Advancing Community Adaptation:
A Framework for Project Prioritization and Decision Making

CENTER *for* PLANNING EXCELLENCE

ACKNOWLEDGMENTS

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About the Center for Planning Excellence

Mission

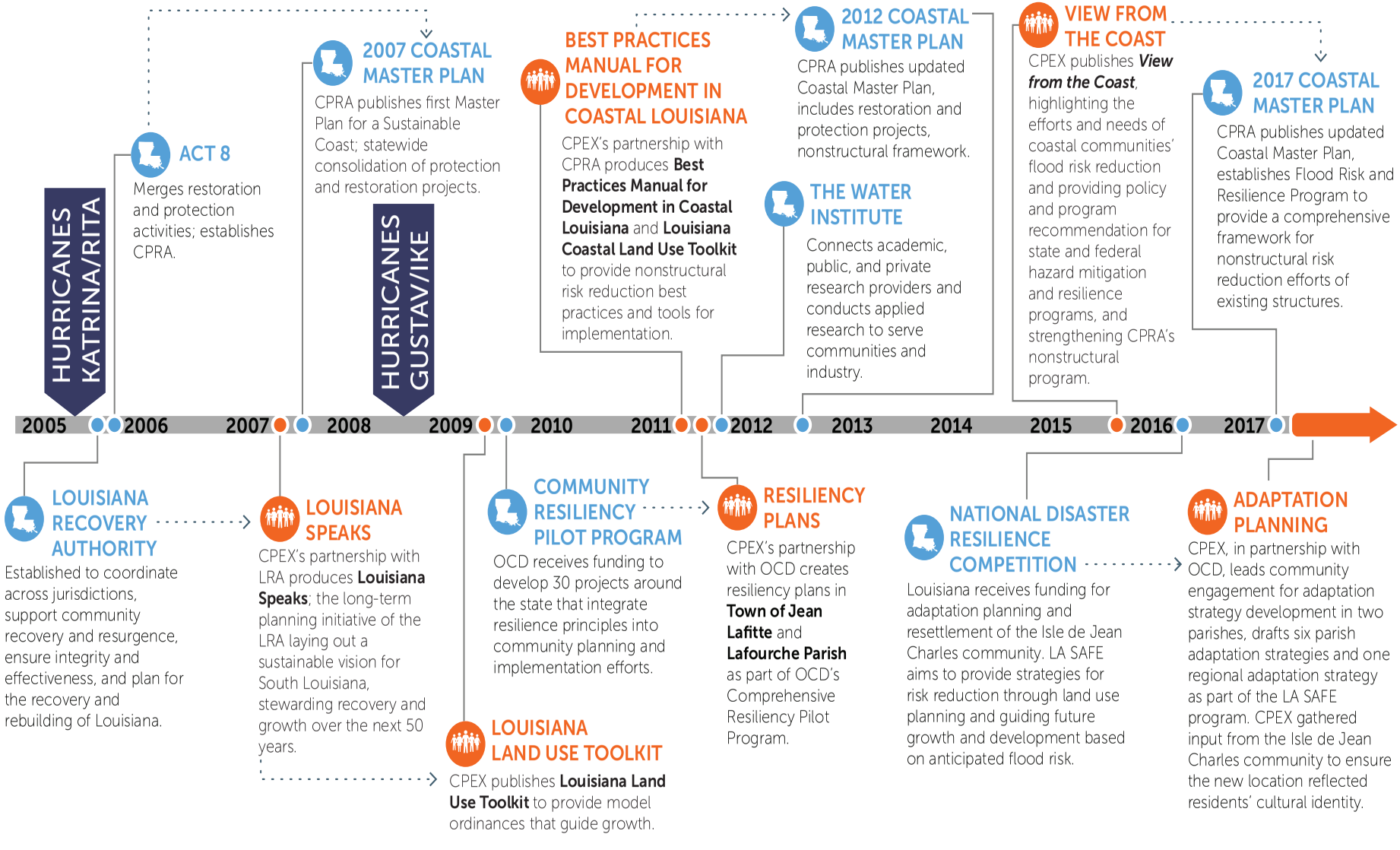
CPEX brings people, culture, and planning together to make great communities happen.

CPEX is a mission-driven not-for-profit organization that coordinates urban, rural and regional planning and implementation efforts in Louisiana. We provide best-practice planning models, innovative policy ideas, and technical assistance to individual communities that wish to create and enact master plans dealing with transportation and infrastructure needs, environmental issues, and quality design for the built environment. CPEX brings community members and leaders together and provides guidance as they work toward a shared vision for future growth and development.

Since our founding in 2006, CPEX has been involved with the planning efforts of the state, and that of more than 30 Louisiana cities, towns and parishes. We have leveraged more than $6 million on behalf of communities all over the state.

TIMELINE OF CPEX'S PLANNING EFFORTS IN COASTAL LOUISIANA

STATE LEVEL EFFORT CPEX EFFORT --> RESULTANT EFFORT



PREFACE

Louisiana is home to diverse communities and rich, productive resources that have defined the state's character, but the state faces great challenges. Climate change, sea level rise, and coastal erosion have changed the way we understand and relate to our environment. Land use patterns are being driven by necessity rather than choice as developable land gets scarcer and people move to higher ground. Rapid landscape scale changes are challenging how residents live and work on the Louisiana coast. Louisiana lost over 2,000 square miles of land in the past 80 years due to subsidence and coastal erosion, greatly increasing flood risk on the coast. The state is expected to lose another 2,000 square miles of land in the next 50 years due to coastal erosion and subsidence made worse by rising sea levels.

Robust planning efforts are needed to ensure that Louisiana's people and its resources, both natural and cultural, have the proper conditions to thrive. However, current planning efforts in Louisiana are largely reactive in nature. Proactive planning and a holistic definition of resilience must be cornerstones in the state's framework for the future. Part of that framework is Louisiana's Comprehensive Master Plan for a Sustainable Coast (Coastal Master Plan). Led by the Coastal Protection and Restoration Authority, the Coastal Master Plan recognizes that the state cannot stop land loss and eliminate flood risk entirely, but it can mitigate the worst impacts of it. The plan calls for a combination of structural protection (levees and floodwalls), restoration (barrier islands and marsh creation), and nonstructural projects.

Louisiana has made great strides in developing the science and engineering of protection and restoration projects but nonstructural projects must be approached differently. While structural and restoration projects involve large engineering and design efforts, nonstructural projects take place within communities where the social and community impacts of the projects are complex and require an ongoing discussion of problem solving as conditions continue to change. It also requires that aspects and elements that make a community are taken into consideration during nonstructural project development.

As the Flood Risk and Resilience Framework is being refined and nonstructural projects are developed by local governments, this document provides additional elements to expand the factors used to evaluate investment impacts of nonstructural projects. These elements take into account the particularities of community context and ongoing or planned projects that may affect community resilience. The framework defines the elements of both near-term and long-term resilience, acknowledging that meeting immediate community needs and planning for the future require different decision-making processes and may entail different priorities.

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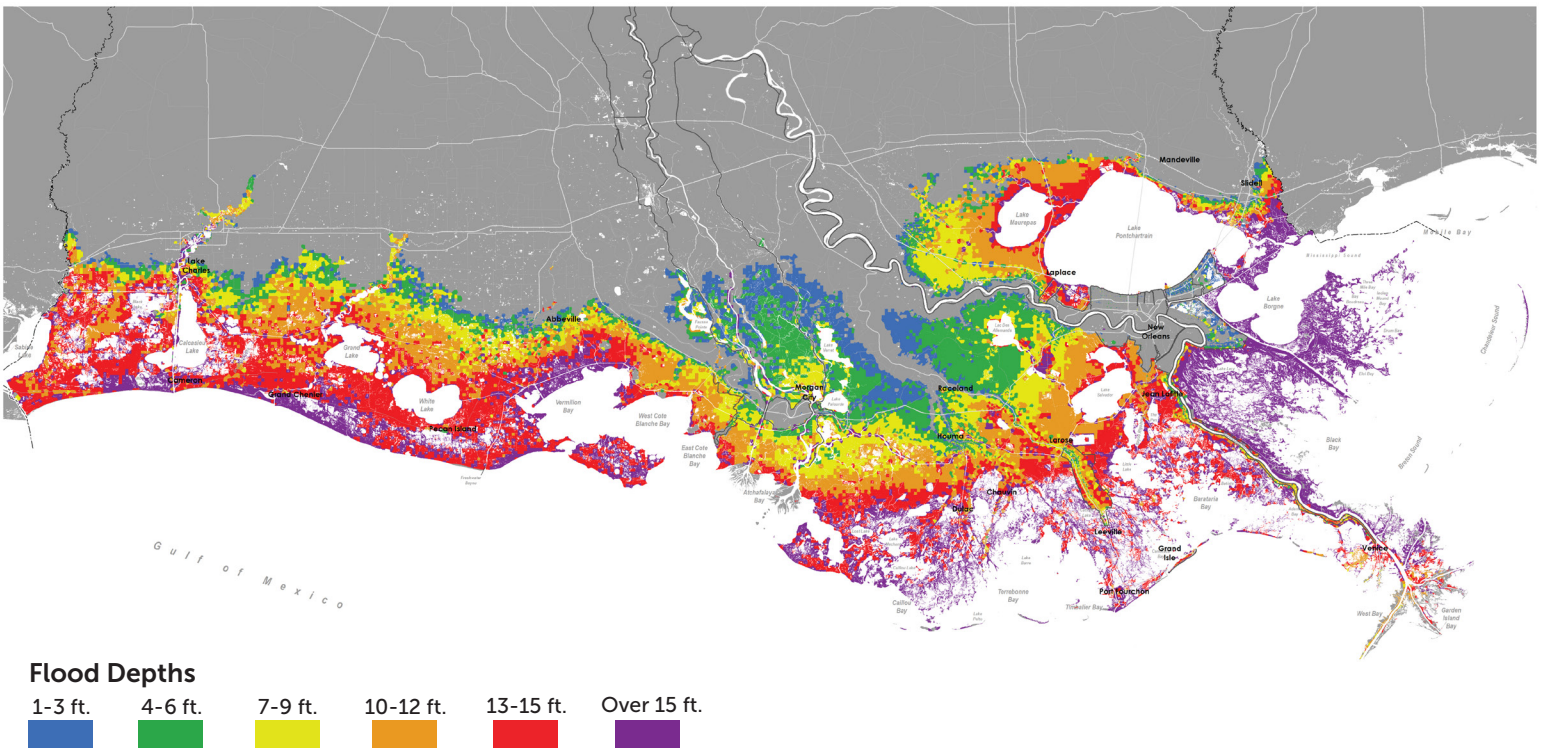
LIST OF ACRONYMS AND ABBREVIATIONS

ACS	American Community Survey
AMI	Area Median Income
ASCE	American Society of Civil Engineers
ASFPM	Association of State Floodplain Managers
BFE	Base Flood Elevation
CDBG	Community Development Block Grant
CPRA	Coastal Protection and Restoration Authority
DFIRM	Digital Flood Insurance Rate Map
DHS	U.S. Department of Homeland Security
LA DOTD	Louisiana Department of Transportation and Development
FEMA	Federal Emergency Management Agency
FRRP	Flood Risk and Resilience Program
FWOA	Future Without Action
GOHSEP	Governor's Office of Homeland Security and Emergency Preparedness
HUD	U.S. Department of Housing and Urban Development
LASAFE	Louisiana's Strategic Adaptation for Future Environments
LMI	Low to Moderate Income
NFIP	National Flood Insurance Program
NIST	National Institute of Standards and Technology
NRCS	Natural Resources Conservation Service
OCD	Office of Community Development
OCD–DRU	Office of Community Development–Disaster Recovery Unit
RLP	Restore Louisiana Program
SFHA	Special Flood Hazard Area
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture

INTRODUCTION

Louisiana's coast is and will continue to be impacted by climate change, primarily relative sea level rise and increases in severe weather events.[1] As a result, continued erosion of the natural environment and increased flood risk for communities and infrastructure are expected (Figure 1).[2]

Figure 1. **100-year flood depths at Year 50 for the 2017 Coastal Master Plan—Future Without Action, Medium Scenario.**



The Coastal Protection and Restoration Authority (CPRA) has developed and periodically updates Louisiana's Comprehensive Master Plan for a Sustainable Coast (Coastal Master Plan). The Coastal Master Plan identifies restoration and protection projects in the southern part of Louisiana that address coastal erosion and increased flood risk. Although many of these responsive projects are under implementation now, the benefits of the investments will not be realized in time for many coastal communities currently at high flood risk, and some voluntary depopulation has already occurred (Figure 2)[3] (CPEX 2015)[4]. In those areas where land is at higher elevation and at lower flood risk but still well within the coastal zone, communities are seeing an increase in population—and with it economic development and infrastructure investments. But, a recent study of the Gulf Coast shows that development in the coastal zone is the main driver behind extreme, infrequent economic losses, and this will continue to be the main factor of major future flood disasters (Reguero et al. 2018). Assuming a two percent compound annual growth rate in assets, two-thirds of the increase in damages in 2030 and 2050 will be due to economic growth and only one-third will be due to climate change. Therefore, the business-as-usual approach to development and growth is no longer feasible and sustainable. A holistic approach grounded in recognizing, acknowledging, and proactively responding to risks is needed to make land use, infrastructure investments, and policy decisions.

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1 EPA, 2017, accessed March 1, 2019. *https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-southeast_.html*

2 Coastal Master Plan, 2017

3 LA SAFE, 2018

4 The View from the Coast, CPEX, 2015

Both CPRA and Office of Community Development–Disaster Recovery Unit (OCD–DRU) have recognized the complexities of societal responses to coastal changes. For communities with current infrastructure at flood risk, the Coastal Master Plan's Flood Risk and Resilience Program (FRRP) provides guidance to reduce economic damages and losses. Recommended direct measures include flood proofing, elevating, and acquiring structures; indirect measures, which often use incentives, encourage communities to concentrate growth and development toward areas with lower flood risk and to build with higher standards. Parallel efforts—such as OCD's Pilot Resiliency Program and Louisiana's Strategic Adaptation for Future Environments (LA SAFE), both supported by disaster recovery funds—have engaged the residents and leaders within eligible parishes in and provided the resources for proactive land use planning to frame strategies for adaptation and future development over time. Although constrained in time and funding, these OCD programs have not yet been directly integrated with the FRRP. Integrating OCD's recent work and lessons learned with the FRRP would provide additional guidance to Louisiana's coastal communities and present a fuller picture of the community-level adaptation challenges they face.

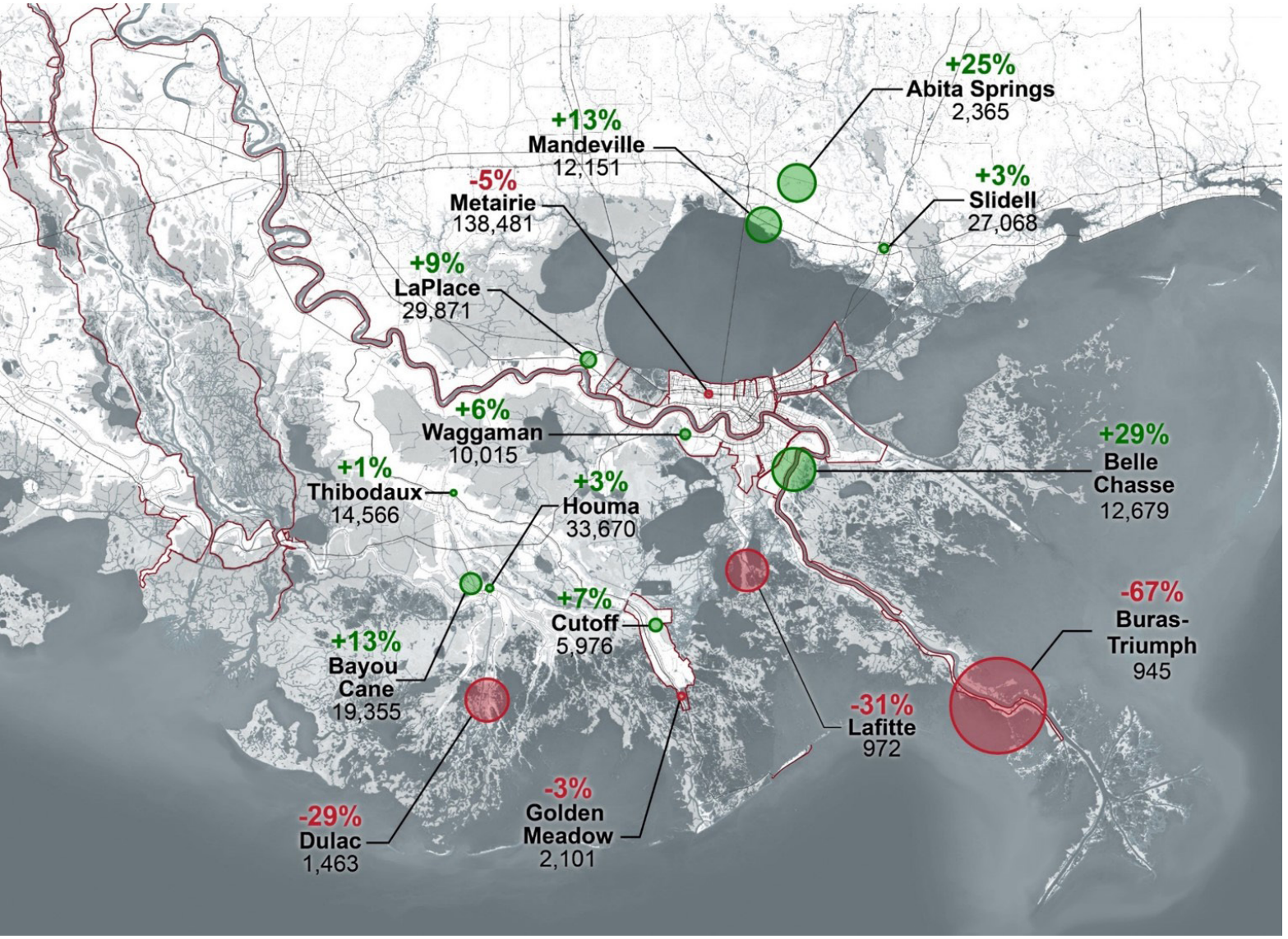

Figure 2. Population increases and decreases between 2000 and 2010 in southeast Louisiana (U.S. Census Bureau).

One key difference between LA SAFE and the Coastal Master Plan analysis, which underlies the FRRP, is the breadth of issues considered. The FRRP's focus is on reducing current and anticipated flood risk for existing structures by elevating and flood proofing properties. The LA SAFE approach is also future-focused in that the strategies to improve conditions and assets respond to the anticipated future flood risk and environmental condition. LA SAFE's program areas include housing, transportation, energy, infrastructure, economic development, planning, and public services/education. Many aspects of the LA SAFE approach involve infrastructure investments other than those that directly target flood risk.

As climate change impacts, restoration and protection projects, resilience planning by state and local governments, and community response to increased flood risk continue to unfold over time, several questions emerge.

1. Are infrastructure investments at the local level influenced by state-level investments? How?
2. Do the protection and restoration projects included in the Coastal Master Plan for near-term implementation warrant a different response at the local level than those planned for implementation in later decades?
3. Should local governments respond differently to Coastal Master Plan projects planned for near-term implementation versus those not expected for decades?
4. To what extent is there coordination and collaboration among parishes and state agencies for planning and implementing risk-reduction measures?
5. What additional factors should be included in the decision-making process of infrastructure investments to support resilience at both the local and state levels?

The approach to addressing these questions is reflected in this proposed evaluation framework for decision-making—Advancing Community Adaptation. The factors used in the FRRP approach for developing community-level projects were assessed. Building on these factors, five identified resilience elements include demographics, household income, critical and essential services, transportation, and environment—all of which are vital aspects of communities. The evaluation framework also recognizes that communities change over time, as does flood risk. Thus, a temporal dimension is included in the framework, guided by the Coastal Master Plan approach to balancing near-term and long-term needs. The near-term evaluation framework considers community character and includes steps designed to further understand and weight factors that are important to communities. As well, the framework encourages the planners and leaders who are using it to get a better understanding of where the community stands currently, where it might want to be in the near term, and what may be required to get there. For the long-term, the evaluation framework considers the coast-wide scale using the same resilience elements. Structured tables pose questions for decision makers on the resilience elements and offer considerations, information needed, and desirable attributes to guide decision-making. ***This framework's main goal is to provide a tool for a more holistic approach to community resilience that can be adjusted to different local circumstances and goals while supporting state-led risk reduction initiatives and efforts.***

NEED FOR THE FRAMEWORK

The 2017 Flood Risk and Resilience Program (FRRP) (CPRA 2017) focuses on "conducting a refined coastal flood risk vulnerability analysis, defining nonstructural project areas, prioritizing projects, and facilitating the implementation of projects." The program is based on risk analysis using estimates of flood depths and economic damages for current and future conditions that considers landscape change and sea level rise. CPRA expects that the FRRP will be implemented through partnership with other state agencies, including GOHSEP, OCD, coastal parishes, and coastal property owners. The FRRP was developed with support from the CPRA Board, the Flood Risk and Resilience Subcommittee and CPRA's Resiliency Technical Advisory Committee.

This framework's objective is to provide a structure through which the FRRP's implementation can consider a broader range of flood risk and resilience issues, which was not possible to incorporate in the master plan's formulation. The framework also offers near-term and long-term considerations relevant for a community interested in flood risk mitigation options and resilience measures.

The 2017 Coastal Master Plan analyses that supported the identification of nonstructural projects used data on residential structures, nonresidential structures, agricultural crops, vehicles, and infrastructure (Fischbach et al. 2017). A number of different data sources was used to characterize assets, and their value, for a series of grid points across the coast. The grid consists of single points representing the centroid of 2010 census blocks with additional, regularly spaced points at one kilometer spacing for areas where the points representing the centroids were greater than one kilometer apart. At each grid point, flood depths were estimated based on modeling of storm surge and waves for a selected set of storms impacting the coast. Using three scenarios of environmental change that could influence landscape dynamics and storm characteristics, storm flooding was estimated for current conditions and 10, 25, and 50 years into the future (Meselhe et al. 2017). Also, future population and asset changes were considered based on how variations in flood depth, land loss, and population density could interact to cause shifts in historical growth rates (Fischbach et al. 2017; see Section 9 for more details). Elevation standards were based on model estimates of the median 100-year flood depths from Year 10 and Year 25 for the high scenario and factored in two feet of freeboard above the estimated flood depth. Generally, nonstructural risk reduction investments designated for the early master plan implementation period use the Year-10 depths, while investments in the final implementation period adopt the mitigation standard from the Year-25 depth.

The 2017 Coastal Master Plan considers the cost effectiveness of nonstructural mitigation to be a function of three factors: the cost of mitigating an asset; the probability distribution of flood depths at the asset's location; and the depth-damage relationship between flood depths and the extent of damage the asset experiences, expressed as a proportion of its actual cash value or total replacement cost. Part of the asset damage values also includes lost income, lost wages, lost sales, disruption costs, and relocation rental costs. Nonstructural projects identified in the 2017 Coastal Master Plan assume an 80 percent participation rate.

The 2017 Coastal Master Plan focused on cost effectiveness but also used an elevation standard based on future expected flood depths. Such considerations represent a more forward-thinking approach than what is traditionally used in flood risk management projects, although there are some variations among existing program. For example, the USACE Southwest Coastal Louisiana Study did consider elevations associated with the zero- to 25-year flood zones, based on the estimated 2025 floodplain, as the first increment of risk reduction, enabling the reduction of damages associated with more frequent flooding than the 100-year flood depth. While there may be some variation in how elevation standards are established and how changing future conditions, such as sea level rise, are considered, most established flood risk management programs include cost effectiveness of mitigating damages as a primary factor in decision-making.

Louisiana's Strategic Adaptation for Future Environments (LA SAFE) provides a broader view of community resilience. LA SAFE is a statewide resilience policy framework focused on helping communities plan for—and implement—safer, stronger, and smarter land use and development strategies (LA SAFE 2018). The program conducted grassroots engagement and outreach to drive the goals and objectives of its plan-making process. The planning process' main goal was twofold: (1) to develop a forward-looking comprehensive plan that incorporates potential climate change impacts and (2) to co-design the future vision of the community with its own members. Through partnering with local nonprofits, community outreach and engagement efforts focused on bringing traditionally underrepresented community members into the discussion. The LA SAFE program was active in six parishes—Jefferson, Lafourche, Plaquemines, St. John the Baptist, St. Tammany, and Terrebonne. Each parish developed their own vision and strategies and prioritized potential projects that will address risk, vulnerabilities, and community development opportunities in targeted geographic areas. Focus areas include housing, transportation, energy, economic development, infrastructure, and risk reduction.

It is widely recognized that social impacts of hazard exposure, such as coastal flooding, often fall disproportionately on society's most vulnerable populations, including children, seniors, low-income earners, people who are marginalized, and people who are disabled. Residents' demographic and social characteristics that make some communities more vulnerable than others include age, gender, race, socioeconomic status, and special needs populations (Hemmerling and Hijuelos 2017). To ensure equitable implementation of risk reduction projects, social justice must be deliberately considered; analysis shows that Louisiana's marginalized population may be more exposed to flood risk (Colten et al. 2018; Dalbom et al. 2014). While these factors are undoubtedly important, it is presently difficult to include them in prospective analysis of flood risk and mitigation during project planning. However, it is possible to consider them more fully in the implementation of projects, especially nonstructural projects, that deal with specific locations and properties, and thus affect specific residents. The framework is intended to provide options that enable a more holistic approach to community risk reduction that can be adjusted to different local circumstances and goals.

A recent capability and capacity assessment of coastal parishes in relation to the FRRP (Foster et al. 2018) notes the need for any statewide program to be adjustable to local needs. In an effort to provide a complementary resource for the FRRP, the framework allows for flexibility to meet different needs and looks to a wide array of issues pertaining to community resilience, not just housing and flood risk. It is designed to use commonly available information to facilitate local government participation and not place an excessive burden on those preparing proposals. It also seeks to leverage local knowledge of communities as well as their needs and priorities. At the same time, the framework shows how long-term, proactive thinking about community needs at a regional scale can utilize a broad set of considerations underlying regional resilience.

Elements of Community Resilience

What makes a community resilient? This topic has been the subject of substantial discussion and study (e.g., Cutter et al. 2013; Koliou et al. 2017).[1] A recent study by the National Academies of Sciences, Engineering, and Medicine (NASEM 2019) identified resilience as multidimensional and noted six community capitals or dimensions (Figure 3)—natural, built, financial, social, political, and human and cultural—as relevant to a community's ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.

At a community level, functions that contribute to resilience are housing/shelter, economics, health care, education, food security, public safety, transportation, culture, and recreation. These functions are delivered through and rely on both physical systems (e.g., buildings, transportation, and communications networks) and social systems (e.g., personnel and staff, public assistance, and health care). Communities organize themselves to provide functions to their members through social institutions including family/kinship; economics; government; health care; education; and community service, religious, cultural, and other organizations. Resilience is complex because communities are complex. Numerous layers of structure and organization, which are often interdependent, make a community function. As a result, a community's resilience has multiple dimensions. Such uniqueness makes it difficult to compare and transfer resilience approaches that have been successful in one community to another. Local knowledge will always be required to assess the condition and function/dysfunction of various components.

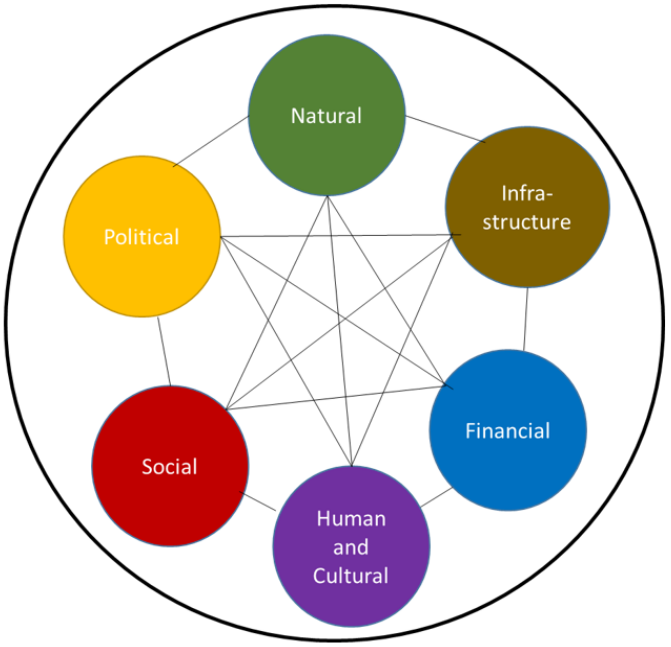

Figure 3. Community Dimensions of Resilience, NASEM 2019

Cutter et al. (2008) notes that constructing resilience measurement techniques is also complex because the conditions defining resilience are dynamic and change with differences in spatial, social, and temporal scales. A community may be deemed as resilient to environmental hazards at one time scale (e.g., short-term phenomena, such as an individual storm) because of mitigation measures that have been adopted but not at another (e.g., long-term circumstances, such as sea level rise).

1 For example, the National Institute of Standards and Technology (NIST) has published planning guides for resilience on buildings and infrastructure and has funded a Community Resilience Center of Excellence. See *https://www.nist.gov/topics/community-resilience* for more information. In 2018, the Congressional Research Service issued the report Flood Resilience and Risk Reduction: Federal Assistance and Programs, which is available at *https://fas.org/sgp/crs/misc/R45017.pdf*.

In this framework, several key elements are used to summarize community character that can be used to support decision-making. Given the institutional context of the Coastal Master Plan and its implementation, governance is not considered explicitly. Similarly, broader ecological resilience is deemed to be encompassed by master plan focus on coastal restoration.[2] The FRRP addresses community competence at the local government scale through consideration of hazard mitigation planning and other factors related to parish planning for flood risk and its mitigation to reduce economic damage. The five resilience elements identified here are demographics, household income, critical and essential services, transportation, and environment.

This section describes each element and how it relates to community resilience. Potential data sources that could be used to characterize each element are described in Appendix 2. The Framework Approach section describes how these elements could be considered in near- and long-term efforts to reduce coastal flood risk and increase community resilience in coastal Louisiana.

Demographics

The ability to tolerate and respond to flooding depends on an individual's circumstances, which influence their ability to respond (see later sections) and their needs. For example, physical, economic, and social aspects of aging pose additional challenges for older adults. Older residents are more likely to have mobility issues that make evacuation in the event of a storm more difficult for them and that require additional facilities for mitigation approaches, such as elevators for raised homes. Older residents are more likely to be on fixed incomes, making rising insurance costs a significant financial burden, and more reliant on the provision of other local community services, such as health care. They may rely on public transportation or government-provided transportation services for health care visits and access to other community services.

Working-age adults in rural communities need access to employment, including reliable transportation networks, and to local services, such as banking, grocery stores, and other retail outlets. Families with children need schools within reasonable distances, especially for younger children, and affordable child care, especially for single parents.

Many of Louisiana's coastal communities were established by indigenous people, in part because European settlers arriving in the eighteenth century drove them toward the southern reaches. Currently, descendants of indigenous people populate many of the state's most vulnerable communities, and several tribes still reside within Plaquemines and Terrebonne Parishes.[3] Dalbom et al. (2014) identified that Asian and Hispanic populations are significantly more exposed to flooding risks in southeast Louisiana than non-Asian and non-Hispanic populations, respectively. Independent of income, historically marginalized groups are likely to occupy more vulnerable positions in the social order, more likely to be located in hazardous locations, and less likely to have connections to outside centers of power and influence (Dunning and Durden 2011).

2 Linkages between long-term landscape change and community resilience are considered in later sections.

3 As an example, the residents of Isle de Jean Charles, many of whom are members of the Biloxi-Chitimacha-Choctaw Tribe, live on an island that has lost about 90 percent of its land mass in the last 50 years due to relative sea level rise and coastal erosion.

Household Income

Poverty increases vulnerability to environmental hazards and stresses. Lower-income households have fewer resources to dedicate to preparing for and recovering from an adverse event. Their economic livelihoods are more likely to be disrupted by flooding because their jobs may offer little protection against employment disruptions. People living in poverty are also more likely to live in high-risk areas with greater degrees of exposure to those risks. Low-income households also endure the greatest difficulty affording homeowner's insurance and flood insurance.

A 2016 study on the rising cost of homeowner's insurance since 2005 shows that, while household income has risen 21 percent, premiums have risen by 67 to 85 percent in the same time frame. In some coastal parishes, the premiums have risen by more than 200 percent. As a percentage of household income, homeowner's insurance premiums are considerably higher in coastal parishes (Sorrells 2016).

A recent study of affordability of flood insurance (DHS 2018) shows that, based on Area Median Income (AMI) for both NFIP policyholders and non-policyholders, a greater proportion of households with income levels of moderate or below live in Special Flood Hazard Areas (SFHA) (Table 1). In this same report, data for Louisiana show that household median income is $1,594 higher for those living outside SFHAs and that residents living within SFHAs who have NFIP policies have household median incomes almost $40,000 higher than those without flood insurance.

Individuals and families with lower incomes and little or no savings are more vulnerable to flood- or disaster-related impacts, including health care- or injury-related costs, direct property damage, vehicle damage, transportation infrastructure or transit service interruptions, school or childcare disruptions, and employer effects, such as temporary shutdowns. Any of these can be the last straw that pushes a vulnerable household into an economic crisis.

Table 1. Distribution of income for NFIP Policyholders and Non-Policyholders (DHS 2018)

	Policyholders		Non-Policy Holders		All Households
	In SFHA	Outside SFHA	In SFHA	Outside SFHA	
Extremely low income (<= 30% AMI)	6%	4%	16%	12%	12%
Very low income (31 to 50% AMI)	7%	6%	16%	12%	12%
Low income (50 to 80% AMI)	13%	11%	19%	17%	17%
Moderate income (81 to 120% AMI)	18%	16%	19%	19%	19%
Middle income (121 to 165% AMI)	17%	16%	12%	16%	15%
Higher income (> 165% AMI)	39%	47%	17%	24%	25%
Total Households	1.8 M	1.9 M	3.3 M	101.1 M	108.1 M

Source: FEMA analysis of NFIP policyholder data and U.S. Census Bureau ACS data. NOTE: Data weighted using ACS sample weights. Number of households in parentheses; M = millions

Critical Facilities and Essential Services

Many basic community functions depend on reliable provision of services and the availability of facilities. FEMA identifies critical facilities as buildings and other structures that house or provide services crucial to human health and safety.[1] This category includes water and wastewater treatment facilities, municipal buildings, educational facilities, and non-emergency health care facilities (Category III). FEMA separately categorizes buildings and other structures designated as essential facilities (Category IV). These include hospitals and fire, rescue, ambulance, and police stations. The Association of State Floodplain Managers (ASFPM)[2] categorizes critical facilities as those that are essential to a community's resiliency and sustainability. Such facilities meet the needs of residents on a routine basis and enable response to and recovery from flooding. According to ASFPM, critical facilities should never be flooded because of economic, social, and environmental impacts and would not normally be located in a floodplain. Sometimes, there are no practical alternatives to locating the facility in a floodplain, and some federal guidelines have required protection from a potential 500-year flood event.[3] The American Society of Civil Engineers (ASCE) Standard 24-05[4] and the International Building Code[5] also provide minimum standards for some category structures.

The status of some of these facilities has recently been examined by CPRA in relation to the 2017 Coastal Master Plan's current and future flood risk estimates (Figure 4, Figure 5). Table 2 shows that few facilities are currently at risk of flooding, but within the next 50 years, the risk increases dramatically for existing and future facilities.

Emphasis on residential properties' risk reduction may reduce some damages associated with flooding. However, the provision of critical and essential services, many of which need to be in close proximity to population to be effective, requires that these facilities also be considered in terms of flood risk and overall community resilience.

Table 2. Expected Changes in Flood Risk (1% flood event) for Selected Critical and Essential Facilities

(http://bit.ly/CPRAhealth; http://bit.ly/CPRAeducation)

	Current Risk		Future Risk (50-Year FWOA)	
	%	#	%	#
Hospitals	3%	2	15%	11
Medicaid providers	1%	1,560	13%	13,240
Medicaid recipients	4%	36,600	14%	131,100
K–12 schools*	4%	30	17–21%	130–160
Early childhood education centers**	3%	20	12–18%	110–160

*Impacts 12,700 students and $167 million in damages under current conditions; 67,000–88,800 students and $897 million to $1.2 billion in damages under future conditions.

**Impacts 1,400 children and $4 million in damages under current conditions; 6,600–9,600 children and $18–27 million in damages under future conditions.

1 *https://www.fema.gov/critical-facility*

2 *https://www.floods.org/ace-files/documentlibrary/Whitepapers/ASFPM_Critical_Facilties_and_Flood_Risk_Final_Feb_2011.pdf*

3 *https://www.archives.gov/federal-register/codification/executive-order/11988.html*

4 *https://ascelibrary.org/doi/book/10.1061/9780784408186*

5 *https://www.iccsafe.org/codes-tech-support/codes/2018-i-codes/ibc/*

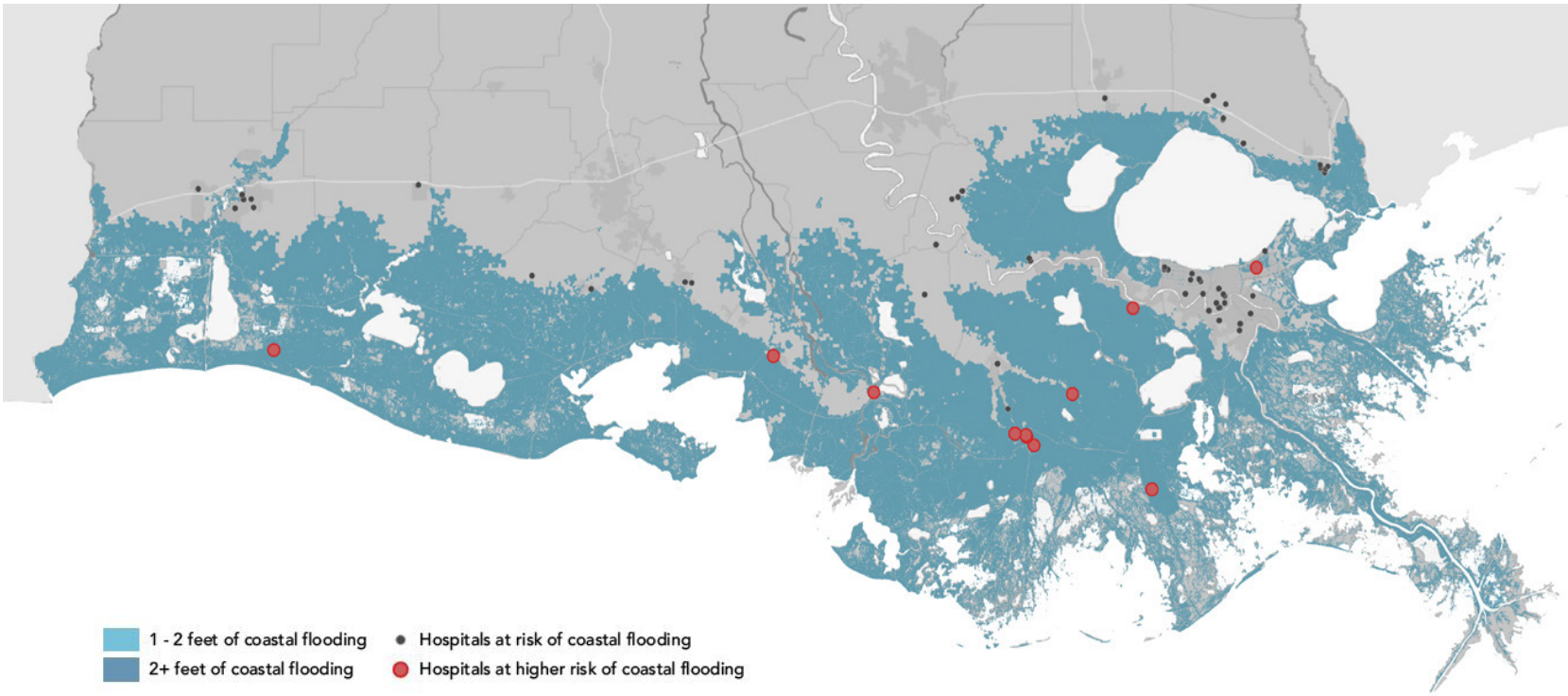

Figure 4. Future Coastal Flood Risk to Hospitals, 50-Year FWOA (CPRA, 2017)

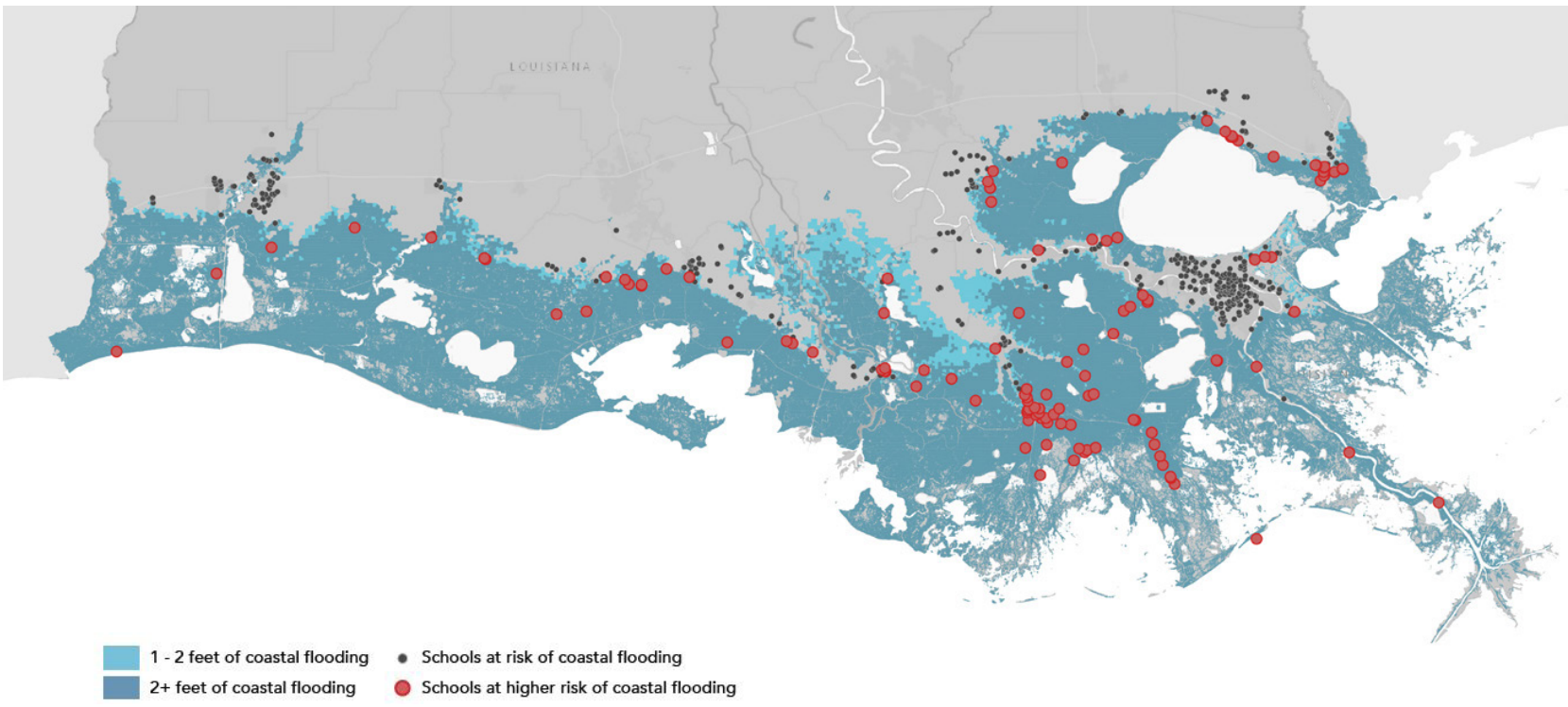

Figure 5. Future Coastal Flood Risk to Schools, 50-Year FWOA (CPRA, 2017)

Transportation

Local and regional transportation systems support commerce, connect people to activities, jobs, and services, and provide an evacuation network in case of emergency. Transportation infrastructure is at risk from flooding because of both submergence during an event and damage from erosion, undercutting, scour, and other related condition, which occurs underlying substrates become waterlogged and flooding frequency/exposure increases due to relative sea level rise. Temporary or permanent loss of transportation infrastructure can have serious impacts on many community functions, including education, commerce, and employment as well as evacuation and recovery. Many rural communities in coastal Louisiana are served by single roads, and this lack of redundancy in the transportation system increases their vulnerability.

Current flood risk levels for coastal roads, as with critical and essential facilities, are low, but the risk is expected to increase dramatically in coming decades (Figure 6). Table 3 shows the extent of the problem associated with a flood that has even a one percent chance of occurring. The costs noted for repairs and replacements do not include the cost of business disruption or other key service interruptions.

Table 3. Current and Future Flood Risk for Coastal Roadways in Louisiana (http://bit.ly/CPRAtransportation)

Current Risk	Future Risk (50-Year FWOA)
4,100 miles of road flooded $1.2 billion in repairs or replacements	8,600-10,300 miles of road flooded $2.5–3 billion in repairs or replacements
	50-70 miles of I-10 flooded $35–47 billion in repairs or replacements
	100-120 miles of US 90 flooded $51–64 million in repairs or replacements

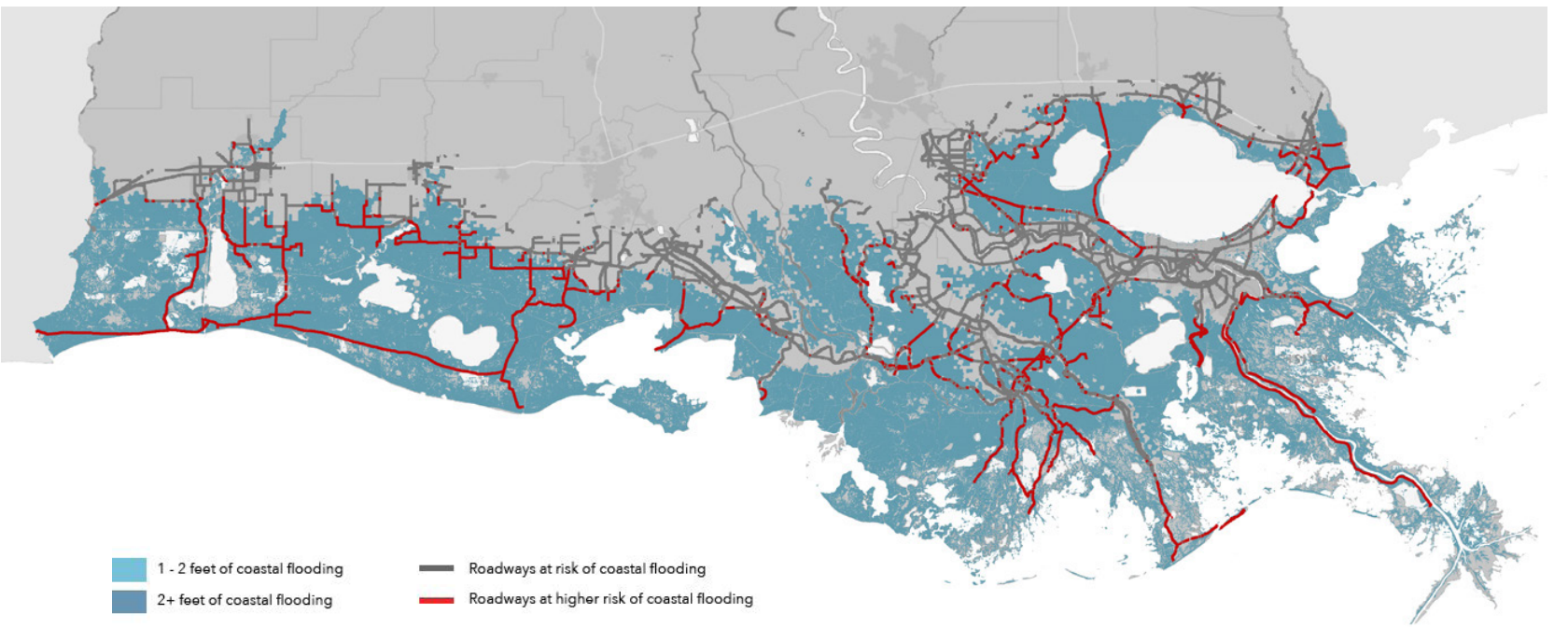

Figure 6. Future Coastal Flood Risk to Roadways, 50-Year FWOA (CPRA, 2017)

NIST (2016) describes the links between transportation and various social institutions, which illustrates the importance of transportation to many aspects of community life and well-being (Table 4).

Table 4. Purpose of Transportation within Each Social Institution (NIST 2016)

	Purpose of Transportation within Each Social Institution
Family	Access to and from housing—e.g., to and from locations for employment, social events, shopping, and other locations important to the family.
Economic	Distribute goods for processing; obtain labor and capital; distribute intermediate goods; distribute final goods and products for sale; bring sellers (providers) and consumers together; transport of products; getting to and returning from work.
Government	Provide access to services; facilitate delivery of services (including emergency response, patrol, and surveillance); provide physical access to lawmakers and law-making bodies; provide physical access to legal venues; transport of products.
Health	Provide access to and from health services for patients; provide access to and from hospitals/clinics/offices for staff; delivery of equipment, materials, and supplies.
Education	Provide access to and from educational services for students/parents; provide access to and from schools/offices for teachers, administrators, and support staff.
Community Service Organization (CSO)	Provide access to and from CSO services for clients; provide access to and from CSO offices for staff and volunteers; transport of products.
Religious Organization	Provide access to and from religious and cultural services for congregation and community members; provide access to and from religious and cultural places of worship or practice/offices/centers for leaders, staff, and volunteers.

Environment

Natural landscapes help define the character of our nation and our communities. Having access to the natural environment is important for recreational opportunities as well as quality of life. For many, it is also their source of sustenance. Overall, people care about conserving recreational, scenic, working, and environmentally valuable lands. In Louisiana, this is manifest through the close ties many communities have to their surrounding wetlands and, more generally, by the importance Louisiana's residents as a whole have placed on coastal issues and restoration through constitutional amendments[1] and frequent surveys.[2] Within communities, parks and natural areas have economic value. Protected open space increases the property values of nearby homes and attracts tourism and recreation. FEMA allows for environmental benefits to be added to a project's net benefits—if the project already has a benefit cost ratio of 0.75—using "traditional" benefits. Coastal Louisiana's distinctive landscape can make a community a great place to live, and local residents want to preserve that character.

A corollary to valuing and maintaining the natural environment is protecting it and its residents from threats. Industrial assets may be vulnerable to direct damage during storms as well as from flooding, with the potential to cause hazardous material releases as well as other physical damage. Ensuring that the infrastructure supporting the oil and gas and chemical industries is protected from and adapted to hazards is important, both to sustain the industry's important contributions to the local economy and to protect residents and the environment from the potentially hazardous effects of a failure or breakdown. Coastal Louisiana residents are familiar with the working coast and appreciate the employment opportunities it has provided. The memory of the 2010 Deepwater Horizon oil spill and its consequences for the health of the coastal ecosystem and exposed residents provides a reminder that considering environmental issues in coastal Louisiana is more than just reducing wetland loss and rebuilding barrier islands.

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1 For example, the Louisiana Wetlands Fund constitutional amendment was approved in 1989. This measure required that at least $5 million a year from state mineral revenue must be used to conserve Louisiana's wetlands. In 2006, the Coastal Protection and Restoration Fund was designated to receive eligible federal revenues received by Louisiana generated from Outer Continental Shelf oil and gas activity and specified that such funds be used only for purposes of "coastal wetlands conservation, coastal restoration, hurricane protection, and infrastructure directly impacted by coastal wetland losses."

2 In the 2016 Louisiana Survey conducted by the LSU Reilly Center for Media and Public Affairs, only five percent of respondents indicated that spending for coastal protection and restoration should be decreased, with 41 percent indicating they favored an increase. For more information, visit *https://pprllsu.com/wp-content/uploads/2016/04/Louisiana-Survey-2016-Full-Report-FINALv3.pdf*. Restore the Mississippi River Delta's poll information can be accessed at *http://mississippiriverdelta.org/new-poll-shows-louisianians-overwhelming-bipartisan-support-for-coastal-restoration/*.

Context for Community Resilience

The elements described previously provide context for decision-making about the mitigation of flood risk to structures within coastal communities and the services and infrastructure necessary to support the population benefiting from the mitigation. However, the community's status, its housing stock, its supporting infrastructure; and its context with the wider landscape of coastal planning need to be considered. This section discusses coastal flood risk and points to some community and coast-wide issues that have important implications for risk reduction programs.

Flood Risk Context

The level of coastal flood risk varies across the coast due to landscape gradients and features and within communities due to local elevation changes and features that impact water flows. The FRRP Framework indicates that CPRA will prioritize properties with the highest flood depths. Flood depth varies among properties but can be categorized to enable to broader view of overall risk to a community within which individual properties are located. For example, the Restore Louisiana Program (RLP) defined High-Risk Communities as those where "a recognized government entity is actively applying or taking steps to participate in" one of several programs that help mitigate community flood risk. Examples of these programs include the USDA NRCS's Emergency Watershed Protection Program–Floodplain Easement[1] (or similar program), the FEMA Severe Repetitive Loss (SRL) grant program, or other programs or coordinated efforts to buyout and/or relocate entire at-risk neighborhoods. More specifically, RLP defines High-Risk Areas as federally determined floodways. LA SAFE categorized the range of possible flood depths for communities, enabling a more regional approach to thinking about risk and its consequences. These were designated into three risk areas (Figure 7):

- **Low-risk areas** (0–3 feet projected flood depths within the 100-year floodplain[2]) have development opportunities to receive populations and economic activity from more flood-prone environments.
- **Moderate-risk areas** (3–6 feet projected flood depths within the 100-year floodplain) are conducive to maintaining current population levels and economic trends, provided such communities orient future development and mitigation activities in alignment with future flood risk projections.
- **High-risk areas** (greater than 6 feet projected flood depths within the 100-year floodplain) can expect to experience population decline and economic losses, up to and including full community-scale resettlement, as environmental conditions deteriorate and repetitive severe flood events take place.

The 2017 Coastal Master Plan flood depths used by LA SAFE incorporated future sea level rise and other changes and included the effects of proposed structural risk reduction projects but only considers flooding associated with coastal storms. The proposed Digital Flood Insurance Rate Map (DFIRM) data consider only completed federally certified flood risk structures and do not consider future sea level; however, the data incorporate the effects of flooding caused by precipitation. Using the greatest flood depth from each of these sources provides an overview of future flood risk. However, both methods focus on the flood event with a one percent chance of occurring in any year, while more frequent flood events can also cause damage and disrupt community life. Actual future flooding at a property or within a community is difficult to predict because of the potential effects of climate change such as rainfall, relative sea level rise, individual storm characteristics, and continual changes—generally improvements—in local, state, and federal structural risk reduction efforts.

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1 *https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/ewp/?cid=nrcs143_008225*

2 LA SAFE flood risk areas are based on 2017 Coastal Master Plan 50-year flood depth projections under a Medium Environmental Scenario and FEMA's proposed DFIRM floodplain data.(see Figure 7)

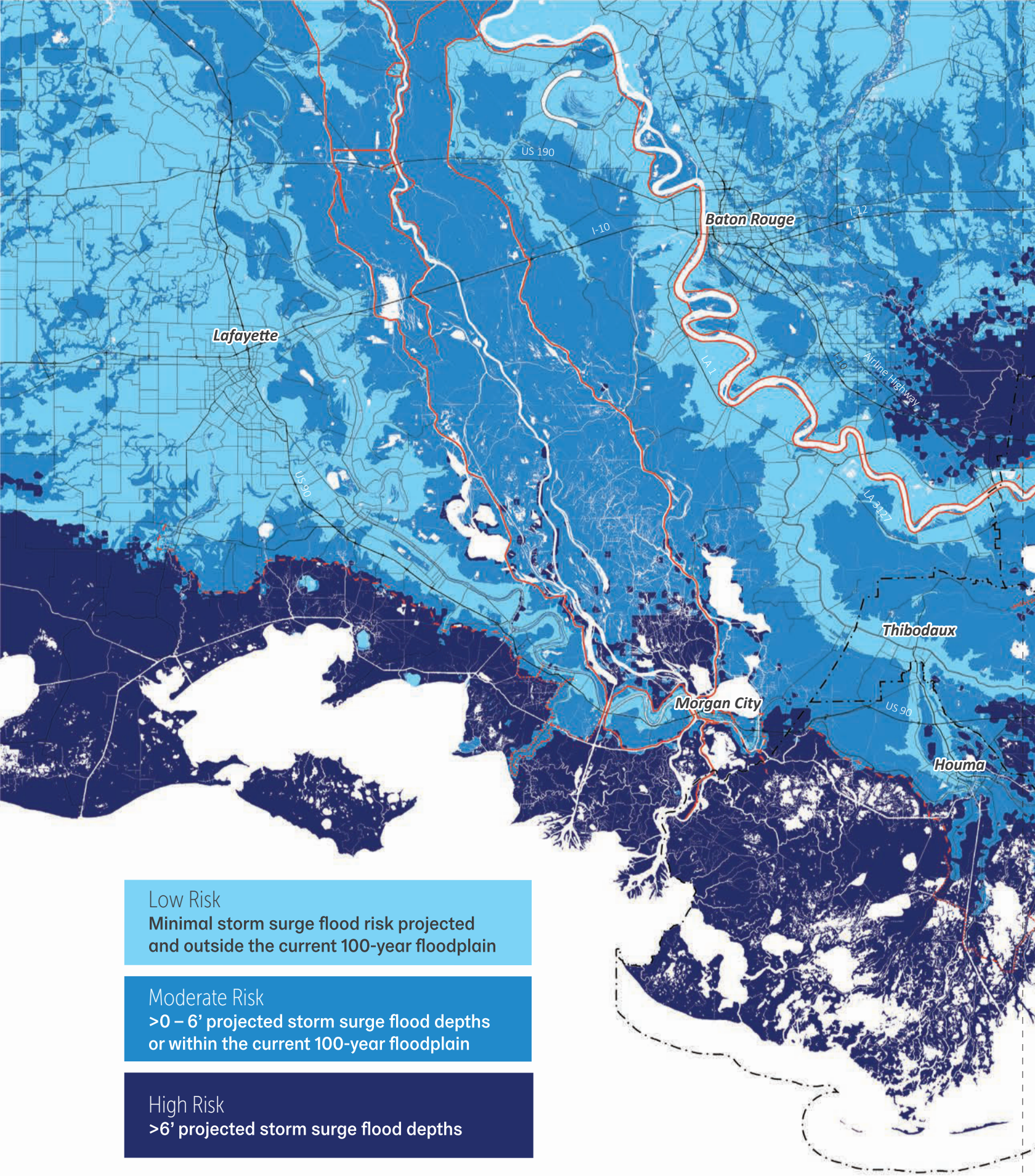
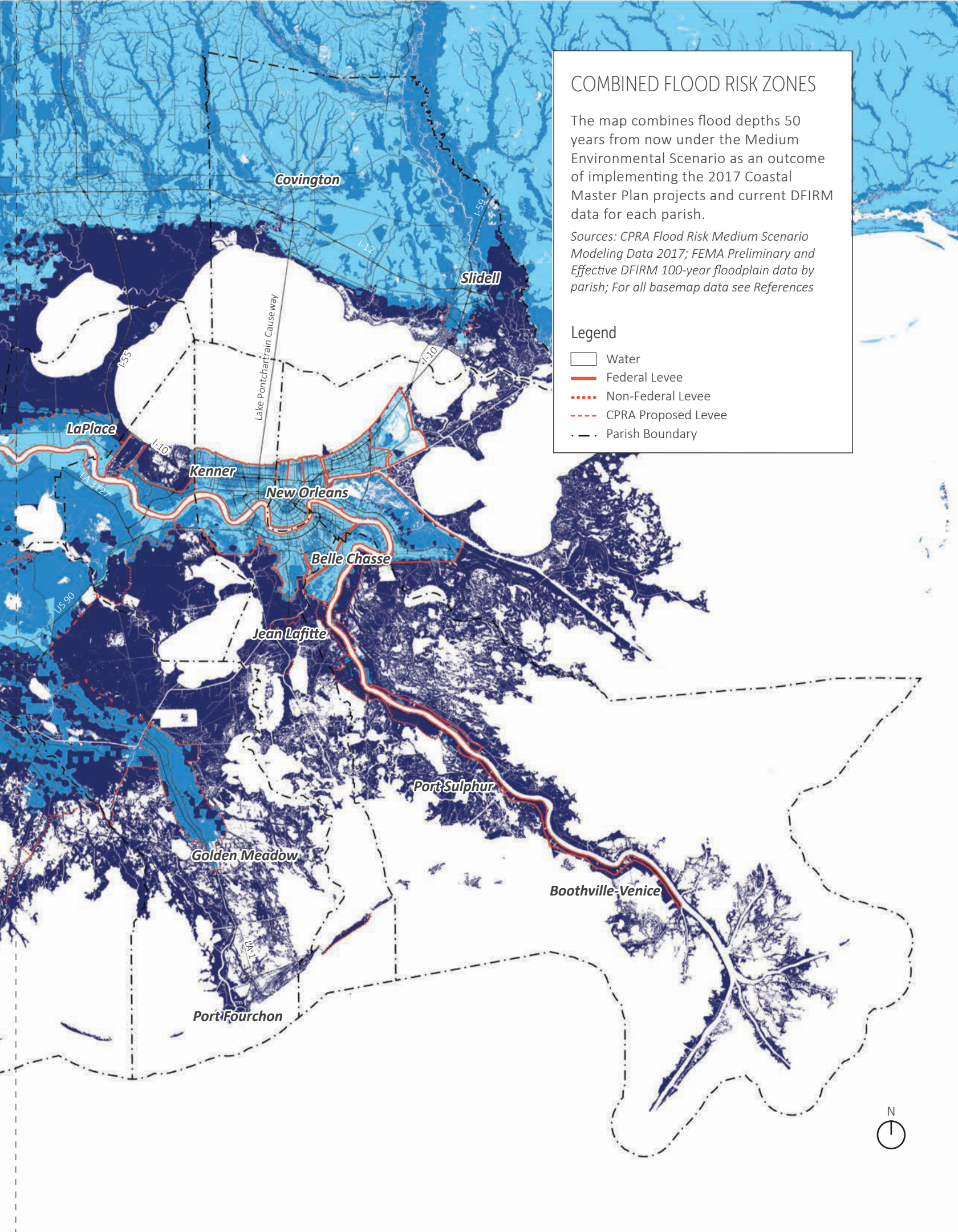


Figure 7. Future Flood Risk and Risk Areas per LA SAFE (LA SAFE, 2018)


COMBINED FLOOD RISK ZONES
The map combines flood depths 50 years from now under the Medium Environmental Scenario as an outcome of implementing the 2017 Coastal Master Plan projects and current DFIRM data for each parish.
Sources: CPRA Flood Risk Medium Scenario Modeling Data 2017; FEMA Preliminary and Effective DFIRM 100-year floodplain data by parish; For all basemap data see References
Legend
Water
Federal Levee
Non-Federal Levee
CPRA Proposed Levee
Parish Boundary
Covington
Slidell
LaPlace
Kenner
New Orleans
Belle Chasse
Jean Lafitte
Port Sulphur
Golden Meadow
Boothville-Venice
Port Fourchon
I-12
I-59
I-55
I-10
Lake Pontchartrain Causeway
LA 1227
US-90
LA-1
N

Community Context

Targeting nonstructural measures to reduce flood risk on a property-by-property basis enables specific conditions of the structures to be considered. The FRRP prioritizes mitigation of properties contiguous to one another because this creates a more seamless project, and it can lead to efficiencies in implementation (USACE 2016). For acquisition projects, this will result in a larger, continuous parcel of land that offers more open space benefits to recreation, conservation, or water management efforts. For elevation and flood-proofing projects, this will result in a more uniform streetscape post-project. Details about individual properties and elevation feasibility is considered as part of the FRRP application. However, FRRP implementation guidance also recognizes that several issues can impact the feasibility of elevating a property. These issues may reduce the likelihood of elevating neighborhoods or streets under the program. FRRP funds cannot be used to ensure wind protection measures are included as needed for elevated structures, which impacts homeowner's insurance. The funds also cannot be used to ensure that raised homes meet required code changes—such as electrical wiring upgrades—unless the need is a direct result of the elevation or flood proofing project. This could leave considerable risk of property damage and/or result in additional costs for homeowners, for which grants may or may not be available.

These implementation constraints are important considerations for efficient allocation of scarce resources for flood risk mitigation. However, they raise larger issues about the long-term expectations for elevated or flood proofed properties. What is the life expectancy of the elevated structures? What is the expectation for future provision of services and transportation? Is the community in an area that has been targeted for development or investment by the parish? What are the long-term impacts of relative sea level rise for the area?

The specifics of these questions will vary among communities. However, parish mitigation plans can provide an indication of the planned activities that support hazard mitigation in the communities of interest. These could include issues that address hazards others than flooding, such as wind, but which can work in concert with properties' flood risk mitigation to lower overall risk. They could also include actions to improve reliability of utilities or other services vital to the community. Parish master plans may identify areas for future development or infrastructure focus. While many of these plans are strategic in nature, local ordinances and building code enforcement, for example, as well as the parish's pattern of proactive investments can be used to identify communities that are foci for resilience planning and action. Whether flood risk mitigation funds should be spent in these areas or those not targeted for other investment depends upon the overall goal of the flood risk reduction program. Refer to the Framework Approach for more information.

Coastal Context

In the 2017 Coastal Master Plan, coastal flood depth predictions consider the effects of coastal land loss and restoration on flood depths. Individual restoration projects provide limited contributions to reduce storm-related flood risk; the effects on more frequent flooding have not been analyzed. Even if ongoing and planned coastal restoration efforts do not make substantial contributions to flood risk mitigation, considering continued land loss and plans for restoration are important for coastal resilience. Depending on the community, changes in the landscape's physical (e.g., wetland extent and location, barrier island status) and dynamic (e.g., salinity patterns, tidal exchanges) character can affect infrastructural, environmental, and economic conditions. For example, variations could impact the viability of roads, the environmental settings for coastal communities, and the future distributions of recreational and commercial fisheries habitat, which is an important source of income and sustenance in some communities. Where a community is in relation to other planned coastal investments is thus a factor in long-term coastal resilience planning and implementation.

Flood Resilience Decisions

There are several potential funding sources for nonstructural flood risk mitigation. Some have specific requirements to identify cost-effective solutions, while others provide more flexibility. Appendix 1 describes programs and their criteria - which represent a top-down view of what is important and often focus on maximizing risk reduction in economic terms. A more bottom-up approach was taken by LA SAFE that used a grassroots engagement and outreach effort to drive the goals and objectives of its plan-making process and, at the same time, worked to educate residents and stakeholders about future flood risk. The engagement process identified potential projects using a collaborative planning process that included residents, elected officials, and key stakeholders. Final project selection was based on

1. Whether a project met specific eligibility and baseline criteria
2. Additional weighted selection criteria
3. Considerations applicable to funding an array of programs and projects across multiple priority program areas,with the intent to build a funding portfolio that maximizes available resources and demonstrates how different project types can achieve multiple benefit.[1]

The LA SAFE process ensured community interests are considered in a program's overall design but recognized that implementation is often constrained by the funding sources' requirements.

The array of federal programs outlined in Appendix 1 show that reducing flood risk and promoting resilience are federal policy objectives. However, federal agencies are not proximate decision makers on where assets are located or what actions are taken. Households and businesses make decisions about location based on many factors, not only flood risk. Businesses will base decisions on profitability, including considerations such as distance to suppliers or resources, distance to markets and transportation access, and proximity to competition or complementary businesses and skilled employees. For coastal Louisiana, many commercial activities are coast-dependent sectors—such as ports, fisheries, and oil and gas companies—which leads to a limited number of economically viable options. Households, however, could consider a range of location-specific amenities or disamenities, such as crime rates, school quality, and public transit availability as well as distance to employment and proximity to recreational facilities. But these location decision factors assume that affordable housing is available equally across flood risk zones, and that individuals have real choices to locate in areas of lower flood risk. Constraints on choices at the household level can be important determinants of who lives where and who is at risk from flooding.

Local and state governments have key roles in most of the programs identified in Appendix 1. Resilience decisions are only one part of an overall set of considerations driving policy and direction. As discussed above, in Louisiana, parish master plans can provide overviews of where development is expected to be focused and which areas are not targeted for development. Local regulations and ordinances—such as zoning and coastal zone management or floodplain management plans—also provide background against which to consider flood resilience decisions. Across coastal Louisiana, flood risk is already high, and there are abundant opportunities for reducing flood risk. When a local or state government allocates taxpayer funds to one project versus another, it often has had many options to select from, and a project that moves forward inherently shows where priorities and opportunities intersect. This also applies to grant applications for flood risk reduction projects. While individual funding programs have specific requirements, those can be met in several different ways and what is included in applications reflects both widespread need and government priorities.

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1 *https://lasafe.la.gov/wp-content/uploads/2018/09/LASAFE_Guidelines_Operational_v1_09162018.pdf*

FRAMEWORK APPROACH

To move toward community resilience, both near-term actions and long-term plans need to consider factors beyond cost-effective flood risk reduction. The framework proposed here provides a way to reflect on the key community resilience factors in the context of long-term coastal change. It is organized around two strategies for considering community resilience.

- **Near-Term Existing Communities Resilience**. The focus is on actions that can make a difference to communities where they are now and can mitigate risk for the existing building inventory. The time frame is the next 20 years or so into the future. Analysis shows that coastal land loss and flood risk increase markedly in later decades of the Coastal Master Plan's 50-year planning horizon.

- **Long-Term Regional Resilience**. The focus is on actions that prepare for the future and transition some communities to areas of future lower flood risk, e.g., considering the future building inventory. For most Louisiana coastal communities, flood risk increases dramatically between Year 25 and Year 50 as sea level rise and coastal land loss take their toll.

Each strategy encompasses the five identified community resilience elements listed on page 13-20 as well as broader local and coast-wide contextual issues. The framework shows how these and other factors can be considered in a structured way to guide investments to more holistic, resilient outcomes than those based largely on cost-effectiveness. The approach is designed to be applicable to a variety of local circumstances, guiding this framework's users to explicitly consider a range of factors while not prescribing a best or optimal approach.

Flood Risk

As noted above, the strategies are based on the expectation that flood risk changes over time. Changing levels of flood risk can also be used to guide where the two strategies can be most usefully applied. The 2017 Coastal Master Plan identifies three approaches to flood mitigation with recommendations based on flood depth (Figure 8).

- **Flood proofing of nonresidential structures**. Recommended in areas where the mitigation standard is less than three feet.
- **Elevation of residential structures**. Recommended in areas that where the mitigation standard is between three and 14 feet.[1]
- **Voluntary acquisition for residential structures.** Recommended in areas where the mitigation standard is greater than 14 feet.

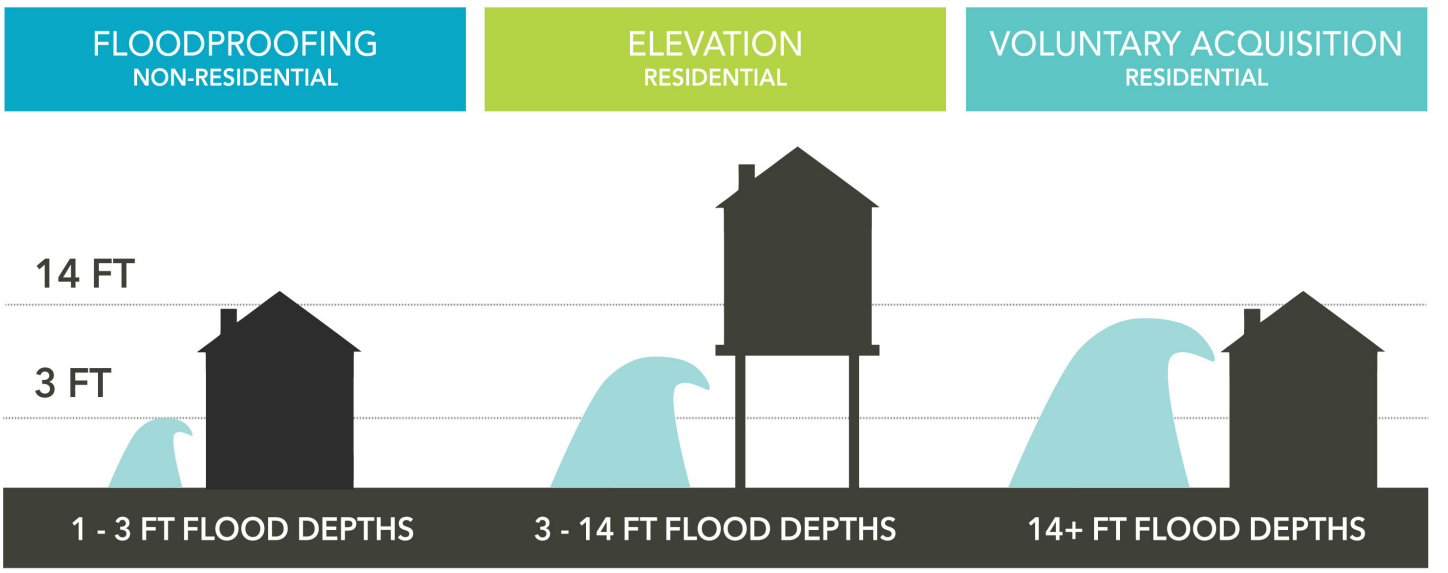

Figure 8. Nonstructural Project Types and Associated Flood Depths (CPRA 2017)

1 Flood depth plus two feet of freeboard.

Flood depth at the scale of individual structures requires detailed information about local conditions. However, at the community scale, categorization of flood depth—such as that used by LA SAFE—can be used to generally assess which types of measures are most appropriate for consideration. The master plan designation of measures to specific depths or ranges of depths assumes that mitigation of the one percent annual flood risk is the target. However, for some communities or some structures, mitigation that is deemed cost-effective within specific program requirements (Appendix 1) could actually reduce a greater level of risk than the one percent annual flood risk and elevation of residential structures experiencing less than three feet of flooding may be desirable. Typically, flood proofing—intended for non-residential structures only—is recommended for 0-3 foot flood depths, elevation for 3-12 foot flood depths, and acquisition for higher than 12 foot flood depths. In some cases, in an area experiencing less than three feet of flooding, residential structure elevations may be also desirable because that mitigation effort is above and beyond recommended levels and the properties will be at lower risk of future flooding.

Table 5 assumes mitigation measures can be broadly considered, but in areas subject to greater flood risk, some measures are likely to be more, and others less, appropriate.

Table 5. Application of Flood Risk Mitigation Measures by Flood Risk Level

		Physical Measures			
		Flood Proofing	Elevation	Acquisition	Relocation
Future Flood Risk Level	Low	•	•	•	
	Medium		•	•	
	High			•	•

Which strategy to adopt and where depends very much on local circumstances and context. Flood risk level has to be considered as well as the general expectation of changing future flood risk. An area that experiences low flood risk now—and likely will in the future— may be more suitable for community-focused planning, which is covered in the Near-Term Strategy, but may be a regional receiver community, which would be addressed through the Long-Term Strategy. Table 6 shows how one might consider the application of the strategy elements/context based on LA SAFE flood risk categories.

Table 6. Meshing Flood Risk Levels with Resilience Elements/Context

		Physical Measures	
		Local Planning Context	Coastal Planning Context
Risk Level at Target Year	Low	•	
	Medium	•	•
	High		•

Resilience Elements

The need for consideration of the five resilience elements—demographics, household income, critical and essential services, transportation, and environment—in decision-making is important. Appendix 2 provides information about readily available information sources that can be used to demonstrate how an individual project performs against each element. How that information is used in decision-making will be context specific. Each of the elements is discussed here in a decision-making and evaluation setting. The framework in the next section shows how these elements can be drawn into an evaluation of coastal resilience projects and plans.

Demographics

Information about which residents benefit from a project and which do not can be used to ensure equal participation/benefit across a community or to promote equity by ensuring flood risk is reduced for more vulnerable populations. The FRRP already seeks to meet the needs of economically vulnerable communities by prioritizing mitigation of structures with LMI households. However, additional demographic information can be used to consider who is being helped with flood risk reduction versus the community's composition. The FRRP notes that the initial assessment provided by the parish as part of an application includes income information from participating households, and additional information could also be collected to provide a broader view of who is being supported relative to the composition of the community as a whole.

Such information could also be used at the coast-wide scale to provide an overview of how a coastal resilience program's implementation benefits vulnerable populations. Dunning and Durden (2011) provide examples of how census variables or vulnerability indices can be used to show variability within a county or region by census tract. Hemmerling and Hijuelos (2017) also plotted a number of vulnerability indices by community in coastal Louisiana. Simple tabulation of where vulnerable populations are located and where flood risk and resilience investments are being made can provide a useful overview of who is being supported by implementation, with detailed information in specific parish applications providing local level within community information.

Household Income

The FRRP already considers that Low to Moderate Income (LMI) households should be prioritized. This is especially important for HUD CDBG funds. However, using the available data types (Appendix 2), it is possible to delve further into levels of household income below the 80 percent of area median income condition and examine whether funds are being used to help those with very low or extremely low incomes. Focus on low-income households may be counter to the FRRP emphasis on owner-occupiers, but this approach does enable identification of who is not being supported. Some sources of funds are restricted regarding whether they can support rental property mitigation while others have broader flexibility.

Areas of low-cost housing, which are often at high flood risk, can be associated with low household income. As flood risk increases over time, housing costs may decline in higher-risk areas, further attracting low-income population. This potentiality should be addressed in coastal resilience long-term plans, and care must be taken so that LMI housing is not inadvertently focused in high-risk areas because the prices are lower. The provision of affordable housing in low-risk areas was a key component of LA SAFE's approach, which used a strategic framework combining mitigation of rising risks where possible, allowing people to remain in place and/or leverage the push and pull forces that lead to population relocation, including the need for safe, affordable housing.

Critical and Essential Services

Reducing flood risk to critical and essential infrastructure may be beyond CPRA's current authority. However, the FRRP includes a provision for lower cost share requirements for parishes that adopt local policies to relocate critical facilities outside of flood risk areas or to build them to the 500-year flood elevation. Many of these facilities may be the responsibility of other state agencies or government entities. Investments in residential risk reduction need to consider the community context, and some types of facilities are needed to ensure a safe and functioning community even under non-flood conditions.

Transportation

Reducing flood risk to transportation networks is not CPRA's responsibility; rather, it is distributed among an array of government entities and owners. However, the crucial nature of transportation to social and economic activities (Table 4) means that it must be considered as part of an overall flood risk and resilience program.

Environment

At the community level, information about the natural environment and local environmental hazards can be considered in relation to where within the community nonstructural risk reduction could be focused. Investing in community resilience in the vicinity of ecosystem restoration projects enables synergy across program elements and supports local fish and wildlife resources. If restoration is of a scale that it could reduce existing or predicted nuisance flooding within the community, then this synergy is also realized through potential flood risk reduction. Natural areas within the community may represent more desirable locations and can provide an additional value contributing to flood risk reduction efforts that keep people in place. As part of a broader within-community strategy, acquisition of properties in high-risk areas could provide within-community opportunities for natural areas and recreation for remaining residents. In contrast, elevating homes in close proximity to industrial sites with potential toxic releases may be less desirable, when considered in a broader context, than supporting those households' relocation to lower hazard areas through acquisition.

Sometimes, environmental factors may not be central to decisions about where to concentrate efforts and who to help. However, considering how desirable an area is—paired with information about the natural environment and environmental hazards—can enhance flood risk decision-making and contribute to an improved quality of life for a community's residents.

FRAMEWORK FOR EVALUATING COASTAL RESILIENCE

The framework consists of key questions and evaluative categories for responses than can be used to display, using a stoplight table approach, the potential strengths and weaknesses of projects or plans that address either strategy for coastal resilience.

A table is presented for both the short-term and long-term resilience strategy. The tables are organized around the five resilience elements, community risk level, local planning/governance, and coastal context. For each of these, considerations and sources of information are identified; Appendix 2 includes more detail on potential data sources for the resilience elements. Desirable attributes are described for rating each consideration. Key questions are listed that can be used to evaluate a project or plan. Guidance is provided on whether a rating of High (green/good), Medium (yellow/middle-of-the-road) or Low (red/poor) should be provided. To apply the framework for evaluation, a single rating would be given for each consideration, and the rating column color coded accordingly, thus readily showing which areas are covered well and which need attention to effectively contribute to coastal resilience. Table 7 provides an evaluation framework for the Near-Term Existing Community Resilience and Table 8 for Long-Term Regional Resilience. Note that the information's order is adjusted to illustrate the importance of within-community characteristics for the near-term strategy and of the coastal planning context for long-term resilience.

USING THE FRAMEWORK APPROACH FOR STRATEGIC PLANNING

The starting point for the development of this evaluation framework was the implementation of existing programs that target flood risk reduction (Appendix 1) and the FRRP. These programs essentially look at project or program ideas and consider them in relation to a series of criteria. While project-by-project and grant-by-grant evaluations may ensure each effort is worthy and a wise use of resources, such a piecemeal approach can leave gaps and could leave vulnerable communities or populations exposed to flood risk.

In the 2017 Coastal Master Plan, formulation of the nonstructural projects took a coast-wide view of coastal flood risk in terms of economic damages and sought to identify projects across the coast where investments in nonstructural measures could reduce expected annual damages. What if a more holistic approach to resilience was used to develop a coast-wide resilience plan? The framework provided here and the consideration and desirable attributes included in Table 7 and Table 8 could be used to identify what is needed to achieve resilience. The desirable attributes could be framed as targets for the coast and specific measures and actions formulated to achieve those targets. Such a process would likely need to be iterative, as actions needed to achieve initial targets may be infeasible or beyond reasonable reach. Timelines for achieving targets also need to be considered in the light of ongoing coastal change. In the face of future coastal land loss and increasing flood risk, an array of entities, not just local governments or CPRA/OCD, must develop actions to achieve desirable attributes of resilient communities. Other state agencies have responsibilities, directly or indirectly, to provide critical and essential services, maintain transportation networks, and support economic development and employment opportunities. They would need to come together to achieve a strategic plan for Louisiana's broad-based coastal resilience.

Table 7. Evaluation Framework for Existing Community Resilience Strategy

Evaluating Existing Coastal Community Resilience

Resilience Element	Resilience Principles	Information Needed to Assess Project	Desired Project At
Demographics	**Social justice**: *Ethnicity and age structure of supported residents*	Demographics of supported residents and current community	Ethnicity and age structure of suppor to existing community
Household income	**Diversity**: *Diversity of income levels; Focus on LMI, and owner/occupier; changing income structure within community and implications for service provision*	Income structure of community	Future community expected to inclu levels comparable to current
Critical and Essential Services	**Service provision**: *Sustainability of existing level of service provision; risk reduction measures for physical service infrastructure*	Plans for floodproofing of public facilities, Expected status of private entities, e.g., banks, grocery stores?	Service provision is maintained, flood residential building is included
Transportation	**Access**: *Nuisance flooding of roads to larger service centers; maintenance of evacuation routes; continued public transportation (where available).*	Emergency response route maps, Nuisance flooding projections, State transportation plans Parish land use plan	Access routes are maintained and fre flooding
Environment	**Quality and extent**: *Open space and natural resources are sustained and accessible*	Land use maps and land use plans, Parish Master Plans	Current open space and natural reso and accessible
Planning Context			
Community	***Flood Risk:*** *100-year flooding levels are manageable (low); Flood insurance can be expected to cover future damages (with action)*	MP 17 flood risk maps, Structural protection details (where current/expected), NFIP participation	Most structures (with project) experie year (medium scenario) and participa
Regional	**Alignment:** Near-term resilience will be more assured if other local planning efforts align with FRRP investments	Parish Master Plan, Hazard mitigation plans, Drainage/stormwater management plans	Local plans provide for ongoing supp community and progressive mitigatio
Coastal	**Coordination and Leverage:** Near term resilience investments may hold longer term benefit if CMP actions (investments in restoration and potentially structural protection) are planned in the vicinity.	Coastal Master Plan	The project is in an area where additi restoration and potentially structural expected.

ct Attributes	Key Questions	Project Impact on Resilience Element		
upported residents similar	Does the project appropriately benefit residents based on age or ethnicity?	Yes	Somewhat	No
include diversity of income	Does the project appropriately include LMI (low to middle income) residents and affordable rental units? Are these left out due to LMI/owner priorities? Are there contiguous properties that remain unmitigated?	Inclusive	Somewhat restrictive	Restrictive
floodproofing for non-	Does the project include plans for floodproofing of local businesses or facilities? If not, does the parish/state have plans for such mitigation?	Included	Other plans	Not included
nd free from nuisance	Does the community (or its access routes) already suffer from nuisance flooding?	No problems	Some problems	Frequent problems
	Does the parish/state have plans to maintain roads?	Yes	Selectively	No
l resources are available	Is open space likely under threat during the target period, e.g., from development, land loss?	Secure	Some risk	Threatened
xperience low risk at target rticipate in NFIP and CRS	What is the expected level of damage in the community once mitigated?	Low	Medium	High
	What is the expected flood depth following implementation?	Low	Medium	High
g support for the tigation	Is the near-term future of the community considered in local master planning efforts?	Yes	Somewhat	No
	Is the community part of a broader effort toward resilience planning and hazard mitigation?	Yes	Somewhat	No
additional investments in ctural protection are	Does MP17 include planned restoration in the vicinity? Are these projects funded?	Yes, funding likely	Yes, no funding	No
	Does MP17 include planned structural protection in the vicinity? Is it likely to decrease or induce flooding? What is the status of the project, e.g., is feasibility completed, are any funds available?	Yes, in planning	Yes, no progress beyond MP17	No, or increases flooding
	How much is flood risk expected to increase in this community in the long-term? Will near-term investments have continued benefit?	No change or stays low	Becomes medium	Becomes high

Table 8. Evaluation Framework for Long-Term Regional Resilience

Evaluating Long-Term Coastal Resilience			
Resilience Element	Resilience Principles	Information Needed to Determine Project Impact	Desired Project A
Coastal Planning Context	*Regional resilience requires areas of low/medium long-term flood risk as a result of coastal gradients (e.g., further inland), or expected actions (e.g., extensive restoration, structural protection or large-scale elevation)*	Coastal Master Plan	The project plans for transition of re livelihoods and supporting services future flood risk.
Coordination and Governance	*Without regional coordination and governance transition of people and activities across existing jurisdictional boundaries may be challenging and constrained by local decision making*	Project proposal	An established regional body coord support of regional coastal flood re local governments enter into forma
Demographics	Social Justice – *Transition from communities from higher to lower risk flood zones needs to be equitable across population groups or focused on most vulnerable*	Census/ACS information on age and ethnicity, SVI maps in MP17	Most vulnerable groups/communit risk areas
Household Income	Income/Employment – *In place risk reduction measures may mean greater distances to employment (as businesses move), loss of employment opportunities in remaining (elevated) higher risk communities*	Emergency response route maps, Nuisance flooding projections, State transportation plans, Parish land use plan	Diverse employment opportunities resident
Essential Services	Service transition – *services such as schools, fire stations, community buildings, grocery stores are needed throughout transition. Decreasing tax base with declining populations limits local government $$.*	Project proposal details	Service provision is maintained with risk areas and available at appropria relocation
Transportation	Capacity and Evacuation – *Evacuation routes need to be maintained for all communities as 'nuisance' flood risk increases. Capacity must increase in areas of increased population. Provision of public transportation in higher density areas.*	Project proposal details, Local/regional/state master plans	Transportation, including evacuatio project proposal.
Environment	Access to nature: *Relocated populations need access to nature for quality of life. Some groups may require continued access to environments to which they have traditional cultural ties.*	Project proposal details	Plans include management of vaca environment and open space withi communities.

ect Attibutes	Key Questions	Project Impact on Resilience Element		
n of residents, their rvices toward areas of lower	What is the future with project expected flood risk during the target period (medium scenario) for most of the population?	Low	Medium	High
	If future flood risk levels rely on structural protection or other projects, is progress being made (e.g., planning underway, funding sources identified)?	Underway	Planning expected	No progress
coordinates actions is ood resilience or individual formal agreements	Does the project involve multiple parishes and show coordination? Are future risk conditions constrained by parish boundaries?	Formal, established coordination in place	Coordination planned	Lack of coordination, acknowledgement of issues
munities transitioned to lower	Does the project prioritize or proportionately benefit vulnerable groups/communities?	Yes	Somewhat	No
unities available in proximity to	Are employment opportunities retained in areas of in-place elevation to reduce risk? Do relocations include specific plans for access to employment?	Detailed plans included	Some consideration of employment	Little focus on employment
ed with population in higher propriate levels in areas of	Does the project include plans for service provision (including funding) as communities transition? Are appropriate plans in place to increase service provision in areas where population will increase?	Private and public services adequately considered	Some consideration of service provision	Little focus on service provision
cuation, is a key element of	Are plans in place to cope with transportation needs of transitioning populations, i.e., maintained to residual population in high risk areas, expanded in areas of increased population?	Transition and end-state both planned for	Some consideration of transportation	Little focus on transportation
	Do plans consider increased effects of nuisance flooding as well as storm events?	Comprehensive consideration of flooding	Acknowledgement of all flooding but few details	Storm events only
f vacated land as natural e within relocated	Do plans consider both the need to access environments to which there are cultural ties as well as open space/nature within receiving communities?	Detailed plans included	Some consideration of natural environment	Little focus on natural environment

OPPORTUNITIES FOR PROGRESS

The framework presented here is designed to provide a common platform for decision makers—at all levels of government and across agencies—to recognize how their actions and plans can contribute to, or detract from, coastal resilience. At and between all scales of government, it promotes

- Coordination across agencies and communities to leverage investments;
- Better alignment of investments with policies and among programs;
- Identification of gaps in resilience elements for communities; and
- Illustration of the technical assistance and capacity needed to maximize the benefits of state and local investments.

Ongoing initiatives within state government provide opportunities for the application and testing of the framework approach.

1. **CPRA's Fiscal Year 2020 Annual Plan** for Integrated Ecosystem Restoration and Hurricane Protection in Coastal Louisiana includes $1 million in FY 2020 and $3 million in FY 2021 for nonstructural program development. In addition to furthering work on implementation of the Southwest Coastal Louisiana project in partnership with USACE, these funds provide an opportunity to kick-start the FRRP's implementation.

2. **Work on the 2023 Coastal Master Plan** is underway within CPRA. Other state agencies see the need for and have expressed their interest in working more closely with CPRA to show how the missions of various agencies intersect and can be aligned with the Coastal Master Plan. The approach to long-term regional resilience (Table 8) could be used as a way **to align agency thinking with the implications of coastal change.** While this may not be directly linked into project selection for the 2023 Coastal Master Plan, there may be ways in which the interests and plans of other agencies could be considered, such as long-term plans for critical infrastructure. Using this framework could be an entry point to start a dialogue among key agency staff and the 2023 master plan team—even at this early stage in the plan's development—to begin the needed shift from state-of-the-art coastal protection and restoration planning to state-led coastal resilience.

3. **The Louisiana Watershed Initiative** recognizes that "proper flood risk management requires a coordinated, coherent and long-term vision for sustainability and resilience." As work on the Initiative proceeds, there is an opportunity to use a broad-based approach to resilience, such as that captured in the framework. The focus of the current work is on data, engagement, standards, funding, capability and capacity, and integrated planning, which are all important. But the resilience outcomes for communities, beyond reduced flood risk, have yet to be clearly articulated. The framework provided here focused on coastal systems but could be readily adapted for consideration in other areas as well as be used to ensure that Louisiana's communities are not only protected from flooding but resilient in a broader sense.

4. **Local communities** can use the near-term resilience strategies (Table 7) to inform local risk-reduction efforts by considering regional and state-led efforts as well as understanding the communities' needs better.

Image left: 2016 Marsh Maneuver
CWPPRA

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APPENDIX 1. OVERVIEW OF KEY REQUIREMENTS OR CONSTRAINTS OF FUNDING SOURCES FOR FLOOD RISK REDUCTION

Program	Overview of Requirements/Constraints[1]
FEMA Flood Mitigation Assistance (FMA) Program	• The FMA program seeks to reduce future NFIP claims. • FMA allows grant recipients to propose actions that will reduce the flood hazard and/or exposure and vulnerability to the flood hazard. Actions can include stormwater management facilities, retention and detention basins, and floodwalls. • Only properties insured by NFIP are eligible for FMA funding. The grant applicant also affirms that flood insurance will be maintained for the life of the structure, regardless of transfer of ownership. • Projects must be technically feasible, as demonstrated through conformance with engineering practices and established codes. • A cost-effectiveness justification is required for specific projects based on savings to the NFIP (e.g., claims net of premiums paid, over time). All projects must be cost-effective, but they do not need to be prioritized according to cost-effectiveness.
FEMA Pre-Disaster Mitigation (PDM) Program	• The PDM grant program will fund the purchase or elevation of properties that are inside SFHAs. • Projects must be technically feasible, as demonstrated through conformance with engineering practices and established codes. • A cost-effectiveness justification is required for specific projects based on savings to the NFIP (e.g., claims net of premiums paid, over time). Benefits are reduced NFIP claims and also may include reduced disaster assistance costs. • The grant applicant also affirms that flood insurance will be maintained for the life of structure, regardless of transfer of ownership.
National Flood Insurance Program (NFIP)	• For a local government to be eligible to participate in NFIP (e.g., residents can purchase flood insurance), it must adopt and enforce minimum land use regulations limiting new development in a SFHA. • Minimum regulations include provisions that require participating communities to mandate permits for all new development in a SFHA; prohibit new development in floodways if it raises flood heights; and require all new construction, or substantially damaged or improved properties in SFHAs, to be elevated so that the lowest floor is at or above base flood elevation, with more stringent standards in some areas.

1 A Synopsis of Federal Programs for Flood Resiliency: Descriptions and Reflections, Working Draft Report, Resources for the Future, 2019; Coastal Protection and Restoration Authority, 2017 Coastal Master Plan: Appendix E: Flood Risk and Resilience Program Framework; and U.S. Army Corps of Engineers,Southwest Coastal Louisiana Study, Appendix L, 2016, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/ewp/?cid=nrcs143_008225.

Program	Overview of Requirements/Constraints[1]
FEMA Hazard Mitigation Grant Program (HMGP)	• After a presidential disaster declaration, states and NFIP-participating communities with an approved Hazard Mitigation Plan (HMP) can apply for HMGP funds. • Local governments use funds to purchase or elevate homes of properties that are inside a SFHA, have been substantially damaged in a flood event, and have a high likelihood of realizing future damages and, in turn, filing an NFIP claim in future floods. These may be Severe Repetitive Loss (SRL) and Repetitive Loss (RL) properties but need not be. • Applicants must show that they have identified resiliency-increasing actions that could be implemented to reduce the flood hazard, flood hazard exposure, and/or vulnerability in a community. • All actions proposed in the grant must pass an engineering feasibility test and show that the benefits exceed the costs in a similar fashion, as required by FMA and PDM programs. • The grant applicant also affirms that flood insurance will be maintained for the life of structure, regardless of transfer of ownership.
HUD Community Development Block Grant– Disaster Recovery (CDBG–DR)	• This program provides financial assistance after a major disaster so state and local governments can repair and rebuild damaged assets, assist residents in rebuilding, and speed recovery of local economic activity, especially in low- to moderate-income areas. • Funds can be used to assist families with housing needs, nonprofits providing public services, businesses with economic development or revitalization needs, and local governments with planning or infrastructure needs. The grant recipient must prepare an action plan describing how their plan's proposed activities respond to the disaster and address remaining unmet recovery needs. • Housing assistance includes rehabilitation and reconstruction as well as restoration and improvements to the existing housing stock and new construction. This can also include property acquisition to reduce future exposure by removing buildings from the floodplain, by structure elevations to at least two feet above NFIP FIRMs' BFE, and reducing vulnerability through flood proofing. • To further increase flood resiliency, a HUD-assisted homeowner whose property remains—even if elevated or flood-proofed—in a SFHA must obtain and maintain flood insurance. • Infrastructure assistance can be used for rebuilding or replacing public facilities such as schools, health care centers, water or wastewater facilities, and local flood hazard reduction projects, including drainage networks. Rebuilding facilities deemed "critical," such as hospitals, must have a first floor elevated to at least three feet above BFE. • CDBG program's authorizing statute requires 70 percent of funds be expended to benefit low- to moderate-income persons, and this is generally applicable to CDBG–DR funds. HUD, however, has lowered the target to 50 percent in response to certain disasters.

Program	Overview of Requirements/Constraints[1]
Small Business Administration (SBA) Disaster Loans	The program supports post-flood recovery with low-interest loans to allow businesses, private nonprofit organizations, homeowners, and renters to repair or replace real estate, personal property, machinery and equipment, inventory, and business assets that have been damaged or destroyed. • Homeowners may borrow up to $200,000 to repair a disaster-damaged primary residence to its pre-disaster condition. Loan amounts are determined by the cost of repair, with deductions made for insurance payments and federal grant assistance. • Homeowners may also borrow additional funds—up to 20 percent of total physical losses—to implement actions to protect against future floods (build back differently), although the maximum loan may not exceed $200,000. Homeowners as well as renters may borrow up to $40,000 to repair or replace personal property. • Businesses of any size and private nonprofit organizations may borrow up to $2 million to repair or replace physically damaged property. These entities may also borrow up to 20 percent of total losses to build back differently, as long as the total loan amount does not exceed $2 million. • Generally, loan funds cannot be used to upgrade, expand, or improve a property unless it is required by local building codes or unless the funds are used to increase flood resiliency. • SBA loans must be repaid, with interest, to the federal government, generally within a period of 30 years. Interest rates for SBA loans can vary by event, but they are generally based on current average market rates as determined by the SBA.
Gulf of Mexico Energy Security Act (GOMESA)	This is a dedicated funding stream for coastal restoration and protection activities. Projects and activities for coastal conservation, restoration, and hurricane protection is one of five authorized purposes. • Louisiana parishes and other coastal political subdivisions receive 20 percent of the total funding to Louisiana, and the state receives the remaining 80 percent share.

Program	Overview of Requirements/Constraints[1]
Water Resource Development Act projects	• USACE's Southwest Coastal Louisiana Study generally proposes to provide nonstructural hurricane and storm surge damage risk reduction measures for a designated coastal area of Louisiana. • The Southwest Coastal Louisiana project was authorized by Congress in 2016 to provide nonstructural hurricane and storm damage risk reduction measures in the 4,700-square-mile study area located in southwest Louisiana. • The project includes approximately $900 million for flood risk management by implementing nonstructural strategies to include flood proofing, voluntary structural elevation, and localized risk reduction features, such as berms. • Preliminary eligibility criteria included that • The residential structure must have a FFE at or below the 0-25-year BFE, based on hydrologic conditions predicted to occur in 2025 (the beginning of the 50-year period of analysis); and • Elevation of the residential structure is deemed to be economically justified.
Federal Highway Administration (FHWA) Emergency Relief (ER) Program	This program supports post-flood repair or permanent reconstruction of federal-aid highways or roads on federal lands. • If a road is damaged in a storm, and if an emergency repair is completed within the first 180 days after a disaster, emergency repair work is wholly funded by the FHWA. Permanent repairs are subject to a non-federal cost share of 10 percent for interstate highways and 20 percent for all other federal-aid roads.
USDA NRCS Emergency Watershed Protection Program–Floodplain Easement Option (EWP–FPE)	This program is for use where acquiring an easement is the best approach (more economical and prudent) to reduce threat to life and/or property. NRCS may purchase EWP–FPE permanent easements in floodplains if the land has been damaged by flooding at least once during the previous calendar year or subject to flood damage at least twice within the previous 10 years. 1 If FPE is being offered as recovery for a specific natural disaster, at least one instance of flooding must have occurred because of that natural disaster. NRCS will pay up to the entire easement value and up to the entire cost of the structure's value if the landowner chooses to have it demolished. If the landowner prefers to relocate the residence instead of demolishing it, NRCS will pay all costs associated with relocating the residence to a location outside the floodplain. A project sponsor is required for lands primarily used for residential housing and for the purchase of the remaining lots after structures are removed.

APPENDIX 2. POTENTIAL DATA SOURCES

Demographics

Demographic information is collected by the U.S. Census Bureau both through the decennial census and the more frequent American Community Survey (ACS), shown as an example in Box 1. It is readily available for download at several different scales at https://www.census.gov/data.html. Table 1 lists some available key data types that reflect a community's demographic characteristics, which can provide context for comparison of those participating in nonstructural project implementation and can enable equality and equity considerations in flood risk management decisions. See the Framework Approach for more information.

Box 1. US Census Data and the American Community Survey

The decennial census provides detailed information, readily available at the census block level every 10 years. The most recent complete census was in 2010. The American Community Survey (ACS) is an ongoing survey also conducted by the U.S. Census Bureau that regularly updates data previously gathered in the decennial census by sampling rather than complete coverage. At small census geographies, such as the census block group, data gathered by the American Community Survey exhibit high levels of sampling error. The block group is a census unit containing approximately 1,000 people, making it the smallest unit for which relatively complete socioeconomic data is available. While vulnerability varies on smaller scales, including the household level, the block group is the most practical unit that can be reliably quantified and is standardly utilized by local officials and public agencies. Errors associated with the sampling are reported and can be reduced by aggregating data to higher spatial units, e.g., census tracts Larger units that average ~4,000 people).

Table 1. Types of Demographic Data Available from the U.S. Census Bureau and ACS

Average number of persons per household	% households that have no vehicles
Housing density; number of households per square mile	% population 25 years or older with no high school diploma
Median age	% population born outside of the United States
% in poverty and over 65 years of age	% population over 65 years of age
% adult population that is disabled	% population under 5 years of age
% female-headed households	% rural population
Population density	% single-parent households
% Hispanic population	% population > 5 years of age who speak little or no English
% African American population	% Asian population

Household Income

Household income data is collected by the U.S. Census Bureau both through the decennial census and the more frequent American Community Survey. It is readily available for download at a number of different scales at https://www.census.gov/data.html. Table 2 lists some available key data types that reflect a community's income characteristics.

In addition, HUD provides calculations of Area Median Incomes by various geographic units, which are updated annually and available for download.1 These may not be calculated for each community but can provide more specific reference points for income determination that the Federal Poverty Level (FPL), which does not consider regional differences.

These data can provide context for comparison of those participating in nonstructural project implementation and can enable equality and equity considerations in flood risk management decisions. See the Framework Approach for more information.

Table 2. Selected Household Income-Related Data Available from the U.S. Census Bureau and ACS

Per capita income $	% labor force that is unemployed
% households making more than $75,000	% employed in forestry, agriculture, and fisheries
% in poverty and over 65 years of age	% employed in mining and petroleum extraction
% households receiving public assistance	% population employed in service industries
% households receiving Social Security income	% population living in poverty
% households receiving Supplemental Social Security	% population participating in civilian labor force

1 https://www.huduser.gov/portal/datasets/il.html#2018_query

Critical and Essential Services

Local parish officials are likely aware of the locations of their parish's critical and essential facilities and can use the CPRA Master Plan Data Viewer (https://cims.coastal.la.gov/masterplan/) to assess current and future flood risk at any address in their parish. The National Oceanic and Atmospheric Administration (NOAA) Coastal Flood Exposure Mapper (https://coast.noaa.gov/floodexposure/#/map) also provides maps of the locations of critical facilities by parish/county and overlays for various NOAA flood hazard categories as well as FEMA flood maps (Figure 1).

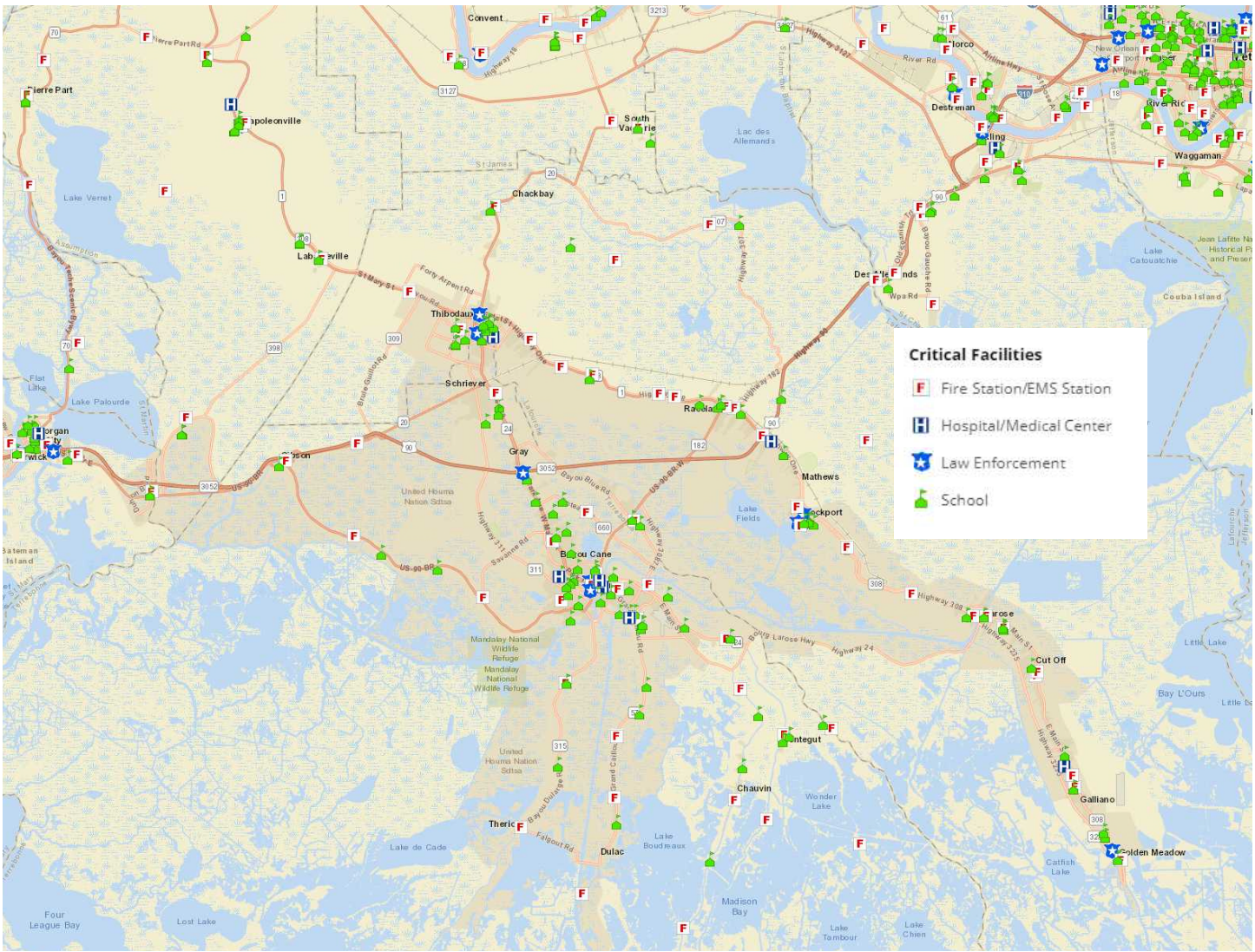

Figure 1. Example Critical Facilities Map from NOAA Coastal Flood Exposure Mapper (no hazard layers selected).

Transportation

Data from the National Transportation Atlas Database (NTAD)[1] can be used to identify rail lines in coastal Louisiana. The NTAD, published by U.S. Department of Transportation's Bureau of Transportation Statistics, is a set of nationwide datasets of transportation facilities, networks, and other associated infrastructure. State-maintained roads information is available from the Louisiana Department of Transportation and Development (DOTD). Information on roads can also be obtained from the U.S. Census Bureau. The DOTD data[2] include information about the number of lanes and surface types for all state-maintained roads, like interstates, federal highways, and state highways. The U.S. Census Bureau's TIGER/Line data[3] offers less detailed information about all roads, but includes local and private roads.

Environment

Information on existing, ongoing, and planned restoration and risk reduction projects is available by parish through CPRA's website.[4] Parish coastal zone management personnel are also useful sources of information on permits for other types of wetland activity.

Key sources of data for land cover are the U.S. Geological Survey GAP Land Cover Data Set, available via the Land Cover Data Portal[5] and can be downloaded at three different levels of detail. At its most detailed, it included 590 land use classes. For more detail in urban areas, the National Land Cover Database provides data at 30m resolution.[6] Louisiana's most current data are for 2011. For species of conservation concern, NatureServe[7] provides summary information at the parish/county level, and Louisiana Department of Wildlife and Fisheries Natural Heritage Program[8] provides parish-level lists of rare animal species. Note that specific locations of species of conservation interest are rarely publicly available.

For information about potential sources of environmental hazard, the EPA's Toxics Release Inventory[9] provides information about toxic chemicals that industrial facilities are using and releasing into the environment and whether those facilities are doing anything to prevent pollution. It also includes a tool for downloading information by community.[10] Data regarding prior oil spills and chemical incidents in coastal areas are available through the U.S. Coast Guard National Response Center.[11]

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1 *https://www.bts.gov/geospatial/national-transportation-atlas-database*

2 *http://wwwsp.dotd.la.gov/Business/Pages/GIS_Maps.aspx*

3 *https://www.census.gov/geo/maps-data/data/tiger.html*

4 *https://cims.coastal.louisiana.gov/outreach/factsheets/Parishes/parish_map*

5 *https://gapanalysis.usgs.gov/gaplandcover/data/*

6 *https://www.mrlc.gov/data*

7 *http://www.natureserve.org/conservation-tools/listed-and-imperiled-species-county-and-watershed/county-map*

8 *http://www.wlf.louisiana.gov/wildlife/species-parish-list*

9 *https://www.epa.gov/toxics-release-inventory-tri-program*

10 *https://www.epa.gov/toxics-release-inventory-tri-program/tri-for-communities*

11 *http://nrc.uscg.mil/*

About the Center for Planning Excellence

Mission

CPEX brings people, culture, and planning together to make great communities happen.

CPEX is a non-profit organization that coordinates urban, rural and regional planning and implementation efforts in Louisiana. We provide best-practice planning models, innovative policy ideas, and technical assistance to individual communities that wish to create and enact master plans dealing with transportation and infrastructure needs, environmental issues, and quality design for the built environment. CPEX brings community members and leaders together and provides guidance as they work toward a shared vision for future growth and development.

Since our founding in 2006, CPEX has been involved with the planning efforts of the state, and that of more than 30 Louisiana cities, towns and parishes. We have leveraged more than $6 million on behalf of communities all over the state.

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