the Parish resulting from Thunderstorm Wind Damage.

Estimated Annual Potential Losses
Plaquemines Parish
\$5,741

Vulnerable Population

Per the NCEI Storm Events Database, there have been no reported fatalities or injuries as a result of thunderstorm winds.

Vulnerability Score

Table 2-51: Vulnerability Score for Thunderstorm Winds in Plaquemines Parish.

Thunderstorm Wind Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	4	2	3	3	1	2.7

Tornadoes

Profile

Tornadoes (also called twisters or cyclones) 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 occurrences, 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.

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. The following table shows the EF scale in comparison with the original 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 2-52: Comparison of the Enhanced Fujita (EF) Scale to the Fujita (F) Scale.

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

Table 2-53: 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 off well-constructed houses; trains overturned; most trees in Brushy 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.

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 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 Doppler radar identifies a distinctive “hook-shaped” area within a thunderstorm line.

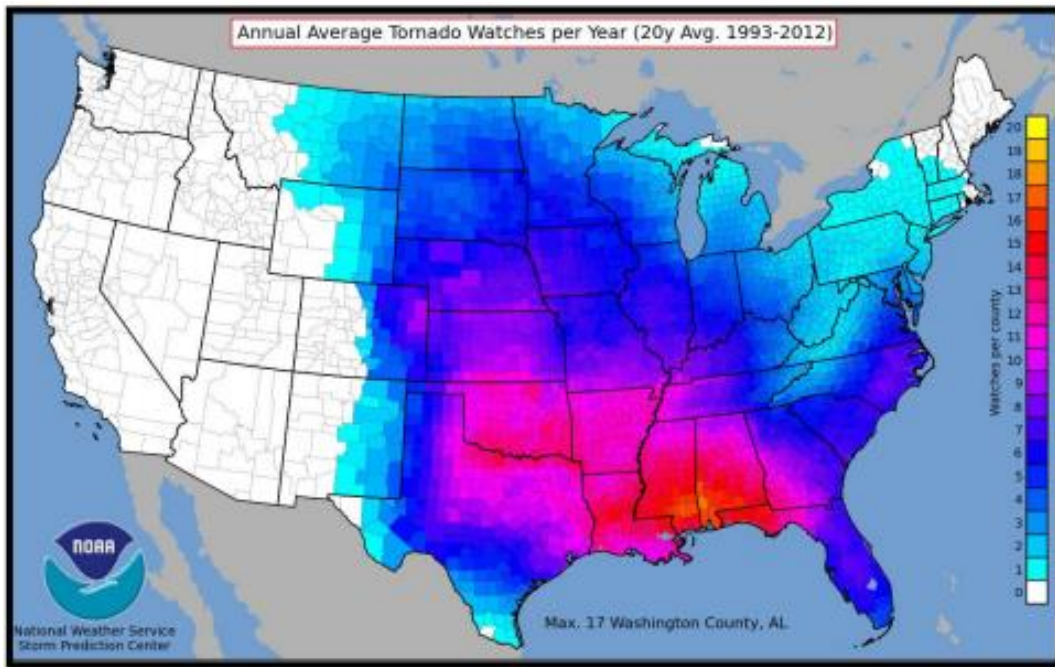


Figure 2-30: County-Level Tornado Watches Issued Per Year on Average
(Source: NOAA SPC)

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 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. Tornadoes have historically impacted all areas of Louisiana.

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.

Risk Assessment

Geographic Extent

Tornadoes occur sporadically throughout the parish and the occurrence of a tornado in the parish is highly unpredictable making it impossible to forecast the exact time and locations of when a tornado will touch down or the path it will take. Because of this, the entire planning area is considered equally at risk for a tornadic incident. The worst-case scenario of a tornado occurrence is an EF3 tornado.

Previous Occurrences

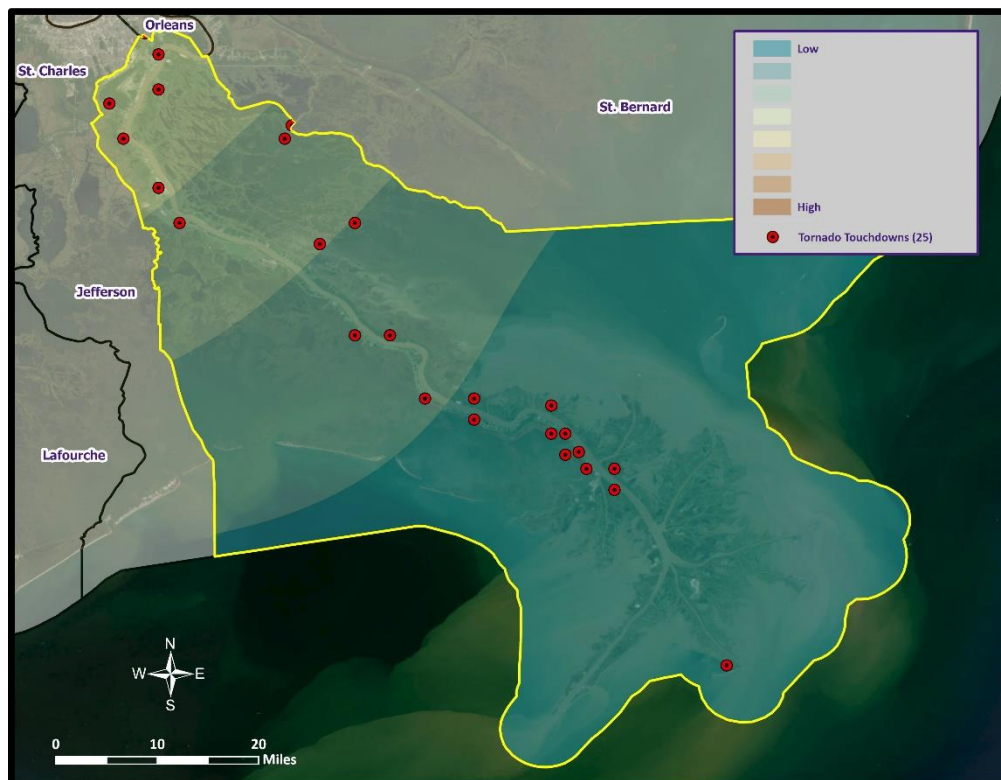
The parish experienced 25 tornado occurrences between the years 1968 and 2024. Since the last update, there has been one tornado occurrence within the boundaries of the parish.

Table 2-54: Historical Tornado Occurrences in Plaquemines Parish since the Last Update.

Date	Magnitude	Property Damage	Crop Damage	Fatalities	Injuries
12/14/2022	EFU	\$0	\$0	0	0

Probability

The annual return rate (frequency) for tornado occurrences in the parish is 0.48 (48% annual probability) or approximately 1 tornado occurrence every 1 to 2 years. The following figure displays the tornado density for the parish.



*Figure 2-31: Density of Tornadoes in Plaquemines Parish
(Source: NOAA/SPC Severe Weather Database)*

Climate Change Impacts

Similar to thunderstorms, the impacts of climate change on the occurrence and strength of tornadoes is not well understood at this time, but is an area of ongoing research. While only about 1% of thunderstorms will produce a

tornado, preliminary research and climate models indicate that the environmental suitability for severe thunderstorms, and therefore tornadoes, could increase over the Eastern United States by the end of the century.

Climate change is contributing to the increasing frequency and intensity of tornadoes, leading to significant impacts on both infrastructure and vulnerable populations. As global temperatures rise, the atmosphere becomes more unstable, creating conditions favorable for the development of severe thunderstorms and tornadoes. Tornadoes are powerful and destructive, capable of causing widespread damage to various types of infrastructure.

One of the most significant impacts of tornadoes on infrastructure is the destruction of buildings and critical facilities. Tornadoes can flatten homes, schools, hospitals, and businesses, leaving communities devastated and in need of urgent assistance. The damage to infrastructure disrupts essential services, such as electricity, water supply, and communication networks, exacerbating the challenges faced by affected communities during recovery and rebuilding efforts.

Vulnerable populations are particularly at-risk during tornadoes. Low-income communities often live in substandard housing and lack access to proper storm shelters, leaving them more exposed to the destructive forces of tornadoes. Furthermore, elderly individuals and people with disabilities may struggle to seek shelter and escape the path of these fast-moving storms, increasing their vulnerability to injury or death. Tornadoes can also disproportionately affect marginalized communities due to limited access to emergency response services and resources.

Moreover, tornadoes can lead to economic hardships for vulnerable populations. Homes and properties are often uninsured or underinsured in these areas, leaving residents with significant financial burdens after tornadoes strike. As a result, vulnerable communities may face challenges in recovering and rebuilding their lives, perpetuating cycles of poverty and inequality.

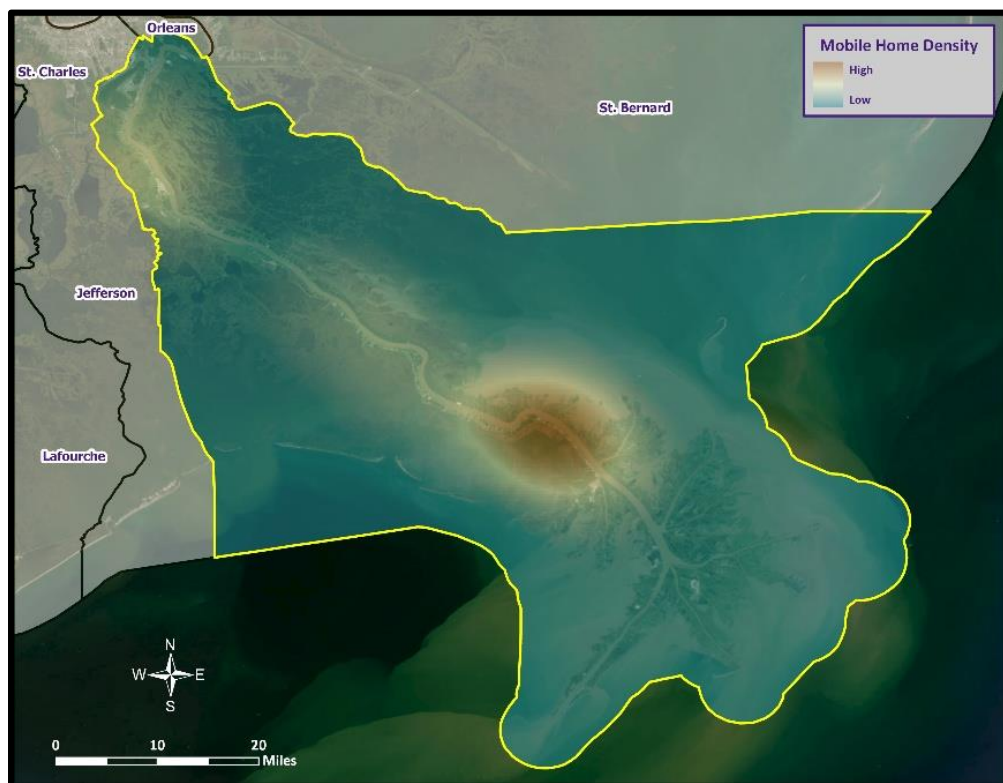


Figure 2-32: Mobile Home Density in Plaquemines Parish

To address the impacts of climate change on infrastructure and vulnerable populations concerning tornadoes, proactive measures are essential. Building tornado-resistant infrastructure and implementing better early warning

systems can help minimize the damage caused by tornadoes. For vulnerable populations, providing accessible storm shelters and ensuring access to emergency resources and support are critical to saving lives and reducing the long-term impacts of tornadoes. Additionally, climate change mitigation efforts are crucial to addressing the root causes of tornado intensification, as reducing greenhouse gas emissions can help stabilize the climate and potentially mitigate the future increase in tornado frequency and severity.

Future Hazard Impacts

Population growth and development trends can influence tornado impacts in several ways. As urban areas expand, there is a higher likelihood of tornadoes affecting densely populated regions, increasing the potential for damage and casualties. Urbanization also alters land cover, creating more obstacles and structures that can disrupt tornado paths and increase the likelihood of tornado-related damage to infrastructure. Additionally, changes in land use can affect atmospheric conditions, potentially influencing tornado formation and intensity.

Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the county level for tornadoes.

*Table 2-55: National Risk Index (NRI) Summarization of Tornado Occurrences for the Parish
(Source: National Risk Index)*

Expected Annual Losses	Overall Risk Rating
Relatively Low	Relatively Low

Estimated Impact and Potential Loss

Since 1996, there have been 17 significant tornado occurrences per the NCEI Storm Events Database. The total property damage associated with these storms totaled approximately \$257,000. To estimate the potential losses on an annual basis, the total damages recorded were divided by the total number of years of available data in the NCEI Storm Events Database (1996 – 2024). This provides an annual estimated potential loss of \$8,862 and \$15,118 per event. The following table provides an estimate of potential property losses for the Parish:

Table 2-56: Estimated Annual Property Losses in Plaquemines Parish resulting from Tornado Damage.

Estimated Annual Potential Losses
Plaquemines Parish
\$8,862

The following table presents an analysis of building exposure that are susceptible to tornadoes by general occupancy type for the parish along with the percentage of building stock that are mobile homes.

*Table 2-57: Building Exposure by General Occupancy Type for Tornadoes in Plaquemines Parish.
(Source: Hazus)*

Building Exposure by General Occupancy Type for Tornadoes: Exposure Types (\$1,000)							
Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Mobile Homes (%)
1,789,963	398,785	158,698	10,487	61,059	32,058	26,321	14.4%

Vulnerable Population

Per the NCEI Storm Events Database, there have been no reported fatalities or injuries as a result of tornadoes. In accessing the overall risk to population, the most vulnerable population throughout the parish are those residing in manufacturing housing. Approximately 14.4% of all housing in the Parish consists of manufactured housing.

Vulnerability Score

Table 2-58: Vulnerability Score for Tornadoes in Plaquemines Parish.

Tornado Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	3	3	2	4	3	2.95

Tropical Cyclones

Profile

Hurricanes, typhoons, and cyclones, are names for powerful tropical storms in which winds rotate around a closed circulation of low-pressure. In the Atlantic and eastern Pacific basins, they are known as hurricanes, in Asia (western Pacific) they are known as typhoons, and in Australia they are called cyclones. In the Northern Hemisphere, hurricane winds rotate in a counter-clockwise direction (clockwise in the Southern Hemisphere). The key energy source for a hurricane is the release of latent heat energy from condensation.

This energy is found where there is a deep layer of warm water to fuel the system. Conditions for hurricane formation include warm waters, rotational force from the earth's spin (Coriolis Effect), and the absence of vertical wind shear (stability in the lower atmosphere). Tropical disturbances that affect North America typically originate off the west coast of Africa. If the tropical disturbance lowers in pressure and starts to rotate around a low pressure center, it may turn into a tropical depression. Barometric pressure (measured in millibars or inches) continues to fall in the center as these storm systems develop in intensity. When sustained wind speeds reach 39 mph, the system becomes a tropical storm and is given a name by the National Hurricane Center. When sustained wind speeds reach 74 mph, it becomes a hurricane. Hurricanes are much larger and powerful storms with an average diameter of 350 miles. The start of the official Atlantic hurricane season is June 1st and ends November 30th. Peak hurricane season is August and September in the Northern Hemisphere, when water temperatures and evaporation rates are greatest. Associated with these storms are damaging winds, heavy precipitation, and tornadoes. Coastal areas are also vulnerable to storm surge, wind-driven waves, and tidal flooding, which can cause more destruction than cyclone winds.

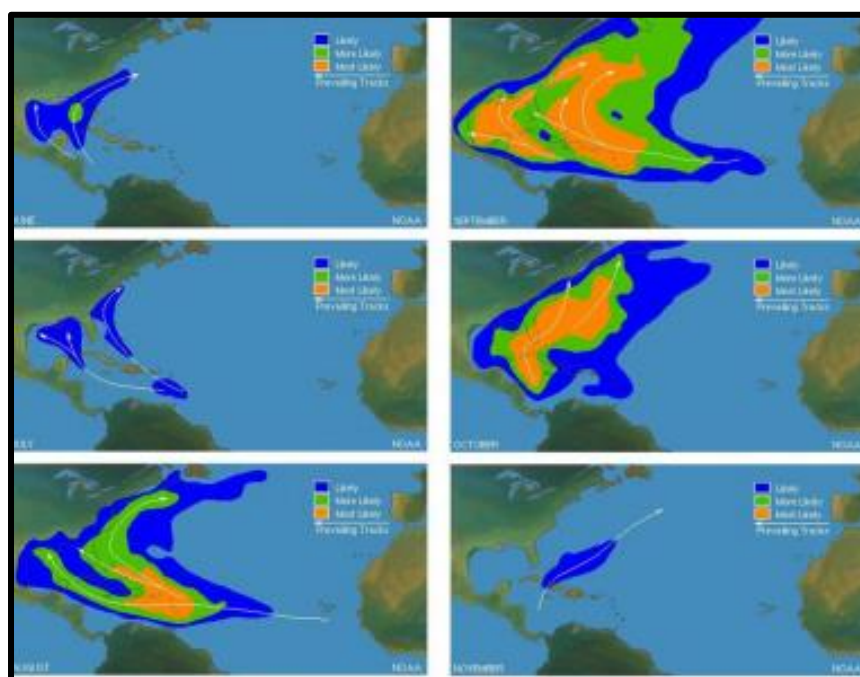


Figure 2-33: Areas of Likely Tropical Cyclone Formation and Tracking
(Source: NOAA NHC)

Hurricane intensity is classified by the Saffir-Simpson Scale, which categorizes hurricane intensity based upon maximum sustained wind speeds on a scale of one to five, with five being the most intense. Typically, higher category hurricanes have lower pressure and greater storm surge. Categories three, four, and five are classified as “major” hurricanes, and while hurricanes within this range comprise only 20 percent of total landfalls, they account for over 70 percent of the damage incurred in the United States. Hurricane (Category 1 or higher) return periods are shown the figure on the following page.

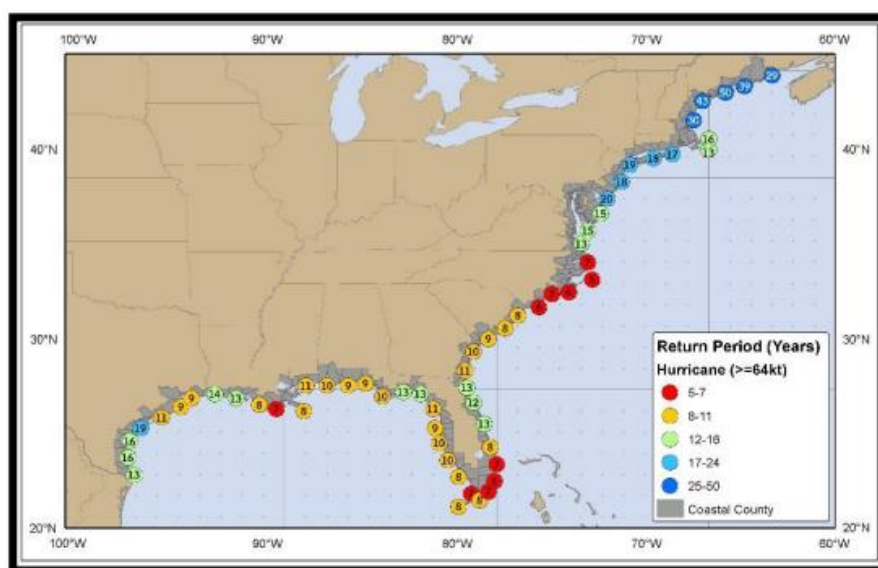


Figure 2-34: Hurricane Return Periods for the Atlantic Basin (USA)
(Source: NOAA NHC)

Table 2-59: Saffir-Simpson Hurricane Wind Scale.

Saffir-Simpson Hurricane Wind Scale			
Category	Sustained Winds	Pressure	Types of Damage Due to Winds
Tropical Depression	<39 mph	N/A	N/A
Tropical Cyclone	39-73 mph	N/A	N/A
1	74-95 mph	>14.2 psi	Very dangerous winds will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap, and shallow-rooted trees may be toppled, especially after the soil becomes waterlogged. Extensive damage to power lines and poles will likely result in power outages that could last several days.
2	96-110 mph	14-14.2 psi	Extremely dangerous winds will cause extensive damage. Well-constructed frame homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted, especially after the soil becomes waterlogged, and block numerous roads. Near total power loss is expected, with outages that could last from several days to weeks.
3	111-129 mph	13.7-14 psi	Devastating damage will occur. Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, especially after the soil becomes waterlogged, blocking numerous roads. Electricity and water may be unavailable for several days to weeks after the storm passes.
4	130-156 mph	13.3-13.7 psi	Catastrophic damage will occur. Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, especially after the soil becomes waterlogged, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 mph or higher	<13.7 psi	Catastrophic damage will occur. A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks to months.

Storm surge is elevated water level that is pushed towards the shore by the force of strong winds that result in the piling up of water. The advancing surge combines with the normal tides, which in extreme cases can increase the normal water height over 20 feet. The storm surge arrives ahead of the storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid and can move far inland, posing a serious threat to those who have not yet evacuated flood-prone areas. Debris carried by the waves can also contribute to the devastation. As the storm approaches shore, the greatest storm surge will be to the north of the hurricane eye, in the right-front quadrant of the direction in which the hurricane is moving. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Storm surge heights, and associated waves, are dependent upon the shape of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. While disassociated with the Saffir-Simpson Scale, storm surge remains the leading killer of residents along immediate coastal areas. Researchers at the Southern Regional Climate Center have indicated that hurricane strength at approximately 12-18 hours prior to landfall is a better indicator of storm surge strength (compared to wind speeds at landfall).

Many other associated hazards can occur during a hurricane, including heavy rains, flooding, high winds, and tornadoes. A general rule of thumb in coastal Louisiana is that the number of inches of rainfall to be expected from a tropical cyclone is approximately 100 divided by the forward velocity of the storm in mph; so, a fast-moving storm (20 mph) might be expected to drop five inches of rain while a slow-moving (5 mph) storm could produce totals of around 20 inches. However, no two storms are alike, and such generalizations have limited utility for planning purposes.

Hurricane Beulah, which struck Texas in 1967, spawned 115 confirmed tornadoes. In recent years, extensive coastal development has increased the storm surge resulting from these storms so much that this has become the greatest natural hazard threat to property and loss of life in the state. Storm surge is a temporary rise in sea level generally caused by reduced air pressure and strong onshore winds associated with a storm system near the coast. Although storm surge can technically occur at any time of the year in Louisiana, surges caused by hurricanes can be particularly deadly and destructive. Such storm surge events are often accompanied by large, destructive waves (exceeding ten meters in some places) that can inflict a high number of fatalities and economic losses. In 2005, Hurricane Katrina clearly demonstrated the destructive potential of this hazard, as it produced the highest modern-day storm surge levels in the State of Louisiana, reaching up to 18.7 feet near Alluvial City in St. Bernard Parish.

Property can be damaged by the various forces that accompany a tropical cyclone. High winds can directly impact structures in three ways: wind forces, flying debris, and pressure. By itself, the force of the wind can knock over trees, break tree limbs, and destroy loose items, such as television antennas and power lines. Many things can be moved by high winds. As winds increase, so does the pressure against stationary objects. Pressure against a wall rises with the square of the wind speed. For some structures, this force is enough to cause failure. The potential for damage to structures is increased when debris breaks the building "envelope" and allows the wind pressure to impact all surfaces (the building envelope includes all surfaces that make up the barrier between the indoors and the outdoors, such as the walls, foundation, doors, windows, and roof). Mobile homes and buildings in need of maintenance are most subject to wind damage. High winds mean bigger waves. Extended pounding by waves can demolish any poorly or improperly designed structures. The waves also erode sand beaches, roads, and foundations. When foundations are compromised, the building will collapse.

Nine out of ten deaths during hurricanes are caused by storm surge flooding. Falling tree limbs and flying debris caused by high winds have the ability to cause injury or death. Downed trees and damaged buildings are a potential health hazard due to instability, electrical system damage, broken pipelines, chemical releases, and gas leaks. Sewage and water lines may also be damaged. Salt water and freshwater intrusions from storm surge send animals, such as snakes, into areas occupied by humans.

Risk Assessment

Geographic Extent

Tropical cyclones typically impact multiple regions and not one specific jurisdiction or campus. Because of this, all of the planning area is susceptible to the effects of tropical cyclones. Tropical cyclones are the single biggest threat to all of South Louisiana. With any single tropical cyclone event having the potential to devastate multiple parishes at once, tropical cyclones are a significant threat to the entire parish planning area. The worst-case scenario for a tropical cyclone event in the parish is a category 3 hurricane.

Previous Occurrences

The parish experienced 27 tropical cyclone occurrences between the years 2002 and 2024. Since the last update, there have been three tropical cyclone occurrences within the boundaries of the parish.

Table 2-60: Historical Tropical Cyclone Occurrences in Plaquemines Parish since the Last Update.

Date	Magnitude	Name	Property Damage	Crop Damage	Fatalities	Injuries
6/19/2021	Tropical Storm	Claudette	\$0	\$0	0	0
8/29/2021	Hurricane	Ida	\$5,000,000	\$0	0	0
9/11/2024	Tropical Storm	Francine	\$0	\$0	0	0

The following figure displays historical hurricanes that have impacted the parish in the past:

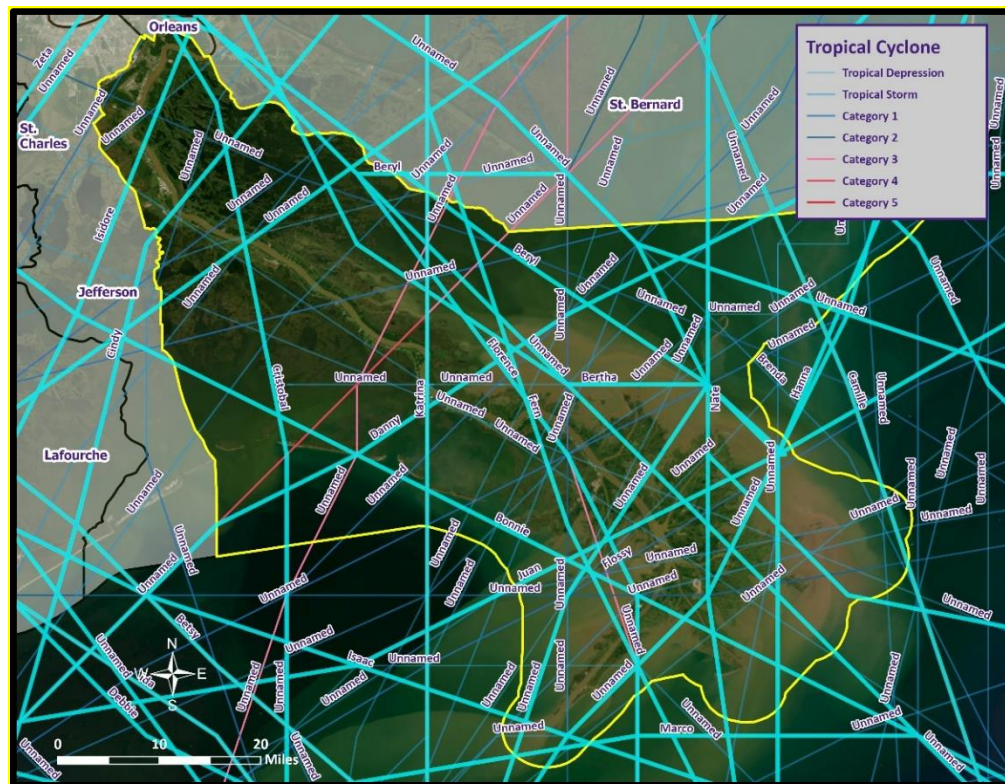


Figure 2-35: Historical Tropical Cyclones Impacting Plaquemines Parish.

Tropical Storm Claudette (2021)

On June 11th, the National Hurricane Center began monitoring a tropical disturbance in the Bay of Campeche. For the next several days, it meandered, gradually forming a broad and elongated area of low pressure. By 4 PM CDT on June 17th, the National Hurricane Center started issuing advisories on Potential Tropical Cyclone Three. The disturbance produced tropical storm force winds but was not named yet since it lacked a defined low level circulation. By 7 PM CDT June 18th, the National Hurricane Center post storm analysis revealed enough of a closed circulation to be designated a tropical storm. Tropical Storm Claudette made landfall a few hours later across Terrebonne Parish, Louisiana at 11:30 PM CDT.

Claudette continued northeast across Southeast Louisiana and Southern Mississippi before weakening to a tropical depression upon entering Alabama by the evening of June 19th. Tropical Depression Claudette continued east northeast across the remainder of Alabama, Georgia, South Carolina through June 20th. Claudette began strengthening across its passage through North Carolina, and strengthened back to a tropical storm across Eastern North Carolina early on June 21st, a rather rare occurrence after being inland for a few days. Claudette exited the North Carolina and Virginia coastal waters later that morning, heading out to sea.

All of the effects of Claudette were felt east of the Atchafalaya River across Southeastern Louisiana, Mississippi, Alabama, Georgia and the Carolinas. No reports of tropical storm force winds, coastal flooding, or even significant rainfall were reported across South Central Louisiana or adjacent coastal waters. In Plaquemine Parish, a few tropical storm force gusts were measured across the parish, but no significant impacts were reported.

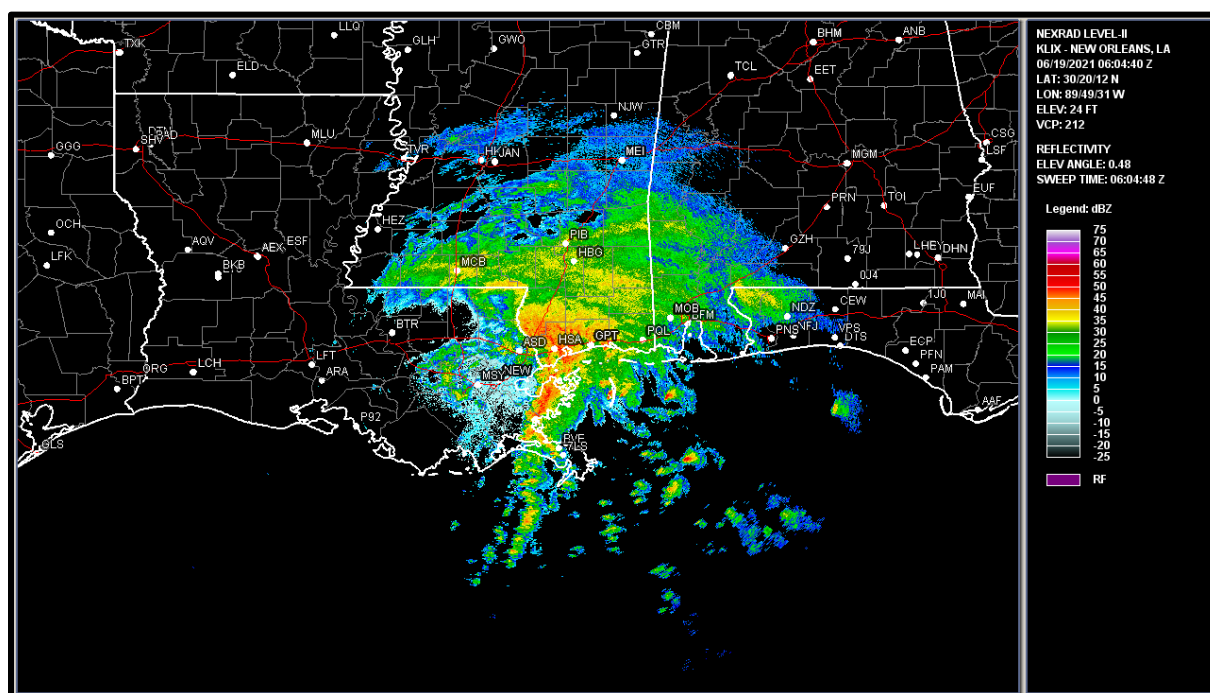


Figure 2-36: Tropical Storm Claudette in the Gulf Coast Area.
(Source: NOAA)

Hurricane Ida (2021)

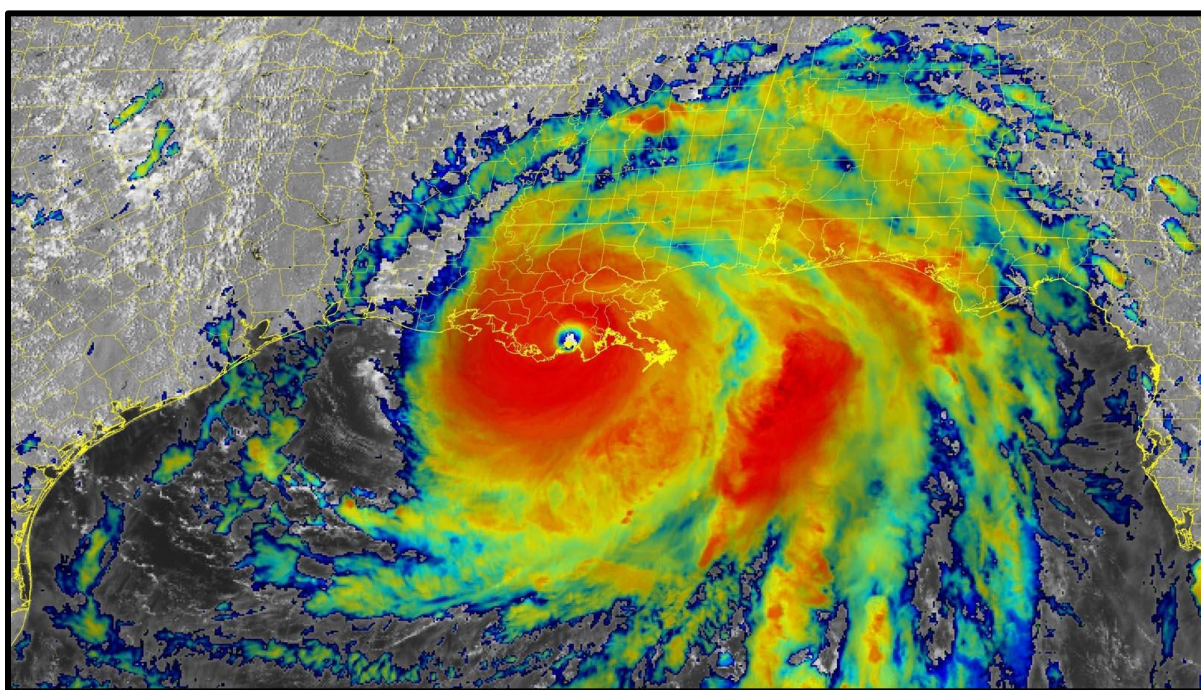
Ida formed from a combination of multiple low-latitude weather systems, starting with a tropical wave emerging from the coast of Africa on 14 August. This wave was weak and hard to track as it moved slowly westward through the monsoon trough environment over the eastern tropical Atlantic. The wave moved into the trade wind environment west of 45°W on 21 August, accompanied by an area of convection that was elongated from east to west, and this convection increased in coverage as the wave moved through the Windward Islands on 23 August. By 24 August, the wave was near Aruba, Bonaire, and Curacao, and it began to interact with a broad area of low pressure

located along the northern coast of South America. This interaction resulted in a large area of pressures near or below 1006 mb by late that day, along with widespread heavy rains over portions of Venezuela. The next day, the convection became more concentrated near a vorticity maximum on the eastern side of a broad low-pressure area over the southwestern Caribbean Sea. The disturbance turned north-northwestward on 26 August on the southwestern side of the subtropical ridge, and the associated convection became better organized while the circulation became better defined. It is estimated that a tropical depression formed near 1200 UTC that day about 150 n mi southwest of Kingston, Jamaica.

The cyclone was moving north-northwestward at the time of genesis. A few hours later, it turned northwestward as it was steered by the flow on the southwestern side of the subtropical ridge, and this general motion continued for the next three days. The cyclone strengthened to a tropical storm 6 h after genesis, and slow strengthening continued as the center passed northeast of Grand Cayman Island early on 27 August. Rapid strengthening occurred after the center passed Grand Cayman, and Ida became a hurricane with 70-kt winds before the center reached the Isle of Youth, Cuba, at 1800 UTC 27 August. After crossing the Isle of Youth, the center made landfall in mainland Cuba near Playa Dayaniguas in the province of Pinar del Rio near 2325 UTC that day. Continuing northwestward, Ida's center subsequently emerged over the southeastern Gulf of America between 0100–0200 UTC 28 August. Passage over land and entrainment of dry air into the hurricane's southwestern quadrant halted intensification as Ida crossed Cuba, and little change in strength occurred during the first several hours after the hurricane reached the Gulf of America. However, during this time microwave satellite imagery and radar data from Cuba showed the central core reorganizing with the formation of a convective ring around the center. This, combined with the favorable conditions of light vertical wind shear (near 10 kt) and sea surface temperatures at or above 30°C, led to a second round of rapid strengthening that started at 1200 UTC 28 August and continued for the next 24 h. During this intensification phase, the maximum winds increased from 70 kt to 90 kt in the first 12 h, and then from 90 kt a peak of 130 kt in the next 12 h. Additionally, the central pressure fell from 986 to 929 mb. By the end of this rapid intensification period, Ida had moved northwestward to a position not far southwest of the Mouth of the Mississippi River. A continued northwestward motion brought the 15-n-mi-wide eye to the Louisiana coast at Port Fourchon at 1655 UTC 29 August. The maximum winds at landfall were 130 kt – category 4 on the Saffir-Simpson Hurricane Wind Scale – and the central pressure was near 931 mb. As best as can be determined, the 130-kt landfall intensity is equal to that of Hurricane Laura of August 2020 and the Last Island Hurricane of August 1856, with these three category 4 storms tied for the strongest on record to make landfall in Louisiana west of the Mouth of the Mississippi River.

Shortly after landfall, Ida turned north-northwestward, and this motion brought the eye across southeastern Louisiana between Houma and New Orleans. A continued north-northwestward motion early on 30 August brought the center just west of LaPlace and then between Baton Rouge and Hammond. The cyclone's intensity steadily decreased as it moved inland, and it weakened to a tropical storm before the center moved into southwestern Mississippi between 0600–1200 UTC that day. Ida then turned northeastward as it moved around the western end of the subtropical ridge, with the center passing just west of Jackson, Mississippi, around 1800 UTC. Soon thereafter, the cyclone weakened to a tropical depression as it moved into northeastern Mississippi. The system then accelerated northeastward across northwestern Alabama, central and eastern Tennessee, and portions of Kentucky and Virginia before reaching southern West Virginia near 1200 UTC 1 September. Ida began an extratropical transition as it moved through the Tennessee Valley, and the system became an extratropical low as it moved over West Virginia later that day.

In Plaquemine Parish, wind damage was common throughout the parish, with numerous trees downed and many homes suffering minor to moderate roof damage. A few were shifted off their foundations in the lower portion of the parish. Power lines and poles were damaged parish-wide, and nearly the entire parish was left without power following the storm.



*Figure 2-37: Hurricane Ida Rainbands in the Gulf Coast Area.
(Source: NOAA)*

Hurricane Francine (2024)

Hurricane Francine was a significant tropical cyclone that impacted the Gulf Coast in September 2024. Originating from a tropical wave off the West Coast of Africa on August 28, 2024, the system traversed the tropical Atlantic Ocean, reaching the Leeward Islands by September 1. Despite initial unfavorable conditions, it intensified as it moved across the Caribbean Sea, becoming a tropical storm on September 9 and a Category 2 hurricane by September 11.

On September 11, 2024, Hurricane Francine made landfall in Terrebonne Parish, Louisiana, with sustained winds of 100 mph (155 km/h). The storm caused widespread power outages, leaving over 400,000 utility customers in Louisiana and Mississippi without electricity. Severe flooding occurred, particularly in New Orleans, where heavy rainfall led to flash floods and necessitated numerous water rescues. The storm also disrupted oil and natural gas production in the Gulf of America, with approximately 42% of crude oil and 53% of natural gas output shut-in. After landfall, Francine weakened rapidly, transitioning to a tropical depression by September 12 and dissipating by September 14. The storm's rapid intensification, from a tropical storm to a Category 2 hurricane within 24 hours, was noted as a concerning trend linked to climate change.

In Plaquemine Parish, Francine resulted in minor impacts across the parish. Tropical storm force winds caused isolated damage to trees and power lines, with 3 homes suffering damage.

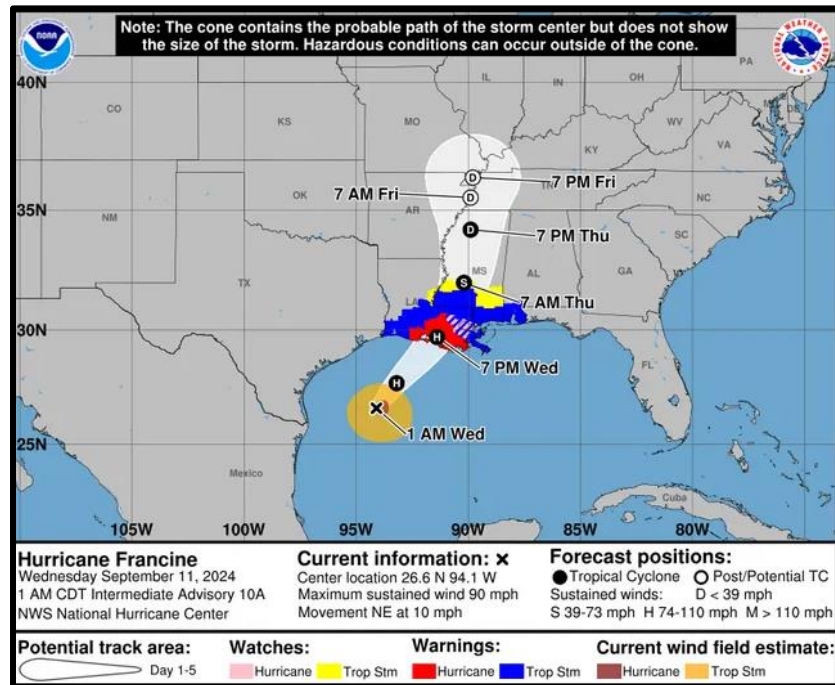


Figure 2-38: Hurricane Francine in the Gulf Coast Area.
(Source: NOAA)

Probability

The annual return rate (frequency) for tropical cyclone occurrences in the parish is 1.17 (100% annual probability) or approximately 1 to 2 tropical cyclone occurrences every year.

Climate Change Impacts

Climate change has the potential to alter the prevalence and severity of extreme incidents such as tropical cyclones. Louisiana is expected to experience more days with temperatures above 95°F this century which means an increase in sea surface and ambient temperatures, alterations in the hydrological cycle, and an increase in sea level which collectively may increase the frequency of large storm incidents and impacts. Research indicates that the warming climate will increase the frequency of Category 4 and 5 hurricanes but decrease the frequency of less severe tropical cyclone incidents by the end of the century. This increase in the frequency of Category 4 and 5 hurricanes will lead to an increase in damage to the built environment and increased negative effects on the economy and ecosystem.

Climate change is amplifying the impacts of tropical cyclones on both infrastructure and vulnerable populations, making them more frequent and severe. As ocean temperatures rise due to global warming, tropical cyclones have access to greater energy, leading to stronger and more destructive storms. The intensification of cyclones poses significant risks to infrastructure located in coastal regions.

One of the primary impacts of tropical cyclones on infrastructure is the damage caused by strong winds and storm surges. Cyclones can rip apart buildings, topple power lines, and uproot trees, leading to widespread destruction of homes, businesses, and public facilities. Coastal areas are particularly vulnerable to storm surges, which can inundate low-lying regions and cause severe flooding, damaging roads, bridges, and critical lifeline infrastructure such as water and sewage systems.

Vulnerable populations face disproportionate risks during tropical cyclones, especially in low-lying coastal communities. People with limited mobility, the elderly, and low-income households often lack resources and access to evacuation options, making them more susceptible to the devastating impacts of cyclones. Displacement, property damage, and loss of livelihoods are common consequences for vulnerable populations affected by cyclones, exacerbating existing social inequalities and pushing them further into hardship.

Moreover, tropical cyclones can have long-lasting effects on the mental and physical health of vulnerable populations. The trauma caused by experiencing such extreme weather events can lead to long-term psychological distress. Lack of access to healthcare and resources after cyclones can also result in a higher risk of waterborne diseases and malnutrition for vulnerable communities.

To mitigate the impacts of climate change on infrastructure and vulnerable populations concerning tropical cyclones, several actions are crucial. Investing in more resilient infrastructure that can withstand stronger storms and higher storm surges is essential to minimize damage and ensure the continuity of critical services. Enhancing early warning systems and evacuation plans can save lives and improve the preparedness of vulnerable populations. Additionally, providing social safety nets and support to vulnerable communities can aid in their recovery and reduce the long-term impacts of cyclones on their well-being. Mitigating climate change by reducing greenhouse gas emissions is also vital to curbing the intensification of tropical cyclones and protecting both infrastructure and vulnerable populations from their devastating effects.

Future Hazard Impacts

Hazard impacts for flood and tropical cyclones were estimated for the years 2025 and 2030. Yearly population and housing decline rates were applied to parish inventory assets for composite floods and tropical cyclones. Based on a review of available information, it is assumed that population and housing units will decrease within the parish from the present until 2030. A summary of estimated future impacts is shown in the table below. Dollar values are expressed in future costs and assume an annual rate of inflation of 1.02%

*Table 2-61: Estimated Future Impacts, 2020 - 2030.
(Source: Hazus, US Census Bureau)*

Hazard / Impact	Total in Parish (2020)	Hazard Area (2020)	Hazard Area (2025)	Hazard Area (2030)
Tropical Cyclone Damage				
Structures	9,625	9,625	9,693	9,741
Value of Structures	\$2,477,371,000	\$2,477,371,000	\$2,678,435,183	\$2,831,968,050
# of People	23,070	23,070	24,734	25,996

Vulnerability Analysis

The NRI includes data on the expected annual losses to individual natural hazards, historical losses, and overall risk at the county and Census tract level. The following table provides an overview of each category at the county level for tropical cyclones.

*Table 2-62: National Risk Index (NRI) Summarization of Tropical Cyclone Occurrences for Plaquemines Parish
(Source: National Risk Index)*

Expected Annual Losses	Overall Risk Rating
Relatively Moderate	Relatively Moderate

Estimated Impact and Potential Loss

Using Hazus 100-Year Hurricane Model, the 100-year hurricane scenario was analyzed to determine losses from this worst-case scenario. The following table shows the total economic losses that would result from this occurrence.

*Table 2-63: Total Estimated Losses for a 100-Year Hurricane Event
(Source: Hazus)*

Jurisdiction	Estimated Total Losses from 100-Year Hurricane Event
Plaquemines Parish	\$210,776,147

Total losses from a 100-year hurricane event for the parish were compared with the total value of assets to determine the ratio of potential damage to total inventory in the table below.

Table 2-64: Ratio of Total Losses to Total Estimated Value of Assets for Plaquemines Parish.
(Source: Hazus)

Estimated Total Losses from 100-Year Hurricane Event	Total Estimated Value of Assets	Ratio of Estimated Losses to Total Value
\$210,776,147	\$2,477,371,000	8.5%

Based on the Hazus Hurricane Model, estimated total losses for the parish are 8.5% of the total estimated value of all assets.

The Hazus Hurricane Model also provides a breakdown for seven primary sectors (Hazus occupancy) throughout the parish. The losses for the parish by sector are listed in the table below.

Table 2-65: Estimated Losses in Plaquemines Parish for a 100-Year Hurricane Event
(Source: Hazus)

Plaquemines Parish	Estimated Total Losses from 100-Year Hurricane Event
Agricultural	\$650,410
Commercial	\$3,919,870
Government	\$690,777
Industrial	\$5,651,799
Religious / Non-Profit	\$2,501,099
Residential	\$195,405,020
Schools	\$1,957,172
Total	\$210,776,147

The following figure displays the wind zones that affect the parish in relation to critical facilities throughout the parish:

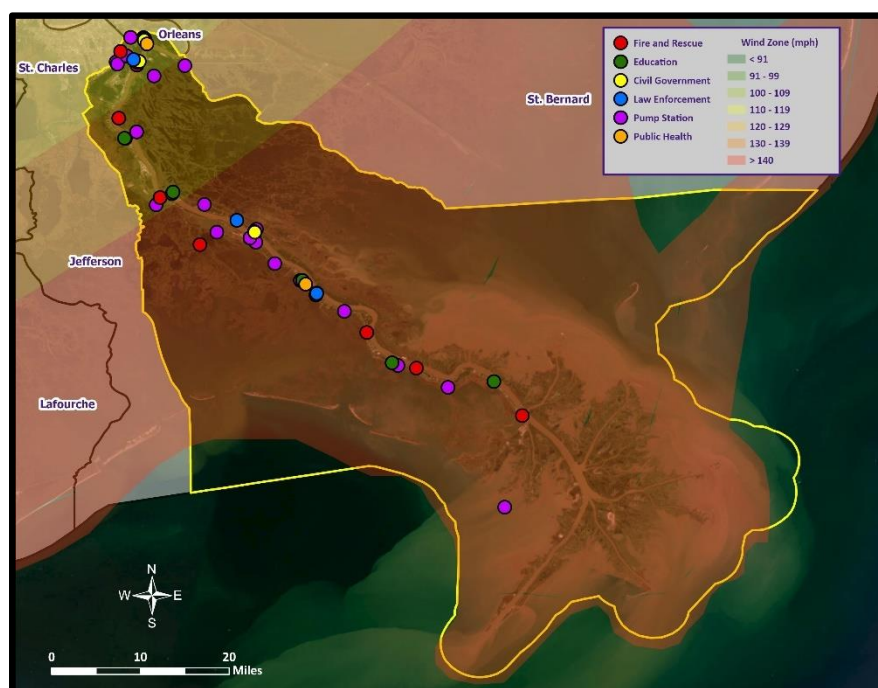


Figure 2-39: Winds Zones for Plaquemines Parish in Relation to Critical Facilities

Vulnerable Population

The total population within the parish that is susceptible to a tropical cyclone hazard is shown in the table below:

Table 2-66: Number of People Susceptible to a 100-Year Hurricane Event in Plaquemines Parish
(Source: Hazus)

Number of People Exposed to Hurricane Hazards			
Location	# in Community	# in Hazard Area	% in Hazard Area
Plaquemines Parish	23,515	23,515	100%

The Hazus Hurricane Model was also extrapolated to provide an overview of vulnerable populations throughout the parish. These populations are illustrated in the following tables:

Table 2-67: Vulnerable Populations in Plaquemines Parish for a 100-Year Hurricane Event
(Source: Hazus)

Plaquemines Parish		
Category	Total Numbers	Percentage of People in Hazard Area
Number in Hazard Area	23,515	100.0%
Persons Under 5 Years	1,481	6.3%
Persons Under 18 Years	5,879	25.0%
Persons 65 Years and Over	3,269	13.9%
White	14,532	61.8%
Minority	8,983	38.2%

Vulnerability Score

Table 2-68: Vulnerability Score for Tropical Cyclones in Plaquemines Parish.

Tropical Cyclone Vulnerability Score						
	Probability	Impact	Spatial Extent	Warning Time	Duration	Risk Factor
Risk Level	4	4	4	1	4	3.55

*****THIS PAGE LEFT INTENTIONALLY BLANK*****

3. Capability Assessment

This section summarizes the results of efforts by the parish and other agency 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 relevant changes in its law since the last plan update, in order to suggest a mitigation strategy.

Through this assessment, Plaquemines Parish is able to identify strengths that could be used to reduce losses and reduce risk throughout the communities. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during, and after a hazard event.

Policies, Plans and Programs

These capabilities are unique to the parish, including planning, regulatory, administrative, technical, financial, and education and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that lay out specific goals, objectives, and policy statements which 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 the Plaquemines Parish planning area 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. Examples of existing documents include the following:

Table 3-1: Planning and Regulatory Capabilities

Capability Assessment Worksheet - Plaquemines Parish		
Local mitigation capabilities are existing authorities, policies and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Please complete the tables and questions in the worksheet as completely as possible.		
Planning and Regulatory		
Please indicate which of the following plans and regulatory capabilities your jurisdiction has in place.		
Plans	Yes / No	Comments
Comprehensive / Master Plan	Yes	
Capital Improvements Plan	Yes	
Economic Development Plan	Yes	
Local Emergency Operations Plan	Yes	
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	No	
Community Wildfire Protection Plan	No	
Other plans (redevelopment, recovery, coastal zone management)	Yes	
Building Code, Permitting and Inspections	Yes / No	Comments
Building Code	Yes	LSUCC
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	
Fire Department ISO/PIAL rating	Yes	Dist 1 - 5; Dist 2 - 4, Dist 3 - 5, Dist 4 - 5, Dist 5 - 6, Dist 6 - 4, Dist 7 - 5
Site plan review requirements	Yes	
Land Use Planning and Ordinances	Yes / No	Comments
Zoning Ordinance	Yes	Local
Subdivision Ordinance	Yes	Local
Floodplain Ordinance	Yes	FEMA
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	No	
Flood Insurance Rate Maps	Yes	Paper & digital
Acquisition of land for open space and public recreation uses	Yes	
Other	No	

All communities within the Plaquemines Parish planning area will work to expand their capabilities by adding to these plans, as well as work to create new plans that will address a long-term recovery and resiliency framework. In instances where there are no existing plans, there will be a concerted effort to explore opportunities to create new plans that will address long-term recovery and resiliency framework as parish and local resources allow.

Building Codes, Permitting, Land Use Planning and Ordinances

Plaquemines Parish Government provides oversight for building permits and codes, land use planning, and all parish ordinances.

As of the 2025 update, Plaquemines Parish and the incorporated communities 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.

Plaquemines Parish is also responsible for enforcing the parish ordinances related to health and safety, property maintenance standards, and condemnation of unsafe structures.

Plaquemines Parish meets regularly to consider any proposed ordinance changes, and to take final actions on proposed changes.

While local capabilities for mitigation can vary from community to community, the communities within the Plaquemines Parish planning area as a whole have a system in place to coordinate and share these capabilities through the OHSEP and through this Parish Hazard Mitigation Plan.

Some programs and policies, such as the above described, might use complementary 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.

Administration, Technical, and Financial

Plaquemines Parish 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 important. The table on the following page shows examples of resources in place.

Table 3-2: Administration and Technical Capabilities

Administration and Technical		
Identify whether your community has the following administrative and technical capabilities. For smaller jurisdictions without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.		
Administration	Yes / No	Comments
Planning Commission	Yes	
Mitigation Planning Committee	No	
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	No	
Mutual Aid Agreements	Yes	
Staff	Yes / No	Comments
Chief Building Official	Yes	ICC Certified Building Official
Floodplain Administrator	Yes	ASFPM Certified Floodplain Manager
Emergency Manager	Yes	
Community Planner	No	
Civil Engineer	Yes	
GIS Coordinator	Yes	
Grant Writer	Yes	
Other		
Technical	Yes / No	Comments
Warning Systems / Service (Reverse 911, outdoor warning signals)	Yes	
Hazard Data & Information	Yes	
Grant Writing	Yes	
Hazus Analysis	No	
Other		

Financial capabilities are the resources that Plaquemines Parish have access to or are 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 acquisition of flood prone properties.

The following financial resources are available to fund mitigation actions in the Plaquemines Parish planning area:

Table 3-3: Financial Capabilities

Financial		
Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.		
Funding Resources	Yes / No	Comments
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	No	
Community Development Block Grant (CDBG)	Yes	
Other Funding Programs	Yes	

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 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 implementation of activities through greater acceptance and consensus of the community.

Plaquemines Parish 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 3-4: Education and Outreach Capabilities

Education and Outreach		
Identify education and outreach programs and methods, already in place that could be used to implement mitigation activities and communicate hazard-related information.		
Program / Organization	Yes / No	Comments
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Yes	
Natural Disaster or safety related school program	Yes	
Storm Ready certification	Yes	
Firewise Communities certification	No	
Public/Private partnership initiatives addressing disaster-related issues	No	
Other		

As reflected with the above existing regulatory mechanisms, programs and resources within the parish, Plaquemines Parish remain committed to expanding and improving on the existing capabilities within the parish. Communities will work together along with Plaquemines Parish 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 enhance and expand overall risk reduction for the entirety of Plaquemines Parish.

Flood Insurance and Community Rating System

Participation in the CRS strengthens local capabilities by lowering flood insurance premiums for communities that exceed NFIP minimum requirements. As noted in the CRS Eligible Communities List effective October 1, 2024, Plaquemines Parish is not a participant in the CRS program.

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 major 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 3-1](#)). 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.

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.			

Figure 3-1: CRS Discounts by Class
(Source: FEMA)

As of October 2024, 318 communities in the State of Louisiana participate in the Federal Emergency Management Agency's National Flood Insurance Program (NFIP). Of these communities, 47 (or 13%) participate in the Community Rating System (CRS). Jefferson Parish and the City of Mandeville in St. Tammany Parish lead the state with a rating of Class 5, followed by three cities with a rating of Class 6: the Cities of Gretna and Kenner in Jefferson Parish and the City of Slidell in St. Tammany Parish. Of the top fifty Louisiana communities, in terms of

total flood insurance policies held by residents, 29 participate in the CRS. The remaining 21 communities present an outreach opportunity for encouraging participation in the CRS.

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 that credit, though, 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 2011¹, 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 certain 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.

¹ <https://www.fema.gov/national-flood-insurance-program-community-rating-system>

In addition to the direct financial reward for participating in the Community Rating System, there are many other reasons to participate in the CRS. As FEMA staff often say, “If you are only interested in saving premium dollars, you’re in the CRS for the wrong reason.”

The other benefits that are more difficult to measure in dollars include:

1. The activities credited by the CRS provide direct benefits to residents, including:
 - Enhanced public safety
 - A reduction in damage to property and public infrastructure
 - Avoidance of economic disruption and losses
 - Reduction of human suffering
 - Protection of the environment
2. A community’s flood programs will be better organized and more formal. Ad hoc activities, such as responding to drainage complaints rather than an inspection program, will be conducted on a sounder, more equitable basis.
3. A community can evaluate the effectiveness of its flood program against a nationally recognized benchmark.
4. Technical assistance in designing and implementing a number of activities is available at no charge from the Insurance Services Office.
5. The public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.
6. A community would have an added incentive to maintain its flood programs over the years. The fact that its CRS status could be affected by the elimination of a flood related activity or a weakening of the regulatory requirements for new developments would be taken into account by the governing board when considering such actions.
7. Every time residents pay their insurance premiums, they are reminded that the community is working to protect them from flood losses, even during dry years.

NFIP Worksheets

Parish NFIP worksheets can be found in [Appendix E: State Required Worksheets](#).

4. Mitigation Strategy

Introduction

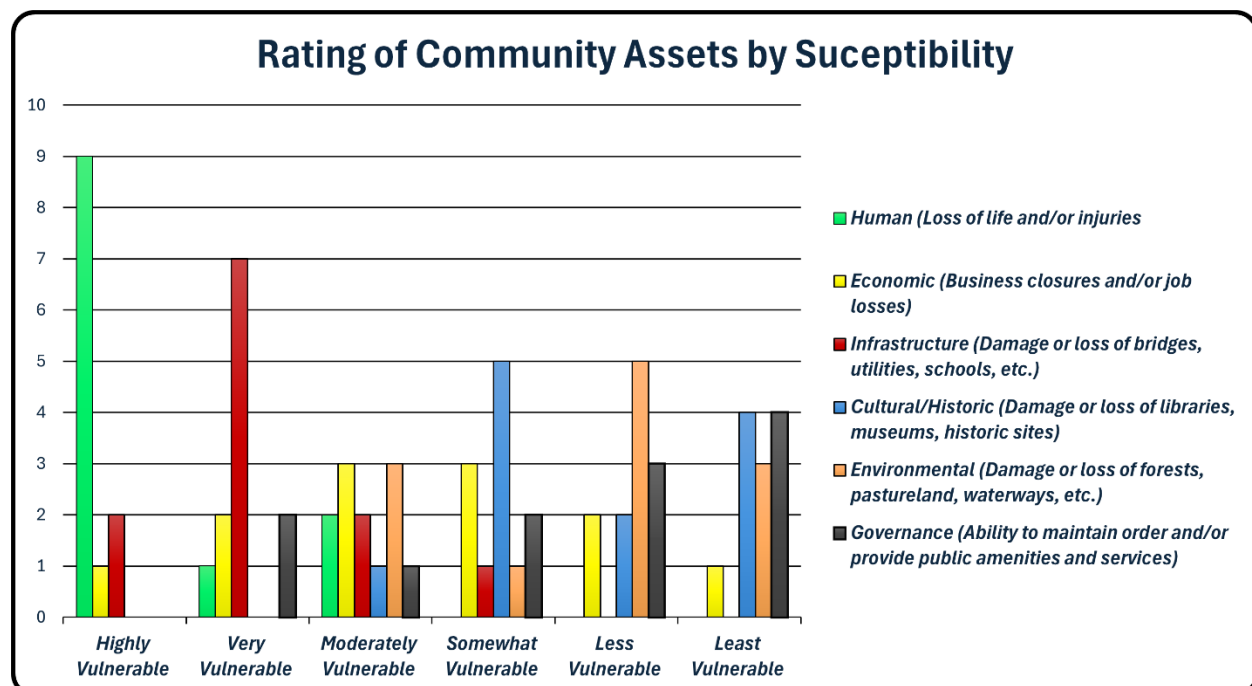
The Hazard Mitigation Strategy for Plaquemines Parish has a common guiding principle and is the demonstration of the parish's commitment to reduce risks from hazards. The strategy also serves as a guide for parish and local decision makers as they commit resources to reducing the effects of hazards.

Officials from the parish confirmed the goals, objectives, actions and projects over the period of the hazard mitigation plan update process. The mitigation actions and projects in this 2025 HMP update are a product of analysis and review of the Plaquemines Parish Hazard Mitigation Plan Planning Committee under the coordination of the Plaquemines Parish Office of Homeland Security and Emergency Preparedness. The committee was presented a list of projects and actions, new and from the 2020 plan, for review from December 2024 – February 2025.

An online public opinion survey of Plaquemines Parish residents was conducted between August 2024 and March 2025. The survey was designed to capture public perceptions and opinions regarding natural hazards in the Plaquemines Parish planning area. In addition, the survey collected information regarding the methods and techniques preferred by the respondents for reducing the risks and losses associated with local hazards.

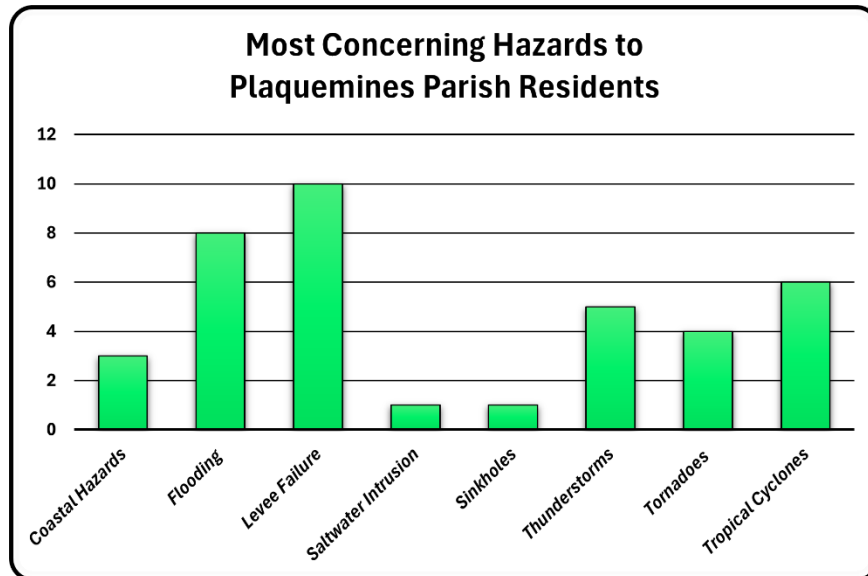
Survey respondents were asked to rank, in their opinion, which community assets were most susceptible to impacts caused by natural hazards. The categories included human, economic, infrastructure, cultural/historic, environmental, and governance. Based on these choices, respondents were asked to rank each of these categories on a scale of one to six, one being highly vulnerable and six being least vulnerable. After collecting all the responses, the top three categories selected were:

1. Human (Loss of life and/or injuries)
2. Infrastructure (Damage or loss of bridges, utilities, schools, etc.)
3. Economic (Business closures and/or job losses)

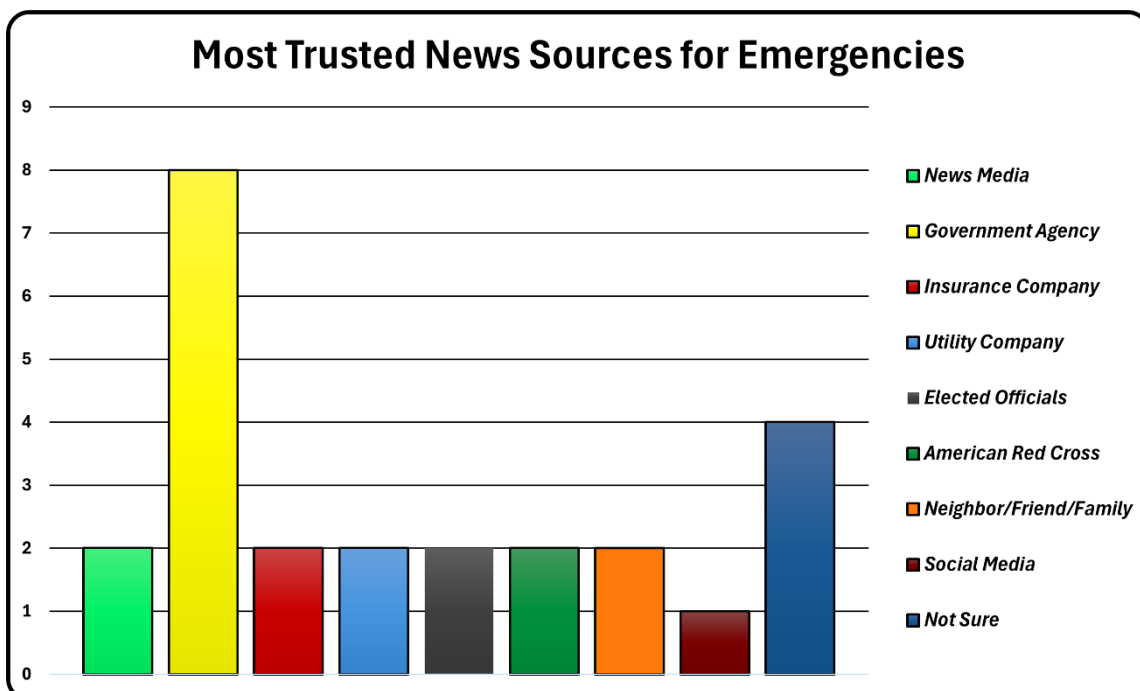


The survey results also indicated which natural disasters citizens were *most concerned* with being affected by in Plaquemines Parish. The top three natural disasters selected were:

1. Levee Failure
2. Flooding
3. Tropical Cyclones



Decision makers need to understand the importance of relaying emergency information to the public and distributing such information in a manner that is reliable and trustworthy to the residents of the area. According to the survey, the residents of Plaquemines Parish most trust government agencies for the distribution of emergency related information. These results are encouraging because it shows that the public has high confidence in the information being disseminated by local government agencies. Implementation of the outreach activities put forth by parish officials and offices seem to have been executed in a successful manner



This activity confirms that the goals and action items developed by the Plaquemines Parish Hazard Mitigation Plan Steering Committee are representative of the outlook of the community at large. Full survey questions and information can be found at the following link:

https://lsu.qualtrics.com/jfe/form/SV_7WWHP1p7wYV6reS

Goals

The goals represent the guidelines that the parish and its communities want to achieve with this plan update. To help implement the strategy and adhere to the mission of the Hazard Mitigation Plan, the preceding section of the plan update was focused on identifying and quantifying the risks faced by the residents and property owners in Plaquemines Parish from natural and manmade hazards. By articulating goals and objectives based on the previous plans, the risk assessment results, and intending to address those results, this section sets the stage for identifying, evaluating, and prioritizing feasible, cost effective, and environmentally sound actions to be promoted at the parish and municipal level – and to be undertaken by the state for its own property and assets. By doing so, Plaquemines Parish can make progress toward reducing identified risks.

For the purposes of this plan update, goals and action items are defined as follows:

- **Goals** are general guidelines that explain what the parish wants to achieve. Goals are expressed as broad policy statements representing desired long-term results.
- **Action Items** are the specific steps (projects, policies, and programs) that advance a given goal. They are highly focused, specific, and measurable.

The current goals of the Plaquemines Parish Hazard Mitigation Plan Update Planning Committee represent long-term commitments by the parish. After assessing these goals, the committee decided that the current remain valid.

The goals are as follows:

1. Reduce losses to existing and future property due to hazards
2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
3. Ensure the abilities of emergency services providers to continue operating during hazardous events
4. Protect existing public and private infrastructure from damage

The Mitigation Action Plan focuses on actions to be taken by Plaquemines Parish and its communities. All of the activities in the Mitigation Action Plan will be focused on helping the parish and its communities in developing and funding projects that are not only cost effective but also meet the other DMA 2000 criteria of environmental compatibility and technical feasibility.

The Hazard Mitigation Plan Planning Committee reviewed and evaluated the potential action and project lists in which consideration was given to a variety of factors. Such factors include determining a project's eligibility for federal mitigation grants as well as its ability to be funded. This process required evaluation of each project's engineering feasibility, cost effectiveness, and environmental and cultural factors.

2025 Mitigation Actions and Update on Previous Plan Actions

The Plaquemines Parish Hazard Mitigation Plan Planning Committee identified new actions that would reduce and/or prevent future damage within the Plaquemines Parish planning area. In that effort, the committee focused on a comprehensive range of specific mitigation actions. These actions were identified in thorough fashion by the consultant team and the committee by way of frequent and open communications and meetings held throughout the planning process. The addition of these new actions, coupled with any ongoing and/or carried over projects from their previous update, provide Plaquemines Parish with a solid mitigation strategy through which risk and losses will be reduced throughout the parish and its communities.

As outlined in the Local Mitigation Planning Handbook the following are eligible types of mitigation actions:

- **Local Plans and Regulations** – These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Projects** – These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area, and also includes projects to construct manmade structures to reduce the impact of hazards.
- **Natural System Protection** – These actions minimize the damage and losses and also preserve or restore the functions of natural systems.
- **Education and Awareness Programs** – These actions inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them.

Status updates for actions included in the previous plan can be found on the following pages. Additionally, new mitigation actions agreed upon by the parish are included.

Plaquemines Parish Mitigation Actions

Previous Action Update

Plaquemines Parish Mitigation Action Sheet						
Jurisdiction-Specific Action	Action Description	Funding Source	Target Completion Date	Responsible Party, Agency, or Department	Hazard	Status
PLAQ1: Building Retrofits	Retrofit public buildings to maintain use during and after storm events. Reduces damage from high winds, and helps assure that the public buildings can be used, occupied and operable during or after storms.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Thunderstorms, Tornadoes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 1)
PLAQ2: Drainage Improvements	Will relieve flooding problems, reduce flood damage and costs of damage, overtopping of roads with drain water, while also keeping open roadways during periods of high precipitation. Relieves parish or local government and property owners of the continual flooding problems, with closed roadways (loss of function). Saves public funds for road repairs, drainage ditch repairs, sandbagging and blocking of roadways during storm periods.	HMGP, Local, and Regional	1-15 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Thunderstorms, Tropical Cyclones	Ongoing - Carried Over (See Plaquemines Parish Mitigation Action 2)
	Comments: Over the past five years, Plaquemines Parish has pursued multiple drainage improvement projects around the unincorporated areas. Over the next five years and beyond, Plaquemines Parish will continue to monitor areas within the parish that are in need of drainage improvement projects and pursue them as necessary. For this reason, this action is to be carried over into the 2025 plan update.					
PLAQ3: Mitigation of Repetitive Loss and Severe Repetitive Loss Properties	Elevation, acquisition-demolition, acquisition-relocations, and reconstruction of repetitive loss or flooding or other hazard prone properties.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish OHSEP	Coastal Hazards, Flooding, Levee Failure, Thunderstorms, Tropical Cyclones	Ongoing - Carried Over (See Plaquemines Parish Mitigation Action 3)
	Comments: Over the past five years, Plaquemines Parish has pursued multiple elevation projects around the unincorporated areas. Over the next five years and beyond, Plaquemines Parish will continue to monitor areas within the parish that are in need of elevations and pursue them as necessary. For this reason, this action is to be carried over into the 2025 plan update.					
PLAQ4: Safe Room Projects	Construction of a safe room for first responders located in Plaquemines Parish. Other locations will be identified based on funding availability.	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Thunderstorms, Tornadoes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 4)

PLAQ5: Education and Outreach	Enhance the public outreach programs for the parish and all communities by increasing awareness of risks and safety for relevant hazards as well as providing information on high risk areas. Informing communities, business and citizens on proper mitigation efforts and activities will create resiliency within the parish and its communities. Educate residents about the importance of flood insurance and promote the purchasing of it.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Ongoing
	Comments: Flyers in public facilities, toll free number to contact for hazard information, various education and outreach initiatives, actively updating the parish website					
PLAQ6: Generators for Continuity of Operations and Government	Procurement and installation of generators at public facilities to ensure continued operations during and after events.	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Thunderstorms, Tornadoes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 5)
PLAQ7: Lightning Mitigation	Procurement and Installation of Lightning rods and surge protectors for public buildings to preserve life and property	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Thunderstorms	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 6)
PLAQ8: Warning Systems	Install/update/upgrade public warning system components throughout Plaquemines Parish as necessary. Install audible and/or reverse 911 warning system(s)	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Ongoing
PLAQ9: Potable Water	Create redundancy of potable water supply to critical facilities, especially hospitals in Plaquemines Parish, and provide protection of potable water supply by acquisition/installation of backflow preventers at appropriate critical locations. Continue to use SCADA software for monitoring.	Local, Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Ongoing
PLAQ10: Promote Flood Insurance	Promote the purchase of flood insurance. Advertise the availability, cost, and coverage of flood insurance through the National Flood Insurance Program (NFIP).	FEMA HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Tropical Cyclones	Deleted - Covered under PLAQ5 Action

PLAQ11: Pumping Station Projects	Elevate or flood proof pump stations; upgrade existing pump stations by installing block valves to prevent/protect against backwater. Upgrade existing pump station capacities and add new stations as needed. Continue to use SCADA software for monitoring.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Coastal Hazards, Levee Failure	In Progress
PLAQ12: Levee Maintenance	Maintain and expand existing levee protection to ensure levees do not fail during a storm surge event.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Ongoing
PLAQ13: Elevation and Acquisition	Elevate, acquire, or pilot reconstruct all RL and SRL structures in Plaquemines Parish.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Deleted - Covered under PLAQ3 Action
PLAQ14: Drainage Projects	Widen drainage ditches and upgrade culverts.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Engineering Public Works Dept.	Flooding	Deleted - Covered under PLAQ2 Action
PLAQ15: Pump Stations Capacity	Upgrade existing pump station capacity and add new pump stations.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Deleted - Covered under PLAQ11 Action
PLAQ16: Block Valves for Pump Stations	Upgrade existing pump stations by installing block valves to prevent against backwater flooding.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards	Deleted
PLAQ17: Wind Retrofit	Wind Retrofit all Critical Facilities against tornadoes and tropical cyclones.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ1 Action
PLAQ18: Pump Station Fuel Tank Hardening	Upgrade existing pump station fuel tanks to harden against wind and storm surge damage from tornadoes and tropical cyclones.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Thunderstorms, Tornadoes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 7)

PLAQ19: Elevate Pump Stations	Elevate or flood proof existing pump stations.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Coastal Hazards, Flooding, Levee Failure	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 8)
PLAQ20: Floodplain Development Ordinances	Add new Regulations reducing development density in floodplains.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Ongoing
<i>Comments: Adopted (2024) updated sections to our local floodplain ordinance in tandem with the most recent FEMA CAV. FEMA believes Plaquemines' definitions and regs are current and in line with NFIP requirements. Furthermore, as FEMA is closing out CAV, they have no known issues with Plaquemines regulations.</i>						
PLAQ21: Community Rating System Participation	Participate in the Community Rating System (CRS).	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Not Started – Carried Over (See Plaquemines Mitigation Action 9)
PLAQ22: National Flood Insurance Program Participation	Continue Parish participation in the NFIP	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Deleted - Covered under PLAQ10 Action
PLAQ23: NFIP Outreach	Establish a public outreach campaign to ensure all homeowners in floodplains are aware of the various types of coverage options under the NFIP.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding	Deleted - Covered under PLAQ5 Action
PLAQ24: Flood Mitigation Outreach	Establish homeowner education program on flood mitigation measures.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding	Deleted - Covered under PLAQ5 Action
PLAQ25: Roadway Elevation	Elevate roadways that currently flood to allow proper evacuation routes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Coastal Hazards, Flooding, Levee Failure	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 10)
PLAQ26: All-Hazard Warning System Acquisition	Acquire all-hazard warning system to ensure proper citizen notification of floods, coastal hazards, levee failures, tropical cyclones, tornadoes and sinkholes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ8 Action

PLAQ27: All-Hazards Outreach Campaign	Develop a parish wide outreach and educational campaign, to provide educational brochures and other materials to libraries, schools, and other public facilities including mitigation measures for all hazards including floods, coastal hazards, levee failure, tropical cyclones, tornadoes and sinkholes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ5 Action
PLAQ28: Acquisition of Bottled Water	Ensure adequate amounts of bottled water are available in the event of total saltwater intrusion.	Local and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards	Completed
PLAQ29: Saltwater Intrusion Protection Measures	Pursue any and all protection measures in regards to, or relating to saltwater intrusion. Mitigation actions include but are not limited to reduction of groundwater pumping, construction of cut-off walls, vegetation planting, SCADA monitoring, artificial recharging of underground wells, barging water to treatment facilities, etc.	Local and Regional	1-15 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 11)
PLAQ30: Marshland Restoration	Restore marshlands in Plaquemines Parish.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Coastal Resources Dept.	Coastal Hazards, Flooding, Saltwater Intrusion, Sinkholes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 12)
PLAQ31: Erosion Barrier Creation	Create man-made and natural barriers to coastal erosion.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Coastal Resources Dept.	Coastal Hazards, Flooding, Saltwater Intrusion, Sinkholes, Tropical Cyclones	Not Started - Carried Over (See Plaquemines Parish Mitigation Action 13)
PLAQ32: Community Education and Outreach Program Creation	Support the creation and implementation of a Community Education and Outreach Program.	HMGP, Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ5 Action

PLAQ33: Critical Facility Wind Hardening and/or Safe Room Installation	Wind Harden and/or install safe rooms in critical facilities against tornadoes and tropical cyclones.	HMGP	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ1 Action
PLAQ34: Generator Installation	Install generators in all critical facilities.	HMGP	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Levee Failure, Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ6 Action
PLAQ35: Responsible Development	Ensure that future development does not increase hazard losses. Guide future development away from hazard areas while maintaining other parish goals such as economic development and improving the quality of life.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
PLAQ36: Responsible Development II	Guide future development away from hazard areas while maintaining other parish goals such as economic development and improving the quality of life.	No Additional Funding Needed	1-15 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Deleted - Covered under PLAQ36 Action
PLAQ37: Building Code Enforcement	Enforce the International Building Code requirements for all new construction to strengthen buildings against high wind damage from tornadoes and tropical cyclones.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Tornadoes, Tropical Cyclones	Ongoing
<i>Comments: Enforcing IBC and IRC 2021 editions, as adopted by the State of Louisiana which includes wind speeds and design pressures in conjunction with ASCE 7-16</i>						
PLAQ38: File and Equipment Storage	Provide safe locations for files, records, and computer equipment.	HMGP, FMA	1-15 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Ongoing
PLAQ39: Environmental Conservation Program Participation	Participate in existing programs at the state and federal levels oriented to environmental enhancement and conservation.	Local, Regional, and Federal	1-15 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Saltwater Intrusion, Sinkholes, Tropical Cyclones	Ongoing

PLAQ40: Historic Resource Protection Integration	Integrate historic cultural resource protection into hazard mitigation planning to improve the ability of resources to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.	HMGP, Local, State, and Federal	1-15 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	Ongoing
PLAQ41: Water/Sewer Infrastructure Improvements	Install, update, upgrade, and replace sewer and water infrastructure around Plaquemines Parish. Target cast iron lines that produce brown/murky water.	HMGP, BRIC, FMA, Local	1-15 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Tropical Cyclones	NEW

New Mitigation Actions

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 1	Building Retrofits
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	<ol style="list-style-type: none"> 1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 3. Ensure the abilities of emergency services providers to continue operating during hazardous events 4. Protect existing public and private infrastructure from damage
PRIORITY	Medium
Action Description	Retrofit public buildings to maintain use during and after storm events.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Reduces damage from high winds and helps assure that the public buildings can be used, occupied and operable during or after storms.
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Flooding, Thunderstorms, Tornadoes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 2	Drainage Improvements
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-15 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	High
Action Description	Will relieve flooding problems, reduce flood damage and costs of damage, overtopping of roads with drain water, while also keeping open roadways during periods of high precipitation.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Relieves parish or local government and property owners of the continual flooding problems, with closed roadways (loss of function). Saves public funds for road repairs, drainage ditch repairs, sandbagging and blocking of roadways during storm periods.
Current Status of Action	Ongoing – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Thunderstorms, Tropical Cyclones

Additional Supporting Information: Over the past five years, Plaquemines Parish has pursued multiple drainage improvement projects around the unincorporated areas. Over the next five years and beyond, Plaquemines Parish will continue to monitor areas within the parish that are in need of drainage improvement projects and pursue them as necessary. For this reason, this action is to be carried over into the 2025 plan update.

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 3	Mitigation of Repetitive Loss and Severe Repetitive Loss Properties
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-15 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	High
Action Description	Elevation, acquisition-demolition, acquisition-relocations, and reconstruction of repetitive loss or flooding or other hazard prone properties.
Type of Mitigation Action	Structure and Infrastructure Projects, Local Plans and Regulations
How Action Aligns with Risk Reduction	Eliminates flooding risk of repetitive and severe repetitive loss structures.
Current Status of Action	Ongoing – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Levee Failure, Thunderstorms, Tropical Cyclones

Additional Supporting Information: Over the past five years, Plaquemines Parish has pursued multiple elevation projects around the unincorporated areas. Over the next five years and beyond, Plaquemines Parish will continue to monitor areas within the parish that are in need of elevations and pursue them as necessary. For this reason, this action is to be carried over into the 2025 plan update.

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 4	Safe Room projects
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	3. Ensure the abilities of emergency services providers to continue operating during hazardous events
PRIORITY	Medium
Action Description	Construction of a safe room for first responders located in Plaquemines Parish. Other locations will be identified based on funding availability.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Allows for continued operations of essential personnel to actively respond during a natural hazard event
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Flooding, Thunderstorms, Tornadoes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 5	Generators for Continuity of Operations and Government
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 3. Ensure the abilities of emergency services providers to continue operating during hazardous events
PRIORITY	Medium
Action Description	Procurement and installation of generators at public facilities to ensure continued operations during and after events.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Installation of generators will allow public facilities to run accordingly and aid with local relief efforts
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Thunderstorms, Tornadoes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 6	Lightning Mitigation
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	Medium
Action Description	Procurement and Installation of Lightning rods and surge protectors for public buildings to preserve life and property
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	The installation of lightning rods and surge protectors in public buildings and critical infrastructure will reduce losses due to lightning strikes and surges in electricity.
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Thunderstorms

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 7	Pump Station Fuel Tank Hardening
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 3. Ensure the abilities of emergency services providers to continue operating during hazardous events 4. Protect existing public and private infrastructure from damage
PRIORITY	Medium
Action Description	Upgrade existing pump station fuel tanks to harden against wind and storm surge damage from tornadoes and tropical cyclones.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Upgrading existing pump stations and fuel tanks will ensure their ability to withstand hazard events and remain operational for the duration of said event
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Thunderstorms, Tornadoes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 8	Elevate Pump Stations
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	Medium
Action Description	Elevate or flood proof existing pump stations.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Elevation of pump stations will allow the facilities to remain functional during flood related events
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Levee Failure, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 9	Community Rating System Participation
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	Medium
Action Description	Participate in the Community Rating System (CRS).
Type of Mitigation Action	Local Plans and Regulations
How Action Aligns with Risk Reduction	Participation in the CRS program will allow flood insurance policy holders to receive discounts on their premiums
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Flooding

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 10	Roadway Elevations
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	<ol style="list-style-type: none"> 1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 3. Ensure the abilities of emergency services providers to continue operating during hazardous events
PRIORITY	Medium
Action Description	Elevate roadways that currently flood to allow proper evacuation routes.
Type of Mitigation Action	Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Elevation of roadways allows for essential personnel to respond to hazard related events without interruptions and ensures the safety of residents in the parish
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Levee Failure, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 11	Saltwater Intrusion Protection Measures
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Engineering & Public Works
TIMELINE	1-15 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	High
Action Description	Pursue any and all protection measures in regards to, or relating to saltwater intrusion. Mitigation actions include but are not limited to reduction of groundwater pumping, construction of cut-off walls, vegetation planting, SCADA monitoring, artificial recharging of underground wells, barging water to treatment facilities, etc.
Type of Mitigation Action	Natural Resource Protection
How Action Aligns with Risk Reduction	Mitigation against saltwater intrusion ensures clean water for residents of the parish. Increased salinity in aquifers can aid the consumption of unhealthy drinking water
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Saltwater Intrusion, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 12	Marshland Restoration
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Coastal Resources Dept.
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
PRIORITY	Medium
Action Description	Restore marshlands in Plaquemines Parish
Type of Mitigation Action	Natural Resource Protection
How Action Aligns with Risk Reduction	Restoring and protecting marshland can aid in decreasing coastal erosion and saltwater intrusion.
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Saltwater Intrusion, Sinkholes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 13	Erosion Barrier Creation
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP, Plaquemines Parish Coastal Resources Dept.
TIMELINE	1-5 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, Local, Regional
ASSOCIATED GOALS	2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
PRIORITY	Medium
Action Description	Create man-made and natural barriers to coastal erosion.
Type of Mitigation Action	Natural Resource Protection, Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Reducing the chances of coastal erosion will reduce the losses to property for the parish as well as reduce the chances for salinity levels to rise in the parish's aquifers
Current Status of Action	Not Started – Carried Over from 2020 Plan
Hazard Addressed	Coastal Hazards, Flooding, Saltwater Intrusion, Sinkholes, Tropical Cyclones

IMPLEMENTATION KEY FOR POTENTIAL HAZARD MITIGATION ACTIONS PLAQUEMINES PARISH	
DESCRIPTION	
PLAQUEMINES PARISH MITIGATION ACTION 14	Water/Sewer Infrastructure Improvements
LEAD AGENCY	Plaquemines Parish Government
SUPPORTING AGENCIES	Plaquemines Parish OHSEP
TIMELINE	1-15 years
COST ESTIMATE	Unknown
POSSIBLE FUNDING SOURCE(S)	HMGP, BRIC, FMA, Local
ASSOCIATED GOALS	1. Reduce losses to existing and future property due to hazards 2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards 4. Protect existing public and private infrastructure from damage
PRIORITY	High
Action Description	Install, update, upgrade, and replace sewer and water infrastructure around Plaquemines Parish. Target cast iron lines that produce brown/murky water.
Type of Mitigation Action	Natural Resource Protection, Structure and Infrastructure Projects
How Action Aligns with Risk Reduction	Upgrading sewer and water infrastructure will allow for clean drinking water and ensure the operation of the systems are undeterred by ongoing hazards
Current Status of Action	New
Hazard Addressed	Coastal Hazards, Flooding, Levee Failure, Saltwater Intrusion, Sinkholes, Tropical Cyclones

Action Prioritization

During the prioritization process, the planning committee considered the costs and relative benefits of each new action. Costs can usually be listed in terms of dollars, although at times it involves staff time rather than the purchase of equipment or services that can be readily measured in dollars. In most cases, benefits, such as lives saved or future damage prevented, are hard to measure in dollars. Therefore, many projects were prioritized with these factors in mind. In addition, prioritization of the mitigation actions was performed based on the following economic criteria: i) whether the action can be performed with the existing parish resources; ii) whether the action requires additional funding from external sources; and iii) relative costs of the mitigation actions.

In all cases, the committee concluded that the benefits (in terms of reduced property damage, lives saved, health problems averted and/or economic harm prevented) outweighed the costs for the recommended action items.

The planning committee prioritized the possible activities that could be pursued. Planning committee members consulted appropriate agencies in order to assist with the prioritizations. The results were items that address the major hazards, are appropriate for those hazards, are cost-effective, and are affordable. On-going actions, as well as actions which will provide maximum benefit that can be undertaken by existing parish staff with or without additional external funding were given high priority. The actions with medium benefit and relatively low cost, political support, and public support but require additional funding from parish or external sources were given medium priority. The actions that require substantial funding from external sources and would result in limited benefit to the community were given low priority.

Plaquemines Parish will implement and administer the identified actions based off the proposed timeframes and priorities for each reflected in the portions of this section where actions are summarized. The inclusion of any specific action item in this document does not commit the parish to implementation. Each action item will be subject to availability of staff and funding. Certain items may require regulatory changes or other decisions that must be implemented through standard processes. This plan is intended to offer priorities based on an examination of hazards.

Appendix A: Planning Process

Purpose

The Hazard Mitigation Plan Update process prompts local communities to keep their hazard mitigation plan current and moving toward a more resilient community. The plan update builds on the research and planning efforts of previous plans while reviewing recent trends. The planning committee followed FEMA's hazard mitigation planning process per the FEMA Local Mitigation Planning Handbook. This planning process assured public involvement and the participation of interested agencies and private organizations. Documentation of the planning process for the updated plan is addressed in this section.

The Plaquemines Parish Hazard Mitigation Plan Update

The Plaquemines Parish Hazard Mitigation Plan Update process began in August 2024 with a series of emails, phone calls, meetings, and collaborations between the contractor (SDMI) and a diverse group of participating agencies and stakeholders. Update activities were intended to give each participating agency and stakeholder the opportunity to shape the plan to best fit their community's mitigation goals. Community stakeholders and the general public were invited to attend and contribute information to the planning process during specific time periods or meetings.

The table below details the meeting schedule and purpose for the planning process:

Date	Meeting or Outreach	Location	Public Invited	Purpose
8/19/2024	Kick Off Meeting	Phone Conference	No	Discuss with the Parish OHSEP Director expectations and requirements of the project. Discuss meeting schedules, committee make up, and next steps.
10/3/2024	Initial Planning Committee Meeting	Belle Chasse, LA	No	Discuss with Plaquemines Parish Hazard Mitigation Planning Committee the process and expectations of plan participants. Discuss timeline and action items for the parish.
1/28/2025	Mitigation Action Workshop	Belle Chasse, LA	No	Discussion with Plaquemines Parish Hazard Mitigation Planning Committee of the outstanding data required for plan update, as well as discussion of mitigation actions (old and new) for plan update.
3/11/2025	Planning Committee Risk Assessment Review	Belle Chasse, LA	Yes	Presentation of Risk Assessment and profiled hazards to Planning Committee.
3/11/2025	Public Meeting	Belle Chasse, LA	Yes	Presentation of Risk Assessment s and profiled hazards to public. Presentation also includes current mitigation project highlights within communities and public survey discussion.
August 2024 – March 2025	Public Opinion Survey	Online	Yes	This survey asked participants about public perceptions and opinions regarding natural hazards in Plaquemines Parish. In addition, questions covered the methods and techniques preferred for reducing the risks and losses associated with these hazards.

Planning

The plan update process consisted of several phases:

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11
Plan Revision											
Data Collection											
Risk Assessment											
Public Input											
Mitigation Strategy											
Plan Review by GOHSEP and FEMA											
FEMA APA											
Plan Adoptions											
Final Plan Approval											

Coordination

The Plaquemines Parish Office of Homeland Security and Emergency Preparedness (OHSEP) oversaw the coordination of the 2025 Hazard Mitigation Plan Update Planning Committee during the update process. The parish OHSEP was responsible for identifying members for the committee. Representatives of relevant local and parish government departments were invited for inclusion in the planning process via email from SDMI and the Plaquemines Parish OHSEP Director. Plaquemines Parish identified and reached out, via email, to representatives of non-profits, local businesses and organizations, and private organizations that provide for the betterment and benefit of populations identified as socially vulnerable and work directly with communities that are deemed as underserved so that they could be involved in the entirety of this plan update process and participate as key stakeholders. Some directors of organizations contacted included the Council on Aging, and the local American Red Cross chapter, but no response was received. There are no higher education institutions in Plaquemines Parish; therefore, no members of academia could be included in the planning process on a parish level. However, SDMI is an institution under the Louisiana State University system, so this plan update received constant feedback from academia personnel on LSU's campus. Therefore, LSU was able to be included for academic participation during the plan update process.

The Parish Director was responsible for inviting the planning committee and key stakeholders to scheduled meetings and activities via phone call and/or email. SDMI assisted the Parish Director with press releases and social media statements for notification to the media and general public for public meetings and public outreach activities.

SDMI was responsible for facilitating all meetings and outreach efforts during the update process.

Neighboring Community, Local and Regional Planning Process Involvement

From the outset of the planning process, the planning committee encouraged participation from a broad range of parish entities. The involvement of representatives from the city, state, and regional agencies provided diverse perspectives and mitigation ideas.

Formal participation in this plan includes but is not limited to the following activities:

- Participation in Hazard Mitigation planning meetings at the local and parish level
- Sharing local data and information with neighboring communities
- Incorporation of other planning documents, studies and efforts
- Action item development and action progress from 2020 update
- Risk Assessment review
- Plan document draft review
- Formal adoption of the Hazard Mitigation Plan

The St. Bernard Parish OHSEP Director was invited to attend the Initial Planning and Risk Assessment Meetings for Plaquemines Parish in an effort to coordinate mitigation efforts where possible as neighboring communities. The St. Bernard OHSEP Director was invited via email and phone call to participate in an effort to collaborate with neighboring communities. SDMI assisted Plaquemines Parish with encouraging the collaboration with these neighboring communities via email by extending an invitation to the Plaquemines Hazard Mitigation Plan Update Meetings.

As part of the coordination and planning process, the parish was provided the State Required Hazard Mitigation Plan Update Worksheet. The completed worksheets can be found in [Appendix E: State Required Worksheets](#).

The 2025 Hazard Mitigation Plan Update Planning Committee consisted of representatives from the following parish, municipal or community stakeholders. Below is a detailed list of the 2025 HMPU Planning Committee:

Plaquemines Parish Hazard Mitigation Planning Committee			
Name	Title	Agency	Email
Patrick Harvey	Director	Plaquemines Parish OHSEP	pharvey@ppgov.net
Keith Hinkley	Parish President	Plaquemines Parish Government	khinkley@ppgov.net
Shannta Carter	Chief of Staff	Plaquemines Parish Government	scarter@ppgov.net
Jeff Dimarco	Public Service Director	Plaquemines Parish Government	jdimarco@ppgov.net
Ken Dugas	Parish Engineer	Plaquemines Parish Government	kdugas@ppgov.net
Jonah Arceneaux	Project Manager	Plaquemines Parish Government	jonah@ppgov.net
Paula Dove	Grant Administrator	Plaquemines Parish Government	pdove@ppgov.net
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning	arose@ppgov.net
John Rahaim	Director	St. Bernard Parish OHSEP	jrahaim@sbgp.net
John Gardner	Region 1 Coordinator	GOHSEP	John.Gardner3@la.gov
Margaret Dejean	Area Director	GOHSEP	Margaret.Dejean@la.gov
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire	jbutcher@ppgov.net
Brad Breuhl	Projects Director	Plaquemines Parish Government	bbreuhl@ppgov.net
Billy Wichers	Operations Director	Plaquemines Parish Director	bwichers@ppgov.net
Zach Smith	Floodplain Manager	Plaquemines Parish Government	zsmith@ppgov.net
Chris Rippetoe	Program Manager	LSU-SDMI	crippe2@lsu.edu
Jason Martin	EM Analyst	LSU-SDMI	jmar293@lsu.edu
Brian Stevens	Special Projects Manager	LSU-SDMI	bstevens2@lsu.edu

Program Integration

Local governments are required to describe how their mitigation planning process is integrated with other ongoing local and area planning efforts. This subsection describes Plaquemines Parish programs and planning.

A measure of integration and coordination is achieved through the HMPU participation of planning committee members and community stakeholders who administer programs such as: floodplain management under the National Flood Insurance Program (NFIP), Community Rating System, parish planning and zoning and building code enforcement.

Since the last update in 2020, Plaquemines Parish has used the hazard mitigation plan as a reference point to various projects and mitigation strategies that take place throughout the planning area. Along with the mitigation actions outlined for each parish, Plaquemines has used vulnerability statistics and integration strategies within the plan to help guide their mitigation practices. The strategies and practices in this plan update build upon the practices that have been used since the previous update. Those strategies and practices can be found in various sections throughout the risk assessment that address climate change, vulnerable populations, and future development trends. Furthermore, the parish has held and will continue to hold annual meetings to discuss any changes that have occurred within the parish that could alter the vulnerability of Plaquemines, and how to combat any issues that have arisen within the means and regulations of the hazard mitigation plan.

Plaquemines Parish will continue to integrate the requirements of this Hazard Mitigation Plan into other local planning mechanisms that are to be identified through future meetings of the parish, and through the five-year review process described in [Appendix B: Plan Maintenance](#). The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of any individual municipal plans that require specific planning and administrative tasks (e.g. risk assessment, plan amendments, ordinance revisions, capital improvement projects, etc.).

The members of the Plaquemines Parish Hazard Mitigation Planning Committee will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their communities or agencies are consistent with the goals and actions of the Hazard Mitigation Plan and will not contribute to increased hazard vulnerability in the parish. Existing plans, studies, and technical information were incorporated in the planning process. Examples include flood data from FEMA and the U. S. Geological Survey. Much of this data was incorporated into the Risk Assessment component of the plan relative to plotting historical events and the magnitude of damages that occurred. The parish's 2020 Hazard Mitigation Plan was also used in the planning process. Other existing data and plans used in the planning process include those listed below.

- Parish Emergency Operations Plan
- Louisiana Coastal Master Plan
- Flood Insurance Rate Maps
- State of Louisiana Hazard Mitigation Plan

Further information on the plans can be found in [Section 3: Capability Assessment](#).

Meeting Documentation and Public Outreach Activities

The following pages contain documentation of the meetings and public outreach activities conducted during this hazard mitigation plan update.

Meeting #1: Hazard Mitigation Plan Update Kick-Off

Date: September 19, 2024

Location: Conference Call

Purpose: Discuss with the Parish OHSEP Director expectations and requirements of the project. Discuss meeting schedules, committee make up, and next steps.

Public Invitation: No

Meeting Invitees:

Plaquemines Parish Hazard Mitigation Planning Committee		
Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish Government
Paula Dove	Administrator	Plaquemines Parish Government
Ken Dugas	Parish Engineer	Plaquemines Parish Government
Jonah Arceneaux	Project Manager	Plaquemines Parish Government
Chris Rippetoe	Program Manager	LSU-SDMI
Jason Martin	EM Analyst	LSU-SDMI
Brian Stevens	Special Projects Manager	LSU-SDMI

Meeting #2: Hazard Mitigation Plan Update Initial Planning Committee Meeting

Date: October 28, 2024

Location: Belle Chasse, LA

Purpose: Discuss the expectations and requirements of the hazard mitigation plan update process and establish an initial project timeline with the Parish's Hazard Mitigation Plan Planning Committee. Assign each individual tasks related to the parish data collection for the plan update.

Public Invitation: No

Meeting Invitees:

Plaquemines Parish Hazard Mitigation Planning Committee		
Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Keith Hinkley	Parish President	Plaquemines Parish Government
Shannta Carter	Chief of Staff	Plaquemines Parish Government
Jeff Dimarco	Public Service Director	Plaquemines Parish Government
Ken Dugas	Parish Engineer	Plaquemines Parish Government
Jonah Arceneaux	Project Manager	Plaquemines Parish Government
Paula Dove	Grant Administrator	Plaquemines Parish Government
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning
John Rahaim	Director	St. Bernard Parish OHSEP
John Gardner	Region 1 Coordinator	GOHSEP
Margaret Dejean	Area Director	GOHSEP
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire
Brad Breuhl	Projects Director	Plaquemines Parish Government
Billy Wichers	Operations Director	Plaquemines Parish Director
Zach Smith	Floodplain Manager	Plaquemines Parish Government
Chris Rippetoe	Program Manager	LSU-SDMI
Jason Martin	EM Analyst	LSU-SDMI
Brian Stevens	Special Projects Manager	LSU-SDMI

Meeting #3: Hazard Mitigation Plan Update Mitigation Action Workshop**Date:** February 12, 2025**Location:** Belle Chasse, LA

Purpose: Discussion with Plaquemines Parish Hazard Mitigation Planning Committee of the outstanding data required for plan update, as well as discussion of mitigation actions (old and new) for plan update. Continued timeline discussions.

Public Invitation: No**Meeting Invitees:**

Plaquemines Parish Hazard Mitigation Planning Committee		
Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Keith Hinkley	Parish President	Plaquemines Parish Government
Shannta Carter	Chief of Staff	Plaquemines Parish Government
Jeff Dimarco	Public Service Director	Plaquemines Parish Government
Ken Dugas	Parish Engineer	Plaquemines Parish Government
Jonah Arceneaux	Project Manager	Plaquemines Parish Government
Paula Dove	Grant Administrator	Plaquemines Parish Government
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning
John Rahaim	Director	St. Bernard Parish OHSEP
John Gardner	Region 1 Coordinator	GOHSEP
Margaret Dejean	Area Director	GOHSEP
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire
Brad Breuhl	Projects Director	Plaquemines Parish Government
Billy Wichers	Operations Director	Plaquemines Parish Director
Zach Smith	Floodplain Manager	Plaquemines Parish Government
Chris Rippetoe	Program Manager	LSU-SDMI
Jason Martin	EM Analyst	LSU-SDMI
Brian Stevens	Special Projects Manager	LSU-SDMI

Meeting #4: Hazard Mitigation Plan Update Planning Committee Risk Assessment Review**Date:** March 11, 2025**Location:** Belle Chasse, LA**Purpose:** Presentation of Risk Assessment hazards and maps to Planning Committee.**Public Invitation:** No**Meeting Invitees:**

Plaquemines Parish Hazard Mitigation Planning Committee		
Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Keith Hinkley	Parish President	Plaquemines Parish Government
Shannta Carter	Chief of Staff	Plaquemines Parish Government
Jeff Dimarco	Public Service Director	Plaquemines Parish Government
Ken Dugas	Parish Engineer	Plaquemines Parish Government
Jonah Arceneaux	Project Manager	Plaquemines Parish Government
Paula Dove	Grant Administrator	Plaquemines Parish Government
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning
John Rahaim	Director	St. Bernard Parish OHSEP
John Gardner	Region 1 Coordinator	GOHSEP
Margaret Dejean	Area Director	GOHSEP
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire
Brad Breuhl	Projects Director	Plaquemines Parish Government
Billy Wichers	Operations Director	Plaquemines Parish Director
Zach Smith	Floodplain Manager	Plaquemines Parish Government
Chris Rippetoe	Program Manager	LSU-SDMI
Jason Martin	EM Analyst	LSU-SDMI
Brian Stevens	Special Projects Manager	LSU-SDMI

Meeting #5: Hazard Mitigation Plan Update Public Meeting

Date: March 11, 2025

Location: Belle Chasse, LA

Purpose: The Public Meeting allowed the public and community stakeholders to participate and provide input into the hazard mitigation planning process. Presentation also included highlights of current mitigation projects, as well as a public survey discussion. The public meeting notice on the following page was presented to stakeholders as well as the general public, including those in underserved communities and those populations deemed as socially vulnerable. This notice was distributed via email as well as posted on the front door of the courthouse, published in the local newspaper, and posted via social media. This public meeting was also open to many different representatives from private, local community-based organizations and businesses, and non-profits that provide for the betterment of socially vulnerable populations and those areas that have been deemed as underserved. The parish was in charge of identifying these specific organizations so that they may be invited to participate at this public meeting and in the plan update process as a whole. This effort was carried out by Plaquemines Parish, and with assistance from SDMI.

Public Invitation: Yes

Meeting Invitees:

Plaquemines Parish Hazard Mitigation Planning Committee		
Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Keith Hinkley	Parish President	Plaquemines Parish Government
Shannta Carter	Chief of Staff	Plaquemines Parish Government
Jeff Dimarco	Public Service Director	Plaquemines Parish Government
Ken Dugas	Parish Engineer	Plaquemines Parish Government
Jonah Arceneaux	Project Manager	Plaquemines Parish Government
Paula Dove	Grant Administrator	Plaquemines Parish Government
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning
John Rahaim	Director	St. Bernard Parish OHSEP
John Gardner	Region 1 Coordinator	GOHSEP
Margaret Dejean	Area Director	GOHSEP
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire
Brad Breuhl	Projects Director	Plaquemines Parish Government
Billy Wichers	Operations Director	Plaquemines Parish Director
Zach Smith	Floodplain Manager	Plaquemines Parish Government
Chris Rippetoe	Program Manager	LSU-SDMI
Jason Martin	EM Analyst	LSU-SDMI
Brian Stevens	Special Projects Manager	LSU-SDMI

Meeting Announcement:

PLAQUEMINES PARISH OFFICE OF HOMELAND SECURITY & EMERGENCY PREPAREDNESS

PUBLIC MEETING ANNOUNCEMENT**Plaquemines Parish and its partners are seeking community input for the 2025
Plaquemines Parish Hazard Mitigation Plan update!**

Plaquemines Parish OHSEP, in partnership with The Louisiana Governor's Office of Homeland Security and Emergency Preparedness and the Stephenson Disaster Management Institute at LSU, is leading the process to update the Plaquemines Parish Hazard Mitigation Plan. The plan describes the **naturally occurring** risks to the region and outlines strategies to reduce these risks to save lives, reduce property damage, and lessen the impact of future disasters.

Are you passionate about building a more resilient future for your parish? Do you have questions about the natural hazards that threaten your community? Please join us on Tuesday, March 11th, for a public meeting at 11:30 AM to learn more about the plan and share your input on the risks and vulnerabilities that most impact you and your community.

Meeting Location:

Belle Chasse Library
8442 Hwy 23
Belle Chasse, LA 70037

Residents of Plaquemines Parish are asked to participate in a survey about public perceptions and opinions regarding natural hazards in the parish. The survey results will be used in the development of the plan. This short web-based survey can be found at the following link or by scanning the QR code:

https://lsu.qualtrics.com/jfe/form/SV_0iioxhtYfIEyYom



The Parish appreciates your input.

If you have questions, please contact the Plaquemines Parish OHSEP.

Outreach Activity #1: Public Opinion Survey

Date: Ongoing throughout planning process

Location: Web survey

Public Invitation: Yes

As referenced in the *Mitigation Strategy* section of this document, an online public opinion survey of Plaquemines Parish residents was conducted between August 2024 and March 2025. The survey was designed to capture public perceptions and opinions regarding natural hazards in Plaquemines Parish. In addition, the survey collected information regarding the methods and techniques preferred by the respondents for reducing the risks and losses associated with local hazards. An overview of the responses to the Plaquemines Parish Hazard Mitigation Public Opinion Survey can be found in the Introduction section of Section 4: *Mitigation Strategy*. The full survey can be found at the following link: https://lsu.qualtrics.com/jfe/form/SV_7WWHP1p7wYV6reS

Outreach Activity #2: Public Meeting Activity - Incident Questionnaire

Date: March 11, 2025

Location: Public Meeting

Public Invitation: Yes

An incident/issue questionnaire was provided at the public meeting in an effort to collect additional information from residents of Plaquemines Parish regarding hazard events and their localized impacts. While the information collected via the questionnaire was to be integrated into this planning document, there was no public turnout for the meeting, and subsequently no results could be collected. A copy of the incident questionnaire can be found on the next page.

Outreach Activity #3: 2025 Plaquemines Parish Hazard Mitigation Plan Public Review

Date: Ongoing

Location: SDMI Hazard Mitigation Website

Public Initiation: Yes

After an initial review by the Plaquemines Parish Planning Committee was completed, the 2025 Plaquemines Parish Hazard Mitigation Plan was made available for public review and comment. The plan was hosted on SDMI's Hazard Mitigation website: <https://hmplans.sdmi.lsu.edu/Home/Parish/plaquemines>

PLAQUEMINES PARISH PUBLIC MEETING**PUBLIC ACTIVITY:
INCIDENT/ ISSUE
QUESTIONNAIRE****1. HAZARD TYPE(S):**

- A. COASTAL HAZARDS
- B. FLOODING
- C. LEVEE FAILURE
- D. SALTWATER INTRUSION
- E. SINKHOLES
- F. THUNDERSTORMS
- G. TORNADOES
- H. TROPICAL CYCLONES

2. DESCRIBE INCIDENT OR ISSUE:**3. LOCATION:**

A. CITY:

B. ADDRESS OR AREA:

4. INTENSITY:

A. DEPTH (FLOODING) OR SIZE (HAIL ETC.):

B. WIND STRENGTH

5. RECURRING OR ONE TIME:

A. IF RECURRING, HOW OFTEN:

**6. WHAT TYPE OF INTERRUPTIONS
DOES/DID THE INCIDENT OR ISSUE
CAUSE? (BUSINESS CLOSURE, DAMAGE,
EVACUATION, ETC.)****7. HOW LONG WAS THE INTERRUPTION
(HOURS, DAYS, WEEKS ETC.)****8. HOW COULD THIS HAZARD OR
IMPACT BE PREVENTED, FIXED
OR ALLEVIATED?**

*****THIS PAGE LEFT INTENTIONALLY BLANK*****

Appendix B: Plan Maintenance

Purpose

The section of the Code of Federal Regulations (CFR) pertaining to Local Mitigation Plans lists five required components for each plan: a description of the planning process; risk assessments; mitigation strategies; a method and system for plan maintenance; and documentation of plan adoption. 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."

Implementing, Monitoring, Evaluating, and Updating the Plan

The Plaquemines Parish Hazard Mitigation Planning Committee will be responsible for implementing, monitoring, evaluating, and documenting the plan's progress throughout the year. Part of the plan maintenance process should include a system by which local governing bodies incorporate the HMP into the parish's other plans where applicable. This process provides for continued public participation through the diverse resources of the parish to help in achieving the goals and objectives of the plan. Public participation will be achieved through availability of copies of HMP in parish public buildings and the SDMI Hazard Mitigation website. This section describes the update process as a whole, which includes the following:

- Responsible parties
- Methods to be used
- Evaluation criteria to be applied
- Scheduling for monitoring and evaluating the plan

Responsible Parties

Plaquemines Parish has developed a method to ensure that a regular review and update of this Hazard Mitigation Plan occurs. This will be the responsibility of the planning committee, which consists of representatives from governmental organizations, local businesses, and private citizens, who will be involved in the process of monitoring, evaluating and updating the plan. All committee members in this plan will remain active in the planning committee.

Although the people filling the positions may change from year to year, the parish and its stakeholders will have representatives on the planning committee. The future planning committee will continue to be comprised of the same job functions as currently evident in the planning committee. However, the decision of specific job duties will be left to the Parish OHSEP Director to be assigned as deemed appropriate.

Methods for Monitoring and Evaluating the Plan and Plan Evaluation Criteria

Plaquemines Parish has developed a method to ensure implementation, monitoring, evaluating, and updating of the HMP occurs during the five-year cycle of the plan. Implementation will be accomplished through constant and transparent efforts to network and highlight the multi-objective, win-win benefits of each project proposed in the *Mitigation Strategy* section. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe and resilient community. The planning committee will seek to become a permanent body and will be responsible for monitoring, evaluating, and updating of the plan. The planning committee meeting will be held annually in order to monitor, evaluate, and update the plan. The Plaquemines Parish OHSEP Director will be responsible for conducting the annual planning committee meetings.

The lead person of the agency responsible for the implementation of a specific mitigation action will submit a progress report to the Director at least thirty days prior to the planning committee meeting. The progress report will provide project status monitoring to include the following: whether the project has started; if not started, reason for not starting; if started, status of the project; if the project is completed, whether it has reduced/eliminated the

problem; and any changes recommended to improve the implementation of the project etc. In addition, the progress report will provide status monitoring on the plan evaluation, changes to the hazard profile, changes to the risk assessment, and public input on the Hazard Mitigation Plan updates and reviews.

Progress on the mitigation action items and projects will be reviewed during the annual planning committee meeting. The criteria that would be utilized in the project review will include the following:

- 1) Whether the action was implemented and reasons, if the action was not implemented
- 2) What were the results of the implemented action
- 3) Were the outcomes as expected, and reasons if the outcomes were not as expected
- 4) Did the results achieve the stated goals and objectives
- 5) Was the action cost-effective
- 6) What were the losses avoided after completion of the project
- 7) In case of a structural project, did it change the hazard profile

In addition to monitoring and evaluating the progress of the mitigation plan actions and projects, the mitigation plan is required to be maintained and monitored annually, and fully updated every five years. The annual maintenance, monitoring and evaluation of the plan will be conducted in the annual planning committee meeting. The planning committee will review each goal to determine their relevance to changing situations in the parish, as well as changes to state or federal policy, and to ensure that they are addressing current and expected conditions. The planning committee will evaluate if any change in hazard profile and risk in the parish occurred during the past year. In addition, the evaluation will include the following criteria in respect of plan implementation:

- 1) Any local staffing changes that would warrant inviting different members to the planning committee
- 2) Any new organizations that would be valuable in the planning process or project implementation need to be included in the planning committee
- 3) Any new or existing procedures that can be done more efficiently
- 4) Any additional ways to gain more diverse and widespread cooperation
- 5) Any different or additional funding sources available for mitigation planning and implementation

The HMP will be updated every five years to remain eligible for continued HMGP funding. The planning committee will be responsible for updating the HMP. The OHSEP Director will be the lead person for the HMP update. The HMP update process will commence at least one year prior to the expiration of the plan. The HMP will be updated after a major disaster if an annual evaluation of the plan indicates a substantial change in hazard profile and risk assessment in the parish.

Additionally, the public will be canvassed to solicit public input to continue Plaquemines Parish's dedication to involving the public directly in review and updates of the Hazard Mitigation Plan. Meetings will be scheduled as needed by the plan administrator to provide a forum for which the public can express their concerns, opinions, and/or ideas about the plan. The plan administrator will be responsible for using parish resources to publicize the annual public meetings and maintain public involvement through the newspapers, radio, and public access television channels. Copies of the plan will be catalogued and kept at all appropriate agencies in the city government, as well as at the SDMI website.

The review by the planning committee and input from the public will determine whether a plan update is needed prior to the required five-year update.

Annual reports on the progress of actions, plan maintenance, monitoring, evaluation, incorporation into existing planning programs, and continued public involvement will be documented at each annual meeting of the committee and kept by the Parish OHSEP Director. The planning committee will work together as a team, with each member sharing responsibility for completing the monitoring, evaluation and updates. It is the responsibility of the Parish OHSEP Director for contacting committee members, organizing the meeting and providing public noticing for the meeting to solicit public input.

2025 Plan Version Plan Method and Schedule Evaluation

For the current plan update, the previously approved plan's method and schedule were evaluated to determine if the elements and processes involved in the required 2025 update. Based on this analysis, the method and schedule were deemed to be acceptable, and nothing was changed for this update.

Incorporation into Existing Planning Programs

It is and has been the responsibility of the Plaquemines Parish Hazard Mitigation Plan Planning Committee to determine additional implementation procedures when appropriate. This may include integrating the requirements of the Plaquemines Parish Hazard Mitigation Plan into planning documents, processes, or mechanisms as follows:

- Ordinances, Resolutions, Regulations
- Floodplain Ordinances
- Master Plans
- Capital Improvement Plans
- Economic Development Plans
- Emergency Operations Plans
- Debris Removal Plan
- Transportation Plan

Opportunities to integrate the requirements of this plan into other local planning mechanisms will continue to be identified through future meetings of the Plaquemines Parish Hazard Mitigation Planning Committee and through the five-year review process described herein. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of each individual plan that require specific planning and administrative tasks (e.g. risk assessment, plan amendments, ordinance revisions, capital improvement projects, etc.).

During the planning process for new and updated local planning documents at the parish level, such as a risk assessment, comprehensive plan, capital improvements plan, or emergency operations plan, Plaquemines Parish will provide a copy of the Parish Hazard Mitigation Plan to the appropriate parties and recommend that all goals and strategies of new and updated local planning documents are consistent with and support the goals of the Parish Hazard Mitigation Plan and will not contribute to increased hazards.

Although it is recognized that there are many possible benefits to integrating components of this plan into other parish planning mechanisms, the development and maintenance of this stand-alone Hazard Mitigation Plan is deemed by the planning committee to be the most effective and appropriate method to ensure implementation of Parish and local hazard mitigation actions.

Plaquemines Parish has the authority to incorporate the contents of the Hazard Mitigation Plan into the parish's existing regulatory mechanisms. Agreements are currently in place with communities to allow for the parish incorporation mechanisms to take place.

The following parish and local plans incorporate requirements of this HMP Update as follows through planning committee member representation throughout the planning process as described on the previous page:

Plaquemines Parish

<i>Comprehensive Master Plan</i>	Updated as needed	Plaquemines Parish Government	✓
<i>Capital Improvements Plan</i>	Updated as needed	Plaquemines Parish Government	✓
<i>Local Emergency Operations Plan</i>	Updated as needed	Plaquemines Parish OHSEP	✓
<i>Transportation Plan</i>	Updated as needed	Plaquemines Parish OHSEP	✓
<i>Economic Development Plan</i>	Updated as needed	Plaquemines Parish Government	✓

Continued Public Participation

Public participation is an integral component of the mitigation planning process and will continue to be essential as this plan evolves over time. Significant changes or amendments to the plan require a public hearing prior to any adoption procedures. Other efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising meetings of the Mitigation Committee in the local newspaper, public bulletin boards, and/or city and county office buildings
- Designating willing and voluntary citizens and private sector representatives as official members of the Mitigation Committee
- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place
- Utilizing city and Parish web sites to advertise any maintenance and/or periodic review activities taking place
- Keeping copies of the plan in appropriate public locations.

Appendix C: Critical Facilities

Critical Facilities within the Plaquemines Parish Planning Area

Plaquemines Parish Planning Area Critical Facilities									
Type	Name	Coastal Hazards	Flooding	Levee Failure	Saltwater Intrusion	Sinkholes	Thunderstorms	Tornadoes	Tropical Cyclones
Civil Government	Plaquemines Parish Courthouse	X					X	X	X
	Plaquemines Parish Government	X					X	X	X
	Plaquemines Parish Government Annex	X					X	X	X
	Plaquemines Parish School Board	X					X	X	X
Fire & SAR	Belle Chasse Fire Department	X	X				X	X	X
	Belle Chasse Fire Department No. 3	X	X				X	X	X
	Belle Chasse Station 5	X	X				X	X	X
	Belle Chasse Volunteer Fire Department	X					X	X	X
	Boothville-Venice Volunteer Fire Station	X					X	X	X
	Braithwaite Fire Department	X	X				X	X	X
	Buras Volunteer Fire Department	X					X	X	X
	Lake Hermitage Fire Station	X	X				X	X	X
	Myrtle Grove Fire Station	X	X				X	X	X
	O'Brien Fire Station	X	X				X	X	X
	Phoenix Fire Substation	X					X	X	X
	Pointe a la Hache Fire Station	X					X	X	X
	Port Sulphur Fire Department	X	X				X	X	X
	Woodlawn Fire Station	X	X				X	X	X
Law Enforcement	Plaquemines Parish Detention Center	X					X	X	X
	Plaquemines Parish Sheriff's Office	X					X	X	X
	Plaquemines Parish Sheriff's Office - District 2	X					X	X	X
Public Health	Plaquemines Medical Center	X					X	X	X
	Plaquemines Parish Health Department	X					X	X	X
Schools	Belle Chasse Elementary School	X	X				X	X	X
	Belle Chasse High School	X					X	X	X
	Belle Chasse Middle School	X	X				X	X	X

	Belle Chasse Primary School	X					X	X	X
	Boothville-Venice Elementary School	X					X	X	X
	Phoenix High School	X					X	X	X
	Plaquemines Parish Learning Center	X	X				X	X	X
	South Plaquemines Elementary School	X	X				X	X	X
	South Plaquemines High School	X					X	X	X
Pump Stations	Barriere Road Pump Station	X	X				X	X	X
	Belair Pump Station	X	X				X	X	X
	Belle Chasse Pump Station No. 1	X	X				X	X	X
	Belle Chasse Pump Station No. 2	X	X				X	X	X
	Bellevue Pump Station	X	X				X	X	X
	Braithwaite Pump Station	X	X				X	X	X
	Diamond Pump Station	X	X				X	X	X
	Duvic Pump Station	X	X				X	X	X
	East Pointe A La Hache Pump Station	X	X				X	X	X
	Gainard Woods Pump Station No. 1	X	X				X	X	X
	Gainard Woods Pump Station No. 2	X					X	X	X
	Good News Pump Station	X	X				X	X	X
	Grand Liard Pump Station	X	X				X	X	X
	Hayes Pump Station	X	X				X	X	X
	Magnolia Pump Station	X	X				X	X	X
	New Lower Ollie Pump Station	X					X	X	X
	Old Lower Ollie Pump Station	X					X	X	X
	Pointe Celeste Pump Station	X	X				X	X	X
	Scarsdale Pump Station	X	X				X	X	X
	Sunrise Pump Station No. 1	X	X				X	X	X
	Sunrise Pump Station No. 2	X	X				X	X	X
	Upper Ollie Pump Station	X					X	X	X
	West Pointe A La Hache Pump Station	X	X				X	X	X
	Wilkinson Canal Pump Station	X	X				X	X	X

Appendix D: Plan Adoption

FEMA Approval Letter

*****WILL UPDATE ONCE THE APPROVAL LETTER IS ISSUED*****

GOHSEP Approval Letter

*****WILL UPDATE ONCE THE APPROVAL LETTER IS ISSUED*****

Plaquemines Parish

*****WILL UPDATE ONCE THE PARISH FORMALLY ADOPTS THE HMP*****

*****THIS PAGE LEFT INTENTIONALLY BLANK*****

Appendix E: State Required Worksheets

During the planning process ([Appendix A: Planning Process](#)), the Hazard Mitigation Plan Update Planning Committee was provided state-required plan update process worksheets to be filled out. The worksheets were presented at the Initial Planning Meeting by SDMI as tools for assisting in the update of the Hazard Mitigation Plan, but also as a state requirement for the update. The plan update worksheets allowed for collection of information such as planning team members, community capabilities, community infrastructure, vulnerable populations and NFIP information. The following pages contain documentation of the state required worksheets.

Mitigation Planning Team

Plaquemines Parish Hazard Mitigation Planning Committee			
Name	Title	Agency	Email
Patrick Harvey	Director	Plaquemines Parish OHSEP	pharvey@ppgov.net
Keith Hinkley	Parish President	Plaquemines Parish Government	khinkley@ppgov.net
Shannta Carter	Chief of Staff	Plaquemines Parish Government	scarter@ppgov.net
Jeff Dimarco	Public Service Director	Plaquemines Parish Government	jdimarco@ppgov.net
Ken Dugas	Parish Engineer	Plaquemines Parish Government	kdugas@ppgov.net
Jonah Arceneaux	Project Manager	Plaquemines Parish Government	jonah@ppgov.net
Paula Dove	Grant Administrator	Plaquemines Parish Government	pdove@ppgov.net
Ametra Rose	Superintendent	Plaquemines Parish Planning & Zoning	arose@ppgov.net
John Rahaim	Director	St. Bernard Parish OHSEP	jrahaim@sbpg.net
John Gardner	Region 1 Coordinator	GOHSEP	John.Gardner3@la.gov
Margaret Dejean	Area Director	GOHSEP	Margaret.Dejean@la.gov
Jonathan Butcher	Fire Superintendent	Plaquemines Parish Fire	jbutcher@ppgov.net
Brad Breuhl	Projects Director	Plaquemines Parish Government	bbreuhl@ppgov.net
Billy Wichers	Operations Director	Plaquemines Parish Director	bwichers@ppgov.net
Zach Smith	Floodplain Manager	Plaquemines Parish Government	zsmith@ppgov.net
Chris Rippetoe	Program Manager	LSU-SDMI	crippe2@lsu.edu
Jason Martin	EM Analyst	LSU-SDMI	jmar293@lsu.edu
Brian Stevens	Special Projects Manager	LSU-SDMI	bstevens2@lsu.edu

Capability Assessment

Capability Assessment Worksheet - Plaquemines Parish		
Local mitigation capabilities are existing authorities, polices and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Please complete the tables and questions in the worksheet as completely as possible.		
Planning and Regulatory		
Please indicate which of the following plans and regulatory capabilities your parish has in place.		
Plans	Yes / No	Comments
Comprehensive / Master Plan	Yes	
Capital Improvements Plan	Yes	
Economic Development Plan	Yes	
Local Emergency Operations Plan	Yes	
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	No	
Community Wildfire Protection Plan	No	
Other plans (redevelopment, recovery, coastal zone management)	Yes	
Building Code, Permitting and Inspections	Yes / No	Comments
Building Code	Yes	LSUCC
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	
Fire Department ISO/PIAL rating	Yes	Dist 1 - 5; Dist 2 -4, Dist 3 - 5, Dist 4 - 5, Dist 5 - 6, Dist 6 - 4, Dist 7 - 5
Site plan review requirements	Yes	
Land Use Planning and Ordinances	Yes / No	Comments
Zoning Ordinance	Yes	Local
Subdivision Ordinance	Yes	Local
Floodplain Ordinance	Yes	FEMA
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	No	
Flood Insurance Rate Maps	Yes	Paper & digital
Acquisition of land for open space and public recreation uses	Yes	
Other	No	

Administration and Technical		
Identify whether your community has the following administrative and technical capabilities. For smaller communities without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.		
Administration	Yes / No	Comments
Planning Commission	Yes	
Mitigation Planning Committee	No	
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	No	
Mutual Aid Agreements	Yes	
Staff	Yes / No	Comments
Chief Building Official	Yes	ICC Certified Building Official
Floodplain Administrator	Yes	ASFPM Certified Floodplain Manager
Emergency Manager	Yes	
Community Planner	No	
Civil Engineer	Yes	
GIS Coordinator	Yes	
Grant Writer	Yes	
Other		
Technical	Yes / No	Comments
Warning Systems / Service (Reverse 911, outdoor warning signals)	Yes	
Hazard Data & Information	Yes	
Grant Writing	Yes	
Hazus Analysis	No	
Other		

Financial		
Identify whether your parish has access to or is eligible to use the following funding resources for hazard mitigation.		
Funding Resources	Yes / No	Comments
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	No	
Community Development Block Grant (CDBG)	Yes	
Other Funding Programs	Yes	

Education and Outreach		
Identify education and outreach programs and methods, already in place that could be used to implement mitigation activities and communicate hazard-related information.		
Program / Organization	Yes / No	Comments
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Yes	
Natural Disaster or safety related school program	Yes	
Storm Ready certification	Yes	
Firewise Communities certification	No	
Public/Private partnership initiatives addressing disaster-related issues	No	
Other		

Building Inventory

Plaquemines Parish Owned Building Information								
Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
Alliance Booster Station	Water Treatment	15000 block Hwy 23	Alliance	29.668937	-89.977677			
Barriere Road Pump Station	Pumping Station	Medal of Honor Park	Belle Chasse	29.85588	-90.021382			Metal
Belair Pump Station	Pumping Station	Belair Pump Road	Braithwaite	29.74228	-89.987659	\$8,300,000	1965	Metal
Belle Chasse Elementary School	School	539 F Edward Hebert Boulevard	Belle Chasse	29.89271091	-89.97442154	\$16,645,000	1993	Concrete
Belle Chasse Fire Department	Fire & SAR	104 New Orleans St	Belle Chasse	29.850807	-89.987438	\$6,500,000		Concrete
Belle Chasse Fire Department No. 3	Fire & SAR	13476 Louisiana 23	Belle Chasse	29.73145628	-90.00625335	\$266,000		Metal
Belle Chasse High School	School	8346 Louisiana 23	Belle Chasse	29.855084	-89.986613	\$25,282,010	1958	Concrete
Belle Chasse Middle School	School	13476 Louisiana 23	Belle Chasse	29.73170346	-90.00765911	\$17,532,608	1955	Concrete
Belle Chasse Primary School	School	601 F. Edward Hebert	Belle Chasse	29.89401	-89.975007	\$26,421,265	2019	Concrete
Belle Chasse Pump Station No. 1	Pumping Station	294 Pump Station Road	Belle Chasse	29.852584	-90.019209	\$7,000,000	1964	Metal
Belle Chasse Pump Station No. 2	Pumping Station	Engineers Road	Belle Chasse	29.895858	-89.997646	\$7,000,000	1996	Metal
Belle Chasse Station 5	Fire & SAR	333 F Edward Hebert Boulevard	Belle Chasse	29.895381	-89.976477			
Belle Chasse Volunteer Fire Department	Fire & SAR	216 Engineers Road	Belle Chasse	29.87322172	-90.01400958	\$767,000		Metal
Belle Chasse Wastewater Treatment Plant	Wastewater Treatment	126 Sewer Plant Rd Belle Chasse	Belle Chasse	29.481758	-90.04915	\$661,000		Concrete
Belle Chasse Water Treatment Plant	Water Treatment	107 E Cuevas St Belle Chasse	Belle Chasse	29.853973	-89.984769	\$2,500,000		Concrete
Bellevue Pump Station	Pumping Station	LA-39	Braithwaite	29.624337	-89.877504	\$15,000,000	1972	Metal
Boothville Wastewater Treatment Plant	Wastewater Treatment	135 Sewer Plant Rd Boothville	Boothville	29.315745	-89.385583	\$200,000		Concrete
Boothville Water Treatment Plant	Water Treatment	38903 Hwy 23 Boothville	Boothville	29.352744	89.440814	\$660,000		Concrete
Boothville-Venice Elementary School	School	1 Oiler Drive	Boothville	29.3362089	-89.40614662	\$17,955,000	1975	Concrete
Boothville-Venice Volunteer Fire Station	Fire & SAR	42661 Louisiana 23	Venice	29.280489	-89.359516	\$7,165,000		Concrete
Braithwaite Fire Department	Fire & SAR	7163 Louisiana 39	Braithwaite	29.76465048	-90.01681897	\$381,000		Metal
Braithwaite Pump Station	Pumping Station	Braithwaite Park	Braithwaite	29.850065	-89.909286	\$7,800,000	1974	Metal
Braithwaite Wastewater Treatment Plant	Wastewater Treatment	1165 Hwy 39 Braithwaite	Braithwaite	29.852986	-89.90943			Concrete
Buras Volunteer Fire Department	Fire & SAR	35410 Louisiana 23	Buras	29.358123	-89.532143	\$3,544,000		Concrete

Buras Wastewater Treatment Plant	Wastewater Treatment	120 Eldorado Dr, Buras	Buras	29.34173	-89.516918	\$900,000		Concrete
Dalcour Water Treatment Plant	Water Treatment	170 Water Plant Rd	Braithwaite	29.857895	-89.922159	\$500,000		Concrete
Davant Wastewater Treatment Plant	Wastewater Treatment	15337 Hwy 15 Davant	Davant	29.62163	-89.867127			Concrete
Diamond Pump Station	Pumping Station	Hwy 23	Port Sulphur	29.527785	-89.762578	\$7,000,000	1978	Metal
Duvic Pump Station	Pumping Station	Duvic Pump Rd	Venice	29.313616	-89.388270	\$17,000,000	1976	Metal
Food Service Maintenance Facility	School	Hwy 23	Port Sulphur	29.517766	-89.729646	\$2,480,600	2017	
Gainard Woods Pump Station No. 1	Pumping Station	West Paula Drive	Port Sulphur	29.450094	-89.649558	\$10,800,000	1960	Metal
Gainard Woods Pump Station No. 2	Pumping Station						1986	Metal
Good News Pump Station	Pumping Station	L Street	Belle Chasse	29.865642	-90.004065			
Grand Liard Pump Station	Pumping Station	Triumph Pump Road	Triumph	29.326501	-89.480765	\$22,000,000	1971	Metal
Hayes Pump Station	Pumping Station	North Street	Port Sulphur	29.500574	-89.720974	\$14,000,000	1963	Metal
Ironton Oxidation Pond	Wastewater Treatment	17200 Hwy 23 Ironton	Ironton	29.637983	-89.970359			
Lake Hermitage Fire Station	Fire & SAR	2766 Lake Heritage Rd	Port Sulphur	29.559076	-89.884823	\$1,000,000		Concrete
Magnolia Pump Station	Pumping Station	Hwy 23	West Pointe A La Hache	29.562587	-89.793534			
Myrtle Grove Fire Station	Fire & SAR	Hwy 23	Port Sulphur	29.635418	-89.949476	\$3,500,000		Concrete
Myrtle Grove Oxidation Pond	Wastewater Treatment	17200 Hwy 23 Ironton	Ironton	29.637983	-89.970359			
New Lower Ollie Pump Station	Pumping Station						1983	Metal
North Transportation Facility	School	F Edward Hebert Blvd	Belle Chasse	29.891459	-89.976948	\$2,163,058	2014	
O'Brien Fire Station	Fire & SAR	31725 Louisiana 23	Buras	29.415777	-89.612943	\$800,000		Metal
Old Lower Ollie Pump Station	Pumping Station						1950	Metal
Phoenix Fire Substation	Fire & SAR	Hwy 15	Phoenix	29.641791	-89.930144			
Phoenix High School	School	12700 Hwy 39	Braithwaite	29.64444	-89.928816	\$27,654,000	2014	
Plaquemines Parish Courthouse	Government	Hwy 15	Pointe a la Hache	29.578909	-89.795218	\$13,000,000		Concrete
Plaquemines Parish Detention Center	Law Enforcement	16801 Louisiana 15	Davant	29.59852126	-89.82469493	\$98,000,000		Concrete
Plaquemines Parish Government Annex Building	Government	301 Main St	Belle Chasse	29.856796	-89.983583	\$2,800,000		Metal

Plaquemines Parish Government Building	Government	8056 Louisiana 23	Belle Chasse	29.859303	-89.991907	\$3,152,000		Concrete
Plaquemines Parish Government Complex	Government	333 F Edward Hebert Boulevard	Belle Chasse	29.896769	-89.979355	\$20,000,000		Concrete
Plaquemines Parish Health Department	Public Health	3706 Main St.	Belle Chasse	29.885210	-89.971093			Masonry
Plaquemines Parish Learning Center	School	26880 Hwy 23	Port Sulphur	29.500379	-89.717697	\$7,800,000	2010	
Plaquemines Parish Library - Belle Chasse Branch	Library	8442 Louisiana 23	Belle Chasse	29.85288602	-89.98738298	\$903,000		Concrete
Plaquemines Parish Library - Buras Branch	Library	35572 Louisiana 11	Buras	29.35505758	-89.52857848	\$3,400,000		Concrete
Plaquemines Parish School Board	School	557 F Edward Hebert Blvd	Belle Chasse	29.891115	-89.975237	\$1,010,000	1993	
Plaquemines Parish Sheriff's Office	Law Enforcement	8022 Louisiana 23	Belle Chasse	29.859967	-89.99271	\$3,400,000		Concrete
Pointe a la Hache Fire Station	Fire & SAR	Adema Lane	Pointe a la Hache	29.57994	-89.795855			
Pointe A La Hache Pump Station	Pumping Station	Hwy 39	Pointe a la Hache	29.583573	-89.792956		1972	Metal
Pointe Celeste Pump Station	Pumping Station		Pointe Celeste	29.579174	-89.856994			Metal
Ponte a la Hache Water Treatment Plant	Water Treatment	17581 Hwy 15 PALH	Pointe a la Hache	29.586281	-89.807102	\$423,000		Concrete
Port Sulphur EMS	EMS	114 Civic Drive	Port Sulphur	29.479799	-89.69505			Concrete
Port Sulphur Faculty Housing	School	Civic Drive	Port Sulphur	29.479318	-89.695449	\$3,164,000	2016	
Port Sulphur Fire Department	Fire & SAR	114 Civic Drive	Port Sulphur	29.47991641	-89.69490782	\$6,900,000		Concrete
Port Sulphur Library	Library	Civic Drive	Port Sulphur	29.479734	-89.695396			
Port Sulphur Wastewater Treatment Plant	Wastewater Treatment	180 Lee Dr, Port Sulphur	Port Sulphur	29.48223	-89.701512	\$2,300,000		Concrete
Port Sulphur Water Treatment Plant	Water Treatment	228969 Hwy 23 Port Sulphur	Port Sulphur	29.57171	-89.80426			Concrete
PPSB Warehouse	School	106 Jarrell Dr.		29.900742	-89.985386	\$304,000		
PPSB Woodland Central Office	School	1484 Woodland Hwy	Belle Chasse	29.901093	-89.984817	\$1,160,000		Metal
PPSO District 2	Law Enforcement	Civic Drive	Port Sulphur	29.479616	-89.694431	\$4,500,000		Concrete
Scarsdale Pump Station	Pumping Station	Scarsdale Rd	Scarsdale	29.833289	-89.959577	\$25,000,000	1965	Metal
South Plaquemines Elementary School	School	311 Civic Drive	Port Sulphur	29.47702884	-89.69587647	\$31,009,059	2014	Concrete

South Plaquemines Faculty Housing (Buras)	School	Hwy 11	Buras	29.353807	-89.525693	\$9,500,000	2012	
South Plaquemines Faculty Housing Annex	School					\$1,658,628	2012	
South Plaquemines High School	School	34121 Louisiana 23	Buras	29.36639048	-89.571664	\$42,730,854	2013	Concrete
South Transportation Facility	School	Packard Lane	Buras	29.366272	-89.565688	\$2,434,000	2012	
Sunrise Pump Station No. 1	Pumping Station	Louisiana 23	Buras	29.362406	-89.562122	\$7,700,000		Metal
Sunrise Pump Station No. 2	Pumping Station							Metal
Upper Ollie Pump Station	Pumping Station	Ollie Drive	Belle Chasse	29.738872	-90.022714		1950	Metal
West Pointe A La Hache Pump Station	Pumping Station		West Pointe A La Hache	29.569438	-89.803144		1981	Metal
Wilkinson Canal Pump Station	Pumping Station		Mrytle Grove	29.623869	-89.955972			Metal
Woodlawn Fire Station	Fire & SAR	Hwy 39	Woodlawn	29.764647	-90.016765			

Vulnerable Populations

Vulnerable Populations Worksheet - Plaquemines Parish					
All Hospitals (Private or Public)					
Name	Address	City	Zip Code	Latitude	Longitude
Ochsner Health Center	7772 Hwy 23	Belle Chasse	70037	29.86423231	-89.99895747
Plaquemines Medical Center	27136 Hwy 23	Port Sulphur	70083	29.50187156	-89.71671523
Nursing Homes (Private or Public)					
Name	Address	City	Zip Code	Latitude	Longitude
Riverbend Nursing Home	13735 Hwy 23	Belle Chasse	70037	29.727619	-89.999352
Mobile Home Parks					
Name	Address	City	Zip Code	Latitude	Longitude
Unknown Mobile Home Park	22 Trey Ln	Belle Chasse	70037	29.81908564	-90.01086919
Unknown Mobile Home Park	106 River Oaks Dr	Belle Chasse	70037	29.79899265	-90.02124789
Unknown Mobile Home Park	116 Badalamenti Ln	Belle Chasse	70037	29.78500612	-90.02381692
Unknown Mobile Home Park	126 W. Oak Grove Ln.	Belle Chasse	70037	29.7693862	-90.02917996
Unknown Mobile Home Park	114 Naomi Dr.	Belle Chasse	70037	29.70309472	-89.99058251
Unknown RV Park	110 Windmill Ln.	Belle Chasse	70037	29.70196911	-89.98995373
Unknown RV Park	14723 Hwy 23	Belle Chasse	70037	29.70599175	-89.98906184
Unknown Mobile Home Park	123 Timber Ridge St.	Belle Chasse	70037	29.87476098	-90.01899906
Pelicans Point	29574 Hwy 23	Port Sulphur	70083	29.45227407	-89.65437445
Gauthier's Get-Away	Nearby: 29820-29828 Louisiana 23	Port Sulphur	70083	29.45068322	-89.64590788
J-Bar Sportsman Lodge and RV Park	32798 Hwy 11	Buras	70041	29.39090492	-89.60352639
Danos Mobile Home Rentals	R P Ln.	Buras	70041	29.33814858	-89.47413114
Kimberly's Kourt	Nearby: 101-199 Moaks Lane	Buras	70041	29.34334807	-89.46689513
Goodman's Trailer Park	Nearby: 100-168 Goodman Lane	Buras	70041	29.35115966	-89.43342838
Unknown Mobile Home Park	121 Ostrica Ln.	Buras	70041	29.34242469	-89.41484151
Jim's RV Sites	Nearby: 41180-41198 Louisiana 23	Buras	70041	29.31389041	-89.38668352
Unknown Mobile Home Park	Yvonne Ln.	Buras	70041	29.31251698	-89.38603406
Delta Dragon RV Park	42101 Highway 23	Buras	70041	29.2926355	-89.36978482
Stumpfs RV Park	113 Stump Ln.	Venice	70091	29.27499962	-89.35613672
Targa RV Park	193 Sooner Ln.	Venice	70091	29.2724111	-89.3560175
Phi Boothville Housing	100 Ernies Ln.	Boothville	70041	29.33294787	-89.40202936
C&H Mobile Home Park	26180 Hwy 23	Port Sulphur	70083	29.51456901	-89.72609282

National Flood Insurance Program (NFIP)

National Flood Insurance Program (NFIP)	
Plaquemines Parish	
Insurance Summary	Comments
How many NFIP policies are in the community? What is the total premium and coverage?	4,824; \$6,205,362; \$1,492,709,000
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	6,156; \$382,194,304; 2,961
How many structures are exposed to flood risk within the community?	Approximately 7,000
Describe any areas of flood risk with limited NFIP policy coverage.	We have large areas of V and AE zones with double digit elevation requirements.
Staff Resources	Comments
Is the Community FPA or NFIP Coordinator certified?	Yes. CFM is certified with ASFPM
Is flood plain management an auxiliary function?	FPM is integrated into the permitting process for renovation/new construction/general development.
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	CFM and permitting staff review permit apps for required benchmarks and communicates deficiencies. Required ECs during construction and post construction to confirm compliance. In addition, CFM and public leadership regularly engage with the public on flood questions via 1:1 and public meetings.
What are the barriers to running an effective NFIP program in the community, if any?	For a parish as large as Plaquemines, barriers include not participating in CRS and as a coastal parish, having public opposition to minimum standards.
Compliance History	Comments
Is the community in good standing with the NFIP?	YES
Are there any outstanding compliance issues(i.e., current violations)?	Minor issues being resolved via the CAV with FEMA Region 6
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact(CAC)?	Currently finishing a CAV
Is a CAV or CAC scheduled or needed? If so when?	Currently finishing a CAV
Regulation	Comments
When did the community enter the NFIP?	17-Jan-85
Are the FIRMs digital or paper?	Both
When did the community adopt the FIRM?	15-Jan-21
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Yes. They meet minimum BFE requirements with the required 1 foot freeboard as required by the State of LA.
Community Rating System (CRS)	Comments
Does the community participate in CRS?	NO
What is the community's CRS Class Ranking?	N/A
Does the plan include CRS planning requirements?	N/A