

# Local Strategies for Resilience Planning in Louisiana

A guidebook for communities in Louisiana and beyond looking to reduce vulnerabilities to natural hazards and increase resilience at the community level.

# Acknowledgments

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*Rural development in coastal Louisiana is often close to water and potentially at risk.*

## How did we get here?

With Hurricane Gustav's landfall on September 1, 2008, and Hurricane Ike's shortly after on September 13th, Louisiana endured back-to-back damage from two devastating storms. While the 2008 hurricane season was not as deadly or costly as 2005, the tolls were high enough. Each storm caused more than 100 deaths in the Caribbean and U.S., with many billions of dollars of damage. Following Hurricanes Gustav and Ike, Louisiana received significant recovery funds. A portion of these funds was dedicated to building resilience at the community level.

In 2009, the U.S. Department of Housing and Urban Development (HUD) provided funding in the form of Community Development Block Grants (CDBG) to create the Louisiana Office of Community Development - Disaster Recovery Unit (OCD-DRU), formerly the Louisiana Recovery Authority, to administer these HUD grants. The OCD-DRU designated \$10 million of these CDBG funds to specifically address community resilience through planning projects by creating the Community Resiliency Pilot Program (CRPP). Over 60 communities impacted by Hurricane Gustav applied through a competitive RFP process. Thirty communities - primarily municipal and parish governments - received funding for their projects.

In addition, the OCD-DRU awarded Louisiana State University's (LSU) Coastal Sustainability Studio (CSS) funds to establish the Louisiana Resiliency Assistance Program (LRAP) to support and provide assistance to the 30 grantees. The CSS is a trans-disciplinary studio that brings together scientists, engineers, and designers to intensively study and respond to issues of settlement, coastal restoration, flood protection, and the economy. The mission of the LRAP is to "collect, develop, house, and disseminate current planning efforts, resources, and local best practices to promote, assist, and build networks around resilience planning in Louisiana."

The LRAP was developed simultaneously with, and drew on the efforts of, the CRPP. Through LRAP, local planning efforts and resources have been collected and compiled into a website as a hub of information focused on resilience planning for Louisiana communities and beyond. In addition, LRAP developed a series of webinars and workshops as educational opportunities for researchers and practitioners focusing on a range of topics related to resilience. Engaging experts from LSU, state government, FEMA, the private sector, and others, LRAP brought local, regional, and national expertise together to discuss local resilience planning and implementation issues in Louisiana. These webinars and workshops informed a body of research and framed the development of a set of strategies for resilience.

This guidebook presents strategies and supporting actions to guide local planning and project implementation. Development of these strategies drew largely on the self-identified needs and goals of the CRPP communities. A kick-off workshop with the 30 grant-receiving communities, combined with research and previous studio projects, helped to identify priority needs and concerns. In addition, an assessment of initial grant proposals, as well as an investigation of local conditions, helped to hone and clarify the main concerns that these communities were facing and trying to address. Interviews with local planners, community stakeholders, and government officials, as well as attendance at public meetings and reviews of project documents, completed the process of information collection and assessment. LRAP augmented this knowledge with in-depth research on resilience, local conditions, and broader regional issues and trends to develop these strategies. Each strategy builds on previous work in Louisiana by drawing on the efforts of local communities to integrate new approaches for short- and long-term solutions. This guidebook of strategies represents a distillation of the work of the LRAP.

# Introduction

We live in an era of increased vulnerability to natural disasters and climate change that threaten coastal communities. This instability threatens core elements of our everyday lives - from the value of our homes and the dependability of our streets to the economic and social viability of our communities and regions. Severe weather events are no longer “storms of the century” but instead are more common events. Record droughts, floods, forest fires, and heat waves are occurring at increasing rates across the United States and elsewhere.

As the country grapples with an increasing number of multi-billion dollar disasters, Louisiana’s coastal communities are already at a crossroads. Many face levels of risk that challenge the economic benefits of development and are considering ways to reduce vulnerability. Others are finding they can adapt over time to risks and maintain vibrant communities. Still others are seeing tremendous growth potential as local, regional, and global economies retool for a 21st-century. These issues are not limited to coastal communities. As sea levels rise and climates change, there are increased risks and vulnerabilities to inland communities as well.

The future of our state depends upon the resilience of individual communities, and their ability to bounce back from both sudden and long-term impacts of hazards and climate change. Current land use planning in Louisiana is based on laws and policies developed decades ago, before the threats posed by hazards and dynamic landscapes were well understood. But this is beginning to change. Increasing risk and greater planning efforts are leading to new regional, integrated approaches to planning and development that support community resilience.

While there is no standard approach to resilience, the tools, policies, and strategies presented in this guidebook may serve as a blueprint to help communities prepare for future uncertainty. While these steps are most successful when taken in conjunction with each other, each can help communities become more resilient. It is also important to note that resilience strategies should continually evolve as new information becomes available and needs become clearer.

*Community along the Mississippi River in Plaquemines Parish.*



## What Is Resilience Planning

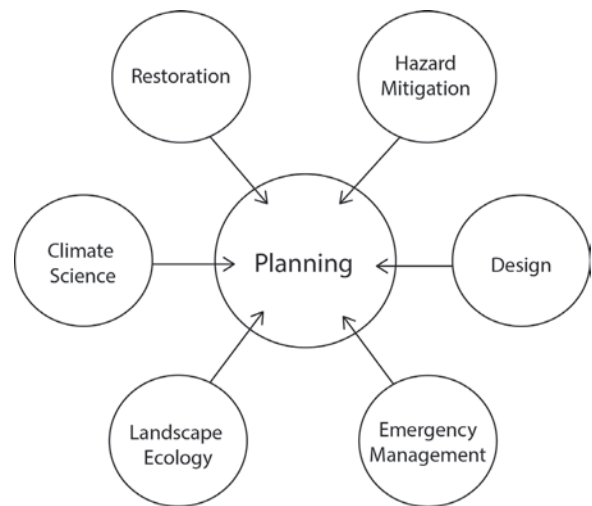
In Louisiana, the devastation from multiple storms over a decade raised awareness of the risks and vulnerabilities faced by coastal communities. This has prompted action toward enhancing the resilience of entire communities, rather than individual systems or structures. **Community resilience is the ability to prepare for, respond to, and recover from an external shock.** To increase their capacity for resilience, communities must adopt planning and design strategies that allow them to better react and adapt to the economic, social, and physical stresses they will face as they confront the challenges of hazards and climate change.

**Resilience planning augments traditional land use planning with information and expertise from various fields, particularly disaster science, floodplain management, climate, and environmental sciences.** The process and outcomes of resilience planning help build stronger communities that are more equipped to respond and adapt to disturbances.

Set against a backdrop of renewed interest in mitigating risk and increasing resilience spurred by these destructive storms, the work of LRAP sought to answer the following questions:

1. How are communities preparing for future events under rapidly changing environmental conditions?
2. How can disaster mitigation be leveraged to help communities achieve their development goals and community visions?
3. What can other communities learn from Louisiana's resiliency efforts?

This guidebook begins to answer these questions by showing how resilience concepts have been translated into practice.



*Resilience planning augments traditional planning with expertise from various fields.*



## The Louisiana Context

The impacts of five hurricanes in Louisiana and surrounding states in less than a decade were staggering. Between 2005 and 2012, Hurricanes Katrina, Rita, Gustav, Ike, and Isaac each resulted in billions of dollars in damages and impacted hundreds of thousands of people in the region. Combined, these storms affected nearly all areas of the state. The impacts in terms of lives lost, people affected, and monetary damages incurred highlight the vulnerability of communities, infrastructure, and development in the region.

Louisiana's coastal communities face immediate and long-term impacts from a changing climate and landscape. Ongoing risks from rising sea levels, land subsidence, habitat degradation, wetland loss, and changing rainfall patterns all exacerbate damages from storms. In Louisiana and surrounding regions, extreme heat, increased drought and flooding, and accelerating sea level rise are threatening communities and important economic sectors.

**Today, both the need and the opportunity exist for planners to engage the general public, grassroots organizations, and professionals working on related issues to collectively steer growth to appropriate areas and secure the health, stability, and vitality of communities. Such collaboration can foster more comprehensive approaches to the inherently complex challenges prevalent in this region.**

In many ways, Louisiana is ahead of the curve. In addition to meeting the immediate needs of response and recovery, the unprecedented devastation of these hurricanes sparked renewed interest and support at the national level for local risk adaptation. Following Hurricanes Gustav and Ike, federal funds were directed towards planning to ensure communities rebuilt in ways that would make them less vulnerable to storms. The U.S. Department of Housing and Urban Development (HUD) distributed a total of more than \$26 billion in Community Development Block Grants (CDBGs) to local governments to work on forward-looking, long-term planning projects. This included \$10 million granted to the State of Louisiana to create the Community Resiliency Pilot Program (CRPP). The 30 projects that comprised

the CRPP are shown on the following map and include zoning ordinances, land-use plans, and water management strategies. But, central to all was the integration of resilience into community planning efforts. The goal of the Louisiana Resiliency Assistance Program (LRAP) was to serve as a resource for local communities, create networks around resilience planning, assess the needs of the 30 CRPP grantees, and serve as a hub of information on resilience planning for the 30 grantees, as well as communities who did not receive funding.

The innovative use of federal funds in Louisiana to promote local resilience through planning is indicative of a broader national trend to allocate federal funds post-disaster for more locally appropriate solutions vulnerability. Funding the Louisiana CRPP represents federal interest in building local resilience. However, local projects were funded without a clear definition of resilience or a clear directive on how to achieve it. Local autonomy came not only with some challenges but also with advantages by allowing communities to identify and prioritize their local concerns. Through research and community outreach, LRAP worked to understand the meaning of resilience planning in Louisiana and identify successful strategies for achieving resilience, which are presented in this guidebook.

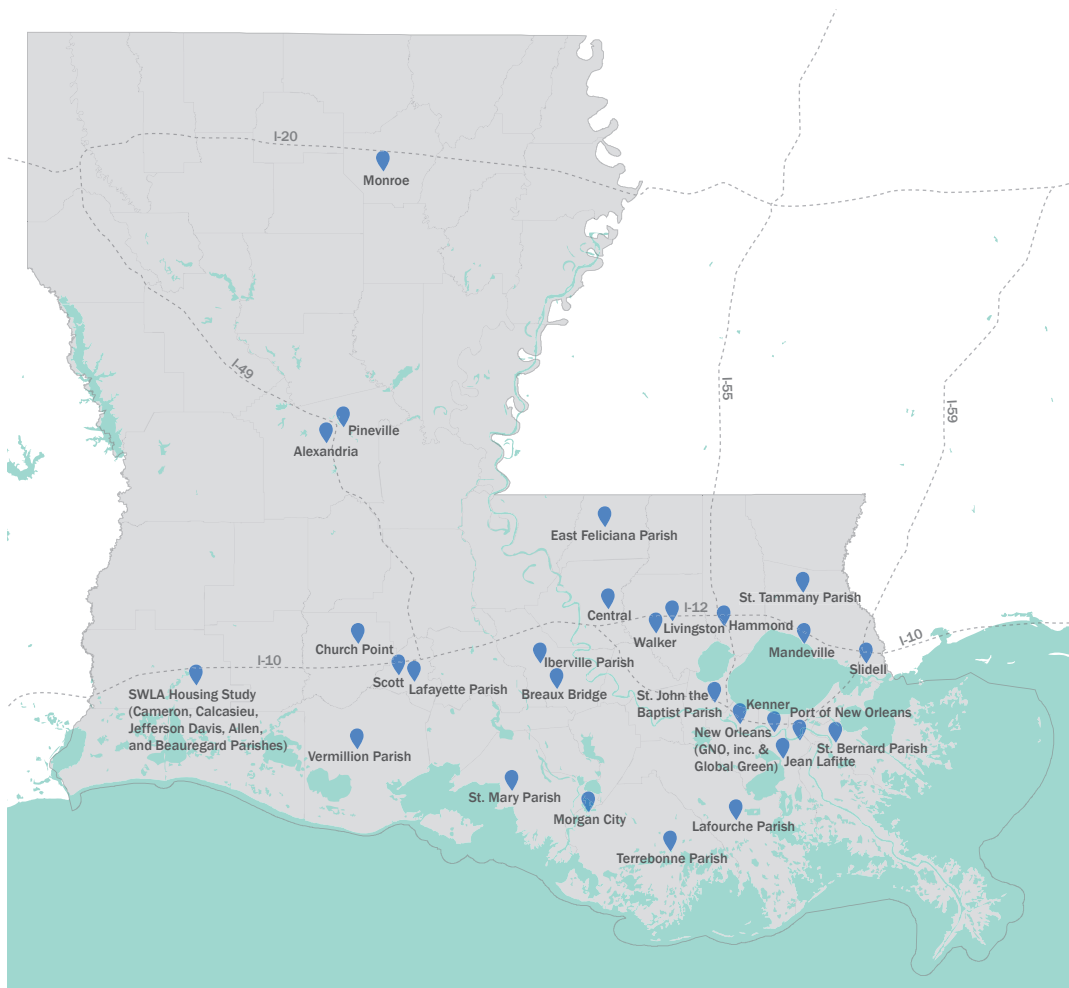
As a more recent example of the national trend to promote local resilience through planning, the Hurricane Sandy Rebuilding Task Force launched a design competition in 2012 called Rebuild by Design. A multi-staged, regional design competition, it developed creative, design-based solutions to promote resilience for Sandy-affected areas. As part of this competition, HUD allocated CDBG Disaster Recovery (DR) funds to incentivize implementation of the winning projects. HUD administered the competition, with the assistance of the National Endowment for the Arts and other federal departments and agencies involved in the process.



CDBG funds are intended to address issues of community development in low-moderate income urban neighborhoods. Recent use of CDBG DR funds represents a recognition of the need for risk reduction and hazard mitigation in all vulnerable communities, particularly those that are economically and socially vulnerable. There is also a growing recognition of the overlap among land use planning, environmental health, and hazard mitigation. It has become more widely accepted that resilience, particularly to natural disasters and climate change, does not mean a return to pre-existing conditions but rather an adaptation. This means communities are recognizing the need to respond to disasters and address environmental health to reduce vulnerability. This includes recognizing the benefits of resilient ecological

systems to communities, and integrating environmental restoration and conservation projects into hazard mitigation and land use planning.

With Louisiana's Coastal Master Plan and increased investment in coastal restoration and protection, adaptation planning has begun at a regional scale. Efforts to address sea level rise as well as reverse wetland degradation and land loss will help rebuild natural barriers to storms and restore the health of vital ecosystems. However, the pace at which changes are occurring will challenge coastal restoration efforts. The State plans to continue investing in these efforts over the next 50 years and expand adaptation approaches to address these challenges.



Location of communities that received planning grants as part of the 2009 Community Resiliency Pilot Program.

## Existing Tools for Louisiana Communities

There are many effective tools and manuals created in response to the various disasters experienced by the state. Many of these were developed to fill gaps for communities who lacked capacity, resources, or a coordinated response from the various state post-recovery planning agencies. The following calls out some of the key planning documents that are shaping the ways communities in Louisiana plan for their futures. While each is briefly touched upon here, more information is available for each of these planning tools on the LRAP website at [resiliency.lsu.edu](http://resiliency.lsu.edu).

Without statewide coordination, communities in

Louisiana have struggled to determine how to build back in smarter, more resilient ways. The Center for Planning Excellence (CPEX), a nonprofit organization that coordinates planning efforts in Louisiana, helped fill this gap by managing development of the **Louisiana Speaks Regional Plan and subsequent Planning Toolkit and Pattern Book**. These planning efforts yielded a plan and policy framework for coordinated planning, storm protection, and coastal restoration. The process engaged 35 coastal parishes and 27,000 citizens to comprehensively address south Louisiana's needs for recovery and safer, more sustainable growth. Louisiana

*Much of coastal Louisiana's infrastructure is vulnerable to the effects of climate change.*



Speaks advocates for local and regional planning that uses the natural environment for added storm protection, preserves natural and cultural resources, enhances economic development and existing infrastructure, and promotes multi-modal transportation options. In 2009, CPEX partnered with the Louisiana Economic Development (LED) to complete the **Louisiana Land Use Toolkit**. The toolkit provides model codes for community development, which was a top priority of Louisiana Speaks. The previously mentioned Pattern Book also works with the Toolkit to provide building-level safety and design.

**Louisiana's Comprehensive Master Plan for a Sustainable Coast** (Coastal Master Plan) was developed by the Louisiana Coastal Protection

and Restoration Authority (CPRA), the state entity charged with building comprehensive coastal protection for Louisiana. The Coastal Master Plan addresses the severe coastal crisis that has resulted in over 1,800 square miles of land loss. Adopted initially in 2007 and updated in 2012, it puts the state at the forefront of adaptive regional coastal management and environmental restoration planning. As a result, communities across southern Louisiana must consider the implications of the projects outlined in the Plan, as these projects will certainly shape many future planning efforts.

The **Best Practices Manual for Development in Coastal Louisiana** (Best Practices Manual) developed by CPEX identifies strategies and best practices for coastal communities at both the community and building scales. It serves as a regional resource designed to help Louisiana meet the objectives of CPRA's Coastal Master Plan. The Manual offers a building development framework that considers Louisiana's unique cultures and geographies. It builds on the recommendations of Louisiana Speaks and works in conjunction with the Louisiana Land Use Toolkit to support implementation of strategies in the Best Practices Manual. The Manual identifies strategies and best practices that can be implemented in Louisiana's unique geographies, as well as guidance on how to implement these strategies.

The **Louisiana Homeowners Handbook to Prepare for Natural Hazards** developed by Louisiana Sea Grant and Gulf of Mexico Alliance, which both support the ecological and economic health of the Gulf of Mexico, offers Louisiana residents vital information on how to prepare for natural disasters. The handbook includes resources and tips specific to Louisiana contexts, such as information on evacuation plans, construction practices, retrofitting, property drainage, insurance, and emergency contacts. The handbook delivers important information directly to homeowners across the coast to provide them with the information they need to become more resilient to future storms.



## Purpose of this Guidebook

This guidebook presents 6 strategies for building community-scale resilience. The strategies and actions are based on an understanding of local needs and the goals of the 30 Community Resiliency Pilot Program (CRPP) grantees. Examples come from the work of these communities and the resulting CRPP planning documents. The LRAP webinar and workshop series *Planning for a Resilient Future* further informed development of the strategies. Many of these strategies and actions specifically address the risks of flooding, as this is a primary concern for many communities in Louisiana. However, these strategies and actions can be used to address risks from many other hazards such as drought, wildfires, and severe storms.

This document draws on the CRPP projects to highlight resilience planning work occurring around the state. It demonstrates how resilience planning is being conducted and implemented on the ground. Many of these strategies and actions are similar to the best practices identified in the CPEX Best Practices Manual and other documents from around the country. This is encouraging, as it shows that many places see the benefits of incorporating these actions to minimize risk from natural hazards while simultaneously enhancing long-term resilience.



## Objectives of this Guidebook

*This guidebook has 3 main objectives:*

1. To serve as a guide for planners and community leaders interested in building resilience at the local scale through action-oriented methods.
2. To document the progress made by Louisiana communities to integrate best practices into planning efforts of reducing risk and prepare for future disturbances.
3. To exemplify a shifting focus at the national, state, and local levels from disaster recovery and hazard mitigation to comprehensive planning that is grounded in resilience in order to reduce risk from natural hazards and climate change.

This guidebook presents on-the-ground strategies for building community resilience. Each strategy includes several actions to guide implementation, along with supporting case study examples from within as well as outside Louisiana. We focus on these strategies and supporting actions because many are already being successfully integrated into ongoing planning efforts. Where they are not, communities can re-purpose existing tools and processes to readily integrate these actions into their planning frameworks.





credit: Getty Images

An aerial photograph showing a large body of water at the top of the frame. Below the water, a green agricultural field is partially submerged, with a small white house and a cluster of trees situated on a small island of land. A dirt road runs horizontally across the middle of the image, with another white building on the right side. The foreground is dominated by a vast, green agricultural field with visible furrows and rows of crops, some of which are partially flooded.

## Strategy 01

### Use Adaptation Measures to Prepare for Changing Risk

The effects of a changing climate are already being felt by communities in Louisiana and across the world. Building climate-prepared communities will be essential in alleviating the adverse impacts of a changing climate and determining how the state will be impacted in the years and decades to come. Local governments are integral in implementing measures on the ground to reduce local impacts. By incorporating climate change information into existing efforts, communities can more readily implement adaptation actions, reduce the negative effects of climate change, and identify new opportunities.

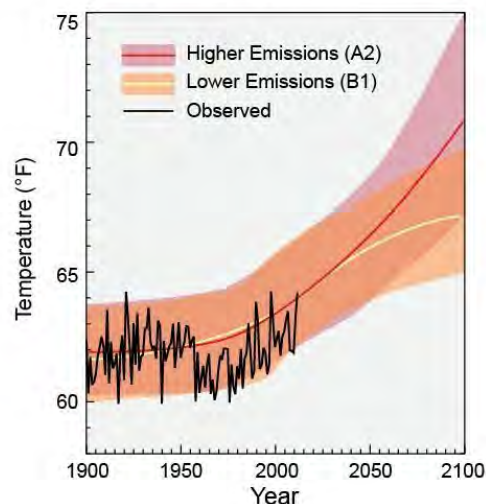
## Why We Need a New Approach

The South has experienced more billion-dollar weather and climate disasters in recent decades than any other region of the country. The effects of climate change will amplify the frequency and severity of extreme events. What does this mean?

- More intense daytime and nighttime heat;
- An increase in the annual number of days 95°+ F and nights 75°+F;
- Longer and more severe regional droughts;
- More intense hurricanes and rain events, with fall becoming especially wet.

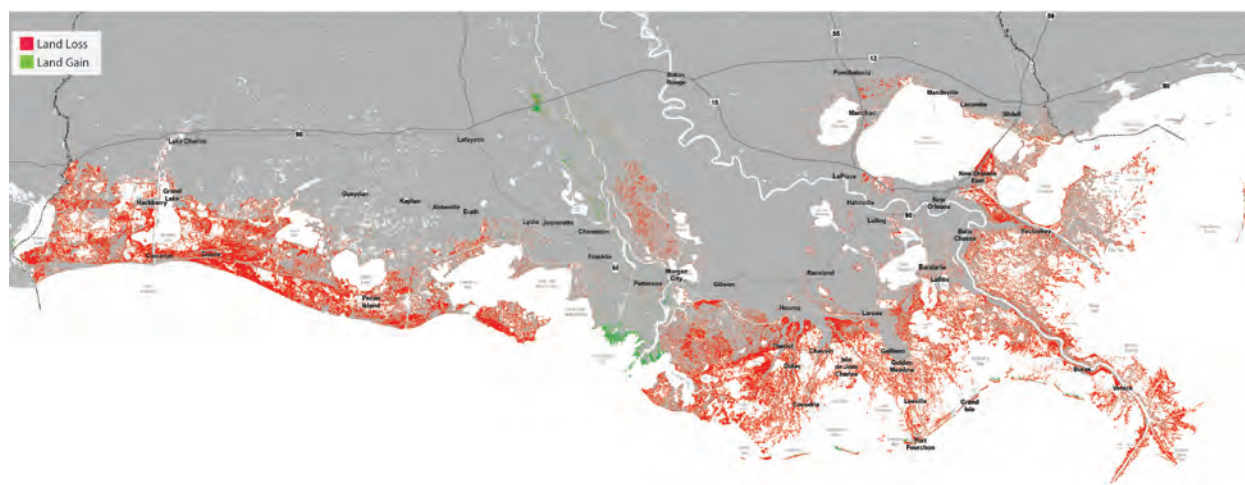
These changes will have important implications on nearly every sector of our economy, including energy demand, infrastructure, agriculture, and human health. Meanwhile, coastal Louisiana communities are already feeling the effects of rising sea levels and local land loss. The need to act is paramount.

Southeast Temperature: Observed and Projected



Projected change in temperature for the Southeast U.S., including observed (black line), high emissions projection (red line), and low emissions projection (yellow line). (Credit: Third National Climate Assessment Report, 2014)

Projected land change over the next 50 years. (Credit: Coastal Protection and Restoration Authority)





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# Prepare for Changing Risk

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Climate change and sea level rise necessitate adaptation strategies for coastal areas. Climate adaptation emphasizes policies that address current and anticipated impacts by reducing risk and creating community benefits. Adaptation helps to reduce barriers to community resilience and further contributes to hazard mitigation efforts. Adaptation approaches fall into three categories:

- **Protection:** involves hard structures such as sea walls and levees, and soft solutions such as wetlands and dunes, to defend communities so that existing land uses can continue;
- **Accommodation:** reduces impacts through changes in behavior and innovative design while maintaining use of coastal areas;
- **Managed relocation:** moves assets at high risk to new, safer locations.

The appropriate adaptation choice is based on expected climate change impacts and community character. The most appropriate adaptation choices also vary spatially based on varying levels of risk in different areas; varying levels of physical and socioeconomic vulnerability; and willingness

to implement change and innovation.

Increasing information and decision support tools exist to help communities assess risk and vulnerability to climate change. Planners, resource managers, local leaders, and others can use these tools to understand climate projections for their region and the likely impacts these changes will have on key sectors.

Empowered with this information, communities are better able to identify which adaptation approaches are most appropriate for them. When climate change projections are considered in local planning and decision-making frameworks, communities are boosting their resilience to future threats. The sooner communities begin to integrate and implement adaptation measures, the better prepared they will be to tackle future challenges.

The following list of actions present some of the ways in which communities are beginning to use climate adaptation to prepare for changing risk. More specific adaptation strategies and tools for achieving adaptation are further discussed in the Strategy 06 chapter.

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## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. A wealth of other options are possible, depending on the priorities and resources of individual communities.

[Action 1.1 Incorporate Climate Adaptation Measures into Other Planning Efforts](#)

[Action 1.2 Use Viewers and Tools to Incorporate the Best Available Data](#)

[Action 1.3 Use Climate Mitigation to Support Other Community Goals](#)

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## Action 1.1 Incorporate Climate Adaptation Measures into Other Planning Efforts

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Much like hazard mitigation planning, communities are beginning to assess their vulnerabilities to climate change and their capacity to address those vulnerabilities through planning. In many cases, communities are able to build on and retool existing efforts to increase their resilience to future threats. This may include taking an inventory of existing measures specified in other community plan documents that contribute to climate mitigation and adaptation goals. For instance, community plans often include actions and policies that aim to reduce the negative effects of natural hazards and, thus, may contribute to climate adaptation. Standalone climate action plans are also advantageous for preparing communities against unknown future risks, but such standalone plans should be integrated into other community planning efforts to maximize effectiveness and ensure implementation.

### How This Action Works:

Natural resource plans must often consider how threats from extreme weather and climate will affect the natural resources on which we rely. For instance, forest managers may be concerned with how extremes in climate harm the health and vitality of forests, and water management planners must consider the likelihood of more severe droughts and their effects on future water quality and supply. In these ways, certain sectors are naturally vulnerable to the impacts of climate change and extreme events. Integrating climate change scenarios and adaptation options into natural resource planning processes will be essential in securing the vitality of critical resources and sectors of the economy.

Hazard assessments are typically based on historic data. However, assessments of communities' risks to natural disasters are beginning to consider how future hazards may be different from past experience. Hazard mitigation planning provides an opportunity to pair hazard risks based on historic data with assessments of future risks. For example, FEMA is beginning to consider how to incorporate future flood risks into the flood mapping process. Incorporating climate change projections, such as predicted sea level rise and changes in extreme precipitation, can help communities plan for a range of future possibilities, update vulnerable infrastructure, and increase their preparedness.



### Case Study: State of Oklahoma

The Oklahoma 2012 Comprehensive Water Plan demonstrates how the state is planning for future water supplies under future uncertainty. The Plan includes a Conservation and Climate Change Addendum to assess water implications under a changing climate. It uses five climate change scenarios consistent with climate projection models to assess the implications of surface water availability for two time horizons – the years 2030 and 2060. This allows stakeholders to consider different water supply options while being more informed about future water management challenges over these planning time horizons.

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*Louisiana Pilot Project Examples:*

### **Greater New Orleans Urban Water Plan**

The Greater New Orleans Urban Water Plan represents a vision for long-term urban water management in the region. It addresses risks from subsidence and common localized flooding from small, recurrent storms. The plan also includes a range of green infrastructure practices, which can reduce the severity of heat island effect by creating shade, increasing vegetated spaces, and increasing surface water. Policy recommendations include adopting new standards and techniques that account for climate change and anticipated sea level rise, making both an economic and a quality-of-life case for promoting these strategies. By enhancing the area's capacity to handle more frequent flooding events and sea level rise, and reducing the effects of extreme heat long-term, the plan helps the region adapt to climate change.

### **Plan for the 21st Century: New Orleans 2030**

The New Orleans 2030 Plan is the City's first complete Master Plan, and includes many adaptation and climate mitigation initiatives. The plan recognizes future risks associated with climate change and natural disasters. Examples of goals include:

- Reforestation to 50% tree canopy by 2030;
- No net loss of park land and enhancement of green connections throughout the city;
- Enhancement of transportation infrastructure to be more resilient against future hazards;
- Minimization of flood damage through elevation, hardening, and flood proofing of facilities;
- Adoption of new standards and techniques for climate adaptation and mitigation throughout the range of city ordinances and development management regulations.

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## **Action 1.2 Use Viewers and Tools to Incorporate the Best Available Data**

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There is an increasing number of web-based decision-support tools available to help communities assess their risks to climate change and take action. These tools often combine observed trends with future projections to determine how future risks may differ from past experience. They are helping communities assess, quantify, and plan for the long-term impacts of climate change over various time horizons and under different future emission scenarios. In addition, understanding how the climate for their region is expected to change under different future scenarios can help stakeholders and local leaders take action despite a range of uncertainty.

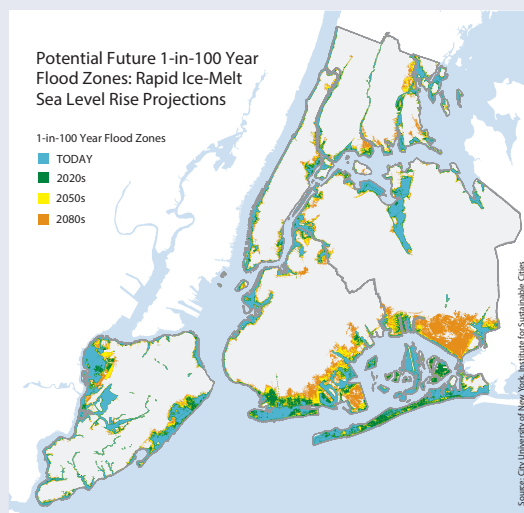
### **How This Action Works**

The availability of numerous web-based tools are making viewing and understanding climate projections much simpler. For example, the NOAA's Sea Level Rise and Coastal Flooding Impacts tool provides information on future flood risks given various sea level rise projections. The USGS Downscaled Climate Projection Portal delivers downscaled temperature and precipitation projections under various climate change scenarios. However, understanding which

tools to use and how they can help address a particular issue or concern is not always clear. With some upfront investment in time and resources, communities can ensure they incorporate these tools and use their information correctly and effectively. With these new tools and information, communities are able to better assess their vulnerabilities to future risks and target appropriate adaptation options to address those vulnerabilities.

## Case Study: New York City, NY

The New York City Panel on Climate Change prepared a report in 2013 to help the city respond to the threats from climate change and accomplish the goals of PlaNYC, the city's 2007 sustainability plan. Titled *Climate Risk Information 2013: Observations, Climate Change Projections, and Maps*, the report provides new climate change projections using climate models and future flood risk maps for the city. Regional sea level rise scenarios out to 2050, 2080, and 2100 are combined with FEMA flood data to show areas at risk to flooding in the future from the 1% annual chance flood event (100-year storm). These scenarios and maps will be used by floodplain managers, engineers, planners, and surveyors for recovery planning and future development decisions.



*Louisiana Pilot Project Examples:*

### Lafourche Parish Comprehensive Resiliency Plan

Lafourche Parish has some of the highest rates of land loss and wetland degradation. The parish's Comprehensive Resiliency Plan further acknowledges the compounding risks associated with projected sea level rise. To better understand local risk and adaptability, Lafourche used multiple data sources - known as psychographics - to understand attitudes and aspirations of residents.

As part of the parish's resilience and hazard mitigation strategies, the Plan outlines several key goals, including new partnerships and data sharing across political and sector boundaries to best understand local and regional sea level rise projections, impacts, and appropriate adaptation measures.

## Action 1.3 Use Climate Mitigation to Support Other Community Goals

Climate mitigation can be used in addition to climate adaptation and hazard mitigation measures to increase a community's overall resilience to future risks. In many cases, specific climate mitigation measures can directly support other community goals. For instance, achieving emissions reduction targets can lead to higher energy savings, generate new energy jobs, and benefit public health. Identifying risk reduction benefits and economic opportunities that can arise from setting climate mitigation targets can further increase the likelihood and effectiveness of project implementation.

### How This Action Works

Addressing climate change risks does not have to be at odds with economic development and community growth opportunities. Rather, communities are finding economic advantages from climate mitigation actions, in addition to adaptation and hazard mitigation efforts. Climate mitigation refers to actions to reduce greenhouse gases.

A wide range of incentives are often used to promote climate adaptation and mitigation. Examples include:

- Incentives for developers to integrate energy efficiency and conservation features into building and site designs;
- Rebate programs that encourage property owners to manage stormwater on site;
- Tax rebates and credits for homeowners to voluntarily elevate their homes or set them back outside of the 100-year floodplain;
- Transfer of development rights to encourage retreat from vulnerable areas;
- Other tools such as siting incentives, low-interest loans, and conservation easements.

Communities are creating “win-win” partnerships with businesses, industry, and landowners to promote climate action. Sometimes the direct benefits of partnering are clear. For example, communities in the Pacific Northwest have partnered with major industries to build mass transit that serves to reduce traffic congestion, greenhouse gases and deliver employees to key employment centers.

When direct benefits are less clear, incentives have been used to get key private sector partners

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*Louisiana Pilot Project Examples:*

### **Terrebonne Parish Comprehensive Plan Update: Vision 2030**

The Terrebonne Parish Comprehensive Plan supports efforts to ensure that all parish buildings and operations are models of resource and energy efficiency to make parish buildings and operations more sustainable. To achieve this, they have proposed several strategies, as follows:

- Green acquisition and building policies;
- Renewable energy sources in parish buildings;
- Energy efficiency for facilities and vehicles;
- 20% reduction in emissions by 2030.

The plan also identified opportunities for partnering with the South Central Planning & Development Commission and the Parish to address ozone-related and greenhouse gas emissions.

involved in the process. One way to do this is by highlighting the multiple benefits a certain project will provide. For instance, a wetland restoration project may provide carbon credits, points in the Community Rating System, and added flood protection.



*Credit: Texas Office of Public Utility Council*

### **Case Study: Texas**

The Texas LoanSTAR is a statewide energy efficiency program that provides low-interest loans to finance energy conservation in public facilities. As of January 2013, the program has funded over 215 loans totaling more than \$257 million for a program energy savings of over \$385 million.

### **City of Hammond Comprehensive Master Plan**

Hammond’s Comprehensive Master Plan recognizes the city’s role in reducing greenhouse gas emissions, while making the city more energy efficient, livable, and economically competitive. The Plan aims to improve the quality of its natural resources, and it encourages “climate-positive planning” by calling for the reduction of greenhouse gases from many sectors. The supporting policies include the following:

- Increased efficiency of existing networks;
- On-site clean renewable energy;
- Incentives for sustainable public buildings;
- Encouraging manufacturing and green jobs;
- Reforestation and green site design to reduce emission and urban heat island.



credit: Google Earth

An aerial photograph of a river delta, showing a large river branching into many smaller channels that flow through a landscape of green fields and some buildings. The water in the channels is a muddy brown color. A blue rectangular box is overlaid on the top right corner of the image, containing white text.

## Strategy 02

### **Incorporate Innovative Data, Communication, and Visualization Tools**

The advance of technology in disaster recovery has revolutionized the way that we respond to disasters. Social media and online reporting tools have allowed citizens to report conditions on the ground to emergency managers, who are now incorporating this flow of information into their disaster response plans. With new information and tools coming from the grassroots, planners likewise have new options for building and maintaining strong, safe, functioning systems at the neighborhood scale.

### Why We Need a New Approach

Effective citizen participation in planning is increasingly important to boost public support and ensure the long-term viability of Louisiana communities. Many small, rural communities are at a disadvantage, with few resources to tackle complex problems in a changing landscape. Small staffs, shrinking budgets, limited expertise, and lack of baseline data all make it difficult for communities to address threats from natural hazards. Technology in the hands of citizens and planners can increase efficiency, generate essential baseline data, supplement traditional sources of information, and improve government responsiveness.

Traditionally, town hall meetings were the primary vehicle for bringing citizens together to collect

feedback during the course of a planning process. These in-person public meetings, while important, confine citizen involvement to short windows of engagement and may exclude people who work, have other commitments during evening public meetings, or those who do not have access to transportation. New technologies allow citizen engagement to be a part of every step in the planning process. Without this level of civic engagement, planners may miss opportunities to garner support and incorporate valuable information that can inform plan development and increase its effectiveness. Continued citizen input can also help local governments address increasing risks early on for hazard mitigation and adaptation projects.

*A community planning meeting in Alexandria, Louisiana engages citizens in the planning process.*





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# Communication, and Visualization Tools

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## How Does This Strategy Increase Resilience?

Community resilience includes building social capital and capacity to anticipate and plan for the future. Within the planning process, a key aspect of this is engaging the public to gain their insight and disseminate useful information. While planning has always been a participatory process, web-based technologies expand opportunities to engage citizens in the planning process; collect and display pertinent community data; collaborate with other organizations around common interests; garner support for completed plans; and monitor and adaptively manage a plan's implementation.

Web-based tools that deliver information to targeted audiences help planners reach populations they might not otherwise, including those in vulnerable or underserved areas. When used effectively, these tools can enhance the process by making citizens more substantive partners in planning decisions and increasing government transparency. Web-based tools should not replace tried-and-true methods of citizen engagement, but rather supplement existing outreach. In fact, new tools may be most useful in conjunction with other modes of outreach and engagement, such as surveys, community presentations, and face-to-face meetings.

Web-based apps and tools are further helping to create networks between planners, emergency professionals, and groups with shared interests. Tools and apps include everything from crowdsourced data and web-based geographic information system (GIS) mapping to online games and interactive apps. Use of web-based technologies may require initial investment associated with setup costs and training to build the framework for collecting and utilizing new data. However, once these tools are set up, their use can make a considerable contribution to the capabilities of local planning staff, as well as other organizations.

As planners begin to use online tools and apps more readily in their work, challenges associated with incorporating and managing the vast amount of new information and data must be considered. For instance, planners will need to consider what the weaknesses or limitations are of different apps and whom they may unintentionally omit from the conversation. In addition, certain tools will be more effective at addressing particular issues than others. These are some of the issues that each community will need to weigh as they consider which types of software and apps to use.

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## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. A wealth of other options are possible, depending on the priorities and resources of individual communities.

Action 2.1 Use Online Forums to Collect Targeted Data and Promote Civic Engagement

Action 2.2 Use Visualization and Mapping Apps to Explore, Visualize, and Understand Data

Action 2.3 Use Technology to Share Information and Increase Collaboration

Action 2.4 Use New Tools to Increase Data Collection for Ongoing and Disaster Needs

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## Action 2.1: Use Online Forums to Collect Targeted Data and Promote Civic Engagement

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Planners now have the opportunity to provide online forums for public comment, much like community forums or charrettes. In online forums, planners are collecting more targeted data directly from citizens, avoiding expensive software or slow and costly surveys. As a result, online platforms make it easier for citizens, community leaders, businesses, and officials to discuss issues and goals, not just sporadically during public hearings but on an ongoing basis.

### How This Action Works

Planners and city officials use technology to collect information and data from citizens, a process known as crowdsourcing. Crowdsourcing tools, or apps, are particularly advantageous for communities struggling with small staffs and tight budgets. The power of crowdsourcing for planning lies in the ability to freely collect data from citizens, provide an ongoing forum for engagement, and offer more convenient access than in-person town hall meetings to increase public input. Community-driven data can also be used by cities to collect more targeted data of

interest and address a wide range of issues, such as code enforcement, community development, and park maintenance.

New technology allows community issues to be presented in new ways. Another type of online community forum is the use of games. Engaging apps and online games offer fun, interactive ways in which citizens can share ideas for their communities with neighbors, planners, and community leaders online.

The flow of information in crowdsourcing apps.



### Case Study: Engaging Apps

Community PlanIt is an online game whereby citizens tell planners and community members what they would like to see happen in their neighborhoods. Planners can pose topical questions and provide background information, while citizens respond and provide feedback through multiple-choice questions and comments, which can include uploaded photos and videos. Learn more about this online tool at: [communityplanit.org](http://communityplanit.org).



Credit: Community PlanIt

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Louisiana Pilot Project Examples:

### City of Alexandria THINKAlex Resiliency Plan

The Alexandria planning team used a variety of successful online engagement tools during the THINKAlex Resiliency Planning process. These tools included:

- A project website and Facebook page used to post results from meetings and enable community members to review and comment;
- A Twitter account that allowed community members to follow progress of the project;
- A 6-week online community survey that allowed members of the community not able to attend on-site meetings to participate.

These online tools were augmented by more traditional in-person meetings and newspaper and radio announcements. Further, the THINKAlex Resiliency Plan recognizes the importance of ongoing traditional and web-based technologies to public engagement and plan implementation.

### Terrebonne Parish Comprehensive Plan Update: Vision 2030

For its Comprehensive Plan update, Terrebonne Parish used social media for the first time in their public participation efforts to effectively communicate with citizens during the planning process. The parish initiated and maintained a project-specific Facebook page to advertise meetings and capture comments online about the plan, reaching over 1,300 friends just one year after the initial parish-wide kickoff meeting. Social media was used in conjunction with email, website updates, and informational flyers to leverage and boost existing communication networks. The Plan further emphasizes use of social media and web-based tools to meet specific goals.

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## Action 2.2 Use Visualization and Mapping Apps to Explore, Visualize, and Understand Data

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Mapping geographic data and conducting spatial analysis often requires expertise in GIS software and research techniques. Mapping and visualization apps allow basic analysis and mapping to be done without expensive software and extensive expertise. These apps can be used as internal tools for analysis by city staff and as ways to visually convey information to the public, such as through graphs, charts, and maps. While not intended to replace more detailed analyses for in-depth understanding of an issue or topic of interest, these apps are helping planners obtain basic information and generate maps for easy and quick communication with colleagues and the general public.

The flow of information in visualization apps.



## How This Action Works

The capabilities of these apps range from simply displaying photographs of specific locations to providing data-intensive maps that can be used for multiple levels of analysis. Users can spatially view and analyze various types of community information, such as demographics, transportation, and access to essential services. Web-based GIS tools, in particular, allow users to view a range of data and create maps without the need for expensive software. For instance, information about the location of blighted property can be viewed with delineations of the 100-year flood zone to more easily and quickly plan future development and land use. This capability makes it easier to view hazard data together with community information for more informed, resilience-based planning and decision-making.

*Louisiana Pilot Project Examples:*

### City of Walker Sustainability Master Plan

A key objective of the City of Walker's Sustainability Master Plan is the development of a GIS database and mapping tool to maintain records on infrastructure, including locations of main breaks; types and sizes of piping; dates of improvements and repairs; and other essential information. This will help the City extend, improve, and maintain public utilities in a more efficient manner.

### East Feliciana Parish Comprehensive Resiliency Plan

The East Feliciana Parish Comprehensive Resiliency Plan identifies improved mapping and data collection as priority for future growth and development. The parish is gathering and updating spatial information and incorporating use of GIS into parish operations. Using GIS, the parish anticipates it will be able to better track development, permitting impacts, infrastructure improvements, progress toward plan goals, and improve decision-making through sound technical analysis. The Plan also considers partnering with towns and the school district for improved efficiencies.

### Scott 2032: City of Scott Comprehensive Plan

The City of Scott's Comprehensive Plan recognizes the benefits of complete data on city services and infrastructure to tackle problems and develop stormwater management strategies that limit runoff and flooding. Recommendations include building on existing data and organizing a database that will enable more visual analysis and mapping of data, as well as more easily facilitate ongoing maintenance and future improvements.

### St. John the Baptist Parish Comprehensive Land Use Plan

Among the goals outlined in St. John the Baptist Parish's Comprehensive Land Use Plan is to protect and preserve lands that are sensitive to disturbance or that provide unique economic, ecological, resilient, cultural, or aesthetic features. To this end, the Plan recommends enhanced GIS and creating databases with complete characteristics of natural ecosystems in the parish. This will help to make informed development decisions and for sharing pertinent information with the public.



### Case Study: Google-Based Tools for Planners

Google Forms is a free service that can be used to collect information and specific data from citizens. These sets of data can then be imported into Google Fusion Tables, an accessible community GIS tool, to visualize the data and perform basic analysis. Finally, the data can be exported from Fusion Tables to Google Maps to spatially display the information and communicate results back to the public.

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## Action 2.3 Use Technology to Share Information and Increase Collaboration

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Communities planning for resilience must create strong partnerships among organizations with interest in land use planning, hazard mitigation, and disaster preparedness, as well as with the broader public. New technologies help to reinforce strong communication and partnerships, breaking down silos that prevent effective action. Information-sharing through apps or online tools allows citizens to quickly and easily access information on a variety of topics. Usually, the information is provided by public agencies but other stakeholders, including non-governmental organizations, the private sector, etc. can provide the information. These apps further allow citizens to be providers of information to agencies and other organizations.

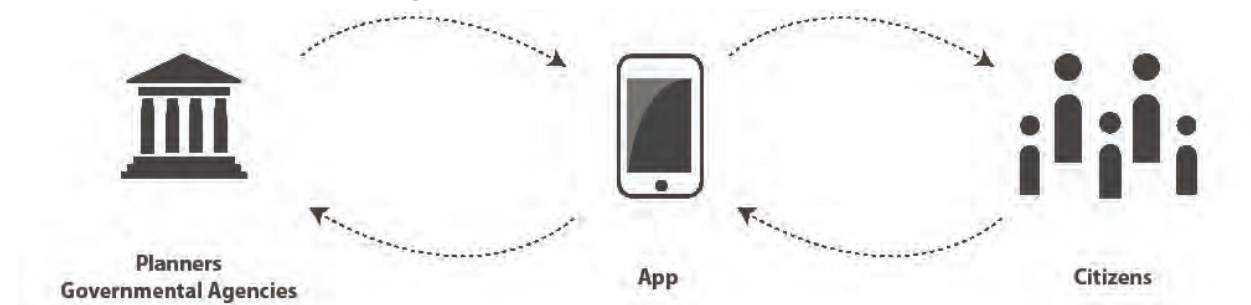
### How This Action Works

Information-sharing apps and tools can be repositories of information on a variety of topics of interest and relevance to planners and citizens, such as the economy, environment, planning and codes, health, and institutional information, to name a few. Planners are using these apps to easily relay information to citizens so that they become more informed participants.

Information-sharing apps and online mapping platforms make it easier for planners, emergency professionals, and other specialists to display and

share information of common interest to multiple groups. For instance, an inventory of all buildings in an area may be of interest to developers and emergency managers. Crowdsourced data can add an additional layer of information that may be of interest and benefit to multiple organizations. In these ways, such tools are helping to facilitate collaboration between planners and various organizations with vested interests in similar issues, such as blight, transportation, housing, conservation, or emergency management.

*The flow of information in information-sharing apps.*



### Case Study: Greater New Orleans, Inc.

Greater New Orleans, Inc. (GNOi) is a regional economic development alliance serving the 10-parish region of Southeast Louisiana. The GNOi app provides economic facts, statistics, and accolades about jurisdictions throughout the Greater New Orleans Region. It puts information directly in the hands of businesses, community leaders, entrepreneurs, and citizens. This information can help users leverage relationships with partners to support sectors, new opportunities, and growth throughout the region.

Louisiana Pilot Project Examples:

### Greater New Orleans Urban Water Plan

As part of their community engagement strategy, Greater New Orleans, Inc. created an iPad app as a supplementary learning tool to the Urban Water Plan. The app is an interactive tool that citizens can use to learn about and stay current on the region's water management strategies, including groundwater levels, subsidence, and flooding.

### Lafourche Parish Comprehensive Resiliency Plan

A goal of the Lafourche Parish Comprehensive Resiliency Plan is to build the economy on existing parish assets through maximization of redevelopment opportunities. Recommendations include maintaining a GIS database of available industrial redevelopment sites for communities and developers to access, and data sharing programs that create partnerships across political boundaries such as the creation of water management, land management, and public safety databases.

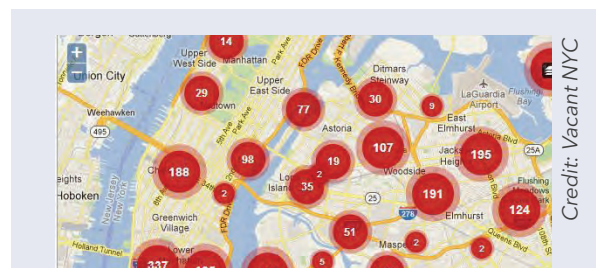
## Action 2.4 Use New Tools to Increase Data Collection for Ongoing and Disaster Needs

Mobile applications for tablet or cell phone help planners perform a wide variety of functions for normal, everyday operations as well as during emergencies. Such apps are geared for collecting community- or neighborhood-level data that can be used to improve the day-to-day functions and disaster-related operations, from locating and tracking potholes, blight, and other neighborhood-scale issues to mapping the capacity of disaster evacuation routes.

### How This Action Works

Sensing and predictive apps collect data from users automatically through features on their smartphones or tablets, such as with a movement sensor, GPS, or camera. Sensing apps have been widely used for transportation modeling, planning, and safety purposes.

During and following disasters, emergency managers and local governments are capitalizing on social media and online apps to collect and map a variety of pertinent information in real time. Use of disaster-related apps that provide information for emergency managers and citizens can further generate data relevant for future community planning. For example, these tools can help to track affected populations and allocate resources to critical areas. Long term, the information collected from disaster apps, including hazard-prone areas and vulnerable populations, can be used to inform disaster preparedness, hazard mitigation planning, and future land use planning.



### Case Study: Ushahidi

Ushahidi is a free, open source platform for information collection, visualization, and interactive mapping. It is commonly used to facilitate disaster response by mapping crowdsourced information collected from SMS, email, Twitter, and the web, and can be customized for a variety of needs. New York City developed a version of the Ushahidi platform called Vacant NYC that allows citizens to map vacant lots and properties, which is too costly for the city to do on its own. View the project at [vacantnyc.crowdmap.com](http://vacantnyc.crowdmap.com).

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The flow of information in sensing and predictive apps.



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Louisiana Pilot Project Examples:

### **St. John the Baptist Parish Comprehensive Land Use Plan**

In its Comprehensive Land Use Plan, St. John the Baptist Parish focuses on disaster preparedness to increase community resilience. The parish recognizes the importance of timely communication before and during emergencies to ensure disaster resilience and citizen confidence. One of the supporting policies for this goal is to enhance communication with residents through multiple available media streams during emergency situations.

### **City of Alexandria AlexConnects**

The City of Alexandria’s 311 mobile application, *AlexConnects*, enables ongoing, efficient communication between citizens and city government. The app allows users to report non-emergency, neighborhood-scale issues, pinpoint the issue location with GPS, attach photos from a smartphone or tablet, and receive status updates as the issues are resolved. The city sees benefits from expanded use of the app to gather baseline data and disseminate information across sectors and during emergency events. For example, the city can adapt the app’s capabilities to show bus and rail information, traffic, and flooding in real time, which would allow citizens to view options for available or alternative transportation during peak traffic or emergencies.





An aerial photograph showing a wide river flowing through a landscape. The river is dark and occupies the lower half of the frame. To the left of the river, there is a paved road and some buildings. To the right, there is a large green field. The background is a vast, flat, brownish-green area, possibly a wetland or marsh. A blue header bar is at the top right, containing the text 'Strategy 03'.

## Strategy 03

### **Retrofit Communities for Everyday and Post-Disaster Needs**

Communities spend large amounts of money on infrastructure improvements, including road maintenance, building renovations, and drainage and sewer repairs. Precisely because these retrofitting efforts represent costly community investments, they are being conducted in ways that achieve multiple goals, which include increasing livability and sustainability; reducing hazards and risks; and preparing for post-disaster recovery.

## Why We Need a New Approach

In Louisiana, increased vulnerability to natural hazards demands innovative planning and design solutions. Historic methods of storm protection and building construction may no longer sufficiently protect homes and businesses from floods. Great opportunities exist to strengthen our communities through innovative public and private investments based on resilience principles. However, these measures can require significant upfront costs and generate conflict among stakeholders. Increasing the resilience in developed areas is challenging and can too often be ignored in favor of short-term, less contentious, or less-costly investments that deliver clear but limited value. To address the complex nature of these challenges, emerging planning, design, and construction techniques, such as innovative water resource management, home elevations, and land use regulations are being used in Louisiana and around the world to allow individuals and communities to bounce back faster, smarter, and stronger after a disturbance.

## How Does This Strategy Increase Resilience?

Community assets are increasingly vulnerable due to aging infrastructure and the impacts of climate change, including increased storms and sea level rise. Adaptation of the built environment is a necessary approach to increase physical and social resilience in the future. Retrofitting occurs at many scales, from a single family's renovation to a region-wide flood protection system. However, there are a range of processes and strategies that can be used to engage communities to retrofit existing buildings and infrastructure to accommodate storm surge and flooding. This includes developing innovative and practical landscape and building techniques to enhance existing structures, modification of land use regulations and financial incentives to encourage sustainable development, and the large-scale re-imagining of neighborhoods and communities for redevelopment after an event. Changes that make the built environment more resilient also benefit communities in terms of economic development and social stability.



# ryday & Post-Disaster Needs

## Scales of Action:

**Single Building Site:** Communities are making important site and structural decisions to mitigate impacts from storms and flooding. Common strategies for building resilience at this scale include elevating buildings, passive survivability, and design for repair and ease of retrofits. Passive survivability is the concept that individuals should be able to survive for several days with limited resources at one's home. Other types of retrofits at the building scale include gardens, green walls, day lighting of interior space, distributive energy systems, removable modular construction, and strengthening building codes and construction standards.

**Neighborhood:** There are many opportunities to retrofit neighborhoods. Some examples include low impact development, infill development, water sensitive design, tree planting and community forests, green roofs and walls, stream and creek day-lighting, community gardens and food production, bioswales and other creative water retention/water management, and neighborhood parks and small green spaces. Green infrastructure - or the use of vegetation, soils, and natural processes to manage water - is highly effective at this scale.

**City-wide:** There are several opportunities to impact communities at the municipal level through retrofitting the existing built environment. Some of the most effective techniques include land use and development regulations, including community plans and plan-making, disaster redevelopment plans, zoning and subdivision regulations, floodplain management and coastal setbacks, land and property acquisition, taxation and financial incentives; and information dissemination and public awareness.

**Regional:** Alterations to regional systems can be challenging due to political and cultural boundaries; however, issue-based cooperation can yield significant benefits to individual communities. Regional coordination can minimize duplicative efforts and optimize resource allocations of for participants. Regional resilient outcomes include river system and floodplain maintenance, watershed-based planning, regional forest ecosystems, regional greenspace, conservation areas, hard flood protection systems, and transportation networks.

*Damage from Hurricane Isaac, August 2012*



## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. Additional measures can be taken to implement this strategy, depending on the priorities and resources of individual communities.

Action 3.1 Retrofit Buildings and Landscapes to Accommodate Flooding

Action 3.2 Incorporate Green Infrastructure

Action 3.3 Retrofit Critical Infrastructure to be More Resilient

Action 3.4 Combine Public Recreation Opportunities and Flood Protection Systems

Action 3.5 Revert Land Use to Open Space in Areas with Elevated Flood Risks

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### Action 3.1: Retrofit Buildings and Landscapes to Accommodate Flooding

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When retrofitting buildings, open spaces, streets, and parks, communities are addressing day-to-day community needs while building in assets that will help the community weather future disasters. Instead of only ensuring buildings and properties can accommodate flooding, citizens and local leaders are making their communities stronger both pre- and post-disaster through increased standards that take into account sea level rise and stronger storms and floods.

#### How This Action Works

Communities are going beyond traditional building codes and FEMA base flood elevation (BFE) requirements by retrofitting important community assets. Examples of this include:

- Civic buildings, such as fire stations or libraries, are being renovated or designed to become multi-functional community centers;
- Parks and open space are increasingly designed for stormwater management during heavy rain events, and as staging areas for disaster recovery.

Within building codes, communities are adopting regulations and design standards requiring wind and flood proofing measures. Examples of include:

#### *Wind Proofing*

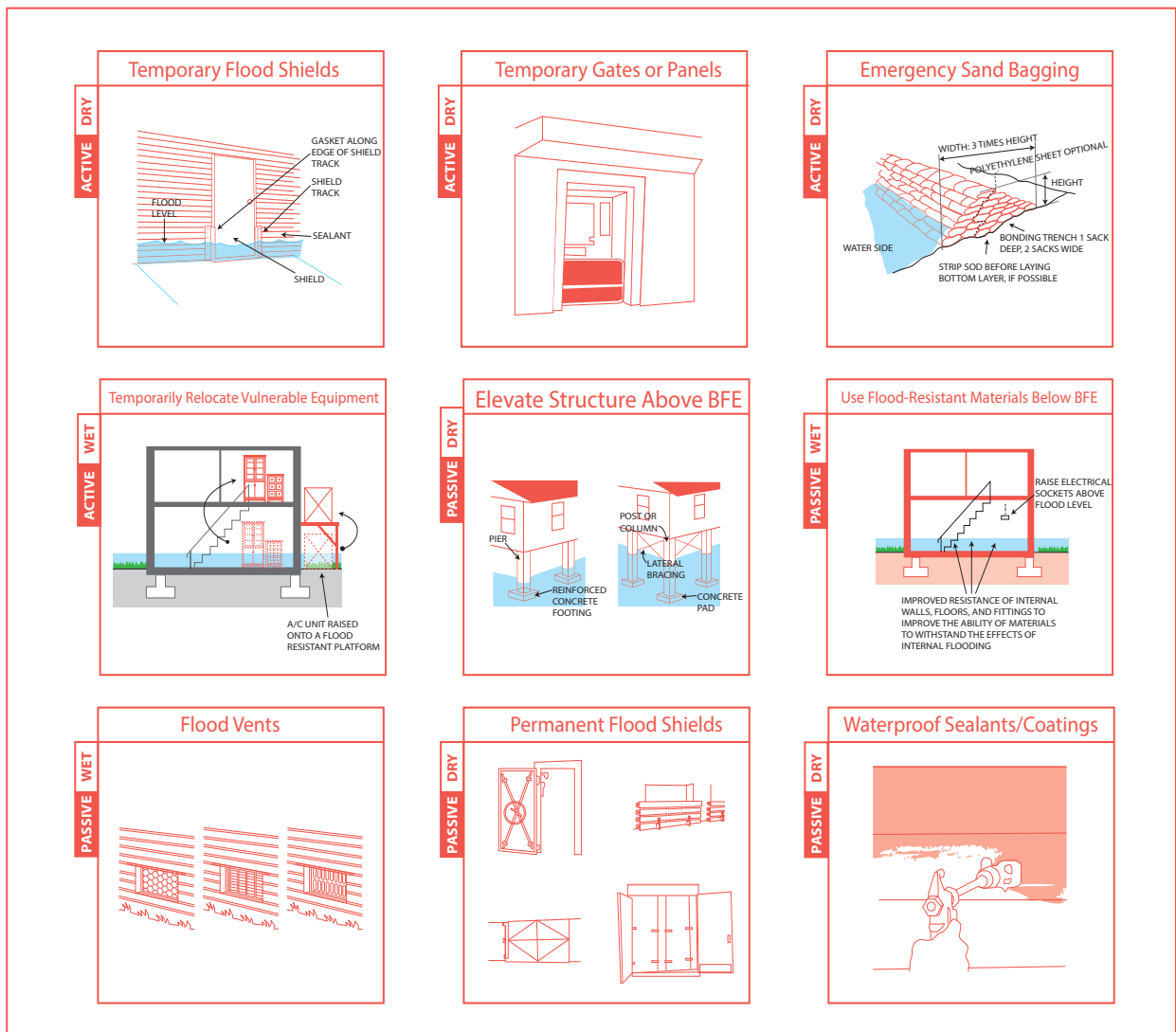
- Hurricane straps
- Hurricane shutters
- Truss bracing
- Removal of potential windborne missiles

#### *Flood Proofing*

- Temporary flood shields
- Temporary gates or panels
- Flood resistant materials below BFE
- Waterproof sealants
- Removable modular construction
- Flood vents
- Relocation or elevation of critical equipment

Homeowners and government agencies in areas vulnerable to disasters are also retrofitting buildings with technology that increased energy performance while also increasing disaster resilience. Examples include:

- Replacing doors and windows with those that are both energy efficient and wind resistant;
- Installing generators and renewable energy back-up technology, such as solar and geothermal, to help keep food from perishing, keep homes heated or cooled, and reduce the risk of mold caused by high humidity.



Examples of building retrofit techniques that can minimize damage from storms, including combinations of dry, wet, active, and passive flood proofing.

Louisiana Pilot Project Examples:

**Breaux Bridge Comprehensive Long-Range Resiliency Plan**

The City of Breaux Bridge has included an initiative in their Comprehensive Long-Range Resiliency Plan that requires all buildings to be structurally sound and flood-proofed. This applies to construction of all new municipal buildings and for retrofits of existing public buildings.

**Old Mandeville Town Center Plan**

Mandeville has included building requirements for flood resilience in its Old Town Center Plan. Nearer Lake Pontchartrain, buildings must meet stricter elevation or dry-flood proofing requirements. The Mandeville Pattern Book provides design and resiliency guidance for foundations that will help to mitigate some of the aesthetic effects of highly elevated buildings.

## Jean Lafitte Tomorrow Town Resiliency Plan

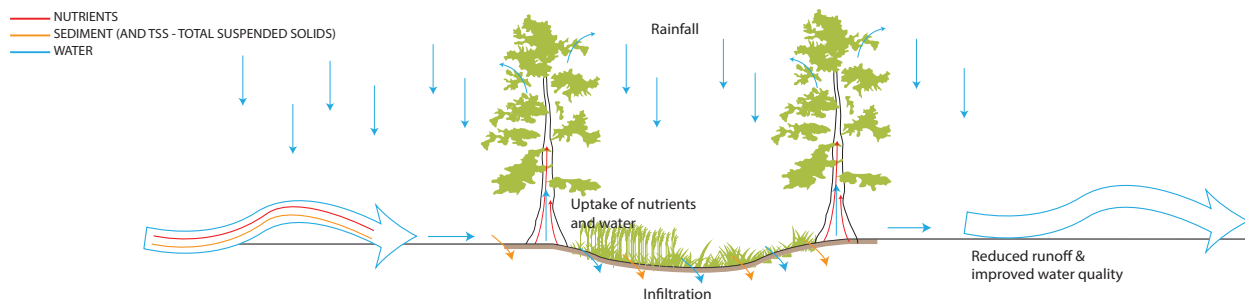
The Town of Jean Lafitte's Resiliency Plan includes a proposal to meet FEMA elevation requirements by lifting buildings and creating a network of elevated walkways at Goose Bayou. The plan envisions reconstructing the marina, adding storm proofed dry boat storage facilities, elevating

overnight lodging for recreational fishermen, creating shared cooking/cleaning facilities, and improving ground level parking. Elevated pedestrian walkways linking the buildings could form a continuous circulation network, encouraging a close-knit community.

## Action 3.2: Incorporate Green Infrastructure

This type of retrofit seeks to augment existing water management systems through the use of green infrastructure in parks, road design, drainage, and wastewater systems. Green infrastructure is an approach that protects, restores or mimics the natural water cycle. The use of green infrastructure reduces point source pollution and peak storm flows, while providing the opportunity for groundwater recharge. These techniques are increasingly incorporated into new designs, retrofits of existing systems, and public works maintenance. They can be implemented at relatively low cost compared to conventional infrastructure; however, ongoing maintenance is required.

*Bioswales are used to capture rainfall on site and reduce runoff.*



### How This Action Works

Bioswales are one type of green infrastructure being incorporated into water management systems. Bioswales are vegetated landscape elements that store water and remove pollutants from stormwater runoff. Bioswales replace or augment sub-surface drainage, and are particularly well suited to streetscape and parking-lot designs. Benefits include the improved water quality, reduction in peak storm flows, and added aesthetic features.

Retention/detention ponds play an important role in adding capacity to existing stormwater systems and mitigating runoff water quality impacts. Whether designed to hold water at all times or only in heavy storm events, these techniques can incorporate passive and active recreation

opportunities - increasing investment returns.

Trees typically intercept significantly more water than other landscape elements such as grass. Tree planting can also significantly impact the ecosystem services in a community. Native trees provide wildlife habitat, stormwater benefits, air filtration, and noise pollution reduction. Successional planting strategies allow natural systems to establish themselves, providing high value benefits to the ecosystem.

Riparian buffers are vegetated areas on either side of a water body that protect ecosystems from the impacts of development via water quality, management, biodiversity. These areas can include public trails and wildlife viewing areas.

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Louisiana Pilot Project Examples:

### Greater New Orleans Urban Water Plan

The Greater New Orleans Urban Water Plan promotes the integration of wetlands in parks distributed throughout the region as a means to store and filter stormwater. The plan further calls for existing wetlands to be restored with treated wastewater and filtered stormwater. Another initiative calls for circulating canals in low-lying areas to recharge groundwater and sustain wildlife habitat. Whether existing or proposed, all recommendations are designed to enhance the quality of life in adjacent neighborhoods.

### Scott 2032: City of Scott Comprehensive Plan

Scott, Louisiana, is incorporating stream restoration in order to reduce flood risks, thereby increasing developable land and increasing property values through their planning work.

### Jean Lafitte Tomorrow Town Resiliency Plan

The Town of Jean Lafitte recognizes the need for stormwater management and natural resource protection ordinances to reduce damages from floods and other hazards. The intent of these ordinances is to regulate runoff caused by development to protect natural systems, and to more broadly plan drainage systems at the scale of the watershed, not based on political boundaries.

### City of Walker Sustainability Master Plan

The City of Walker's Sustainability Master Plan calls for the incorporation of low impact development; bioswales in parking lots; and bio-retention areas or rain gardens to collect rainwater after storms and divert it from the stormwater system.

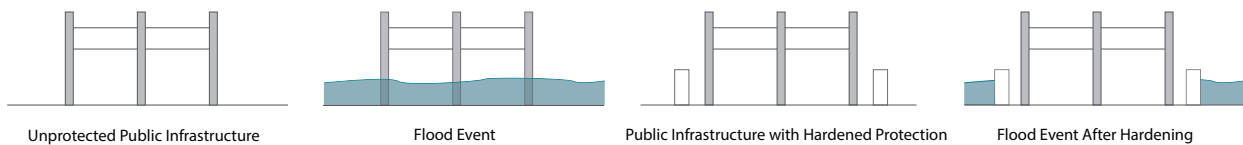
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## Action 3.3: Retrofit Critical Infrastructure to be More Resilient

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The impacts of extreme weather events, sea level rise, and shifting precipitation and temperature patterns pose challenges to public infrastructure in the energy, water, building, storm protection, and transportation sectors. These systems require significant investments, not only in up-front costs, but also ongoing maintenance. Integrating resilience principles into existing maintenance programs can provide funding for such retrofits.

*Example of the importance of retrofits made to infrastructure to reduce flood impacts.*



## How This Action Works

Concerns about potential effects of extreme weather events and climate change on infrastructure and water systems are growing. Retrofit strategies include:

- Relocation to less vulnerable locations;
- Installation of water tight protective measures around crucial equipment and assets;
- Switching to submersible utilities and pumps.

In the wake of major natural disasters, some state utility commissions have adopted new regulations to “disaster-proof” critical infrastructure against extreme climate and weather events. Key retrofits for these systems include:

- Stricter construction standards;
- Increased infrastructure inspection frequency;
- Vegetation management programs;
- Requiring gas stations to have back-up energy sources to prevent crisis situations.

Funding stormwater infrastructure upgrades to address aging and increasingly stressed systems is an ongoing issue for communities. Communities are assessing funding options to meet expanding service needs, employ new technologies, and comply with evolving regulatory requirements. Uses for these funds include capital improvements, operation and maintenance of stormwater systems, and green infrastructure implementation.

*Louisiana Pilot Project Examples:*

### **Breaux Bridge Comprehensive Long-Range Resiliency Plan**

The Breaux Bridge Comprehensive Long-Range Resiliency Plan recommends implementing a citywide water conservation program to ensure average daily water use remains stable or decreases over the horizon of the plan.

### **Lafourche Parish Comprehensive Resiliency Plan**

Lafourche Parish’s Resiliency Plan calls for the adoption of resilient development practices outlined in the Coastal Best Practices Manual, specifically to protect roads and street networks, electrical networks, water and sewage infrastructure, and to elevate critical infrastructure.

### **Port of New Orleans Design Resiliency Manual 2013**

The Port of New Orleans Design Resiliency Manual provides flood and wind mitigation options to protect buildings in addition to electrical and mechanical, potable water, and wastewater systems. Flood mitigation strategies include elevation, dry flood proofing, and damage-resistant materials. Wind mitigation guidelines specifically strengthen new and existing buildings, structural frames, foundations, and the building envelope.



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## Action 3.4: Combine Public Recreation Opportunities and Flood Protection Systems

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Communities can combine functions between infrastructure otherwise exclusively used for flood protection or recreation. This action has been successful in some places in Louisiana, and communities around the world have used it as a way to strengthen flood protection systems, increase passive and active recreation sites, and provide communal spaces for gathering and celebration.

*A multi-use natural levee system in south Louisiana used for flood protection and recreation.*



### How This Action Works

Communities may relocate flood protection structures to accommodate more room for water bodies to flood. This can reduce the risk of flooding in homes protected by levees and sea walls, while providing opportunities for riverfront parks with recreational, cultural, and natural assets.

Derelict industrial waterfronts are being used to engage natural systems and provide open space for communities to enjoy. Low elevation components of these parks can include trails with native riparian plantings; great lawns to host large events; flexible play space; and areas for loading boats.

Bayous and other water bodies can link underserved neighborhoods, schools, parks, and other civic use buildings to downtown cores of communities. This is often accomplished by

creating a pedestrian park that also addresses flood control efforts, such as bank stabilization and stream debris removal.

Concrete drainage channels are being retrofitted to create usable public space that supports a variety of community and landscape types, while maintaining flood protection and restoring a functioning ecosystem. This type of reclamation can include landscape terraces that support habitat and improve water quality. Potential long-term improvements include expanding channel capacity to reduce flow velocity; creating underground flow diversions; and widening channels. Benefits include rainwater reclamation, aquifer replenishment, neighborhood revitalization, recreation activities, job creation, and open space.

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Louisiana Pilot Project Examples:

### **Terrebonne Parish Comprehensive Plan Update: Vision 2030**

A goal of Terrebonne Parish’s Comprehensive Plan is to create a reliable and efficient public utility and facilities infrastructure to meet the needs of the community for the next 30 years. Supporting policies include an interconnected green infrastructure network of retention basins and drainage facilities that can be used for recreation.

### **Greater New Orleans Urban Water Plan**

The Greater New Orleans, Inc. Urban Water Plan includes the development of waterfront development zones along key waterways and parks to anchor higher-density, mixed-use districts on high ground less prone to flooding.

### **City of Central Resiliency Plan**

The City of Central’s Floodplain and Watershed Management Plan element specifically mentions the benefits of using the floodplain and greenways to provide aesthetic and ecological benefits, as well as recreational benefits, such as walking and biking trails and water access.

*Local farmers markets strengthen social networks and support community resilience.*



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## **Action 3.5 Revert Land Uses to Open Space in Areas with Elevated Flood Risks**

When development encroaches into the floodplain, flood risks and damages rise. Many communities are working to remove residential and commercial land uses from low-lying areas, and restricting future development to lower flood risks and associated damages.

### **How This Action Works**

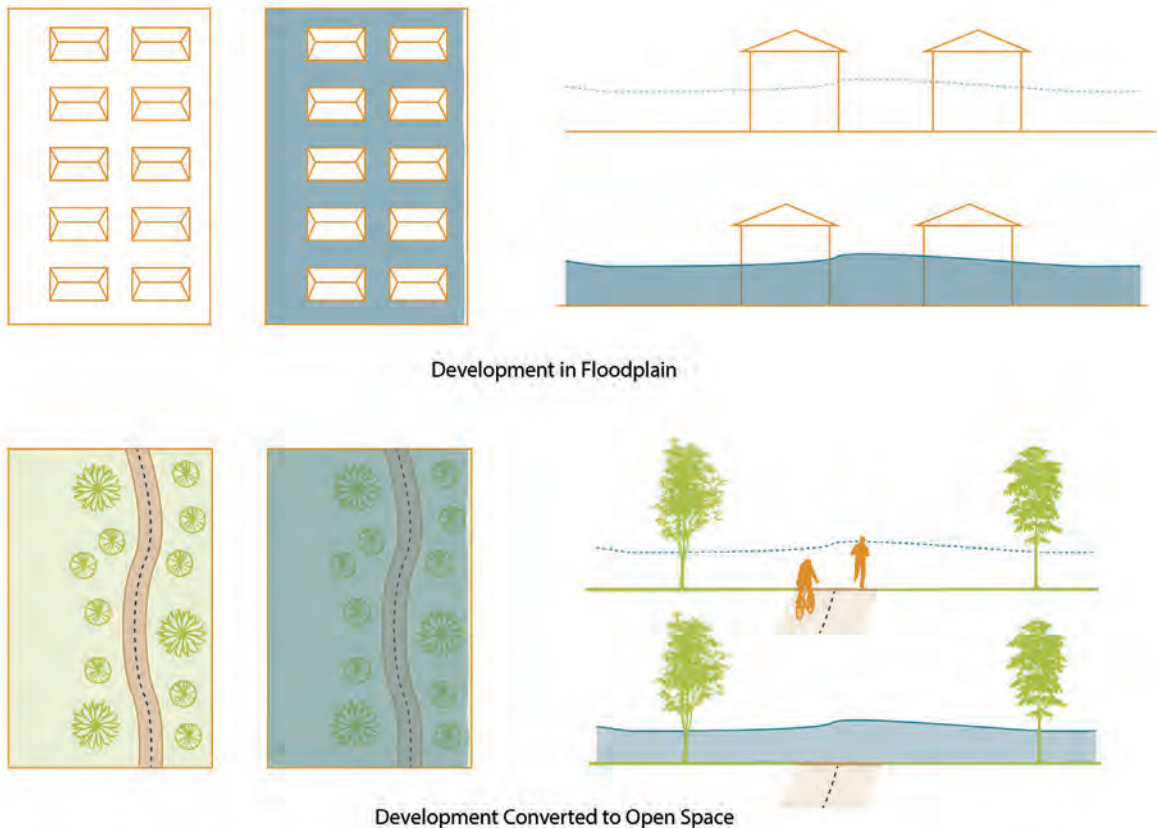
Vulnerable locations are being converted to open space and storm water capacity through the purchase and removal of structures from floodplains. Communities vulnerable to sea level rise and flooding are adopting unique

development regulations such as rolling easements that allow shorelines to migrate, and wetland mitigation that maintains storage and habitat functions. Zoning can also be used to provide space for community gardens - including

on public land - which can serve as stormwater management areas, community gathering spots, and address public health issues associated with lack of access to fresh food.

By retrofitting with resilience in mind, these projects - infrastructure, buildings, landscapes, or flood protection - are strengthening communities and ensuring safer and smarter development.

*Example of how land use can be converted to accommodate flooding and minimize costs.*



*Louisiana Pilot Project Examples:*

**Scott 2032: City of Scott Comprehensive Plan**

The City of Scott recognizes the need to restrict development in the 100-year floodplain. Recommendations in the city's Comprehensive Plan support the creation of recreation and community assets such as parks, active and passive recreation facilities, and parking areas within the floodplain.

**City of Central Resiliency Plan**

The City of Central Resiliency Plan's Floodplain and Water Management Element analyzes the six drainage sub-basins in the city to assess capacity.

This analysis is overlaid with the existing land use and associated densities. The plan proposes alterations to density zones to reflect the capacity of each area to drain effectively.

**Lafourche Parish Comprehensive Resiliency Plan**

The Lafourche Comprehensive Resiliency Plan recommends identification and pursuit of preventative measures to reduce damages from future hazards. One strategy is to address chronic flood damage through mitigation measures such as elevation, acquisition, or reconstruction of all repetitive loss and severe repetitive loss structures.



credit: Getty Images



## Strategy 04

### **Prepare Communities for the Rising Costs of Disasters**

Catastrophic losses from disasters in many parts of the U.S. over the last decade, particularly from hurricanes, have strained federal disaster relief funds, forcing local governments to consider alternative ways to reduce impacts from flooding. The changing political climate offers local governments across Louisiana opportunities to take proactive steps to reduce risk and address issues of instability in their communities.

## Strategy 04

# Prepare Communities for the

### Why We Need A New Approach

In response to a series of damaging and costly storms, federal legislation passed in 2012 significantly reformed the National Flood Insurance Program (NFIP). Among other things, this law required immediate steps to eliminate a variety of existing flood insurance subsidies. As a result, flood insurance rates rose to meet full-risk rates. This means properties in high risk areas have seen significant increases in premiums. Louisiana residents, with the third most flood insurance policies in the country, have been heavily impacted.

With significant population and infrastructure in high-risk areas, new policies must be considered that increase resilience, mitigate increased insurance costs, and improve current or future development in high risk areas. To this end, communities are adapting their planning and development practices to reflect full risk and risk reduction. This includes updating development regulations to exceed minimum NFIP requirements, conservation and protection strategies that better address unique community needs, and removing development from high risk areas. By reducing individual and community rates, and reducing dependence on the NFIP, communities are better positioned to achieve economic and environmental sustainability.

### How Does This Strategy Increase Resilience?

Planning plays an increasingly important role in floodplain management and risk reduction. Through resilience planning that combines hazard mitigation efforts with land use and adaptation planning, communities are using multi-pronged approaches to coordinate policies that may otherwise have occurred separately. This includes re-purposing existing regulatory tools, sharing resources across entities and regions, and increasing public outreach and education about risk reduction. These varied but concerted efforts help communities combat rising flood insurance rates and losses incurred from disasters.



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# Rising Costs of Disasters

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*Elevating homes is a common approach used in Louisiana to reduce long-term costs associated with flooding.*

## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. Additional measures can be taken to implement this strategy, depending on the priorities and resources of individual communities.

Action 4.1 Maximize Insurance Savings Provided by the Community Rating System

Action 4.2 Build Flood Control Structures to Protect Critical Development

Action 4.3 Target Voluntary Acquisition Areas to Relocate Homes and Businesses Out of Flood-Prone Areas

Action 4.4 Conserve Undeveloped Lands in Flood-Prone Areas as a Mitigation Strategy

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### Action 4.1 Maximize Insurance Savings Provided by the Community Rating System

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The Community Rating System (CRS) has been used across the country since 1990 to mitigate risk and lower flood insurance premiums. The CRS offers flood insurance discounts of between 5% and 45% to individuals who live in communities that voluntarily participate. When communities participate, they agree to enforce higher regulatory standards to reduce damage to insurable property and encourage a comprehensive approach to floodplain management. The CRS serves as a strong incentive for communities to pursue new and expand on existing flood mitigation measures.

#### How This Action Works

Flood insurance is a necessary tool that requires a multi-pronged approach to reduce cost and risk over time. While flood insurance is sold to individuals, voluntary measures taken by communities can help consumers save money. Communities increasingly use a diverse set of strategies to maximize protection and reduce associated cost. Examples include:

- Limiting land use on undeveloped and conservation lands
- Acquisition and buyout programs
- Structural protection

The CRS awards points for enacting stringent floodplain regulations. In Louisiana and around the country, homes and businesses are choosing, or being required, to elevate above mandatory base flood elevations (BFE). This involves building above BFE to accommodate future risk and potential losses associated with flood hazards. Oftentimes, when communities are requiring

this they are enacting regulations that limit development in the more conservative 500-year floodplain or for the 50-year flood - as opposed to the 100-year flood - to further reduce vulnerability to hazards.

In addition, communities are conducting education and outreach campaigns. As citizens contend with rising flood insurance costs, they need to know all the options available to them to mitigate their individual risks. Developing education and outreach materials also earns communities points in the CRS. Educating citizens on changes to federal flood insurance, as well as the options available to mitigate on-site flood risk, can better prepare individuals for rising flood insurance costs and help minimize the economic shocks of disasters.





### Case Study: King County, WA

King County, Washington, has incorporated a variety of flood mitigation projects to reduce flood-related damages and save money. Among many floodplain management strategies, the County requires a 3-foot freeboard standard above the 100-year floodplain elevation for most structures, as well as a zero-rise standard throughout the zero-rise floodway to provide proper flood conveyance. They have combined this with other strategies including preservation of over 100,000 acres of open, natural space, acquisitions, and making flood data readily available online to the public. As a result, King County has a Class 2 CRS rating - among the highest in the country.

*Louisiana Pilot Project Examples:*

### Scott 2032: City of Scott Comprehensive Plan

The City of Scott Comprehensive Plan recommends a four-part solution to reduce individual flood insurance rates:

1. Full participation in the CRS program
2. Prioritization of flood mitigation in specific areas with a focus on recreation and conservation
3. Regional stormwater planning with the Lafayette Consolidated Government
4. Accurate, annually-updated flood maps for making sustainable development decisions.

### City of Walker Sustainability Master Plan

The City of Walker is integrating resilience measures through multiple strategies to mitigate the effects of large- and small-scale events. The City has taken the necessary steps to participate and expand participation in the CRS. In line with the CRS's recommendation to adopt and enforce disaster-resistant building codes, Walker has identified amendment of zoning and subdivision regulations to reduce risk. This includes such policies as requiring all new development to place utilities underground and elevation standards for new and existing structures.

### Greater New Orleans Urban Water Plan

Three areas of the Urban Water Plan's water management strategy were identified as strategies to increase the community's CRS rating. These include:

- Open space preservation;
- Stormwater management;
- Floodplain management planning.

To estimate the savings these would provide in relation to the CRS, two scoring scenarios were outlined and discount percentages were assigned. Moderate application of these scenarios resulted in a 10% average flood insurance discount regionally, for an estimated savings of nearly \$609 million.

### Lafourche Parish Comprehensive Resiliency

A goal of the Lafourche Parish Comprehensive Resiliency Plan is to continue to work with state and adjacent parishes to collectively increase the affordability of flood insurance for homes and businesses. Identified strategies include:

- Reduced development densities in floodplains;
- Strong public outreach to educate homeowners on flood mitigation options;
- Ensuring all levees, regardless of certification, are included in FEMA's flood risk mapping evaluation process to maximize insurance savings for its residents.

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## Action 4.2 Build Flood Control Structures to Protect Critical Developments

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In addition to the use of green infrastructure and shoreline restoration projects, levees and other hardened infrastructure remain central components of flood protection programs in Louisiana.

### How This Action Works

Communities are finding ways to fund structural protection at the local level when necessary. Levee construction is often directed and certified by the U.S. Army Corps of Engineers so that levees can be considered in the CRS flood insurance rate setting process. Changing environmental conditions requires continual maintenance and upgrades to levee systems, which can be costly. Local

governments have successfully raised money and lobbied for better levees. Oftentimes, a portion of the costs are split by the federal government and the city/cities that will be protected, such as through city stormwater fees and taxes. Levee improvements may also be conducted in phases to reduce the economic impact on communities.



Credit: ENGEO

### Case Study: San Mateo, CA

In 2008, residents of San Mateo, California, voted to build a levee for their community using annual fees to fund construction and flood wall improvements. A new district was formed as a financing mechanism to spread the cost to all properties that receive direct benefit from the improvements. Completed in 2011, all 8,000 properties in the area were subsequently reclassified into low-risk flood zones, effectively reducing the cost of flood insurance by as much as \$1,000 per year for residents. The project was funded solely by the city and taxpayer dollars.

*Louisiana Pilot Project Examples:*

### Jean Lafitte Tomorrow Town Resiliency Plan

Jean Lafitte recognizes flooding threats from weather and natural hazards; particularly subsidence, hurricanes, and other weather events. The Resiliency Plan focuses on increasing standards for vital infrastructure such as levees, utilities, bridges, streets, and pedestrian paths. The Plan also requires a stable source of funding for these efforts to ensure their upkeep and safety. Policy recommendations include protecting the street network through strategic levee and flooding investments, and elevating critical infrastructure above BFE.

### St. John the Baptist Parish Comprehensive Land Use Plan

St. John the Baptist has recognized both the positive and negative aspects of structural protection. While the Plan continues to support the construction of the Westshore Lake Pontchartrain levee to protect sections of the community and I-10, it also recognizes the need for both restored wetlands and increased pumping capacity to prevent those same levees from trapping floodwater within.

*The Morganza Spillway along the western bank of the Mississippi River in Louisiana.*



## Action 4.3 Target Voluntary Acquisition Areas to Relocate Homes and Businesses Out of Flood-Prone Areas

Acquisitions can help remove risk altogether by relocating people and property to safer areas, such as further inland or outside special flood hazard areas. Voluntary property acquisition programs are supported by FEMA and can provide cost-effective ways to reduce risk in flood-prone areas. However, non-voluntary acquisitions can be achieved partially through funds from federal grant programs, such as FEMA's Hazard Mitigation Grant Program (HMGP), as well as other government expenditures.

### How This Action Works

Flood-prone areas are increasingly being converted to open space for risk reduction. Following a disaster, cities are using funds to acquire structures in the floodplain and turn these properties into conservation areas, park spaces, or other natural landscapes. Converted spaces can then be used for added flood protection through strategies such as constructed wetlands, floodplain terraces, and habitat conservation. This reduces communities' future losses to floods while providing other social and environmental benefits.

Alternative funding sources may be available. In addition to the HMGP, communities oftentimes have access to multiple streams of money to fund acquisition programs. For example, federal money may become available through Community Development Block Grants, which can be paired with funds from state and local governments, local parks departments, metropolitan or regional planning commissions, nonprofit organizations, or other groups with shared interests.



*Credit: California Emergency Management Agency*

## Case Study: Roseville, CA

Though only 7% of the city is located in a floodplain, the City of Roseville, California, used voluntary home acquisitions to convert the majority of the city's floodplain to open space. The city bought out 273 homes at high risk of flooding to convert the majority of the floodplain to open space. Current development requirements include the prohibition of construction or infilling within the 100-year floodplain, except in the city center and only if no adverse impact is demonstrated.

*Louisiana Pilot Project Examples:*

### Terrebonne Parish Comprehensive Plan Update: Vision 2030

The Terrebonne Parish Comprehensive Plan and Hazard Mitigation Plan emphasize the use of acquisitions and elevation of repetitively flooded properties to increase community resilience to reduce the amount of flood insurance claims after storms. Acquisition of land may be through fee, simple purchases, easements, or other methods to transform the land into multi-use spaces such as drainage or stormwater management, greenways, and/or utility areas. The Plan also aims to strengthen provisions for parks and open space preservation in new or existing zoning ordinances and land development or subdivision regulations.

### St. John the Baptist Parish Comprehensive Land Use Plan

St. John the Baptist's Comprehensive Land Use Plan supports the development of a voluntary targeted buyout and relocation program for homes in high-risk areas. This will further ensure that development is avoided in areas subject to hazards from routine rainfall, storms, and storm surge.



*Southeastern Louisiana residents rely heavily on levees for flood protection.*

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## Action 4.4 Conserve Undeveloped Lands in Flood-Prone Areas as a Mitigation Solution

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Floodplains are naturally equipped to handle regular flooding. Traditional urban and agricultural developments impede this natural ability of floodplain soils and plants to absorb floodwaters. Communities may either restore these lands or modify existing developments to ensure they do not further increase flood risks by altering the natural landscape and flow of water.

### How This Action Works

Communities are finding innovative ways to implement conservation efforts that achieve increased flood protection and improve local quality of life. Local conservation approaches generally fall into four categories:

- **Public-Private Partnerships** allow for the conservation of natural floodplains without raising federal, state, or local taxes;
- **Fee Simple Purchase** whereby local communities purchase undeveloped lands or development rights;
- **Conservation Ordinances** and regulations that take natural systems and flood protection into account;
- **Regional Resource Sharing** enhances local capacity and allows governments to partner with neighboring municipalities, nonprofits, and others facing similar impacts and/or who share similar conservation interests.

*Louisiana Pilot Project Examples:*

#### **Town of Church Point Comprehensive Long-Range Resiliency Plan**

Church Point's Resiliency Plan recognizes the combined benefits of preserving undeveloped land as open space and natural storm protection. While the plan emphasizes economic development, it ensures that future development will recognize the need to protect its citizens. The plan identifies modification of zoning and subdivision ordinances to ensure sustainable residential neighborhood development. Recommendations include using floodways as buffers between uses, and conserving floodplains as both flood control and amenities to boost leisure and quality-of-life.



*Credit: Christina Rutz*

#### **Case Study: Sanibel Island, FL**

Decades ago, Sanibel Island, Florida, recognized the paired environmental and economic benefits of preservation and took a proactive approach to conserve undeveloped land. Officials recognized the ecosystem benefits of largely undeveloped areas of the island, as well as the recreation and tourism opportunities. After an assessment of landscape and environmental features, the 1970 Sanibel Island Plan restricted further development in conservation zones. In addition, this approach has also reduced vulnerability to hazards.

#### **St. John the Baptist Parish Comprehensive Land Use Plan**

The Comprehensive Land Use Plan proposes using flood-prone areas as open space for passive recreation activities to minimize flood damage to structures within the parish. Any permanent facilities that would be damaged in a flood event are not permissible in the floodplain. This further supports a broader goal of creating and conserving open spaces as integrated, connected greenways throughout the parish to foster resilience.



An aerial photograph of a city waterfront. A wide river flows through the center, with a large bridge on the left. The city is densely packed with buildings of various heights and colors. In the foreground, a tall, light-colored building with a 'Holiday Inn' sign is prominent. To the right, a modern, multi-story office building with a grid of windows stands out. The background shows a hazy horizon with distant structures and a body of water.

## Strategy 05

### Achieve Economic Stability in a Dynamic Environment

For communities to remain viable in the face of increasing risks from climate change and environmental dynamics, they must focus on pre-disaster preparedness planning and community and neighborhood stabilization. Through resilience planning, communities are addressing their risks to natural disasters and ongoing environmental change while cultivating opportunities for economic stability, growth, and expansion. And by addressing risk, communities can catalyze a movement to foster new businesses and expertise.

## Why We Need A New Approach

Coastal communities in Louisiana have experienced several large hurricanes and are also seeing some of the highest rates of relative sea level rise in the world. The economic effects of storms and floods are myriad - from shrinking tax revenues to increased expenditures on levees and maintenance of drainage infrastructure. These economic burdens are exacerbated by Louisiana's dependence on resource extractive industries, such as fishing, oil and gas exploration, and refining - all of which can also be severely impacted by hazards. These sectors are further vulnerable to global boom and bust cycles.

## How Does This Strategy Increase Resilience?

Louisiana communities can meet these challenges by engaging in resilience planning to diversify local economies and focus on job creation in growing fields like coastal restoration, water management, and green technology. By strengthening local assets and fostering entrepreneurial innovation, communities are more equipped to tackle urgent land use and environmental challenges, while building the foundation for long-term economic prosperity. In doing so, communities may diversify their economies and gain the tools needed to secure their futures in the face of dynamic environmental conditions and a changing climate.

*Mobile business assistance following disasters. (Credit: Florida Small Business Development Center)*





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# a Dynamic Environment

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## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. Additional measures can be taken to implement this strategy, depending on the priorities and resources of individual communities.

Action 5.1 Support Business Disaster Preparedness and Recovery

Action 5.2 Stabilize Economies Through Sustainable Urban Design and Planning

Action 5.3 Plan for Emerging Growth Sectors

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### Action 5.1 Support Business Disaster Preparedness and Recovery

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Communities with strong, diverse private sectors recover more quickly after disasters by retaining and providing jobs and a stable tax base (see FEMA's *National Disaster Recovery Framework*). Providers of critical infrastructure are essential in this regard. But so are small- to medium-sized businesses supported by vibrant neighborhoods. This action seeks to build communities' economic strengths by supporting business disaster preparedness and recovery, thereby minimizing downtime after disasters.

#### How This Action Works

By making capital investments in business corridors and districts, communities support adjacent neighborhoods, strengthen social networks, and increase overall economic stability. If businesses in these zones are asked to contribute to a community's disaster readiness, the spin-off innovations and jobs further boost overall economic benefits while also reducing vulnerability to disasters.

For communities vulnerable to the impacts of disasters and climate change, it is ever more important that businesses have proper education, training, and assistance in business continuity and risk management to minimize loss and increase survivability when affected by disasters.

In some cases, nonprofits can also serve as economic and business development organizations. In disaster preparedness or response, nonprofits can coordinate both immediate and long-term business relief and redevelopment programs.

The impacts of natural disasters are also raising community awareness of the importance telecommunications in recovery. Base level service is required at all times for emergency communication. Other resiliency strategies include increasing telecommunication investment requirements, hardening facilities to reduce impacts, and creating redundancy to reduce power outages.

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Louisiana Pilot Project Examples:

### **Port of New Orleans Design Resiliency Manual 2013**

The Port of New Orleans Design Resiliency Manual is intended to minimize damage from hazards to critical infrastructure in order to enhance business and regional economic resiliency. The manual provides benchmarks for acceptable levels of risk and flood mitigation best management practices for use by all businesses located within the port complex. This document works in conjunction with other port emergency preparedness plans to assist the port and related businesses recovery as quickly as possible from the impacts of a disaster.

### **Jean Lafitte Tomorrow Town Resiliency Plan**

The Town of Jean Lafitte's Resiliency Plan identifies education and businesses preparedness strategies as key to community resilience. In particular, the plan calls for education programs for home and business owners on the importance of emergency readiness, and what elements an emergency preparedness plan should contain. Further, building codes include elevation, floodproofing, and retrofitting requirements for commercial structures to minimize downtime after an event.

### **Lafourche Parish Comprehensive Resiliency Plan**

The Lafourche Parish Comprehensive Resiliency Plan recognizes that there is a need to create workforce training programs that develop the skills of existing residents to match industry needs. To this end the Plan identifies several strategies to train local workers - and particularly vulnerable and displaced workers such as fishermen and oil workers - to capitalize on the parish's experience managing emergency operations in the event of a disaster.

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## **Action 5.2 Plan for Emerging Growth Sectors**

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New businesses related to community resilience are growing, and planners and local government leaders can take the lead in introducing these new business opportunities to their wider communities. Planning teams can analyze projections of job creation, evaluate possible revenue gains, and document other economic spin-offs that could result from new economic investment. These efforts may lead to a more diverse range of employment opportunities for citizens and an economic base that addresses local issues.

### **How This Action Works**

Resilience planning can lead to future employment opportunities. For example, Louisiana's Coastal Master Plan will guide the expenditure of an estimated \$50 billion, which translates to major economic investments with job creation potential in restoration fields. Communities are beginning to use these opportunities to spur related job training efforts, such as through partnerships with the Louisiana Economic Development (LED) and other regional economic development organizations.

For-profit innovative business pitch competitions support entrepreneurial solutions that apply

innovative approaches to how we deal with environmental challenges. Entrepreneurs play a key role in developing scalable solutions. These competitions help to build resilience by considering and supporting outside-the-box thinking to local environmental challenges.

Emerging technology can further support traditional industries. For instance, mobile and online technologies are being used to link farmers and fishermen directly with consumers and build community support for fresh, local products.

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Louisiana Pilot Project Examples:

### Lafourche Parish Comprehensive Resiliency Plan

While Lafourche Parish’s economy has continued to grow, even after recent impacts from recent hazards, there is a recognition that efforts need to be made to attract and retain younger people. To accomplish this, the Plan recognizes the need to match training and educational opportunities to emerging sectors with living wages so that residents are prepared, and businesses view Lafourche as an attractive employment environment. One of the plan’s economic development goals is to “create workforce training programs that develop skills of existing residents to match industry needs.” Lafourche Parish expects to build on Nicholls State University’s Clean Power & Energy Research Consortium to develop the knowledge base to build an emerging green energy sector. This is important in overall diversification of employment opportunities.



Credit: Idea Village

### Case Study: New Orleans, LA

New Orleans has gained national recognition for its encouragement of innovation and entrepreneurship. The non-profit community has spearheaded a substantial boom in for-profit companies. This has been accomplished by providing expertise, physical space, and education for entrepreneurs, as well as through competitive processes, such as The Water Challenge sponsored by The Idea Village and the Greater New Orleans Foundation, that reward innovation – especially innovation in addressing local issues of coastal land loss and water management.

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## Action 5.3 Stabilize Economies Through Sustainable Urban Design and Planning

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Urban design professionals have shown that there are economic benefits associated with good design strategies for housing, retail, and mixed-use developments. Beyond hazard mitigation, building design and planning for greener multi-modal cities will help communities cope with the shocks and stresses associated with climate change. In this regard, planners and design professionals play an important role in facilitating construction and communicating the fiscal benefits to stakeholders.

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## How This Action Works

Wise investments of time and money in sustainable urban design and infrastructure can serve as a foundation for economic development and growth. Examples of these types of strategies include:

- **Green infrastructure** can reduce costs and reverse the decline of traditional infrastructure, and provides quality of life benefits beneficial to any economic development strategy;
- **Low impact development** is a viable option that can reduce environmental impacts, lower development costs, and provide additional profits for developers;
- **Infill/Redevelopment** builds on existing infrastructure, reducing cost and breathing life into areas that may be economically depressed.

Implementation mechanisms include a mix of laws, financing, technical assistance, training, and design. However, the economic benefits must be quantified and communicated to decision-makers who must justify the use of scarce public funds.

*Louisiana Pilot Project Examples:*

### Old Mandeville Town Center Plan

The Old Town Center Plan discusses Mandeville's plans to relocate civic functions from dispersed locations along Highway 190 to the heart of Old Mandeville. This includes building a town hall, police station, community garden and farmer's market, mixed-use commercial development, library, and visitor's center in order to encourage additional development in the center of town.

### Greater New Orleans Urban Water Plan

The Urban Water Plan provides an economic justification for open space networks that integrate stormwater management and community space. Studies have shown that parks and green spaces have positive effects on property values and economic development in neighborhoods. The Urban Water Plan estimates a cost savings of \$8 billion in reduced flooding over 50 years and increased property values of \$183 million over the same period.

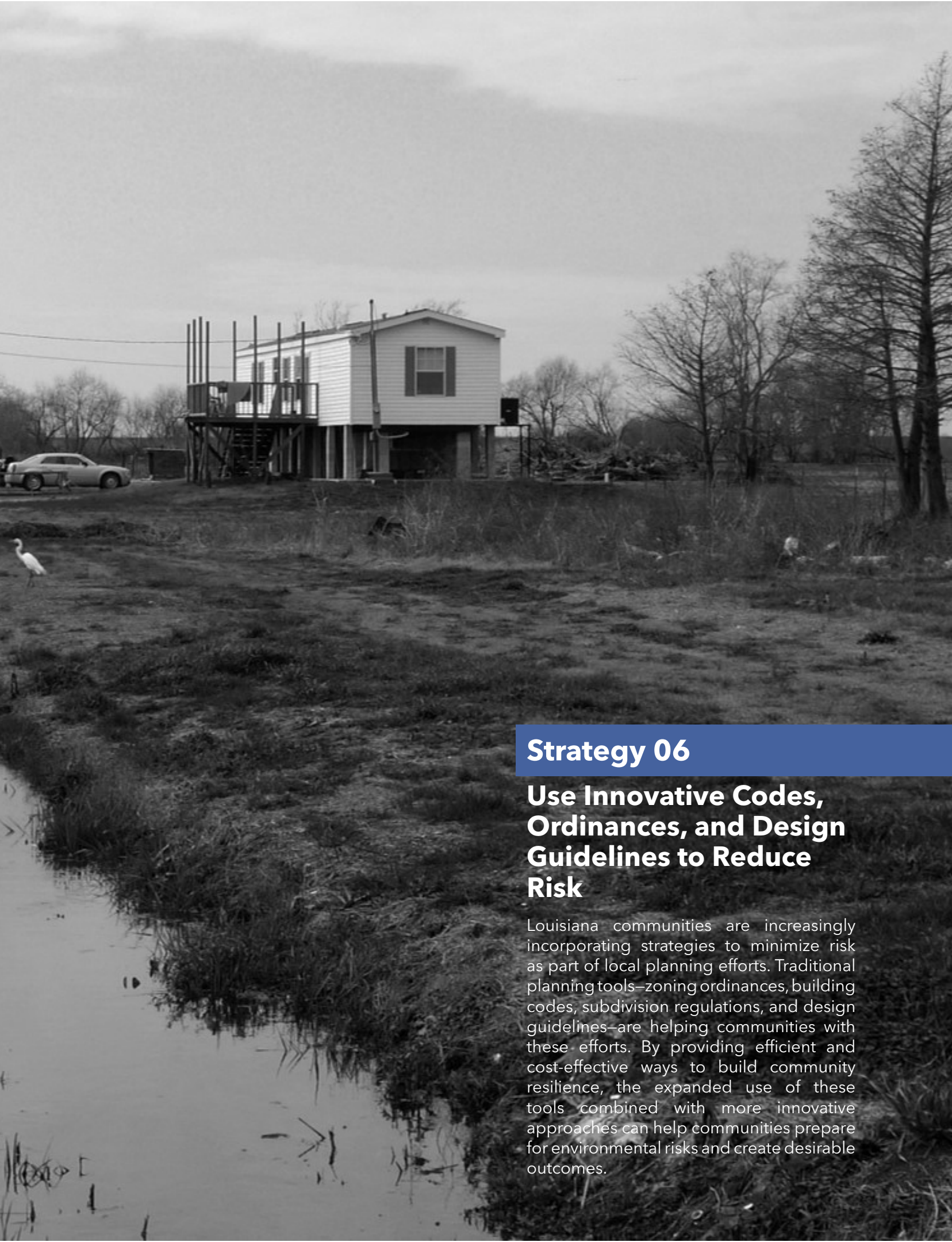


*Outdoor fairs and seasonal farmers markets provide opportunities to boost local economies and community networks.*



*Louisiana's inland waterways provide vital links between industrial centers and offshore resources.*





## Strategy 06

### **Use Innovative Codes, Ordinances, and Design Guidelines to Reduce Risk**

Louisiana communities are increasingly incorporating strategies to minimize risk as part of local planning efforts. Traditional planning tools—zoning ordinances, building codes, subdivision regulations, and design guidelines—are helping communities with these efforts. By providing efficient and cost-effective ways to build community resilience, the expanded use of these tools combined with more innovative approaches can help communities prepare for environmental risks and create desirable outcomes.

## Why We Need a New Approach

Louisiana communities, like many others, must contend with unpredictable environmental hazards and disasters as they try to promote economic development and address demographic changes. Local governments are oftentimes stretched to capacity and may hesitate to introduce requirements that could complicate the work of local administrators and developers. Further, Louisiana’s land use governance system is largely the same today as when its governing statutes were adopted some 80 years ago. Except for the latitude enjoyed by Louisiana’s home rule parishes and cities, the state’s current zoning and planning legislation is the product of a time when the impact of development on the environment and vice versa, was much less understood. However, updated codes, ordinances, and design guidelines can play an important role in addressing many environmental risks and natural hazards facing communities. Communities are pairing creative uses of existing tools with new approaches to better handle the challenges of upgrading regulations and policy.

## How Does This Strategy Increase Resilience?

Many of the tools commonly used by municipalities provide opportunities to address risks from hazards and build resilience without major changes to a community’s growth management strategy or local laws. For example:

- **Ordinances** such as subdivision regulations or capital improvement plans help communities prepare for climate change by requiring that current projections be included in designing new infrastructure projects;
- **Form-based codes** and other regulatory approaches ensure compliance with set standards and can address the use, form, or performance of a structure or site in different ways;
- **Design guidelines** and other incentive-based tools promote voluntary actions, encourage innovation, and address emerging concerns.

## Actions for Implementation

Examples of how this strategy is being applied are discussed below through a series of implementation actions. Additional measures can be taken to implement this strategy, depending on the priorities and resources of individual communities.

Action 6.1 Utilize Building Codes and Ordinances to Lesson Impacts to Structures

Action 6.2 Incorporate Design Guidelines into Ordinances to Reduce Risk Through On-Site Improvements

Action 6.3 Address Environmental Hazards and Reduce Risk at the Neighborhood or Community Scale Through Ordinances, Codes, and Design Guidelines

Action 6.4 Inform Land Use Decision-Making with Climate Change Data

Action 6.5 Incorporate Flexibility and Innovation into Regulatory Ordinances and Codes



# nces, & Design Guidelines to Reduce Risk



*Elevated homes in coastal Louisiana.*

## Action 6.1 Utilize Building Codes and Ordinances to Lessen Impacts to Structures

Building codes and ordinances can include specific requirements or design guidelines to lessen the impacts of environmental hazards and disasters to structures. Reducing the vulnerability of individual structures decreases total damages for the entire community.

### How This Action Works

Traditional zoning ordinances that regulate type and location of use are being expanded to ensure that specific uses are not located in hazard-prone areas. This can be based on the types of buildings constructed for that use, as well as the potential for there to be vulnerable people and materials associated with those uses.

Building codes provide specific requirements to ensure the safety and character of buildings in a neighborhood or zone. Examples of these requirements include materials and methods of construction used in buildings to minimize damage to the property itself, its inhabitants, and neighboring structures. Requirements for

minimum base flood elevations (BFEs) are used to reduce the likelihood of flooding. Structural requirements are used to reduce vulnerability to earthquakes. Requirements regarding construction methods can reduce flood-borne or wind-borne debris and the broader damage these hazards can cause.

Design guidelines, specifically form-based codes, are helping to reduce risk while promoting local character. Such guidelines may range from strict rules dictating architectural design and details to a variety of options that can be applied or included based on individual preferences.

*Louisiana Pilot Project Examples:*

### City of Slidell Code of Ordinances

The City of Slidell Code of Ordinances very specifically addresses the use of codes and ordinances to reduce damages to structures. The City's subdivision regulations provide detailed information and diagrams for how to construct or rebuild homes while limiting flood vulnerability and maintaining community character. In addition, the code includes specific regulations

for break-away walls and enclosures around raised foundations. These regulations address the community aesthetic and ensure that structures do not pose additional risk by becoming water-borne debris, requiring that such features be attached to the structure or be of sufficient weight that they would not float.

## City of Monroe Comprehensive Zoning Ordinance

The City of Monroe Comprehensive Zoning Ordinance addresses impacts of high winds and flooding on the stability of mobile homes. Mobile homes are often more likely to be located within floodplains and are often inhabited by residents who lack the resources to repair or replace their homes after a disaster. The ordinance includes specifications for construction methods, materials, and retrofits that can lessen the vulnerability of mobile homes within the community.

## Jean Lafitte Tomorrow Town Resiliency Plan

The Lafitte Tomorrow Town Resiliency Plan encourages local decision-makers to investigate ordinance options to reduce the vulnerability of structures, such as a form-based code or portions of the CPEX Louisiana Land Use Toolkit. Researching and implementing such guidelines as ordinances will reduce the vulnerability of new and renovated structures in the town and build the resilience of residents, businesses, local government, and public services. This allows members of the community to focus on larger community issues of economic strength and preparedness for and recovery from tropical storms, flooding, and other disturbances.

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## Action 6.2 Incorporate Design Guidelines into Ordinances to Reduce Risk Through On-Site Improvements

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Zoning ordinances and design guidelines offer opportunities to build resilience at the site level through on-site risk reduction interventions. Although resilience requires strength in numbers, reducing vulnerability and risks on individual sites reinforces the landowner and property, and collectively allows the community to become stronger. Eventually, individual efforts work together to support the larger goals of the community and enhance overall resilience.

### How This Action Works

Incentive-based and regulatory tools are used and fine-tuned by communities to meet their specific needs, finances, and conditions. Together, these tools are used to regulate a basic level of compliance regarding certain aspects of construction, while incentivizing additional measures that can increase the resilience of the structure and the community. The basic premise is that individual buildings, just like critical facilities and infrastructure systems, need to be operational and functional during and after a hazard event by limiting the amount of potential damage. Ordinances that respond to local conditions can incorporate design guidelines and mitigation measures at the site level, allowing developers and local landowners to undertake innovative approaches that are most appropriate for their site conditions.

The following are examples that apply specifically to stormwater management:

- **Design guidelines** can reduce flood risks by including stormwater runoff best management practices (BMPs) to reduce peak runoff and capture and collect water on site;
- **Zoning** may require large parking lots to be furnished with BMPs to capture on-site runoff, while a subdivision regulation can require similar measures at the neighborhood scale;
- **Performance-based standards** are often used to reduce off-site flood risks from new development by determining the impacts and/or identifying specific interventions;
- **Capital improvements** plans and specifications dictate the size of pipes and sewer outflows so that they can adequately accommodate projected future rainfall amounts and frequencies.



*Design guidelines help to ensure the safety of critical infrastructure and building aesthetics.*

*Louisiana Pilot Project Examples:*

### **City of Monroe Comprehensive Zoning Ordinance**

The City of Monroe Comprehensive Zoning Ordinance requires that parking lots with 25 or more parking spaces must be designed to filter or store the first 1 inch of rainwater on site during each rainfall event. This can be accomplished through the use of pervious paving, rain gardens, bioswales, detention areas, constructed wetlands, and other methods deemed appropriate by the city engineer. This allows the property owner or developer to determine which combination of interventions is appropriate and feasible for the site, while ensuring that flood impacts will be limited - both to structures on the site and to adjacent sites.

### **City of Hammond Unified Development Code**

The Hammond Unified Development Code places a large emphasis on individual developments not altering the flow of water through the watershed. A Drainage Impact Study is required for new developments in the floodplain, and all development must include FEMA flood zones, FIRM Base Flood Elevation (BFE), and the record inundation. The flood risks and appropriate elevations are reviewed based on a combination of both the FIRM BFE and the record flood level. This approach ensures the community is using the most up-to-date information on local risks.

### **Morgan City Zoning and Land Development Code**

Morgan City Zoning and Land Development Code strives to reduce on-site impacts of flooding not only through site improvements, but also by giving greater attention to the location of development. The Code works to limit new development in flood-prone areas by highlighting risk, including floodplain extents and soil types. Further, the code encourages development in less risk-prone areas through the creation of a Cultural Overlay District, which will provide tax credits for development and re-development in these targeted areas. Additionally, this overlay district promotes community resilience by incentivizing blight reduction.

### **St. Mary Parish Unified Development Code**

St. Mary Parish Unified Development Code (UDC) tackles on-site environmental risks at several levels. Subdivision regulations prohibit development on vulnerable land unless adequate methods are formulated by the subdivider or developer to solve the problems created by the unsuitable land conditions. Regarding flood risks, the UDC is more specific. In addition to providing very detailed specifications regarding building elevation requirements and a list of methods to reduce flood losses, the code addresses on-site improvements required for permitting in the

floodplain. A Drainage Impact Study is required, and a drainage and storm sewer system for a new subdivision or development must be designed to accommodate 5- and 10-year storms.

### **Jean Lafitte Tomorrow Town Resiliency Plan**

The Jean Lafitte Tomorrow Town Resiliency Plan encourages on-site improvements for infrastructure, specifically elevating critical facilities, such as electrical sub-stations and pump stations, above the base flood elevation. This

will not only protect the facilities themselves, but will ensure they are functional and reliable to assist the larger community in the event of a flood, storm, or other disaster. Further, the plan encourages on-site interventions on both public and private property to retain rainwater instead of pumping and draining. This can help minimize the exacerbation of natural subsidence by human activity. Subsidence destabilizes soils and causes the land to sink, creating immediate risks to structural stability, as well as increasing risks from flooding and tropical storms.

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## **Action 6.3 Address Environmental Hazards and Reduce Risk at the Neighborhood or Community Scale through Ordinances, Codes, and Design Guidelines**

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The risks from natural hazards to a neighborhood or on a community-wide scale can be tackled through carefully constructed codes and ordinances. The approach to looking beyond the immediate on-site impacts and effects can play a large and very positive role in safeguarding not only the property and adjacent land, but the entire community.

### **How This Action Works**

Communities are considering the cumulative impacts of development in new ways and are incorporating risk reduction measures into existing codes or ordinances. Identifying opportunities for addressing multiple concerns begins with an assessment of existing tools that have proven effective. These tools can then be updated with new information or innovative tools to avoid or minimize hazards.

Zoning ordinances are among the most common tools available to communities. Zoning controls the overall location, type, and intensity of land uses and may contain provisions to regulate the physical characteristics of development - all of which can be updated to reduce hazard risk. Zoning also provides unique opportunities for overlay zones

that can be used to guide development away from hazard areas, such as by limiting development or prohibiting the placement of critical infrastructure in floodplains.

Subdivision regulations provide unique opportunities to address community-wide hazard impacts. These regulations generally control the division of land and provide specifications for the construction of community infrastructure. Opportunities to integrate risk reduction into these regulations include restrictions on subdividing land within hazard areas, inclusion of performance standards that avoid or mitigate hazards, and incentives for creative designs that avoid or minimize hazards.

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*Louisiana Pilot Project Examples:*

### **City of Hammond Unified Development Code**

The Hammond Unified Development Code tackles community-wide impacts of flooding at

several levels. The city recognizes the broad range of community impacts of flooding, including fiscal impacts of recovery and prolonged business interruptions. The UDC limits filling, grading, dredging, and other development that

may increase flood damage, and it prevents or regulates the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards in other areas. Further, the code identifies relevant factors considered in the approval or denial of a permit. These factors include debris fields in the event of a flood and the costs of providing governmental services during and after floods, including maintenance and repair of streets and bridges and public utilities and facilities, such as sewer, gas, electrical, and water systems.

### **Morgan City Zoning and Land Development Code**

The Morgan City Zoning and Land Development Code strives to reduce flood risks to the community by considering the impacts of development on stormwater runoff versus retention. The code requires the density of development to be calculated according to a specific formula to better understand the role of neighboring and regional development on runoff within the watershed. Morgan City has also employed the creative use of a specific overlay zone, which is focused on the historically developed part of the city along the Atchafalaya River. This part of the city is also the least vulnerable to flooding, as it is on high ground and has more suitable soils for development. The creation of this overlay zone allows development to qualify for historic tax credits, thereby driving development to targeted areas. This will encourage efforts to revitalize blighted properties and direct redevelopment and new development in less vulnerable districts, rather than in undeveloped land largely in a floodplain.

### **Town of Livingston Subdivision Regulations**

Through subdivision regulations, Livingston is addressing potential community-wide impacts of flooding due to new development. A Stormwater Drainage Study must be submitted with the application for preliminary approval of any major subdivision. Through this study, the developer must ensure that the new development will not increase stormwater runoff onto adjacent and neighboring sites. The ordinance also prohibits development on drainage easements and discourages the development of areas with extremely poor drainage.



*Neighborhood-scale design guidelines can help to retain the aesthetic qualities of a street while reducing risk.*



### **Case Study: Portland, OR**

Portland, Oregon, established environmental overlay zones in the city to minimize damage to significant natural resources from development. Environmental overlay zones benefit the public by protecting water quality, preserving habitat, preventing erosion/landslides, and reducing flooding. They cover streams, wetlands, other water bodies, upland forests, and steep slopes. A conservation overlay zone, a type of environmental overlay zone, conserves important natural resources where they can be protected, while allowing environmentally sensitive development. A protection overlay zone provides the highest level of protection for the most important urban natural areas and streams.

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## Action 6.4 Inform Land Use Decision-Making with Climate Change Data

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A municipal or parish-level ordinance or code can provide an opportunity to better prepare for the impacts of climate change, while also addressing more immediate needs and concerns. Knowledge of changing future conditions can help inform infrastructure investments and development patterns, which will in turn ensure conservative expenditures of resources and limit risk to life and property, ultimately strengthening the long-term resilience of the community.

### How This Action Works

As planners integrate hazard mitigation and climate adaptation measures into decision-making, it is helpful to understand how these efforts are helping communities meet broader community goals. Adaptation measures are generally grouped into the following 3 categories:

- **Protection** prioritizes people and property, and typically employ both structural and non-structural safeguards such as levees and environmental restoration to prevent impacts.
- **Accommodation** allows for continued development in vulnerable areas, but manages risks by requiring that structures be built or retrofitted to be more resilient to hazards and climate change impacts.
- **Managed relocation** limits armoring, discourages development/redevelopment in high-risk areas, and is used to proactively plan for moving structures to less vulnerable locations.

Traditional tools used by planners to support growth and development are also being used to reduce risk and prepare for the impacts of climate change. Knowing which tools can be used to support different types of adaptation can help planners and policy makers realize opportunities to build on existing tools to address concerns over climate change (see Table 1 for examples). Additional explanations of these tools and their potential applicability can be found on the LRAP website ([resiliency.lsu.edu](http://resiliency.lsu.edu)).

Not every planning approach will work in every community. Recognizing how to work with local challenges will yield the best results. Furthermore, a number of different planning tools can be applied to tackle the same concern. For example, when local communities in California were required to address sea level rise, they did so in very different ways (see Table 2 for examples).



*Elevated structures in southern Louisiana are one type of accommodation to adapt to sea level rise and increasing storm surge.*

**Table 1: Planning tools that are used as hazard mitigation and climate adaptation strategies.**

	Protect	Accommodate	Relocate
Zoning & Official Maps	X	X	X
Conditional Uses		X	
Overlay Zones	X	X	X
Floating Zones	X	X	X
Unified Development Code	X	X	X
Form-based Codes		X	X
Subdivision Regulation & Exactions		X	
Impact Assessment & Impact Fees	X	X	X
Smart Codes	X	X	X
Rural Cluster Development Ordinances	X		X
Performance Requirements & Performance Zoning		X	
Incentive Zoning		X	
Rolling Easements	X	X	X
Inclusionary Programs for Affordable Housing			X
Transfer of Development Rights	X		X
Conservation Easements	X		
Site Plan Review		X	
Tax Increment Financing	X	X	X
Urban Growth Boundaries	X		X
Phased Growth Approaches & Adequate Facilities Ordinances			X
Moratoria & Interim Development Ordinances	X		X

*Louisiana Pilot Project Examples:*

**Greater New Orleans Urban Water Plan**

The Greater New Orleans, Inc. Urban Water Plan responds to the threat of climate change by assessing the effect of rising sea levels in the waterways surrounding the New Orleans metropolitan region. The Urban Water Plan aims to alleviate stormwater flood risks and address the problem of subsidence. As sea levels rise, the increasingly subsiding land will be at ever-greater risk of storm surge and coastal flooding, reinforcing the need to address subsidence through new, innovative approaches as proposed by the Urban Water Plan.

**Terrebonne Parish Comprehensive Plan Update: Vision 2030**

The Terrebonne Parish Comprehensive Plan Update, although not a binding code or ordinance, compels the parish to consider impacts of climate change in future planning, policy, and funding decisions. Specifically, the plan calls for the preparation of a parish-wide climate action plan, taking into account the impacts of sea level rise and land subsidence on the parish. Such a plan can help inform updates to local and parish-wide codes, ordinances, and zoning designations.

**Table 2: Development management tools California communities have used to address sea level rise.**

<b>Development Management Tool</b>	<b>California Jurisdiction/Organization</b>
<b>Overlay Zones</b>	City of Huntington Beach City of Malibu
<b>Non-Conforming Uses &amp; Amortization Period</b>	City of Carlsbad Local Coastal Program
<b>Setbacks</b>	Del Monte Beach Land Use Plan
<b>Buffers</b>	City of Malibu
<b>Conditional Uses/Development</b>	Santa Barbara County
<b>Shoreline Protection Devices</b>	San Francisco Bay Plan California Coastal Act
<b>Managed Retreat</b>	City of Pacifica City of Ventura
<b>Acquisition Programs</b>	California Coastal Conservancy Sonoma County Land Trust
<b>Conservation Easements</b>	Santa Barbara County
<b>Transfer of Development Rights</b>	Santa Monica Mountains Transfer of Development Credit Program Big Sur Scenic Transfer of Development Credit Program
<b>Real Estate Disclosures, Deed Restrictions</b>	Humboldt County Local Coastal Program Amendment Samoa Town Master Plan

### **Lafourche Parish Comprehensive Resiliency Plan**

The Lafourche Parish Comprehensive Resiliency Plan clearly identifies some of the impacts of climate change on the parish - predominantly focusing on the coupled effects of subsidence and sea level rise on land loss. Although the plan includes recommendations rather than regulations, it provides the foundation for updating other legally-binding ordinances and regulations. The plan's stated intention in its Implementation Plan to create links and partnerships with other regional organizations tackling coastal, wetlands, and estuarine issues, suggests that these climate change concerns may be tackled proactively. As a guiding document, this provides an important first step for the parish to preemptively address increasing future risks to the community.

### **City of Hammond Unified Development Code**

The Hammond Unified Development Code prepares for the uncertainty associated with the impacts of climate change on flood risks. The area is prone to downstream riverine flooding, and climate change will likely alter rainfall timing and intensity. To respond to these changes, the code requires identification of both the extent of the floodplain and the record flooding in development proposals. Floodplain boundaries help identify areas at risk, even though they might not have been impacted recently, while record flood events can reveal increasing risk in an area before official floodplain maps are updated. While the city should further consider changes in future rainfall, using these multiple types of flood risk information will help ensure the city develops in a manner that minimizes their exposure to future risks.



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## Action 6.5 Incorporate Flexibility and Innovation into Regulatory Ordinances and Codes

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An important aspect of codes and ordinances is to leave adequate opportunity for new, innovative, individual approaches that can build resilience. Flexibility can be incorporated at several levels within codes and ordinances, such as by limiting over-regulation or allowing for a variety of approaches in addressing a single issue.

### How This Action Works

Design guidelines often allow for greater flexibility of uses, styles, and approaches. There is a large variety of specificity in how these are being applied. For example, form-based codes require particular architectural styles or features but allow for less strict designations of use on a site, such as mixing residential with light commercial or retail uses. Very detailed guidelines can produce a specific and uniform character; however, they can restrict investment for new developers and limit creativity, and they often require a high level of technical expertise to permit. Design guidelines can also be applied exclusively to one type of item, such as hazard mitigation measures.

Design review committees are trained professionals and citizens that evaluate proposals to determine if the intent of an ordinance or code is satisfactory. Design review committees are often used to consider the character of a neighborhood or renovations affecting historic structures. In much the same way, a design review committee can consider different proposals for addressing environmental and disaster concerns and their effects on neighborhoods. However, using design review committees can be a time consuming process; can be difficult to find an appropriate mix of professionals and citizens in a small town; and can be seen as a subjective and, at worst, biased process.

Performance measures focus on the performance of a structure or parcel of land with regard to a specific measure. Often used in conjunction with use or form-based regulations, the performance can be limited to on-site impacts or extend to the larger community. For example, performance requirements may specify that any development on a piece of land must capture a minimum amount of rainwater given a certain intensity of storm. Ways of achieving this are not specified within

the ordinance, but they must be demonstrated based on known conditions and calculations. Another example of a performance measure is a checklist of hazard mitigation measures or BMPs appropriate to the given part of the community, which must be incorporated on site. Typically, a certain number are required and must be met to receive permitting approval; however, there is flexibility with which ones are chosen or in what combinations. This allows for complex issues to be addressed in ways that are deemed most appropriate by the developer or landowner, while further allowing for creative and innovative approaches.

Performance measures can be popular to implement, given their flexibility. However, requirements for engineering calculations to prove impacts can be costly for developers, and local government staff may need additional training to evaluate more complex permit applications.

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Louisiana Pilot Project Examples:

### **City of Hammond Unified Development Code**

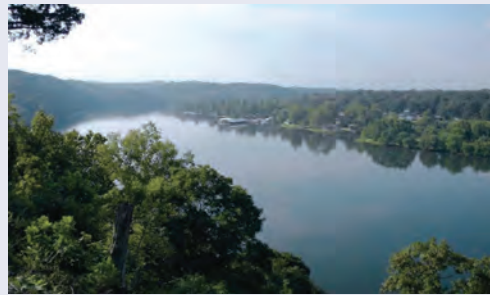
The Hammond Unified Development Code includes flexibility in several places to ensure that important issues are addressed in the most appropriate ways. The Landscaping and Open Space Requirements are regulated through a point system, allowing the individual developer or property owner to determine which interventions to apply based on combinations that are cost-effective and appropriate for the site, its size, purpose, aesthetic, and other constraints. This allows for flexibility of interventions, plantings, improvements, etc., without being overly prescriptive or restrictive. This system encourages innovation by allowing for alternative or more economically viable options to achieve intended results.

### **Town of Livingston Subdivision Regulations**

The Town of Livingston has included a forward-looking provision within their Subdivision Regulations that promotes flood-risk reduction actions and allows residents to draw on their knowledge of the issues to help develop new solutions. The regulations clearly lay out the opportunities for innovation and new approaches to address risk - specifically flooding concerns, and more broadly, community resilience. The regulations state, "alternate management measures, applied alone or in combination with standard management measures, to satisfy the intent of this article are acceptable if there are no objectionable secondary consequences and provided they conform to standard and acceptable engineering principles, and they comply with other existing Town development standards. Innovative techniques and ideas will be considered and may be used when shown to have potential to produce successful results."

### **City of Monroe Comprehensive Zoning Ordinance**

The City of Monroe Comprehensive Zoning Ordinance has included a provision for greater flexibility of strict regulations when they promote



### **Case Study: Branson, MO**

Branson, Missouri, is a small waterfront city of about 10,800 people and a popular tourist destination. The city's zoning code designates districts by use. The code utilizes the concept of cascading uses, where one-family residential is the most restrictive and commercial is the least restrictive by allowing all previously permitted uses. To allow for flexibility and creativity in undeveloped parts of the community, Planned Development districts have been established. By using Euclidean zoning for most areas and incorporating Planned Unit Development districts in other specific areas, flexibility is given to developers of greenfield sites. Cascading uses can be particularly useful when establishing regulations for places with varying levels of risk.

new approaches or innovations on the immediate site as well as within the larger community. For example, the ordinance provides flexibility for solar panels that exceed high restrictions, recognizing the value of incorporating such measures. The ordinance states that, "any proposed departure from the standards will be considered if it is demonstrated that the approach will produce a compensating or comparable result to the benefit of both the City and the system user."



*Commercial movement of cargo along the Mississippi River.*

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# Putting It All Together

Risk reduction measures must be incorporated across communities at all scales to address the increasing impacts of natural disasters associated with climate change and demographic shifts to vulnerable locations. The strategies presented in this guidebook are being used to collectively build resilience at the community scale. They offer concrete steps, with supporting examples, of how to integrate implementable actions into community planning efforts that both reduce risk and move communities toward their individual goals. Taken together, these strategies promote community-level resilience planning that augments traditional land use planning with hazard mitigation, disaster recovery, and climate adaptation. By elevating planning for risk reduction and pairing this with community visioning, economic development, and natural disaster preparedness, communities will become more resilient to future disturbances.

The integration of land use, hazard mitigation, and disaster recovery efforts can maximize community investment in planning for short and long-term resilience. However, coordinating these different planning efforts can be challenging. Because these efforts are often funded from different sources, implemented by separate government divisions, and consider different time horizons, communities are challenged to fully integrate these concepts in effective ways. For instance, land-use, hazard mitigation, and disaster recovery planning typically each have their own update cycles at regular intervals. This can make it difficult for plans to accurately reflect the priorities and values of a community's vision in relation to its vulnerabilities. In addition, each of these plans considers different time horizons and without intentional coordination, the potential for producing documents that counteract each other increases. Each plan is typically initiated by a different government agency. Without coordination of the data and mapping efforts, local governments may duplicate efforts and cooperation may be hampered. Lastly, these plans address different needs and must meet different requirements for approval. For instance, hazard mitigation plans must comply with FEMA regulations and be approved by the State Office of Homeland Security and Emergency Preparedness.

Municipal and parish plans, on the other hand, focus on land use, transportation, floodplain, and economic development. These plans are political documents largely informed by the public and local leadership. The differences in client, process, and funding explain why these plans are often tackled separately.

Despite their differences, the integration of traditional land use planning with hazard mitigation and disaster recovery can be achieved through innovative communications and working methodologies. Resilience planning can be accomplished by coordinating plan update cycles; sharing data and mapping resources across agencies and departments; and cross-coordinating goals across all planning time horizons. If these different types of community plans are not prepared in relation to each other, there may be missed opportunities for aligning safety concerns, minimizing costs, and devising mutually reinforcing goals that can substantially strengthen the community.

The strategies and supporting actions presented in this guidebook exemplify the resilience planning work of communities in Louisiana and best practices across the country. They demonstrate how resilience planning can be effective at addressing the risks from natural hazards and moving communities toward their goals.





*Baton Rouge farmers market promotes local foods, community networks, and higher quality of life.*

## Conclusion

Researchers and practitioners are continually investigating and applying different methodologies to foster resilience at the local level. Through resilience planning, a range of approaches and processes are considered that can work together to reduce a community's vulnerability and cultivate smart community growth.

The example of the Louisiana Resiliency Assistance Program and resilience strategies discussed in this guidebook showcase the valuable work that is underway. These strategies build from locally-identified needs and efforts, and they reach across disciplines and established hierarchies. The process of developing these resilience strategies and associated implementation actions represent an approach for promoting community-based

resilience that is responsive to local needs and concerns.

While no one strategy can guarantee resilience within a community, looking forward in an era of increasing impacts from climate change requires a new approach to planning. Resilience planning is the centerpiece of this new approach. It bridges traditional land use planning with information and experience from community activists and expertise from various fields. It allows communities to be receptive to new information and flexible to adapt to changing conditions. In conjunction with top-down, regional-scale approaches, these strategies empower local communities to take action and shape their own futures.

# Appendices

- Appendix A: Strategies & Actions for Resilience Planning
- Appendix B: CRPP Pilot Project Summaries
- Appendix C: Summary of Terms



## Appendix A: Strategies & Actions for Resilience Planning

Strategy	Action	LA Pilot Project Examples
1.0 Use Adaptation Measures to Prepare for Changing Risk	1.1 Incorporate climate adaptation measures into other planning efforts.	Greater New Orleans Urban Water Plan
		Plan for the 21st Century: New Orleans 2030 Master Plan
		Terrebonne Parish Comprehensive Plan Update: Vision 2030
	1.2 Use data viewers and tools to access the best available data.	Lafourche Parish Comprehensive Resiliency Plan
	1.3 Use climate mitigation to support other community goals.	Terrebonne Parish Comprehensive Plan Update: Vision 2030
		City of Hammond Comprehensive Master Plan
Global Green Louisiana Wetland Action Program		
2.0 Incorporate Innovative Data, Communication, and Visualization Tools	2.1 Use online forums to collect targeted data and promote civic engagement.	City of Alexandria THINKAlex Resiliency Plan
		Terrebonne Parish Comprehensive Plan Update: Vision 2030
	2.2 Use visualization and mapping apps to explore, visualize, and understand data.	City of Walker Sustainability Master Plan
		East Feliciana Parish Comprehensive Resiliency Plan
		City of Hammond Unified Development Code and GIS Needs Assessment
		Scott 2032: City of Scott Comprehensive Plan
		St. John the Baptist Parish Comprehensive Land Use Plan
	2.3 Use technology to share information and increase collaboration.	Greater New Orleans Urban Water Plan
		Lafourche Parish Comprehensive Resiliency Plan
	2.4 Use new tools to increase data collection for ongoing and disaster needs.	St. John the Baptist Parish Comprehensive Land Use Plan
		City of Alexandria's AlexConnects



3.0 Retrofit Communities for Everyday and Post-Disaster Needs	3.1 Retrofit buildings and landscapes to accommodate flooding.	City of Breaux Bridge Comprehensive Long-Range Resiliency Plan
		Old Mandeville Town Center Plan
		Jean Lafitte Tomorrow Town Resiliency Plan
	3.2 Incorporate green infrastructure.	Greater New Orleans Urban Water Plan
		Scott 2032: City of Scott Comprehensive Plan
		Jean Lafitte Tomorrow Town Resiliency Plan
		City of Walker Sustainability Master Plan
	3.3 Retrofit critical infrastructure to be more resilient.	Breaux Bridge Comprehensive Long-Range Resiliency Plan
		Lafourche Parish Comprehensive Resiliency Plan
		Port of New Orleans Design Resiliency Manual
	3.4 Combine public recreation opportunities and flood protection systems.	Terrebonne Parish Comprehensive Plan Update: Vision 2030
		Greater New Orleans Urban Water Plan
		City of Central Resiliency Plan
	3.5 Revert land uses to open space in areas with elevated flood risks.	Scott 2032: City of Scott Comprehensive Plan
		City of Central Resiliency Plan
Lafourche Parish Comprehensive Resiliency Plan		
4.0 Prepare Communities for the Rising Costs of Disasters	4.1 Maximize insurance savings provided by the Community Rating System.	Scott 2032: City of Scott Comprehensive Plan
		City of Walker Sustainability Master Plan
		Terrebonne Parish Comprehensive Plan Update: Vision 2030
		Lafourche Parish Comprehensive Resiliency Plan
		Greater New Orleans Urban Water Plan
	4.2 Build flood control structures to protect critical developments.	Jean Lafitte Tomorrow Town Resiliency Plan
		St. John the Baptist Parish Comprehensive Land Use Plan
		Port of New Orleans Design Resiliency Manual

	4.3 Target voluntary acquisition areas to relocate homes and businesses out of flood-prone areas.	Terrebonne Parish Comprehensive Plan: Vision 2030
		St. John the Baptist Parish Comprehensive Land Use Plan
	4.4 Conserve undeveloped lands in flood-prone areas as a mitigation solution.	City of Central Resiliency Plan
		Old Mandeville Town Center Plan
		Town of Church Point Comprehensive Long-Range Resiliency Plan
		Jean Lafitte Tomorrow Town Resiliency Plan
		Lafourche Parish Comprehensive Resiliency Plan
		City of Monroe Comprehensive Zoning Ordinance
		St. John the Baptist Comprehensive Land Use Plan
		Terrebonne Parish Comprehensive Plan Update: Vision 2030
5.0 Achieve Economic Stability in a Dynamic Environment	5.1 Support business disaster recovery.	City of New Orleans Main Street Resiliency Plan
		Old Mandeville Town Center Plan
		Jean Lafitte Tomorrow Town Resiliency Plan
	5.2 Stabilize communities through sustainable urban design and planning.	Old Mandeville Town Center Plan
		Scott 2032: City of Scott Comprehensive Plan
		Greater New Orleans Urban Water Plan
	5.3 Plan for emerging growth sectors.	Greater New Orleans Urban Water Plan
		Lafourche Parish Comprehensive Resiliency Plan
	6.0 Use Innovative Codes, Ordinances, and Design Guidelines to Reduce Risk	6.1 Utilize building codes and ordinances to lessen impacts to structures.
Port of New Orleans Design Resiliency Manual		
City of Monroe Comprehensive Zoning Ordinance		
City of Walker Sustainability Master Plan		
Jean Lafitte Tomorrow Town Resiliency plan		

		City of Central Resiliency Plan
	6.2 Incorporate ordinances and design guidelines that reduce risk through on-site improvements.	City of Monroe Comprehensive Zoning Ordinance
		City of Hammond Unified Development Code
		Morgan City Zoning and Land Development Code
		Jean Lafitte Tomorrow: Town Resiliency Plan
		St. Mary Parish Unified Development Code
	6.3 Address environmental hazards and reduce risk at the neighborhood or community scale through ordinances, codes, and design guidelines.	City of Central Resiliency Plan
		City of Hammond Unified Development Code
		Morgan City Zoning and Land Development Code
		Town of Livingston Subdivision Regulations
		City of Alexandria THINKAlex Resiliency Plan
	6.4 Inform land use decision-making with climate change data.	Old Mandeville Town Center Plan
		City of Hammond Unified Development Code
		Greater New Orleans Urban Water Plan
		Lafourche Parish Comprehensive Resiliency Plan
		Terrebonne Parish Comprehensive Plan Update: Vision 2030
	6.5 Incorporate flexibility into regulatory ordinances and codes to allow for new and innovative individual efforts.	City of Hammond Unified Development Code
		Town of Livingston Subdivision Regulations
		City of Monroe Comprehensive Zoning Ordinance

## Appendix B: CRPP Pilot Project Summaries \*

### City of Alexandria THINKAlex Resiliency Plan



*Project Type:* Land Use

*Date:* Adopted October 2013

*Primary Consultant:* Concordia, LLC

*Related Topics:* Infrastructure, Planning, Regional Coordination, Housing, Transportation, Land Use

Located in the geographic center of Louisiana, the City of Alexandria serves as a regional hub and major conduit to all other parts of the state, yet the city wants to maintain a hometown feel for its current and future residents. To ensure it successively meets these dual roles, the City of Alexandria divided the city into seven planning units using the city's arterial infrastructure as a way to approach the planning process. This ensured that proposed land uses supported the creation of strong neighborhood communities whereby citizens live in proximity to amenities while also supporting regional networks marked by greater connectedness and accessibility.

The THINKAlex Resiliency Plan consists of long-term housing, transportation, and land use plans, as well as an updated Land Development Code, which collectively replace the city's 20-year-old Comprehensive Master Plan. The Housing Plan addresses stagnant growth in recent years and promotes mixed use, relatively dense neighborhoods with a variety of housing options. The Land Use Plan further aims to concentrate development in areas not prone to flooding to minimize impacts from natural disasters. It proposes land use changes based on a low

and moderate land area growth scenario that can handle different population capacities. The Transportation Plan calls for well-connected pedestrian and bicycle networks and improved efficiency of transportation networks. The new Land Development Code incorporates zoning and development regulations tailored to meet the city's current needs, increase its resilience to hazards, and support the three constituent plans.

Alexandria's community-driven planning process is organized around six nexus domains that are important to a healthy and vibrant community system. These are focused on the physical, cultural, social, organizational, educational, and economic aspects of its community. This strategy further emphasizes collaboration by bringing together community citizens, businesses, organizations, and public officials to make decisions regarding future growth and development in support of community resilience.

#### Resilience Planning in Action

The THINKAlex Resiliency Plan considers resilience in the context of the entire community, in addition to disaster preparedness. A resilience map of the city was created that identifies areas with high and low resilience assets for all seven planning units, derived from existing development patterns and based on three community resilience assets: safety, function, and value.

#### Environment

While Alexandria lies further inland and generally avoids direct hits from hurricanes, the city is susceptible to flooding from storms. While the THINKAlex Resiliency Plan does not focus on flooding or disaster resilience, it recommends active and heavy engagement in these issues to ensure the city's long-term resilience. The planning process was based largely on issues related to flooding and drainage in and around the city. It supports concentrating new development in existing, more resilient areas to avoid development in higher risk areas. The plan further recommends exploration of floodplain management strategies to benefit the city's existing drainage infrastructure that is based on natural and man-made systems.

*Proposed Actions:*

- Use conservation easements or outright purchases to strategically acquire flood-prone properties and help develop an interconnected greenway system throughout the city.
- Concentrate future development in areas of the city that are not prone to flooding.
- Encourage densification in appropriate areas and eliminate zoning regulations that impede development in these places.

## Infrastructure

The Transportation Plan aims to maximize the operational efficiency of the city's transportation facilities, as well as enhance the safety and beauty of its street, bicycle, and pedestrian networks. The plan focuses on a multi-modal transportation network that is easy and safe to use. Key strategies include a pavement preservation program, intersection and traffic signal improvements, access management standards, and street connectivity improvements.

*Proposed Actions:*

- Require sidewalks for all new roadway development, redevelopment, and construction through subdivision regulations and provide connections to existing or proposed sidewalks where possible.
- Concentrate future development in areas of the city currently served by existing infrastructure.
- Encourage higher density, mixed-use developments and educational facilities within the downtown area to support public transportation and maximize effectiveness of existing downtown transportation infrastructure.
- Require all new developments to mitigate adverse impacts on the transportation system and implement LA DOTD's Access Management Policy where applicable.
- Promote and facilitate private sector initiatives to help finance new construction, new transportation services, and improvements to existing facilities and services.
- Promote regional and sub-regional transportation planning by cooperating with neighboring jurisdictions to develop a planned network of transit routes, services, and roads.

- Ensure that all transportation planning goals and improvements are in compliance with land use planning goals for the city, and vice versa.

## Community

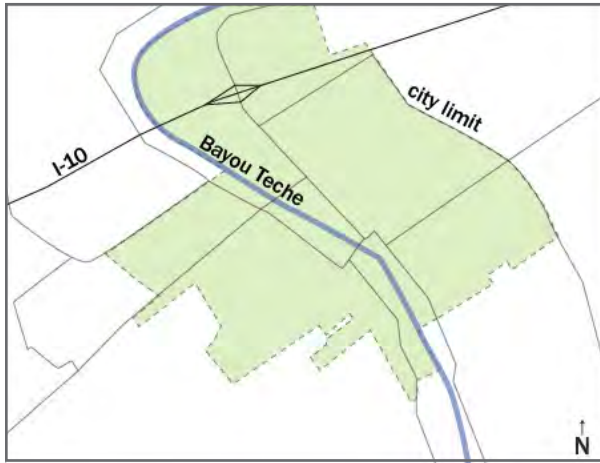
Alexandria is using multiple strategies to accommodate a variety of desired housing types and amenities to increase the attractiveness of its neighborhoods and housing stock. The Housing Plan establishes historic districts and design standards to preserve the unique, historic character and walkability of existing, older neighborhoods, something that Alexandrians strongly desire. The plan also calls for the use of incentives to increase the attractiveness of its housing stock to workers and potential citizens.

*Proposed Actions:*

- Make broad improvements to quality-of-life amenities that continue the Special Planned Activity Redevelopment Corridors (SPARC) initiatives, including complete streets, parks, public open spaces, and bicycle trails.
- Improve street beautification and increase amenities for all transportation networks.
- Update the current zoning code to establish historic districts and a review board to approve alterations to the outside of homes to ensure adherence to design standards.
- Provide a monetary grant to employees who choose to rent or purchase a home within the city boundaries.
- Encourage minimum energy efficiency standards for new developments, as well as sustainable retrofitting opportunities for existing historic homes.
- Retain and strengthen existing neighborhood centers of commerce.

**\* At time of publication some of the original projects were not yet complete. Please refer to [resiliency.lsu.edu](http://resiliency.lsu.edu) for more information**

## City of Breaux Bridge Comprehensive Long-Range Resiliency Plan



*Project Type:* Land Use

*Date:* Adopted March 2012

*Primary Consultant:* T. Baker Smith, LLC

*Related Topics:* Infrastructure, Planning, Regional Coordination, Stormwater Management

With limited area to grow before encountering swamps, unsuitable soils, and floodplains, many communities in south Louisiana use infill development in targeted areas to manage growth and ensure long-term resilience. While some growth beyond the city limits is inevitable, Breaux Bridge, Louisiana developed a Long-Range Comprehensive Resilience Plan that directs development to areas already within city limits. To make infill more appealing than greenfield development, the plan proposes ordinances and incentives to direct new construction toward downtown and established neighborhoods.

Breaux Bridge is a small city east of Lafayette with a strong Cajun identity. The city is home to multiple festivals, popular restaurants, a historic downtown, and natural areas that attract visitors from across the region. However, natural hazards and uncontrolled development can undermine the appeal of Breaux Bridge for tourists and residents alike. Breaux Bridge has seen most of its new development grow along the major I-10 corridor instead of in the downtown. Sprawling development is taxing on the environment and puts pressure on the city to annex more land, straining the city's budget through the extension of infrastructure and public services.

Currently, Breaux Bridge has limited tools to address community planning issues. A proposed revision to the city's zoning ordinance was drafted in 2008 but has not yet been adopted. The Breaux Bridge Comprehensive Long-Range Resiliency Plan offers strategies to improve the 2008 code that will help the city prepare for natural threats, protect historic districts, and avoid unsustainable development patterns. The plan outlines modifications to the zoning code to create a downtown district by re-establishing its traditional urban character and allowing for mixed-used development. Citywide land use proposals, including the adoption of a Unified Development Code, create clear guidelines for residential and commercial development, promoting a specific character. Financial incentives in areas targeted for redevelopment, including tax abatements and reduced permitting fees, make infill economically appealing for private developers. The plan undertaken by the consultants and the city also outlines strategies for improving transportation planning, public services and infrastructure, economic development, affordability of housing, and methods for strategic annexation to expand the city. With takeaways for departments ranging from police and fire to the housing authority and public works, the plan aims to assist the city with holistic improvements that will keep Breaux Bridge regionally competitive and resilient.

### Resilience Planning In Action

The Comprehensive Long-Range Resiliency Plan aims to grow the city in economically, socially, and environmentally sustainable ways, while ensuring the city can rebound quickly and efficiently following natural disasters. The plan takes a close look at current conditions, ordinances, and annexation procedures, then outlines structural and non-structural strategies the city should follow to address major threats in a coordinated manner.

### Environment

Flooding from storm events is an ongoing threat that can be partially addressed with well-maintained drainage, stormwater management, and natural land preservation. Soils that are unsuitable for construction, including wetlands, can be valuable to communities for flood mitigation purposes. Breaux Bridge is recognizing the multiple benefits

of improved growth management through preservation of undeveloped lands. By limiting sprawl and directing new development to appropriate locations, the city is able to preserve wetlands and fragile soils, as well as protect construction that could occur in those places.

*Proposed Actions:*

- Regularly maintain and clean drainage ditches.
- Coordinate stormwater management practices across regions.
- Designate “preferred growth areas” to avoid new development encroaching into flood-prone areas.
- Incentivize infill development.

### **Infrastructure**

Antiquated infrastructure is more vulnerable to natural hazards and can prolong recovery following storm events. To increase the city’s resilience to storm damage, Breaux Bridge is seeking funding to improve its infrastructure. The plan calls for ongoing infrastructure improvements that further support future growth in line with the city’s existing character. It proposes a restructuring of annexation procedures to reduce undesirable land uses by directing development to preferred areas and ascribing infrastructure extension costs to the developer instead of the city.

*Proposed Actions:*

- Update zoning to direct development to areas best suited for buildings.
- Restrict extension of city services or infrastructure outside of city limits without agreement for annexation and payment for improvements by the developer.
- Require all utilities, including new power, phone, and cable lines, to be buried.
- Form a TIF district downtown to encourage infill development.
- Improve municipal buildings with investments in wind-hardening, flood-proofing, and back-up generators.
- Clean out all drainage ditches.
- Improve water/wastewater systems.
- Coordinate stormwater management regionally, particularly with St. Martin Parish and Lafayette Consolidated Government.

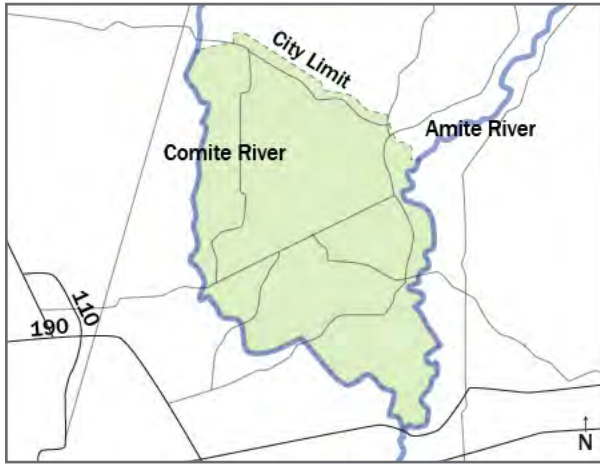
### **Community**

Sprawling development in and around Breaux Bridge is leading to the neglect of older neighborhoods, traffic congestion, and added expenses for municipal government. Faced with a 25% poverty rate, a waiting list for its limited HUD units, and a 21% increase in population by 2030, the city needs new, affordable, and safe housing developments. The Resiliency Plan links strategies for encouraging infill development to efforts that increase affordable housing availability. As multiple strategies are paired with increased code enforcement and local programs to target abandoned properties, Breaux Bridge will improve the appeal of its older neighborhoods and increase options for safe, affordable housing.

*Proposed Actions:*

- Invest in emergency services by hiring more staff when needed, increasing benefits, and improving facilities and equipment.
- Allow and incentivize second-story residential units in the proposed downtown district.
- Modify the current residential zoning to create districts that allow for a mix of housing types and variable lot sizes.
- Use federal grant programs that promote homeownership and provide funds for weatherization improvements for middle- and low-income families in older neighborhoods.
- In multi-family and mixed-use districts, grant density bonuses to developers for the inclusion of Accessory Dwelling Units.

## City of Central Resiliency Plan



**Project Type:** Zoning, Land Use, Water Management

**Date:** Final Draft July 2013

**Primary Consultant:** Environmental Resources Management

**Related Topics:** Architecture, Data Management, Economic Development, Hazard Mitigation, Landscape Architecture, Planning, Stormwater Management

*How can a nascent city with much of its land in a floodplain plan for a sustainable future that is resilient to both economic and environmental risks?*

The two primary challenges facing the city of Central involve the management of its extensive floodplain, and the development of a civic center that provides Central a unique identity. The city has addressed these challenges through a planning process that promotes environmental, economic, and community resilience. This was accomplished through three distinct, yet inter-dependent deliverables: a Floodplain Management Plan; City Center implementation strategies; and Design Guidelines and Pattern Book for the City Center Development.

The City of Central is located on the eastern edge of East Baton Rouge Parish. The area was originally settled in 1810 when a ferry began operating on the Amite River. In the mid-1800's, the area became known as Greenwell Springs and grew into a small rural community for people moving from Baton Rouge and New Orleans.

Until the 1980's the area remained mostly rural. After experiencing rapid growth through the next decade, the City of Central decided to incorporate in the spring of 2005. Soon after incorporating, the city began a comprehensive planning process to guide development in the fledgling community. The Master Plan was officially adopted in 2010. The plan reflects the community's goals and incorporates Smart Growth Principles to establish a future land use map, which will help shape the City's physical, economic, and social form.

### Resilience Planning in Action

Central's resiliency planning efforts build toward successful implementation of their 2010 Land Use Plan. The Floodplain Management Plan is based on a scientific analysis of the area's natural features and flooding risks to test the proposed density and intensity of development in the land use plan. This approach proposes development types based on the drainage capacity of natural and built infrastructure, and provides the city a baseline of information to amend the land use plan and guide future development to be more resilient to flooding. The City Center Implementation Strategies provide the City a set of strategies that will bring the City Center from a proposal to construction. The Design Guidelines and Pattern Book create visual expressions of the regulations defined in the Land Use Plan. The Pattern Book and Design Guidelines provide guidance for the appropriate density, aesthetic, and quality of development for the proposed City Center. This includes a model ordinance of a City Center overlay district. These are valuable contributions to greater resilience for the city.

### Environment

Central sits between the Amite and Comite Rivers and 70% of its 64 square miles are within the 100-year flood zone. This presents a challenge for effectively zoning the growing community to insure the safety of residents, minimize property damage from flooding, and protect the river ecosystems. The Resiliency Plan includes a Floodplain Management Plan, which will guide the city toward responsible development decisions in the future related to its floodplain and ecosystem services.



*Proposed Actions:*

- Improve environmental resiliency by demonstrating innovative development and best practices in compact development patterns, density, and design guidelines.
- Based on floodplain zones identified in the plan (natural, simulated natural, and hard engineered) implement appropriate strategies as designated in the plan.
- In “natural zones” minimize intensity of use in A and AE zones through passive detention in green spaces and buffering streams. These are low density areas.
- In “natural zones” projects should demonstrate 100 year and 500 year flooding post-development; 2- and 10-year or 2- and 25-year events for design of projects.
- In “simulated natural zones” avoid A and AE zones and move development to X and 0.2 zones by detaining water with structures and soft BMPs such as rain gardens and swales. These are middle density zones.
- In “simulated natural zones” projects should demonstrate 100-year and 500-year flooding post-development.
- In “hard engineered zones” minimize filling and conflicts with storage and conveyance capacity through the optimization of removal of water and maximize storage through structures and semi-engineered solutions such as rain gardens. These are core density areas.

## **Infrastructure**

The Central Resiliency Plan largely focuses on drainage infrastructure as it relates to drainage basins, floodplains, and future projected development. The plan identifies inadequate capacity for stormwater, and provides mitigation recommendations.

*Proposed Actions:*

- Improve capacity of culvert and bridge sizing where flooding has occurred in the past.
- Improve capacity of hard engineered structures through implementation of impervious surfaces, bio-swales, green roof techniques, and careful attention to detention systems.
- Remove inadequate culverts/pass-throughs under Hooper Road and other roadway crossings. These improvements could be

made whenever major road improvements are scheduled.

## **Community**

As a young city, Central currently lacks civic space and public gathering space to foster a greater sense of community and identity. Through the city’s master plan, the desire to create an identifiable place to centralize city services, as well as provide space for different types of public gathering, became an evident shared value among the citizens. The Resiliency Plan provides further guidance through both the City Center Implementation Strategies and the Design Guidelines and Pattern Book, which provides a model ordinance and standards for the City Center. The City Center is an important step for Central in the development of a shared identity for the community.

*Proposed Actions:*

- Improve social resilience by creating a signature public space conducive to public gatherings, community interaction, and integration with other existing public facilities.
- Leverage public investment to build a City Hall to stimulate private investment in high-quality commercial and residential development.
- Improve economic resilience by diversifying commercial activity and attracting new retail, office, service, and job creation in the city.
- Develop site-selection criteria for City Center; engage property owners.
- In site selection, value image and community branding potential, location, and connectivity to green space and other public assets, including schools.
- Encourage a mix of uses in the City Center.
- Reference Design Guidelines and Pattern Book when creating a City Center overlay district, which will set standards and control development types in the new district.

# Town of Church Point Comprehensive Long-Range Resiliency Plan



*Project Type:* Land Use  
*Date:* Adopted August 2011  
*Primary Consultant:* LJC Poole, LLC  
*Related Topics:* Economic Development, Planning, Policy, Public Safety, Revitalization

The people of Church Point value living in a safe and attractive community with a strong economic base. The Church Point Comprehensive Long-Range Resiliency Plan aims to ensure that goal. The plan guides future development in the town through Smart Growth planning principals, zoning code updates, flood mitigation, and strategies for economic development and crime prevention. Unlike many communities in south Louisiana, Church Point is fortunate in that it experiences limited flooding during major storm events. Natural hazard mitigation strategies are briefly discussed in the plan, but the emphasis is on economic development and improving quality of life. Due to the small tax-base and limited financial resources of the town, the plan puts emphasis on relatively inexpensive changes that local government can make for improvement in the short-term. Medium and long-term capital improvement projects requiring additional funds are included as well, to inform long-range planning efforts. The Church Point Long-Term Resiliency Plan thoroughly analyzes the current condition of the town and outlines a vision for the future. With suggestions for streetscape improvements, new laws, and increased enforcement of current codes, this plan aims to be a springboard for future land use planning and economic development efforts.

## Resilience Planning in Action

The primary threats to resiliency in Church Point are economic, social, and political. Disinvestment has plagued the town for decades. An increasing, yet aging, population has strained the resources of the municipal government. Main Street in downtown Church Point is dotted with vacant and under-utilized structures. Crime has become a problem as well. The town has difficulty attracting new businesses and younger residents that would add to the tax base. The Town of Church Point has not been able to overcome the economic downturn that hit in the 1980s. The recent economic crisis has resulted in more vacancies and an increased poverty rate. A comprehensive approach must be taken to bring back investment to Church Point and to improve quality of life for its residents.

Through improved land use controls, capital improvements, code enforcement, and maintenance of natural drainage channels, the Church Point Comprehensive Long-Range Resiliency Plan looks to make the town an attractive place to live, work, and visit.

## Environment

Located over 40 miles inland from the Gulf of Mexico, Church Point is not at risk for coastal flooding from storm surges and, thus, is not facing as many challenges to flooding as some communities in south Louisiana. However, major storms do result in property damage from wind and localized flooding. The area around Bayou Plaquemine Brule, which drains the majority of Church Point, has been designated as a 100-year floodplain by FEMA. The bayou has not been maintained and over time, and as a result, the stormwater storage capacity of the bayou has decreased. Consequently, in 2010 FEMA expanded the 100-year floodplain area. If Bayou Plaquemine Brule continues to be neglected, the floodplain may expand and place more properties at risk of flooding.

### *Proposed Actions:*

- Coordinate at a regional level for improved stormwater drainage.
- Ensure regular maintenance of channels that drain the town.

- Decrease damage from severe weather events by means of several options, including stormwater management and zoning code enhancements.

### Infrastructure

Because of lack of population growth, new roadway infrastructure is not recommended during the twenty-year planning horizon. However, the planning document contains a Sidewalk Improvement Plan, which provides a framework for capital improvements of pedestrian networks across Church Point. The plan also encourages Church Point to encourage infill development to take advantage of existing infrastructure and minimize future maintenance costs.

#### *Proposed Actions:*

- Minimize expansion of existing infrastructure by encouraging infill development.
- Focus investment in the downtown area.

### Community

The majority of this planning document focuses on improving quality of life in Church Point. High crime and a weak local economy are major threats to the long-term viability of the town. Applying the “broken window theory” that one building allowed to deteriorate (one “broken window”) will deter investment and attract crime (more “broken windows”), this plan encourages improvements to the physical environment to increase livability. The capital improvement plan lists infrastructure projects and policies that should be implemented over the next 10 years. Enhancements to sidewalks, streetlights, and parks, for example, will improve quality of life for residents and also attract new investment. Investment in the town will strengthen the local economy and provide funds for more civic improvements, leading to a higher quality of life. In turn, additional businesses will be attracted to the area and the cycle continues. A few strategic structural projects and improvements to the civil ordinances of Church Point will set the town on the road to continued prosperity.

Strengthening and enforcing the civil and criminal code is a critical step to resiliency outlined in the plan. The Town of Church Point currently lacks the legal tools necessary to combat problems stemming from abandoned and nuisance properties. The current zoning ordinance, based

on cumulative districts, is also inadequate for guiding development to reflect the vision of the community. Codes based on cumulative districts commonly lead to incompatible land uses existing in close proximity.

#### *Proposed Actions:*

- Undertake a thorough restructuring of the zoning code, with parcel-based maps, districts based on desired character, and ordinances to improve property aesthetics, such as buffering, landscaping, parking, and building design.
- Adopt a Unified Development Code as an alternative strategy to equip the town with more tools to implement their vision.
- Create a position in town government to oversee planning and code enforcement to ensure that the updated ordinances are followed and violators are penalized.
- Increase funding for the police department will also aid in strong code enforcement and increased public safety.

## East Feliciana Parish Comprehensive Resiliency Plan



*Project Type:* Land Use

*Date:* Adopted August 2013

*Primary Consultant:* Kimley-Horn and Associates, Inc.

*Related Topics:* Agriculture, Architecture, Economic Development, Education, Landscape Architecture, Planning, Public Health, Recreation, Technology, Transportation

Like many Louisiana communities, East Feliciana Parish residents want to retain the rural quality of the parish while enhancing economic services within the parish's town centers. The East Feliciana Parish Comprehensive Resiliency Plan helps to preserve the parish's rural character by encouraging new residential growth in or adjacent to established town centers, creating rural "smart growth" communities. Town centers retain their historic and cultural patterns, and existing historic structures are rehabilitated and reused. New development highlights the region's historic charm while also infusing modern qualities to produce varied and culturally rich communities.

The Comprehensive Resiliency Plan stems from a strong public engagement process that included more than 100 stakeholder interviews, two parish-wide and two town-focused public workshops, and project websites with up-to-date information. Collectively, they allowed hundreds of residents to provide input during the planning process.

Aligned with the Louisiana Speaks Regional Plan, the East Feliciana Parish Comprehensive

Resiliency Plan guides land use, economic development, and transportation investments in the parish for the next 20 years. Its five major guiding principles are: 1) land use and housing, 2) equity and opportunity, 3) environmental health, 4) economy, and 5) transportation.

The guiding principles were ranked and several strategic priorities were identified based on the parish's existing needs and vulnerabilities. Some of these needs included economic development that is compatible with existing land use and development patterns; improved quality of roadways; diverse and affordable housing options; diverse employment options; more health and human services; protection of rural character; increased access to recreational services; and challenges introduced by a low tax base. The plan also supports the continuation of farming, agriculture, and timber industries outside of the parish towns. The parish-wide plan includes additional plans for the towns of Slaughter, Clinton, the Sticks Community, Jackson, Wilson, and Norwood.

### Resilience Planning in Action

The Comprehensive Resiliency Plan includes four main elements that provide the foundation for the strategies and policy guidelines. They are land use and transportation, economic development, housing needs, and cultural heritage assessment. With emphasis on these four elements, the parish identifies and accommodates desired development types, opportunities to capitalize on existing assets, and strategies to strengthen the parish's economy by protecting and fostering important industries to ensure long-term resilience.

### Environment

The natural, rural setting is an essential asset in the parish that provides economic opportunities in certain sectors and that parish residents cherish. The plan aims to protect natural, open areas and promote housing and roadway developments that suite the rural qualities of the parish. The parish's natural resources are also essential to protecting and fostering the forestry, agriculture, and manufacturing industries that are central to the local economy.

*Proposed Actions:*

- Adopt a rural overlay to maintain the parish's rural character and natural assets that encourages things like larger minimum lot sizes and building setbacks, as well as minimum standards for landscaping and/or tree retention, in certain locations.
- Consider the impact of the oil and gas industry on the environment by conducting an impact analysis and create a parish 'oil and gas master plan' to guide where future drilling should occur and ensure the parish's natural landscape is maintained.

### **Infrastructure**

Parish residents expressed concern about the quality of roadways and sewer infrastructure in the parish. The plan prioritizes infrastructure and park needs, including a roadway improvement program, more and safer walking options, a truck route signing program, well connected infrastructure and services, and future water and sewer infrastructure considerations.

*Proposed Actions:*

- Balance infrastructure enhancements with the town's existing rural, small town feel.
- Improve vital infrastructure to ensure it can meet the parish's future needs, including roads, sewers, water, technology, education, trails, etc.
- Prepare a water and sewer inventory, needs assessment, and plan to provide for future infrastructure needs.
- Identify a process for creating and maintaining horse and bicycle trails in various locations throughout the parish.
- Create a premier 21-mile multi-use trail that spans the length of the parish, such as by transforming the former railroad into the trail system.
- Provide the most up-to-date digital infrastructure to support business and community needs.

### **Community**

The strategies and goals outlined in the plan heavily emphasize quality of life issues and economic development. The plan aims to create diverse, quality housing options to meet the desires and needs of East Feliciana Parish residents, particularly retirees and young adults. The plan further emphasizes increasing jobs and job skills throughout the parish to attract and retain expertise. Public health is improved through outreach and educational programs, as well as greater recreational opportunities.

*Proposed Actions:*

- Ensure that any amendments to the zoning ordinance protect the parish's agricultural, ranching, and tree farming practices.
- Identify opportunities through feasibility studies to expand businesses related to locally grown agricultural products, especially organic food products.
- Seek out opportunities to connect cultural and heritage tourism to the parish's other economic development priorities, particularly through public-private partnerships.
- Expand use of existing schools and renovate uninhabited school buildings to be used as community centers for community gatherings and social events.
- Consider expanding the number of second homes for use during major storm events.
- Identify publicly-owned sites in the parish's towns, such as schools, parks, or town halls, to serve as local fitness centers and recreation centers.

## Greater New Orleans Urban Water Plan



*Project Type:* Water Management

*Date:* Final Report September 2013

*Primary Consultant:* Waggonner and Ball Architects

*Related Topics:* Architecture, Coordination, Hazard Mitigation, Infrastructure, Landscape Architecture, Planning, Policy, Public Safety, Stormwater Management, Waterfront, Wetlands

*How can planning projects address regional or watershed issues that benefit individual municipalities?*

The Greater New Orleans Urban Water Plan addresses the systematic water resource management issues of communities in St. Bernard Parish and on the East Bank of the Mississippi River in Jefferson and Orleans Parishes. The heavily urbanized neighborhoods of Orleans, Jefferson, and St. Bernard Parishes are encircled by levees to protect from river and storm surge flooding, but even with a few inches of rain, water floods some streets. Heavier rains can lead to flooding of buildings and extremely dangerous road conditions, despite the large-scale pumping infrastructure and network of canals. This regiment of draining to canals and pumping has led to significant rates of subsidence in parts of the subject area leading to greater vulnerability to flooding as well as building and infrastructure decay. To complicate matters, stormwater management, flood protection responsibilities, and water pipe maintenance are divided among a number of agencies at the local, parish, state, and federal levels.

Greater New Orleans, Inc., a non-profit economic development alliance, directed this multi-parish planning effort with a consultant team of designers, engineers, scientists, and policy experts led by Waggonner & Ball Architects. The Greater New Orleans Urban Water Plan team worked closely with local governments during plan development, though the implementation of the plan will be the responsibility of the communities.

The major goals of the project include increasing safety, providing economic opportunity, and improving quality of life. The project aims to address flooding and subsidence by intervening at different scales of community - the ground (soil, groundwater, vegetation), infrastructure networks (sewer and water systems, roads, utilities), structures (homes, schools, businesses), and people.

### Resilience Planning in Action

The Greater New Orleans Urban Water Plan provides sustainable strategies to address flooding caused by excess runoff and subsidence caused by the pumping of stormwater. The plan provides a clearer vision for a new paradigm of water resource management, the urban design opportunities, and the economic benefit of implementation, as well as non-action.

### Environment

The New Orleans area is situated on land built by the MS River. Over time, development pressures and the advent of new technologies have pushed human settlement into vulnerable areas and masked natural processes that have traditionally sustained the landscape. The region is also highly susceptible to the effects of climate change, specifically increased storm intensity and relative sea level rise. The plan works in the concept of multiple lines of defense, which relies on structural flood protection measures. Levees, the predominant structural protection infrastructure in the area, cuts off natural hydrologic flows, which exacerbates subsidence.

*Proposed Actions:*

- Delay stormwater by using bio-retention and infiltration strategies.
- Storing stormwater in the landscape longer

by retrofitting canals and finding space for new canals and ponds.

### **Infrastructure**

The existing drainage infrastructure is built on the idea of drain, pipe, and pump. This has caused high rates of subsidence that impacts the quality of roads and the effectiveness of drain pipes. This plan proposes a new method for managing water, which adds capacity to the existing drainage system and minimizes subsidence rates over time.

#### *Proposed Actions:*

- Divide the water basins based on an existing ridge in the city.
- Drain stormwater through existing and upgraded infrastructure.
- Raise water levels of canals during dry seasons to reduce subsidence.
- Build/retrofit streets to detain stormwater.
- Utilize neutral grounds (medians) to store water in rainfall events.
- Design parks to accommodate flood waters – reducing the vulnerability of the hard drainage system.

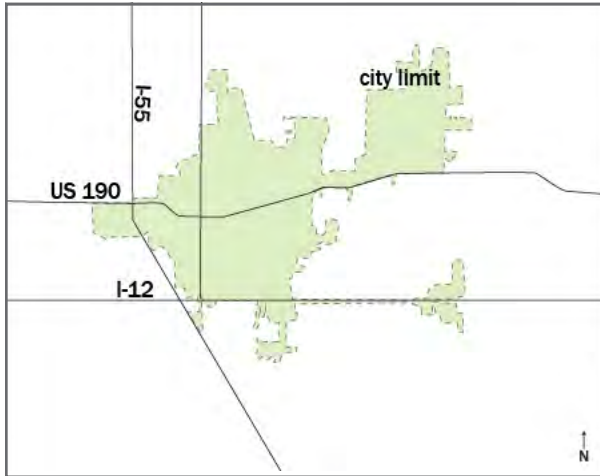
### **Community**

The Greater New Orleans region has historic reasons it has turned its back on water. Whether it is walls to protect from flooding or pumps to keep the city dry and mosquito population low – the cultural attitude toward water has discounted the opportunity water infrastructure to connect neighborhoods, build new industries based on water management, and stabilize property values in adjacent areas. This plan addresses this by providing the economic case for this new paradigm of water management and communicating the aesthetic benefits provided by well-designed open spaces that connect neighborhoods and provide room for water.

#### *Proposed Actions:*

- Remove some existing flood walls around canals that have upgraded pumps and no longer require walls.
- Design and build a number of pilot projects in the study area to show the many benefits of plan implementation.

## City of Hammond Unified Development Code



*Project Type:* Zoning

*Date:* Completed April 2013

*Primary Consultant:* Forte and Tablada, Inc.

*Related Topics:* Economic Development, Flooding, Hazard Mitigation, Stormwater Management

*How can cities manage rapid growth while balancing concerns over environmental risks and maintaining the community's character?*

The City of Hammond has undergone major changes following Hurricane Katrina and subsequent storms over the past 8 years. The city has experienced major flooding and wind damage. However, the response to storms has extended far beyond restoring power and raising, retrofitting, or rebuilding damaged structures. Hammond experienced a population increase of 30% following Hurricane Katrina, as residents, businesses, and military operations relocated from coastal communities in response to the associated risks with having a base of operations in vulnerable areas. Hammond's accessibility, as it is conveniently located at the intersection of Interstates 55 and 12 in Tangipahoa Parish, paired with locally available and inexpensive land, made it a desirable destination for relocation. Although Tangipahoa Parish does touch on the northwestern shore of Lake Ponchartrain, Hammond is further inland and does not encounter the threat of storm surge facing lake-front communities. The explosion of growth, rapid development pressures, and the promise of rapid economic expansion compelled

the city to develop a plan to shape the future of its community. Despite the reprieve of storm surge in Hammond, the city nevertheless faces major environmental risks, predominantly due to flooding.

In June 2011, Hammond adopted the Hammond Comprehensive Master Plan, which established a collective vision and set of policies to direct future development in the city. The plan balances quality of life concerns and economic opportunities, while promoting sustainable and responsible land use and development decisions. To help ensure the realization of the goals laid out in the Comprehensive Master Plan, the City of Hammond has developed a new Unified Development Code (UDC). This comprehensive zoning ordinance not only codifies the intentions of the master plan, it combines the city's different regulatory statutes into one cohesive document. Furthermore, in preparing the UDC, the consultants conducted a rigorous set of audits of the Comprehensive Master Plan, to ensure that the regulations spelled out in the code respond accurately and appropriately to the desires of the master plan, and to highlight items requiring further action.

### Resilience Planning in Action

The City of Hammond's new UDC will help promote local resilience by providing a clear set of land use and development rules and regulations for achieving the community's goals, as well as clarifying potentially conflicting provisions from multiple ordinances. In light of ongoing and expected rapid growth, the UDC integrates multiple regulations to mitigate the potential for new development to increase flood risks and subsequent impacts on the community, including costs of recovery, infrastructure, and business down-time, which elevate the need for action beyond on-site flood risks.

### Environment

The Hammond UDC addresses environmental factors through specific requirements related to drainage. The overriding concept is that any new development should not adversely impact or change natural drainage patterns, and a Drainage Study is required for many permits.



*Proposed Actions:*

- Any new construction or modification must demonstrate that it will not make any changes to the flow of water through the property, including the location and amount of water that enters and exits the property.
- Flood information that determines regulatory standards and that is provided in the permit review process must include FEMA designated floodways and floodplains, as well as record flood extents and levels. In some cases, the greater of these determines on-site regulations.
- Stormwater management proposals are encouraged to maximize efficient use of natural drainage systems.
- Any proposed development on land abutting any drainage canal must be reviewed by the City Engineer and Drainage District.
- Permit requirements for any grading work must include significant information relating to impacts to runoff and flooding.
- Stormwater runoff from a site must not cause detrimental impacts in terms of the quantity of runoff, nor in the quality of the water.
- Planned developments have specific open space requirements, including 50% greenways and a minimum of 1 acre of dry detention basins or retention areas.

### **Infrastructure**

The Hammond UDC ensures that all infrastructure is constructed to meet the highest standards – both technically and in line with state and parish regulations – as well as to promote the community’s character. The thorough and technical requirements clarify required specifications without being overly restrictive or limiting innovative solutions.

*Proposed Actions:*

- Minimum road grade for local streets should be the greater of 1 foot above the 50-year flood elevation or record inundation elevation.
- Large flood control infrastructure projects are discouraged if other measures can be used to reduce risk.
- Reductions in required parking are available based on specific uses, factors, and criteria to ensure an efficient provision of infrastructure, encourage investment in areas with favorable conditions, and limit stormwater runoff.
- Landscape requirements can be met through

a variety of interventions. Each measure equates to a predetermined number of points, and a set number has to be met to fulfill the requirement. This allows for innovative, alternative, or more economically viable options.

- Street-section details in the Appendix provide clarity regarding street and community infrastructure requirements.
- Road construction or improvements require a series of studies, including an impact study, to determine appropriate materials for paving.

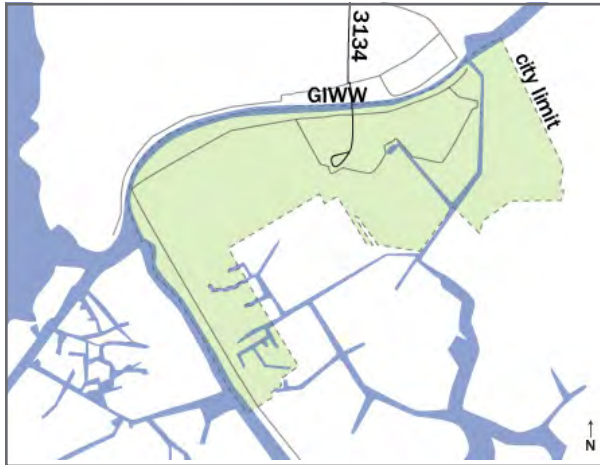
### **Community**

The Hammond UDC promotes resilience by considering economic development and community character and how these priorities are undermined by flood risks. In addition, the UDC provides clear information and expectations for residents and potential development. This creates a positive climate for investment through a straightforward, clear permitting process.

*Proposed Actions:*

- Flood protection and mitigation are promoted for the goals of minimizing prolonged business interruptions, minimizing future flood blight, and minimizing the need for rescue and relief efforts.
- The UDC requires that potential buyers be notified if a property is in a flood area.
- The Hammond Historic District pairs community character concerns while fostering economic development.
- The UDC lays out a clear review authority and includes a system for managing disputes.

## Jean Lafitte Tomorrow: Town Resiliency Plan



*Project Type:* Land Use

*Date:* Adopted April 2013

*Primary Consultant:* Dover, Kohl & Partners

*Related Topics:* Architecture, Economic Development, Governance And Policy, Hazard Mitigation, Infrastructure, Landscape Architecture, Livability, Natural Resources, Planning, Tourism

*How does a community proactively address risk now in light of anticipated increased structural protection in the future?*

Jean Lafitte is located along Bayou Barataria nearly 30 miles south of New Orleans very close to the open waters of brackish lakes and bays that connect to the Gulf of Mexico, making coastal flooding from high winds and storm surge a serious threat to the community. The communities of the Barataria Basin are not protected by a federal levee system. Wetlands provide nearly all the protection from storm surge, with only a few areas benefiting from short, disconnected lines of low levees. The state's coastal master plan includes building a ring levee for the communities along Bayou Barataria, but it is not expected to be completed until 2032 and a source of funding for the project has not yet been identified. While a new ring levee will help reduce the frequency of flooding, it will not completely remove Jean Lafitte's risk of flooding. Jean Lafitte must proactively reduce risk and increase its resilience under an environmentally and economically uncertain future.

Acknowledging the serious environmental threats of sea level rise, coastal erosion, and wetland loss, the Jean Lafitte Tomorrow: Town Resiliency Plan will help Jean Lafitte and the neighboring unincorporated villages of Lafitte, Crown Point, and Barataria create a safer future. The plan includes urban design, land use, transportation, disaster management, economic development, and water management elements, including policy recommendations for community leaders. Additional community planning tools are strongly referenced in the Jean Lafitte Tomorrow plan, including the Best Practices Manual for Development in Coastal Louisiana and the Louisiana Land Use Toolkit. In addition, the plan is designed to be used in conjunction with the Louisiana Coastal Land Use Toolkit manuals for zoning, subdivision ordinances, and additional ordinances when developing new zoning code and/or Unified Development Code.

### Resilience Planning in Action

The people of Jean Lafitte value the area's rich history, lush natural environment, and casual working waterfront. The Jean Lafitte Tomorrow Plan defines resilience as having effective, flexible response strategies to prepare for an uncertain future while working toward future goals that build upon community values. The plan presents strategies to address the risks from sea level rise, storm events, and economic uncertainties, with the overall goal of improving the quality of life for Jean Lafitte residents. During the planning process, several themes were consistently identified by citizens as important principles to helping guide the town's growth. The plan is framed around six principles of resilience: 1) assess opportunities and threats, 2) enhance local assets, 3) focus on the heart of town, 4) diversify mobility options, 5) build stronger and safer, and 6) live with water. The Jean Lafitte Plan further encourages proactive measures to find and adopt solutions to current challenges to increase resilience, without relying or depending on state and federal funds alone.

### Environment

Jean Lafitte's natural setting is a major attraction to locals and tourists alike. The Jean Lafitte Tomorrow Plan seeks to capitalize on its environmental assets provided by surrounding lush wetlands

and Bayou Barataria. However, its elevation near sea level and proximity to the Gulf of Mexico also pose increasing environmental risks that must be addressed to secure the safety and vitality of Jean Lafitte's future.

*Proposed Actions:*

- Establish a policy for native plant usage wherever possible in required landscaping, re-plantings, and on public properties as land-generating systems to increase protection against wind and water erosion and storms.
- Maintain ground water levels to hold water in place and drain only when needed using small strategically placed pumps to limit subsidence.
- Preserve open spaces and bayou lands to protect and enhance the town's existing rural, small-town character.
- Establish a demonstration garden by City Hall or the Senior Center to show and educate the community about native plants and plantings that should be used in Jean Lafitte.

### **Infrastructure**

The plan identifies deficient infrastructure as a major threat to the resilience of Jean Lafitte. The plan identifies several strategies to bring vital infrastructure up to contemporary standards and more in line with community goals, as well as funding sources to ensure the continued upkeep and safety of vital infrastructure.

*Proposed Actions:*

- Invest in pedestrian-oriented infrastructure that supports and helps create safe, welcoming, and walkable streets, including upgrading existing infrastructure, expanding sidewalks, adding crosswalks, and ensuring new construction includes well-connected sidewalks.
- Provide safe, convenient infrastructure for bicyclists to encourage bicycling as a form of personal transportation and for tourism.
- Elevate critical infrastructure, including electrical sub-stations, pump stations, and other infrastructure hubs, above the base flood elevation.

### **Community**

Jean Lafitte is a tight-knit community set in the middle of the wetlands with good schools, low taxes, and abundant recreational opportunities. The town and surrounding area boasts a rich culture with many assets in the seafood and fishing industries, historical architecture, and untamed natural beauty. The plan strongly reflects the goals and desires of its citizens, and it recognizes the importance of community cohesion in making these goals reality.

*Proposed Actions:*

- Provide increased recreational opportunities for residents and visitors to enjoy the natural and historic qualities of Jean Lafitte and surrounding area.
- Replace mobile homes with more storm-resilient structures, particularly in lower Lafitte.
- Identify, protect, and encourage the preservation and rehabilitation of the town's existing historic resources.
- Protect businesses in the 'working waterfront' community to evaluate business needs and ensure new additions to the area are not in conflict with existing businesses.
- Construct new facilities to house businesses that cater to visitors interested in fishing, bird watching, and air boat rides, such as lodging with shared cooking facilities.
- Diversify housing options in the town center to accommodate residents and tourists, including boutique hotels, bed and breakfasts, fish camps, and housing that caters to older retirees.
- Capitalize on the town's waterfront access to encourage locals and visitors to enjoy waterfront amenities.

# Lafourche Parish Comprehensive Resiliency Plan



*Project Type:* Land Use

*Date:* Final Draft January 2014

*Primary Consultant:* Fregonese Associates

*Related Topics:* Agriculture, Architecture, Economic Development, Education, Landscape Architecture, Planning, Public Health, Recreation, Technology, Transportation

*How do low-lying communities in southeast Louisiana plan for their futures in a changing environment?*

Like other coastal parishes in the state, Lafourche Parish is highly vulnerable to risks from natural hazards and future land loss. The Lafourche Parish Comprehensive Resiliency Plan addresses the coastal issues threatening its long-term viability in conjunction with other parish needs, including greater diversity in jobs and housing options, improved transportation facilities, and greater quality of life for residents.

Land development patterns along Bayou Lafourche follow the arpent system with long, narrow parcels of land, constraining development. The town is strengthening its resilience to disasters by focusing on strategic economic growth and diversity while preserving the natural assets and existing character. To help lead them toward greater long-term sustainability and resilience, Lafourche Parish partnered with the Center for Planning Excellence (CPEX) to develop the community-tailored Comprehensive Resiliency Plan and implement the Louisiana Land

Use Toolkit, a resource for model development codes and ordinances. The plan utilizes both structural and non-structural tools to help the parish identify critical areas in need of protection while promoting sustainable growth patterns and resilient structures.

## Resilience Planning in Action

Central to Lafourche Parish's long-term resilience is protection from natural hazards and future land loss. The Comprehensive Resiliency Plan emphasizes structural and non-structural flood protection measures, including coastal restoration, economic diversity, and elevated homes, to reduce that impacts from storms and flooding. It recognizes the importance of regional coordination to maximize the effectiveness of coastal restoration projects, increase the sustainability of the parish and surrounding region, and secure the safety of residents.

## Environment

Lafourche Parish is susceptible to coastal erosion, subsidence, and sea level rise. While Lafourche communities are protected by a levee system that parallels Bayou Lafourche on both sides, the area remains vulnerable to the impacts of flooding and hurricanes. Lafourche residents place coastal restoration and wetland preservation as top priorities to ensure the long-term stability of their communities and local economies. The Comprehensive Resiliency Plan stresses the need to plan for future land loss and restoration efforts while maximizing the many economic and recreational opportunities that living so close to water provides.

### *Proposed Actions:*

- Plan waterways and water bodies as recreational amenities.
- Introduce associated wetlands in long-term phasing to clean water and provide habitat and amenities on the protected sides of levees.
- Reduce the distance between storm drains and canals or detention/retention basins to allow for higher water levels and limit subsidence.
- Enforce the International Building Code

requirements for new construction to strengthen buildings against high wind damage.

- Expand and provide programs that include land banking and preservation areas, prioritizing locations on the bayou side, outside levees for farming, birding, and fishing areas.
- Promote land building, marsh creation, sediment diversion, barrier island restoration, and shoreline protection for natural lines of defense from storms and flooding.
- Restore the region's natural hydrologic function, where possible.

### Infrastructure

Resilient infrastructure that can withstand the impacts of storms and handle large flooding events is required to protect residents from the impacts of floods. The Plan aims to strengthen stormwater infrastructure systems and pursue efficient regulatory actions. It directs future growth into areas equipped with adequate infrastructure, while hardening and improving existing infrastructure.

#### *Proposed Actions:*

- Follow historic settlement patterns and building types with land uses organized by elevation and hydrology from high to low ground.
- Develop an outreach and engagement plan to involve multiple stakeholders and partners in the design and performance of infrastructure.
- Plan investments in infrastructure as the basis for other kinds of investment and economic development, resulting in public dollars leveraging private investment and growth.
- Widen drainage ditches and upgrade culverts to protect current structures and future construction from floods.
- Develop new green infrastructure that integrates into existing drainage systems for detaining and retaining stormwater.
- Increase access routes and alternative routes for evacuations and traffic flows by supporting highway initiatives through council resolution.
- Coordinate with Port Fourchon to provide shuttle transportation for dock workers, coordinating this effort with residential service to Golden Meadow.
- Design new developments to accommodate the 4% annual chance flood (25-year storm), with a 24-hour duration event with a total

depth of 10.8 inches according to the National Weather Service.

- Limit flow rate and volume of discharge from any proposed development to the 25-year storm pre-development rate, and require all development to be above the peak water stage elevation for the 25-year storm or the FEMA BFE, whichever is higher.
- Prioritize infrastructure projects that will support and enhance the ecotourism industry.

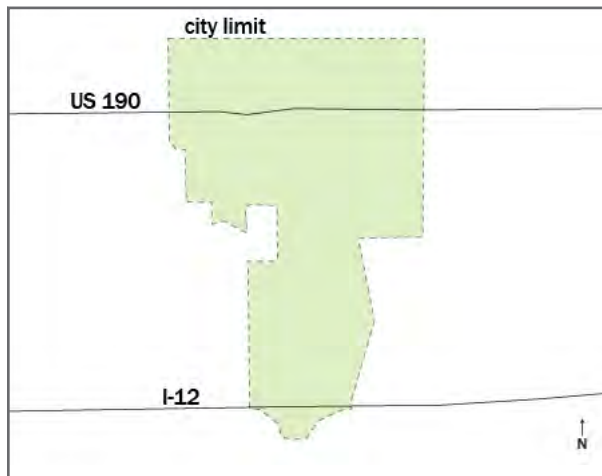
### Community

The economy of Lafourche Parish is strongly linked to the oil and gas and seafood industries. Port Fourchon distributes roughly 18% of the nation's oil supply, and the Parish contributes nearly 40% of U.S. exports in the seafood industry. The plan seeks to strengthen these industries, meet the needs of workers employed in these industries, and attract new workers and businesses to the parish.

#### *Proposed Actions:*

- Develop a parks and recreation plan.
- Identify funding for prioritized projects in the 2007 Bayou Lafourche Corridor Plan, including a trail system through publicly owned swampland forest in Lockport, a new seafood market and safe harbor marina in Golden Meadow, and a nature park and marina in Larose, among others.
- Increase public access facilities along the bayou for visitors and residents.
- Consider developing Eco Parks into the Bayou Plazas focused on sustainability principles.
- Work with employers to create parish-wide regional transit partnerships from worker housing to employment centers.
- Consider developing a micro-lending program for very small businesses and self-employment and create incubator programs for businesses.

## Town of Livingston Subdivision Regulations



*Project Type:* Zoning

*Date:* Final Draft August 2013

*Primary Consultant:* Villavaso & Associates

*Related Topics:* Flooding, Hazard Mitigation, Infrastructure, Policy

Subdivision regulations can help communities address flooding risks exacerbated by new developments. Livingston has undertaken this approach to address one of its main risks to local resilience.

Flooding is a major concern in the Town of Livingston, the parish seat of Livingston Parish, approximately 25 miles east of Baton Rouge. The town is located at the convergence of four watersheds and frequently floods during severe weather events and routine rainfall events. Hurricane Gustav caused extensive flood damage as well as damages to structures and utilities from fallen trees throughout the town. Moreover, the town had trouble clearing debris from drainage ditches both in the town as well as the watersheds throughout the parish. This debris led to continued long-term flooding risk months after the actual storm. Compounding the risk of flooding is the town's rapid population growth due to high quality of life, good schools, and close proximity to both Baton Rouge and New Orleans. Livingston Parish ranks among the top three fastest-growing parishes in the state. The town is seeing population growth rates of up to 2% per year and a 56% projected population increase from 1990-2015. Job growth in the area

is projected to increase by 16% over the next 10 years. Subdivision and business growth along major corridors indicate these numbers are fairly accurate. Furthermore, the location of the Town of Livingston on the I-12 growth corridor, one of the fastest growing areas in the State of Louisiana, indicates a pressing need to address land use, watershed, and growth management issues in preparation for future need and development.

In response to future growth projections, the Town of Livingston adopted a Comprehensive Plan in 2010 to preserve the town's integrity and way of life while guiding future growth and development through proper and flexible planning. The next step to realizing the goals laid out in this plan is to develop a set of accompanying codes and ordinances. Codifying these regulations provides clarity to residents and developers, while ensuring that the objectives of the plan are enacted. The development of Subdivision Regulations, particularly in a rapidly growing region, plays an important part in promoting a safe, desirable, and resilient community.

### Resilience Planning in Action

The Town of Livingston's new Subdivision Regulations lay out clear rules, procedures, and regulations that will ensure new development does not increase flood risks in the community. These measures are laid out in Section 24 of the new ordinance, Stormwater Drainage Requirements. In addition, the new ordinance clarifies the town's requirements, facilitating the application process for residents, developers, and local government staff alike.

### Environment

The natural flood risks in Livingston, being located at the convergence of 4 watersheds, are exacerbated by the rapid development that does not address those risks. The town's new Subdivision Regulations will require major new developments to incorporate those concerns.

Proposed Actions:

- A Stormwater Drainage Impact study is required for all new developments over a certain size.
- New subdivision developments are required to demonstrate that their construction and

on-site mitigation measures will prevent any changes to stormwater runoff affecting either upstream, downstream, or neighboring properties.

- Impact studies should take into account the predominant existing land use and future land use in the project watershed using the latest data available. They should also describe the proposed development, soil types, vegetative cover, and watershed slopes, as well as provide an estimate of percent of impervious area for pre- and post-development conditions.

### **Infrastructure**

The design, layout, and specifications of public infrastructure play a major role in determining how stormwater will be channeled through a new subdivision and affect flooding risks throughout the community. These subdivision regulations include such requirements and regulations for infrastructure. Specifically, elements of Section 24: Stormwater Drainage Requirements address stormwater management and flood protection.

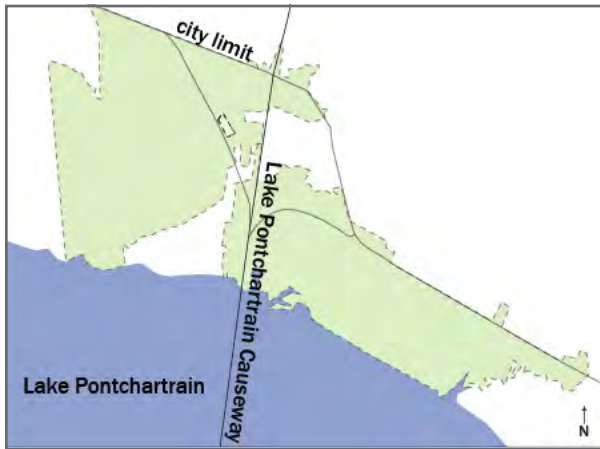
### **Community**

An informed community is a major asset in promoting local resilience, as well as encouraging local investment. A clear ordinance provides valuable guidance, information, and transparency for current and potential residents, business owners, developers, and local government.

#### *Proposed Actions:*

- Clear requirements for construction and development of new subdivisions are provided in the regulations.
- Specifications are included for informing new landowners in areas with particular restrictions. For example, for any property within an open ditch subdivision, the following statement must be placed on the bill of sale of property: "Buyer Beware: Installation of any subsurface drainage (other than a driveway culvert) is prohibited in this subdivision designed for open ditches."

## City of Mandeville: Old Mandeville Town Center Plan



*Project Type:* Land Use

*Date:* Adopted November 2011

*Primary Consultant:* Duany Plater-Zyberk & Company

*Related Topics:* Architecture, Coordination, Economic Development, Hazard Mitigation

Mandeville has developed a plan to strategically locate key elements of its civic downtown to promote community character and build economic vitality, while reducing its vulnerability to flooding.

The City of Mandeville, located on the North Shore of Lake Ponchartrain, faces considerable threats from flooding and storm surge during tropical storms. The community cherishes their lakefront location and views, and does not want to sacrifice these for the protection provided by levees or a sea wall. Nevertheless, they recognize the risk of flooding, increasing risks as sea levels rise, and the significant damage the community experienced during Hurricanes Katrina (2005) and Isaac (2012). Hazard mitigation grants funded most affected homes to be raised in the aftermath of those two storms. However, a larger, coordinated effort to address the civic needs of the community and the Town Center as a whole was needed.

The Old Mandeville Town Plan builds on the efforts and recommendations of the city's 2007 Comprehensive Plan, a 2007 small area plan, and a 2006 redevelopment plan for the city, which all "emphasized the critical need for a Town

Center that will locate civic institutions within a mixed-use, walkable and economically thriving area." In determining the best location for a Town Center, the town paired the needs of economic opportunity, proximity to the highway, and existing infrastructure, with safety from flood and wind hazards from tropical storms.

### Resilience Planning in Action

The Old Mandeville Town Center Plan outlines an approach for ensuring the Old Town Center is resilient. It focuses on the related issues of economy, character, and disaster mitigation, which are all intertwined in ensuring a sustainable and resilient community.

### Environment

The local environment and environmental risks plays an important role in choosing a location and appropriate interventions for different projects within the Old Mandeville Town Center Plan. Although environmental concerns are not presented in the beginning of the plan as the predominant priority, the weight of these concerns becomes evident in the details of the plan.

#### *Proposed Actions:*

- The plan directs new and targeted investment to areas of the city that are naturally least vulnerable to the flood, surge, and wind impacts of tropical storms.
- The plan considers not only existing threats from natural hazards, but how these will change in the future - and how the city should prepare for them. Specifically, Mandeville is integrating future projections over two main concerns. The first is rising sea levels - and how that will exacerbate flood and surge probabilities off Lake Ponchartrain. The second concern addresses disappearing wetlands along Louisiana's southern coast - and how that will allow for an increased number and intensity of tropical storms and hurricanes to impact Mandeville.

### Infrastructure

Infrastructure investments are recommended to align with the concerns and priorities for the community character, economy, and



environmental risk facing the City of Mandeville.

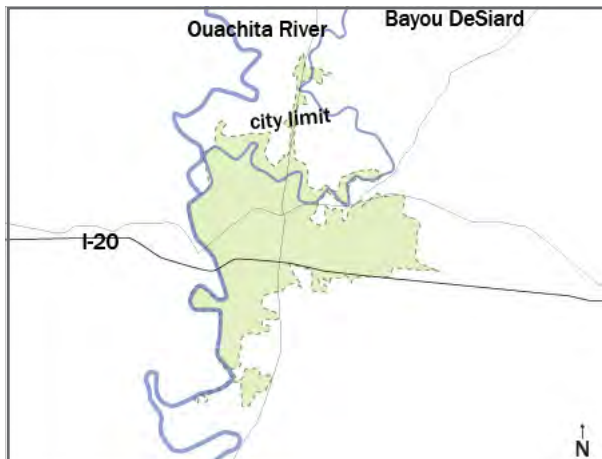
### **Community**

The plan looks to strengthen the local economy with particular focus on the character of the Mandeville community.

#### *Proposed Actions:*

- The creation of a Mandeville Pattern Book provides guidance for both design and resiliency in promoting the local character. It also draws on the “Louisiana Speaks” Plan - in encouraging smarter growth and specific elements of Louisiana architecture.
- The focus of economic growth is based in realistic expectations of what the city has to offer and its relationship within the region.
- The creation of an Economic Resiliency Study looked at both short-term and long-term resilience.

# City of Monroe Comprehensive Zoning Ordinance and Subdivision Regulations



*Project Type:* Zoning

*Date:* Final Draft November 2013

*Primary Consultant:* Villavaso & Associates

*Related Topics:* Economic Development, Livability, Planning

*How can cities in Louisiana strengthen resilience beyond simply mitigating immediate impacts of tropical storms?*

The City of Monroe, on the banks of the Ouachita River in Northeast Louisiana, has experienced a number of changes in the past years that have challenged its resilience. While the city serves as an important hub for northeast Louisiana and surrounding regions, it has suffered economically from the contraction in forest product industries and the closing of the Guide Automotive Plant. The impacts of Hurricane Katrina prompted a growth spurt in Monroe, helping to revitalize its economy and bring further changes to the region.

In response to these changes, Monroe adopted a new comprehensive plan in 2008, *One City, One Future*, which sets the overall policy framework for future development and growth in the city to the year 2020. This Comprehensive Plan addresses future land use, transportation, parks and recreation, and other infrastructure, as well as environmental challenges and opportunities. Through the comprehensive planning process, Monroe identified specific priorities for its future, namely fostering growth in jobs and the local

economy, enhancing educational opportunities, and beautifying the city.

To ensure the goals of the Comprehensive Plan are realized, and through funding from OCD's CRPP Program, Monroe commissioned new Comprehensive Zoning Ordinance and Subdivision Regulations. In addition, and in keeping with their history of urban planning, the City of Monroe completed an update to the city's Comprehensive Master Plan. Finally, the consultants hired to work on the planning documents for Monroe have also produced a report titled "Recommendations for Sustainability & Resiliency in Monroe City Codes and Plans." This report raises ideas and makes suggestions to help guide the city's actions moving forward, but in a less political manner, as it is non-binding and did not have to be approved by the City Council.

## Resilience in Action

Monroe's new Comprehensive Zoning Ordinance and Subdivision Regulations help build resilience by clarifying requirements and regulations, incorporating concerns of environmental risk, and promoting economic development and community stability.

## Environment

Monroe's new zoning documents address environmental concerns at different scales in two main ways: by valuing natural sites and environmental systems, and by responding to environmental hazards.

*Proposed Actions:*

- Planned Unit Developments prioritize environmentally sensitive design, preservation of natural features, and functional and beneficial uses of open space.
- Corridor design standards encourage reducing provision of redundant parking to minimize surface runoff.
- Pervious surface cover is encouraged where feasible.
- New or expanded off-street parking facilities, with 25 or more spaces, must filter or store the first inch of rainwater during each rain event,

through use of pervious paving, rain gardens, bioswales, detention areas, constructed wetlands, or other methods approved by the City Engineer.

- Wind risks to mobile homes are minimized by requiring specific ground anchor methods and number and types of tie-downs.

### **Infrastructure**

Monroe's new ordinances ensure adequate and appropriate provision of infrastructure, given a range of contexts and needs.

#### *Proposed Actions:*

- To ensure that adequate infrastructure is constructed for a new subdivision, before beginning construction, the developer is required to provide a financial commitment, such as through a certified check or performance bond, which could cover the total construction costs of all required infrastructure improvements. This guarantees that the new infrastructure will be completed as required. If it is not, the city has the right to draw on those funds to finish construction.
- Stormwater Management Requirements of the Subdivision Regulations not only prohibit adverse downstream drainage or flooding impacts, but also require that all on-site retention and detention systems be based on a 25-year storm event.
- To efficiently allocate infrastructure resources, the zoning ordinance allows for shared parking facilities. Specifically, off-street parking spaces for separate uses may be provided collectively for two or more uses with different hours of operation in order for each use to meet its minimum off-street requirement.

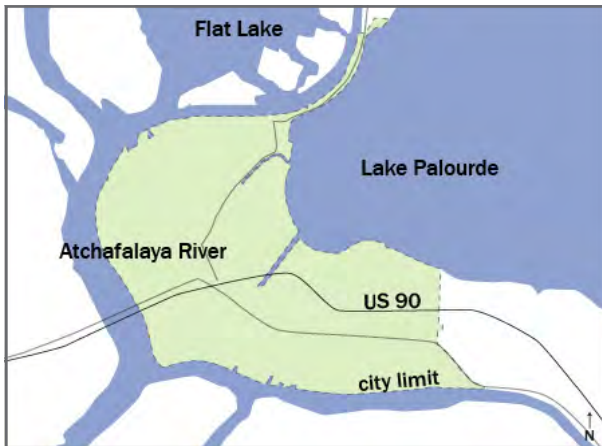
### **Community**

The main focus of Monroe's new Zoning Ordinance and Subdivision Regulations follows those of its Comprehensive Plan: to promote economic development and stable communities. These new documents present land use and design regulations to help achieve these goals. Specifically, several of the special use districts help focus on multiple, and complementary benefits, thereby fostering strong neighborhoods.

#### *Proposed Actions:*

- The Riverfront District special use district is established to promote revitalization and investment in the area by cultivating the unique characteristics of the area.
- Open Space Recreation Districts are established to provide important connections between residential neighborhoods and public amenities through a range of recreational options and specific commercial activities.

## Morgan City Zoning and Land Development Code and Future Land Use and Development Plan



*Project Type:* Zoning

*Date:* December 2012

*Primary Consultants:* Kendig Keast Collaborative and T. Baker Smith, LLC

*Related Topics:* Hazard Mitigation, Infrastructure, Planning

Morgan City is defined by its relationship to water. The economy, culture, and urban form are all functions of Morgan City's position on the Atchafalaya River, Intracoastal Canal, and Lake Palourde, yet its proximity to these major bodies of water increases flood risks. Following damages and changes in base flood elevations resulting from Hurricane Katrina, new levee construction and upgrades were made to reduce the impacts of flooding. Despite increased protection, the city is considering the ongoing risks from sea level rise, subsidence, and storms as it maps out a plan for future growth and development. The city is using a character-based approach to describe future land use that recognizes these risks and the importance of balancing economic, social, and environmental health for sustainable, long-term growth.

The Future Land Use and Development Plan (FLUDP) describes the goals and objectives to achieve the type of development the community desires in light of existing environmental conditions. It sets the stage for the city's Zoning and Land Development Code (ZLDC), which guides investment and ensures new development is consistent with the goals outlined in the FLUDP.

The FLUDP and ZLDC seek to improve dilapidated neighborhoods by identifying and targeting areas for investment. Opportunities for growth in the city are limited by population declines, insufficient number of sites for water-based development, and adequate lands to accommodate water-based development. In addition, much of Morgan City's urban area exists in the older parts of the community that have been neglected and are in need of reinvestment. Revitalization of these critical urban areas is essential to the vitality of the community.

The FLUDP categorizes neighborhoods into conservation, stabilization, improvement, and redevelopment to evaluate and prioritize improvements. It also sets a plan for the growth and diversification of Morgan City's economy. The new ZLDC refocuses the zoning ordinance to emphasize the character and form of development in appropriate zoning districts. It also establishes better screening and buffer yard provisions, and it preserves the city's surrounding rural character.

### Resilience Planning in Action

Morgan City faces both near- and long-term risks from sea level rise, land loss, and storms. The city's future vision must consider these risks while striving to maintain its importance as an industrial center. Both the FLUDP and ZLDC serve to guide future development in a way that contributes to the community's overall character and minimally impacts the area's natural resources to foster resilience and sustainability. They recognize that any short-term development must be considered in the context of a long-term vision that is based on sustainable growth and reinvestment.

### Environment

Morgan City is ensuring that any new or substantially improved properties do not adversely affect the environment, and the ZLDC aims to minimize the impacts of flooding caused by new development on neighboring properties.

*Proposed Actions:*

- Strengthens the process for permitting procedures in floodplains by requiring the following information for development in

special flood hazard areas: elevation of the lowest floor of all new or improved structures; elevation to which the structure will be floodproofed; certificate of compliance to floodproofing criteria; and a description of extent to which any natural water systems will be altered or relocated due to proposed development.

- Prevents the overcrowding of land and the unnecessary concentration of population.
- Uses development patterns that preserve and increase the amount of pervious surfaces to mitigate the impacts of storms, expand green spaces, and reduce the heat island effect with no additional strain on external infrastructure systems.
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or which increases flood hazards to other lands.
- Landscaping incorporates storm water runoff best management practices, such as through the use of vegetated swales, bio-infiltration, and other types of water quality measures.

### **Infrastructure**

The ZLDC aims to ensure that transportation systems are carefully planned and function smoothly. It also steers development in places where adequate infrastructure already exists and limits development where facilities do not exist.

#### *Proposed Actions:*

- Calls for the diversification of energy production and distribution infrastructure through the exploration of renewable energy sources and appropriate redundancies in the distribution network to reduce damage from major natural disasters.
- Seeks to improve transportation by reducing congestion on roadways, enhancing multimodal travel opportunities, and reducing travel times.

### **Community**

The ZLDC supports community growth with adequate public ways and utilities, as well as educational and recreational facilities to support healthy surroundings and quality of life. Traditional, conventional, and mixed neighborhoods each have respective characteristics that function in their distinct role within the city, and the FLUDP seeks to optimize the distinct neighborhoods that exist today. The ZLDC and FLUDP also ensure that the needs of businesses and industry are being met.

#### *Proposed Actions:*

- Promotes strategic growth, development, improvement, and redevelopment of the community.
- Provides for sufficient commercial and industrial property to allow for economic development within the city.
- Preserves and protects places and areas of historic, cultural, scenic, or architectural importance and significance.
- Imposes specific elevation and other flood control standards for all new or substantially improved residential and nonresidential structures, including recreational vehicles, in special flood hazard areas.
- Considers employing a form-based code to allow for greater variety in the city's residential makeup.
- Attempts to improve the community appearance by emphasizing the character and form of development in appropriate zoning districts.
- Aims to improve the compatibility and transitions between districts by establishing better screening and buffer yard provisions to increase compatibility between competing uses and to preserve the rural character in the city's periphery.

# Port of New Orleans Design Resiliency Manual



*Project Type:* Zoning

*Date:* Adopted September 2013

*Primary Consultant:* MDM Design Group, Inc.

*Related Topics:* Coastal, Hazard Mitigation, Infrastructure, Waterfront

*How can a large port facility prepare to better withstand tropical storms and hurricanes?*

As part of the Lower Mississippi and Gulf Coast region, the Port of New Orleans (PONO) is often subject to natural hazards, particularly hurricanes, and is vulnerable to storm surge, flooding, and strong winds that often accompany these storms. The Port of New Orleans was badly hit during Hurricane Katrina. And although the Port was operational within 2 weeks, some portions of the port were closed for months. An investment of over \$400 million in new facilities has been made for the Port over the past decade; however, there has been little regulation over the design or construction of these facilities with regards to natural hazards. This left the Port of New Orleans exposed to multiple, foreseeable risks that could undermine the resilience of the Port itself, as well as the greater regional economy.

The New Port of New Orleans Design Guidelines Manual establishes standards for future construction, modification, and rehabilitation for all port facilities and infrastructure. These guidelines will minimize damage from future storm events, with minimal restrictions on techniques and materials used in the design and construction

process. In addition, the Port intends to provide training to staff engineers to implement the new guidelines and standards.

## Resilience Planning in Action

The Port of New Orleans, like all ports, contends with the intersection of land and water. The frequency of tropical storm and hurricanes in the region compound the risks to the port, through storm surge, flooding, and strong winds. The Port has developed a set of Design Resiliency Guidelines to incorporate hazard mitigation activities into existing infrastructure and new construction projects.

## Environment

Rising sea levels and diminishing natural buffers from coastal wetlands are exacerbating the port's vulnerability to natural hazards and environmental risks. The environmental impacts to particular structures within the large port complex can vary widely. The Resiliency Guidelines Manual outlines several actions for addressing these risks.

### Proposed Actions:

- Considers and prepares for all types and impacts of flooding: standing or slow-moving water, storm surge, wave runup, outflow of floodwaters, strong currents, flood-borne debris, erosion and localized scour.
- Responds to the latest analysis and flood risk maps by FEMA in designating appropriate mitigation and BFE for different structures.
- Recognizes that sea level rise and long-term erosion will compound the extent and magnitude of actual flood hazard that a coastal building will experience over its lifetime. Therefore, more stringent standards and higher levels are encouraged than those that simply respond to current conditions.
- Requires strategic on-site placement of water and wastewater facilities to minimize the likelihood that discharge of effluent in a storm event could pose a risk to public health, and to ensure that potable water is not affected by contaminated surface runoff.

## Infrastructure

The infrastructure of the port facilities, buildings, and auxiliary structures are critical to the resilience

of the entire port. Clear sets of standards and guidelines ensure that these structures will withstand foreseeable flood and wind hazards.

*Proposed Actions:*

- References to specific sections and subsections of codes, ordinances, standards and guidelines by the IBC, the ASCE, the USACE, and FEMA are provided throughout this manual. (Table 3) This clarifies exactly which requirements should be used for what types of structures or conditions, as outlined in the manual. Furthermore, definitions, such as definitions of material classifications, cross-reference Army Corps and FEMA standards. (Table 2) This ensures clarity for contractors and for agency requirements.
- As all facilities and structures cannot be constructed or retrofitted to withstand the highest flood, surge, and wind impacts, the manual explains how design standards should be determined based on risk or occupancy category of structure classification.
- A list of best practices for securing rooftop equipment in high-wind events is included and explained. (Section 3.2.2.1)
- Provides a flowchart with a clear set of checks and recommendations to evaluate preparedness of structures to withstand wind hazards. (Appendix A)
- Includes construction document details showing typical construction practices used at the port, to provide clarity in expectations and standards for the port as well as outside contractors. (Appendix B)

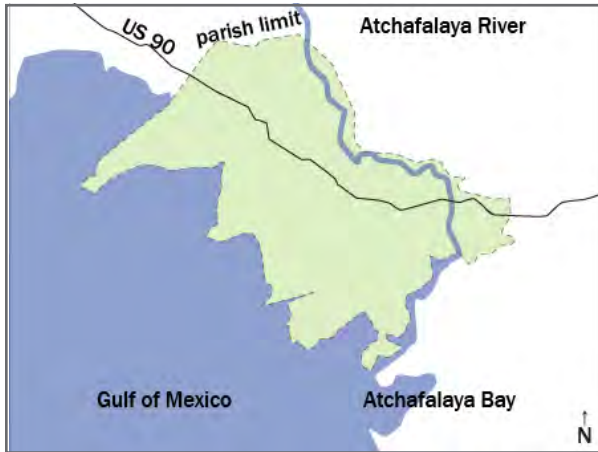
## **Community**

The first goal for hazard mitigation of the port is to protect life at the Port of New Orleans. The resilience of the port also has wide ramifications for business resilience in New Orleans, southeast Louisiana, and the broader economy. Securing such critical infrastructure and economic drivers is critical to the resilience of the region.

*Proposed Actions:*

- Recognizing that even in the event of evacuations due to an extreme storm, personnel might remain at the port to assist with response or recovery, due to critical facilities, or to ensure continuity of operations in the immediate aftermath of a storm, the manual requires adequate provisions to protect human life at the port, such as promoting a safe room or storm shelter to provide life-safety protection.
- Recognizing the important role that the port plays in the local (as well as regional and national) economy, the manual encourages classification of occupancy, which determines the level of flood or wind protection, to take into consideration the importance of safeguarding building contents that are critical to reviving economic functions.

## St. Mary Parish Unified Development Code



*Project Type:* Zoning

*Date:* Final Draft January 2014

*Primary Consultants:* T. Baker Smith, LLC and Kendig Keast Collaborative

*Related Topics:* Architecture, Coastal, Flooding, Governance and Policy, Hazard Mitigation, Planning

With a focus of reducing the risk of damage from disasters and promoting high standards of development, the St. Mary Parish has developed a Unified Development Code. A major goal of the Unified Development Code is to improve the overall organizational structure and consistency in the Parish's development codes. This new code incorporates Smart Growth principles and floodplain management to better prepare the parish, its communities, and landscapes for natural disasters as well as development pressures. To this aim, the code also includes form-based alternatives, such as TNDs, as well as other quality-of-life measures, such as sign and landscape regulations.

In 2002, St. Mary Parish prepared its first comprehensive master plan, which was approved by resolution in December of that same year. A major component of the plan was a first-time parish wide zoning ordinance. The Parish has since established a planning and zoning office, planning and zoning commission, and board of adjustment, as well as completed several amendments to its land use maps. However, the recent spate of storms has made the significance of planning and mitigation all the more apparent.

St. Mary Parish is located in south Louisiana near the center of the state's coastline. With its proximity to the coast and the Atchafalaya River, the Parish is subject to storm and riverine flooding throughout the year. In particular, the Atchafalaya River generates flooding in the region on a near annual basis during winter and spring. The Parish is also subject to stormwater events and backwater flooding resulting from the combination of riverine and surge events. State and Federal officials rated the Parish eighth in flood-related damages from Hurricanes Gustav and Ike.

### Resilience Planning in Action

Due to St. Mary Parish's geographical location, vulnerabilities related to climate change are increasing. Through the new Unified Development Code, the Parish has been able to integrate ordinances that mitigate flood hazards and design standards that promote appropriate density in specific locations.

### Environment

A key component to resilience planning is the integration of Hazard Mitigation and Urban Planning. St. Mary Parish is particularly vulnerable to riverine flooding, storm surge, and backwater flooding. The Unified Development Code includes standards that mitigate flood hazards to residential and non-residential structures by requiring certain mitigation activities. These regulations protect the natural environment as well as citizens' property.

#### *Proposed Actions:*

- Require structures to be built at or above the Base Flood Elevation (BFE)
- Non-residential structures to be either built at or above BFE or the structure below BFE be water tight
- The document provides opening specifications for enclosed, waterproofed structures, i.e. minimum opening requirements; location above grade, etc.
- Manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement
- Base Flood Elevation data required for new subdivision proposals
- Prohibit the use of fill in floodplain



- Prohibit man-made alterations of sand dunes and mangrove stands in the floodplain

### **Infrastructure**

St. Mary Parish employs a levee protection system to reduce its vulnerability to flooding. This requires careful consideration for how internal stormwater is managed. The plan acknowledges that it is in the public interest to control stormwater runoff increases due to construction and development activities, and protect from environmental degradation through soil erosion, stream channel erosion, and non-point source pollution.

#### *Proposed Actions:*

- Require separate storm and sewer systems in new developments
- Require a Drainage Impact Study for any project which subdivides, develops, improves or builds upon any residential, industrial, or commercial site, unless development increases runoff by less than 10%, or impervious surfaces of development are less than 20% of site area

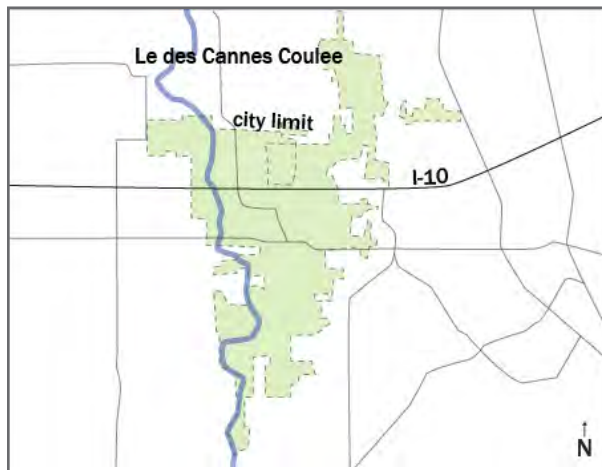
### **Community**

The Unified Development Code does several things to promote a sense of community and ensure quality development in safe places across the Parish. Aspects of the code include various design standards, construction standards for building in high risk areas, and new planning and economic development oversight entities for the region.

#### *Proposed Actions:*

- Establish a new Regional Planning Commission, the Acadiana Regional Planning Commission
- Establish architectural standards for Traditional Neighborhood Developments (TND) per district (Center, General, and Edge) and pedestrian elements
- Implement building design standards to protect quality of building materials, property values, and community character
- Establish density and intensity of development and common open space requirements
- In coastal high hazard zones, all new construction to be located landward of mean high tide
- In coastal high hazard zone, all new construction and substantially improved structures shall be elevated on pilings and columns with the lowest horizontal member at or above BFE; and footings designed to withstand lateral movements due to wind or water loads
- New construction and subdivision improvements have a space below lowest floor free of obstruction or with non-load-bearing break away walls

## Scott 2032: City of Scott Comprehensive Plan



*Project Type:* Land Use

*Date:* Adopted January 2013

*Primary Consultant:* C.H. Fenstermaker & Associates, LLC

*Related Topics:* Architecture, Economic Development, Flooding, Governance and Policy, Landscape Architecture, Livability, Planning, Stormwater Management

*How do small communities plan for development, while also discouraging construction in environmentally sensitive areas?*

In 2011, the City of Scott began work on its first formal comprehensive plan, Scott 2032. The plan strives to make Scott more resilient to flooding risks, while also laying the groundwork for land use planning, economic development, historic preservation, and recreation and transportation improvements in the city. Early in the planning process, the Scott 2032 consultant team began engaging the community to identify the shared goals and concerns of citizens and to create an exchange of ideas between the city government, consultants, and community. The public participation strategy involved meetings with the 17-person Advisory Committee, members of the 36-person Stakeholder Group, and other citizens. A key component was a “Charrette Week” involving a town hall meeting, focus group sessions, and presentations by consultants. Most of the concerns, goals, and desired outcomes outlined in the plan were initially identified through the public engagement process.

The Scott 2032 Plan addresses three major categories of threats undermining the resiliency of the Scott community, namely frequent flooding, absence of a zoning code, and limited government capacity for land use planning. By incorporating Smart Growth principals, stormwater management strategies, and steps to increase economic development, the Scott 2032 is laying the groundwork to help the city establish itself as the community of choice for residents and businesses looking to locate in the Acadiana region.

### Resilience Planning in Action

The Scott 2032 Plan outlines goals for improving natural systems, including minimizing risks from flooding, managing stormwater, building a greenway park system, and preserving trees and soils. Improvements to other infrastructure and services are outlined in the plan, as are steps for improving city government and strengthening the economy of the city are included in the plan. The city government needs to grow to meet the needs of its citizens and businesses.

### Environment

Scott is located outside the area of concern for storm surge, and has a limited risk of flooding from levee failures compared to many other areas in south Louisiana. However, major storm events can cause flooding from stormwater back-up in natural channels and drainage ditches. Scott is taking a multifaceted approach to managing the flow of stormwater and reducing development in flood-prone areas, including land use ordinances, property acquisition and conservation easements, creating flood data inventories, GIS mapping, increased FEMA compliance and regular drainage ditch and stream maintenance measures. Recognizing that stormwater is not confined to municipal boundaries, Scott is coordinating with Lafayette Consolidated Government on stormwater management planning and channel maintenance.

*Proposed Actions:*

- Develop a comprehensive approach to stormwater management including: regional coordination, a drainage channel/structure maintenance plan, compiling a hydrology

data inventory, and adopting land use ordinances that will restrict development in the floodplains and floodways, reduce erosion, and encourage the use of stormwater management best practices.

- Hire a full-time floodplain manager to coordinate stormwater management activities.
- Reduce pollution through regular recycling and solid waste pick up, along with special days for hazardous wastes and "white goods" (such as appliances and electronics).

### Infrastructure

Through transportation planning based on Smart Growth and Complete Streets principles and best practices, the Scott 2032 Plan aims to improve how people travel within the city.

Include expanding the sewer system, building an additional wastewater treatment facility, constructing a water tower, returning recycling and hazardous waste pickup, building a new emergency services complex and library, and locating a regional Acadiana Welcome Center in one of the city's historic houses.

#### *Proposed Actions:*

- Create a Capital Improvement Program that prioritizes infrastructure improvements between immediate, short-term, and long-term needs and assigns projects to government agencies.
- Create a Transportation Improvement Plan and adopt goals and principals that consider the needs of pedestrians and cyclists along with automobile users (Complete Streets). Improve connectivity and access from the interstate.
- Develop a citywide Sewer and Water Master Plan to determine needs for the future. Plan for the construction of new sewer lines, a treatment plant and a water storage facility north of I-10 where the city is experiencing the most growth. Discourage use of septic tanks that are a source of non-point water pollution.
- Implement a code enforcement program within the Department of Public Works to insure compliance of existing and forthcoming civil ordinances, promote safety, and protect property values.

### Community

Currently, Scott lacks departments and commissions for city planning, parks and recreation, and economic development. There is not a designated person in the public works department who is responsible for overseeing the maintenance of drainage ditches and channels. Hiring new city staff and establishing commissions for these departments is critical for successful and efficient implementation of the Scott 2032 plan.

#### *Proposed Actions:*

- Establish a community planning department and planning commission to attract and direct future growth. Create positions for economic development and recreation and grow the capacity of city government.
- Adopt Smart Growth land use controls that promote resiliency. Use the SmartCode as a zoning ordinance and create a land use plan tailored to the city's unique conditions.
- Develop a system of greenways (linear parks) on the undeveloped land in the 100-year floodplain. This will reduce loss of life and property during major storms and create a valuable recreational asset for the community.
- Create incentives for infill businesses development in the city center. Drive economic development through the leveraging of special tax districts including tax increment financing districts along major transportation corridors.
- Promote art, history, and culture through the creation of cultural and historic districts with public amenities, leveraging special tax programs and forging private-public partnerships to run festival and regular public markets.
- Prepare emergency evacuation plans for the city that consider man-made disasters, not just storm events, such as rail accidents and chemical spills on the interstate.

## City of Slidell Code of Ordinances Amendment



*Project Type:* Zoning

*Date:* Adopted March 2013

*Primary Consultant:* Kendig Keast Collaborative

*Related Topics:* Architecture, Flooding, Governance And Policy, Hazard Mitigation

*As large numbers of homes are being raised, how should municipalities regulate the development and character of their communities?*

The City of Slidell, on the northeastern shore of Lake Ponchartrain, is vulnerable to the impacts of tropical storms from multiple directions. With Lake Borgne and the Gulf of Mexico directly southeast of the city, the Pearl River, which is prone to flooding nearby, local coastal wetlands being degraded, and sea levels rising, the immediate risks to Slidell are clear. Hurricane Katrina hit Slidell on August 29, 2005, damaging or completely destroying nearly 70% of properties in the city. The need to better prepare the city, the residents, and the businesses of Slidell was clear.

In the winter of 2008, the City adopted the Slidell Tomorrow Master Plan, a set of policies regarding future land uses and roadways, annexation, and strategies for unique areas of the City, such as Olde Towne and the Fremaux corridor. The Plan identified the following priorities: sidewalk connectivity, property maintenance, traffic, flooding, land use conflicts, stronger development regulations, and commercial building aesthetics. To ensure that the goals of the Slidell Tomorrow Master Plan are enacted, the

City of Slidell considered appropriate policies, ordinances, and codes for accomplishing those goals within the local context. In 2011 the city developed a Strategic Assessment and Annotated Outline to achieve that goal. One set of needs specifically identified in that assessment was the lack of direction, regulation, or compliance with local codes facing homeowners planning to raise homes in the floodplain with the assistance of FEMA Hazard Mitigation funds. By late 2011, much of the post-Katrina repair work and many of the FEMA funded development projects, such as a new municipal auditorium, were being completed. Yet many homeowners eligible to receive funding to raise their homes out of the floodplain, had not applied or started their projects. The city was concerned about regulating these new and raised homes – in terms of both structure and character – as well as dealing with anticipated widespread variance requests. In response, Slidell applied for and received funding through the Community Resiliency Pilot Program to amend sections of their Code of Ordinances to address these specific issues.

### Resilience Planning in Action Environment

The environmental risks to residents and property owners in Slidell, particularly from flooding, are clear. This amendment to the code of ordinances addresses these risks as homeowners look to raise their new or existing homes, at multiple scales and levels of detail.

*Proposed Actions:*

- Regulations and requirements are provided for how homes should be raised and/or floodproofed.
- Specific requirements for enclosing raised foundations are presented, explained, and diagrammed.
- Break-away walls, enclosing raised foundations, must either be attached to the residence or heavy enough to ensure they will sink, to limit water-borne debris.

### Community

Given the fundamental change to development of homes and properties and Slidell, there was considerable concern over changes to the character

of the community. This amendment to the Code of Ordinances addresses a number of specific technical concerns as well as ensuring continued development in a consistent architectural and stylistic character. In addition, the benefits to resilience from this ordinance amendment relate to the clarity, transparency of this document and how it will facilitate the permitting process for city administrators, residents, and developers alike.

*Proposed Actions:*

- Use of materials, siting of entrances, height lines, etc. are all detailed to ensure a very cohesive character.
- The clarity of explanations and wide-spread use of images and diagrams throughout this Amendments to the Ordinance provide clarity for specific regulations and requirements.
- Common requests for variance due to noncompliance of newly raised structures with local building codes are addressed in the amendment. One typical issue is stairs to raised entrances encroaching on required setbacks. A set of guidelines are provided, that, if adhered to and approved by the planning staff, do not require the homeowner to apply for a variance.

## Terrebonne Parish Comprehensive Plan Update: Vision 2030



*Project Type:* Land Use

*Date:* Accepted February 2013

*Primary Consultant:* Providence Engineering and Environmental Group, LLC

*Related Topics:* Flooding, Green Infrastructure, Hazard Mitigation, Housing, Infrastructure, Planning, Regional Coordination, Stormwater Management, Transportation, Wetlands

*How can coastal parishes address coastal land loss, while promoting economic and cultural development?*

Terrebonne identified 8 specific natural hazards that can significantly impact its communities, which are flooding, subsidence, coastal erosion, sea level rise, tornadoes, hurricanes, and storm surge. Currently, 90% of land in Terrebonne Parish is classified as environmentally sensitive, and the parish continually experiences significant land loss due to erosion and subsidence. As a result, future development options are limited. On the land that Terrebonne is able to develop, flood issues are worsened by extensive impervious surfaces, particularly the large number of homes built slab-on-grade. The paved surfaces occupy vital flood storage capacity. The parish estimates that 106 acres of land are currently under slab. With a 2,100 square foot house displacing 15,709 gallons of flood capacity, it is estimated that Terrebonne Parish is losing approximately 35.4 million gallons of flood capacity due to this type of home construction technique. Such data provides the impetus for Terrebonne to engage a new, more resilient approach to development.

Compelled by the destruction of its wetlands and resulting population migration, Terrebonne Parish, located on the southeastern coast of Louisiana, updated its 2004 Comprehensive Master Plan to incorporate resilience. Terrebonne Parish and its largest city, Houma, together form a consolidated city-parish government. Since 2004, a series of particularly destructive hurricanes hit the parish causing extensive damage. In the aftermath, residents of the southern bayou communities began to migrate to north Terrebonne Parish. The 2004 Comprehensive Plan soon became largely unusable due to the population shifting faster than anticipated, causing strains on infrastructure and housing stock. These hurricanes also underscored the increased vulnerability to storms of communities in Terrebonne due to wetland loss. Wetlands act as a natural sponge that trap and slowly release flood waters, as well as buffer coastal areas from storm surge.

### Resilience Planning in Action

Vision 2030 adjusts recommendations made in the 2004 plan to reflect current settlement trends and environmental concerns. In addition, the 2012 plan adds 3 new sections to help the parish better address environmental, social, and infrastructure needs. The plan acknowledges that settlement patterns will become more restricted due to coastal land loss and a focus on denser development on higher, less vulnerable land. The plan proposes options to protect communities' cultural identities, conceding a changing landscape.

### Environment

With over 90% of its land considered environmentally sensitive, or undevelopable, Terrebonne Parish sees increased vulnerability by loss of wetlands, swamps, and marshes due to erosion caused by salt water intrusion from the Gulf of Mexico. The plan addresses this issue as well as other environmental concerns, such as air quality, water quality, hazard mitigation, and the existing regulatory framework.

*Proposed Actions:*

- Protect environmentally sensitive habitat areas through the creation of conservation zones, a Terrebonne Parish Nature Priorities report,

- and native plantings in public landscapes.
- Protect wetlands for their stormwater management, flood control, and habitat value through greater coordination of Parish capital projects.
- Implement stormwater management best practices and strengthen local codes to meet or exceed national clean water standards.
- Develop and implement a greenway plan and program that uses floodplains, drainage basins, retention ponds, and undeveloped land to connect neighborhoods with parks, schools, community destinations, and downtown Houma.
- Increase public access to the parish's water resources through planning and design of non-boating public access to the waterfront.
- Reduce storm damage from wind and water along the coastal plain and in the 100-year floodplain through hazard mitigation activities.
- Reduce ozone-related emissions by 20% by 2030 through an emissions audit and an Ozone Reduction Pilot Program.
- Quantify and better understand the impacts of sea level rise on the parish by preparing a parish wide climate action plan.
- Make parish buildings and operations models of resource and energy efficiency through the institution of a green procurement and building policy, overall energy efficiency efforts, and by pursuing the use of compressed natural gas in parish owned vehicles.

### Infrastructure

The parish's geographical location and topography make drainage of storm and rainwater the most important infrastructure. In the 2012 capital improvement budget, 52% of the budget was devoted to drainage and levee projects, 22% to bridge and road projects, 14% to sewer improvements, and 6% to buildings.

#### *Proposed Actions:*

- Upgrade and rehabilitate deteriorating infrastructure through implementing the parish sewer master plan, identifying funding to expand the community sewage system, working to eliminate the causes of sanitary sewer overflows, and amending building codes to require apartment complexes to be constructed with grease traps.

- Implement a GIS-based asset management system.
- Integrate drainage facilities into a public amenity network by implementing non-structural solutions to urban runoff treatment and management, and by incorporating an inter-connected system of runoff retention basins and drainage infrastructure.
- Reduce solid waste streams by 25% by 2030 through best practices for solid waste recycling and disposal and regional strategies.

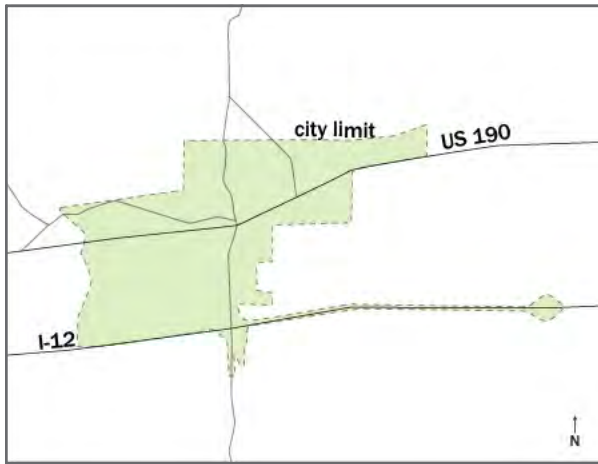
### Community

The culture and economy of Terrebonne Parish are linked to its abundant natural resources. The plan identifies a number of actions to protect these assets through environmental protection, community identity building, and historic preservation.

#### *Proposed Actions:*

- Promote sustainable growth and resilient development practices by incorporating elements from the Louisiana Speaks Regional Plan and actively participating in the State's Coastal Master Plan.
- Balance development with preservation of natural resources by implementing a gateway improvement plan, adopting design review standards in specific corridors and districts, preserving rural landscapes, encouraging cluster and TND development types, and connecting neighborhoods by sidewalks and bikeways
- Promote downtown Houma as the cultural center of Terrebonne Parish.

## City of Walker Sustainability Master Plan



*Project Type:* Land Use

*Date:* Adopted May 2012

*Primary Consultant:* Kendig Keast Collaborative

*Related Topics:* Economic Development, Flooding, Hazard Mitigation, Landscape Architecture, Planning, Policy, Stormwater Management, Transportation

*How can a small suburban city foster sustainable growth with significant population increases are projected in the coming decades?*

In 2011, the City of Walker began its first master planning process, despite being an incorporated municipality since 1909. The plan, "Blueprint of a City: A Community Vision for Walker, Louisiana," was adopted on May 14, 2012. Unlike some communities lacking master plans, Walker does have its own zoning code independent of the parish's code. Current zoning and subdivision regulations do not consistently reinforce the community's vision and goals for the future, though the land use ordinances have in many ways promoted sprawl. Overall, development and growth has been under-regulated inside Walker city limits and in adjacent areas under the jurisdiction of Livingston Parish.

Community concerns identified during the master planning process were grouped into the following categories: growth management, traffic congestion and access management, infrastructure, parks and recreation, community character and enhancement. "Blueprint of a City" establishes priorities for the City of Walker based

on the concerns of residents, businesses, civic groups, and public officials, developing a 20-year plan for sustainable and resilient growth. The plan includes specific recommendations related to community function, planning, and growth, organized hierarchically into goals, objects, and actions and initiatives. The city can adopt the actions and initiatives into policies, ordinances, or projects to implement the community's vision of becoming "a clean, safe, and highly livable community where residents can enjoy the conveniences of the city without losing its small town character comprised of close-knit and family friendly people. Walker envisions achieving this by accommodating growth through progressive grassroots thinking, well-planned annexation, smart infrastructure investments, strategic business support, and sustainable and efficient capital improvements" (Blueprint of a City 2012).

### Resilience Planning in Action

When Hurricanes Gustav, Ike, Rita, and Katrina devastated the Gulf Coast, deficiencies in the physical infrastructure and operational organization of many Louisiana communities were exposed, including the City of Walker. Walker is threatened by a number of natural hazards, particularly tropical storms and hurricanes, but also floods and tornadoes (Livingston Parish Hazard Mitigation Plan 2009). Heavy rains and strong winds initially cause problems for Walker during storm events, but following recent major hurricanes, a different category of threat has affected the resiliency of the city. Walker has seen a steep increase in population as residents from communities further south, displaced and/or frustrated by frequent storms, have migrated north to the Baton Rouge area.

### Environment

Walker is at risk from tropical storms and flooding. The expansion of impervious surfaces following new development has led to increased stormwater runoff and its associated problems of localized flooding and water pollution. Approximately 70% of Walker lies in the FEMA designated 100-year floodplain and a smaller portion in the 500-year floodplain. Further, development of I-12 had only a few relatively small culverts and created a man-made barrier to natural drainage,



exacerbating flooding problems in the area. The plan is comprehensive in examining Walker's built environment, natural resources, and public services necessary for the city's next 20 years of development.

*Proposed Actions:*

- Walker will prepare a city-wide Storm Drainage Master Plan in conjunction with Livingston Parish Gravity Drainage District Five to develop a long-range plan for improvements.
- A Capital Improvement Plan will aid in funding and construction of projects recommended in the plan.
- The city will require dedicated drainage servitudes for all new construction and establish a storm drainage tax for all property owners.
- The city proposes new provisions in zoning and subdivision regulations for Low Impact Development, using site design techniques to store, infiltrate, evaporate, and detain runoff.
- New provisions will require the use of bio-retention areas and bio-swales in parking lots and along roadways to collect and hold stormwater, enhance recharge rates, and improve water quality.
- Incentives for density are encouraged to protect large tracts of natural resources, leaving them available for flood and drainage control, while leaving less infrastructure for the city to maintain.
- Adoption of construction and post-construction Best Management Practices will help reduce pollution and erosion.
- Will add incentives for private-sector development to meet established third-party green building standards and promote sustainability.
- New municipal buildings should be used as pilot projects to design with innovative rainwater capture.
- Establish a network of linear parks through property acquisition, conservation easements, and buffer requirements that will protect sensitive natural environments, preserve open space, provide recreational opportunities, and reduce flooding.

## **Infrastructure**

Walker's master plan outlines many actions to remedy the effects of decades of sprawl and improve the city for current and future generations. To aid in the implementation of actions, the master plan explains the primary means of implementation and prioritizes recommendations. The master plan mandates regular amendments and updates to the plan and reviews of the city's progress in implementation, allowing the document to remain relevant as the city grows and evolves.

*Proposed Actions:*

- Update zoning and subdivision regulations, or create a Unified Development Code, which will convert the actions and initiatives of the master plan into enforceable city ordinances.
- Create a transportation plan.
- Create a capital improvements plan.
- Utilize the Growth and Annexation Plan to annex territory.
- Develop a fiscal impact model to weigh the benefits of expansion. City infrastructure and services will not be expanded unless developments strictly adhere to Walker's Future Land Use and Thoroughfare Plans.

## **Community**

The character and appearance of Walker is a top concern of residents. The plan invests in the development of attractive greenways, streetscape improvements, landscaping, and signage ordinances.

*Proposed Actions:*

- Update land use ordinances to promote the desired character of the community.
- Develop an evacuation and emergency preparedness disaster response policy and plan.
- Coordinate with the state to build a dwell-purpose state evacuation center and community center in one of the parks.

## Appendix C: Summary of Terms

A lexicon of defined terms used in this guidebook and commonly used in resilience planning.

### A

#### ACCEPTABLE RISK

level of risk at which, given costs and benefits associated with risk reduction measures, no action is deemed to be warranted at a given point in time. (U.S. Dept. of Homeland Security)

#### ACQUISITION

the act or process of acquiring fee title or interest other than fee title of real property, including acquisition of development rights or remainder interest. (U.S. National Park Service)

#### ADAPTATION

in the context of human dimensions of global change, usually refers to a process, action or outcome in a system (household, community, group, sector, region, country) in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard, risk or opportunity. (Smit and Wandel, 2006, Glob Environmental Change)

#### ADAPTIVE CAPACITY

the ability or capacity of a system to modify or change its characteristics or behavior to better cope with existing or anticipated external stresses. Often used in the climate change literature as the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. (Adger et al., 2004, Tyndall Centre for Climate Change Research)

#### ADAPTIVE MANAGEMENT

a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. (Williams et al., 2009, U.S. Dept. of the Interior Technical Guide)

#### AFFORDABLE HOUSING

housing for which the occupant(s) is/are paying no more than 30 percent of his or her income for gross housing costs, including utilities. Often refers to housing developed through some combination of zoning incentives, cost-effective construction techniques, and governmental subsidies that can be rented or purchased by households who cannot afford market-rate housing in the community. (U.S. Dept. of Housing and Urban Development; Pace University School of Law)

#### ANTHROPOGENIC

resulting from, or produced by human beings. (Intergovernmental Panel on Climate Change)

### B

#### BARRIER BEACH (BARRIER ISLAND)

a ridge of deposits separated from the mainland by an interval of water. (U.S. Environmental Protection Agency)

#### BASE FLOOD

a flood having a 1-percent chance of being equaled or exceeded in any given year (also known as the 1-percent chance or 100-year flood). The Base Flood has been adopted by the National Flood Insurance Program (NFIP) as the standard for flood mapping, insurance rating and regulating new construction. (Federal Emergency Management Agency)

#### BASE FLOOD ELEVATION (BFE)

the elevation shown on the Flood Insurance Rate Map (FIRM) that indicates the water surface elevation resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year - shown for flood zones A and V with

numbers. The relationship between the lowest habitable floor of a structure and the BFE is one metric used for calculating NFIP policy rates. (Federal Emergency Management Agency)

## BEST MANAGEMENT PRACTICES (BMP)

In stormwater management, a best management practice is a technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of storm water runoff in the most cost-effective manner. BMPs can be structural (e.g. bio-retentions) or non-structural (e.g. pollution prevention practices). (U.S. Environmental Protection Agency)

## BIODIVERSITY

refers to the variety and variability among living organisms and the ecological complexes in which they occur; the term encompasses different ecosystems, species, and genes. (U.S. Environmental Protection Agency)

## BIOMASS

the total amount, or mass, of living organisms within a given unit or area; recently dead organic material, referred to as "dead biomass," is often included when calculating total biomass. (U.S. National Park Service; Intergovernmental Panel on Climate Change)

## BIOREMEDIATION

the process whereby organic wastes are biologically degraded by the use of microorganisms and/or plants under controlled conditions to an innocuous state, or to levels below concentration limits established by regulatory authorities. (Mueller et al., 1996, Cambridge University Press)

## BIORETENTION

a structural best management practice for the on-site retention of stormwater in vegetated depressions engineered to collect and store runoff, treat pollutants and encourage infiltration through the utilization of ecosystem services provided by plants and soils. (Prince George's County, Maryland Dept. of Environmental Resources; U.S. Dept. of Housing and Urban Development)

## BOG

a type of wetland characterized by spongy peat deposits, acidic waters, and a floor covered by a thick carpet of sphagnum moss. Bogs receive all or most of their water from precipitation rather than from runoff, groundwater or streams. Bogs are one of North America's most distinctive kinds of wetlands, but are not as extensive in Louisiana as they are in Northern states. (U.S. Environmental Protection Agency)

## BRACKISH MARSH

the transitional wetland ecosystem between freshwater and salt marsh communities. They form occasionally along the upland edge of salt marshes and tidal riverbanks where freshwater runoff or groundwater dilutes the salinity of the high marsh surface, creating a mesohaline or brackish water condition that is a mix of freshwater and salt water. (State of New Hampshire, Division of Forests and Lands; U.S. Fish and Wildlife Service)

## BROWNFIELD

abandoned, idled, or under-used industrial or commercial property where expansion or redevelopment is complicated by real or perceived environmental contamination. Special federal, state, and regional programs have been created to support the redevelopment of brownfield sites, with EPA's Superfund program being one of the most prominent. (U.S. Environmental Protection Agency)

## BUILDING CODE

a collection of laws or other statutory requirements adopted by a legislative authority intended to assure the adequacy and healthy conditions of physical structures. Building codes establish predictable, consistent standards that apply to the quality and durability of construction materials. In the U.S., building code also refers to the Uniform Fire Prevention and Building Code, as modified by local amendments. (U.S. Environmental Protection Agency; Pace University School of Law)

## C

### CAPITAL IMPROVEMENT

a substantial, nonrecurring expenditure for a physical improvement with a long and useful life. Specific criteria vary across jurisdictions. (National Capital Planning Commission)

### CAPITAL IMPROVEMENT PLAN/ PROGRAM (CIP)

a short-range plan, typically covering a 4-10 year period, for capital expenditures estimated for each year. Identifies each capital project, its expected start and end dates, the annual amount to be expended, and the method for financing those expenditures. The CIP provides a link between the visions articulated by comprehensive plans and annual capital expenditure budgets, matching the costs of planned future projects, such as water, sewers, roads, or schools, to anticipated revenues. A CIP allows for a systematic, simultaneous evaluation of potential projects, and it facilitates coordination among the units of government that are responsible for project implementation. (City of Gresham, Oregon; National Capital Planning Commission; Cowlitz County, Washington, Dept. of Building & Planning)

### CAPITAL PROJECT

construction projects, including public buildings, roads, street improvements, lighting, parks, and their improvement or rehabilitation, paid for under the community's capital budget. (Pace University School of Law)

### CARRYING CAPACITY

the level of use which can be accommodated and continued without irreversible damage to natural or human resources; or the maximum quantity of organisms that any particular habitat can support over an extended period before invoking a collapse of the ecosystem. (Cowlitz County, Washington, Dept. of Building & Planning; U.S. Environmental Protection Agency)

### CATCHMENT

an area (usually smaller than a watershed) which "catches" rainfall and is drained by a common stream. (see also: watershed) (U.S. National Park Service)

### CENTRAL BUSINESS DISTRICT (CBD)

the traditional retail and service center of a community, characterized by a relatively high concentration of business activity within a relatively small area. Because of its compactness, there is usually an emphasis on pedestrian traffic in the CBD. (Pace University School of Law)

### CHARACTER-BASED ZONING

a zoning system that focuses on the relative relationship among the land areas that are used for buildings, landscaping, and vehicular use. Rather than emphasizing the separation of uses into different land use designations or zoning districts, a character-based system relies upon a mix of open space and intensity controls to ensure development within each district has a predictable character. (Kendig Keast Collaborative & T. Baker Smith/LJC Poole)

### CHENIER PLAIN

the area of alternating beach ridges and marsh in the southwestern portion of coastal Louisiana, formed by the longshore transport of fine-grained Mississippi River sediments that were deposited to the west of the deltaic plain. These sediments, transported by westward flowing nearshore currents, were eventually deposited along the existing shoreline as mudflats. When deposition ceased or declined these deposits were reworked by coastal processes, concentrating the coarse grained sediments, and forming shore-parallel ridges called "cheniers," named after the French word for oak tree, which often grown on cheniers. Introduction of new sediment by westward shifts of the Mississippi River delta resulted in the isolation of these ridges by accretion of new material on the existing shoreline. Numerous cycles of deposition and erosion have been responsible for creating the alternating ridges separated by marshlands which are characteristic of the chenier plain. Cheniers are found near river deltas through the world. (Britsch and Dunbar, 1993, J Coastal Res)

### CLIMATE

broadly defined as the average weather or, more rigorously, the statistical description of long-term conditions in terms of the mean and variability of relevant variables, most often surface temperature,

precipitation, and wind over a period of time ranging from months to thousands or millions of years. The classical climate period is based on a 30-year period, as defined by the World Meteorological Organization. (Intergovernmental Panel on Climate Change)

## CLIMATE ACTION PLAN

describes the policies and measures intended to guide efforts for reducing greenhouse gas emissions and increasing a community's resilience to climate change.

## CLIMATE CHANGE

a change in the state of climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer, whether due to natural variability or human activity. (Intergovernmental Panel on Climate Change)

## CLIMATE VARIABILITY

refers to variations in the mean state (i.e. average conditions) and other statistics (such as the standard deviations, occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). (Intergovernmental Panel on Climate Change)

## CLUSTER DEVELOPMENT (CONSERVATION SUBDIVISION)

an alternative to typical subdivision development aiming to protect environmental, cultural, historic, etc. assets through the modification of the arrangement of lots, buildings and infrastructure permitted by the community's zoning law to be placed on a parcel of land. Buildings are concentrated in specific areas to minimize infrastructure and development costs while achieving the allowable density for the development. (Pace University School of Law; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## COASTAL IMPACT ASSESSMENT PROGRAM (CIAP)

the federal program established through the Energy Policy Act of 2005 providing approximately \$496 million to Louisiana to mitigate impacts from Outer Continental Shelf oil and gas production in support of the conservation, protection and preservation of its coastal area and wetlands. (State of Louisiana, Office of the Governor)

## COASTAL PLAIN

a plain between sea and higher land, usually at a low elevation. (U.S. Environmental Protection Agency)

## COASTAL WATERS

waters surrounding the continent which exert a measurable influence on uses of the land and its ecology; includes the Great Lakes and the waters extending from land to the edge of the continental shelf. (U.S. Environmental Protection Agency)

## COASTAL ZONE

coastal waters and adjacent lands which exert a measurable influence on the uses of the sea and its ecology. In terms of natural geography, the zone extends onshore to the upper reaches of the tidal zone and adjacent shore areas. The area within the Louisiana Coastal Zone Boundary does not conform to the ecological definition of coastal zone; instead, it is defined as a political boundary including all lands subject to the provisions of the federal Coastal Zone Management Act. (U.S. Environmental Protection Agency; Louisiana Dept. of Natural Resources)

## COASTAL ZONE MANAGEMENT ACT

a federal act passed in 1972 and administered by NOAA's Office of Ocean and Coastal Resource Management to provide for the management of the nation's coastal resources, including the Great Lakes, and balances economic development with environmental conservation. (U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration)

## COMMUNITY

a group of individuals and organizations bound together by geography or common social, economic or political interests; an assemblage of interacting organisms forming a distinctive group within a given area. (Community & Regional Resilience Institute; U.S. National Park Service)

## COMPLEX ADAPTIVE SYSTEMS

systems with inherent uncertainty in their dynamics that tend to have multiple stable (i.e. equilibrium) states and that exhibit self-organization. (Holling, 2001, Ecosystems)

## COMPREHENSIVE PLAN

a written document that identifies the goals, objectives, principles, guidelines, policies, standards and strategies for the growth and development of the community. Serves as the official statement of local government policy regarding the physical development of the community. A plan that is comprehensive encompasses all or most community functions, such as infrastructure, transportation, housing, land use, accessibility, affordability, economic development, public safety, environmental protection, parks, public facilities, open space, etc., as well as the interrelationships of those functions. While generally a separate document from a community's zoning ordinance, the comprehensive plan is used as a guideline for the creation or updating of zoning and other ordinances. The term is often used interchangeably with "master plan." In Louisiana, there is no legal difference between comprehensive plans and master plans, although this varies by state. (Pace University School of Law; Ohm, 1996, Perspectives on Planning)

## CONSERVATION

the planned management of natural resources for the retention of natural balance, diversity and evolutionary change in the environment. (U.S. National Park Service)

## CONSERVATION EASEMENT

a voluntary, legally binding agreement that limits certain types of uses or prevents development from taking place on a piece of property, thereby protecting the property's ecological or open-space values. By creating a conservation

easement, a landowner voluntarily agrees to sell or donate certain rights associated with his or her property - often the right to subdivide or develop - and a private organization or public agency agrees to hold the right and enforce the landowner's promise not to exercise those rights. The restrictions on development are bound to the deed and remain in place even if the property is sold. Specific areas are generally designated appropriate for or in need of conservation easements for reasons such as biodiversity preservation or flood control. Conservation easements may enable the landowner to qualify for tax benefits in compliance with U.S. Internal Revenue Service rules. (The Nature Conservancy)

## CONSERVATION PRACTICE

a specific treatment, such as a structural or vegetative management technique, commonly used to meet specific needs in planning and conservation for which standards and specifications have been developed. (U.S. Department of Agriculture)

## CORRIDOR

Ecology: a natural or restored pathway for a population of organisms to use in order to breed and/or remain contiguous (e.g. habitat corridor). (U.S. National Park Service)

Transportation: a broad geographical band that follows a general directional flow connecting major sources of trips that may contain a number of streets, highways and transit route alignments. (U.S. Dept. of Transportation Federal Highway Administration)

## COST-BENEFIT ANALYSIS

an analytic technique used to compare alternatives according to the relative costs incurred and benefits gained, typically measured in monetary terms. (U.S. Dept. of Homeland Security)

## COST-EFFECTIVENESS ANALYSIS

an analytic technique that compares the relative costs of two or more alternatives with the same or similar outcomes. Often used to evaluate an alternative by how much it delivers per unit cost, or how much has to be spent per unit benefit. (U.S. Dept. of Homeland Security; The Center for Climate Strategies)

## CRISIS

an acute disturbance that significantly impedes community function(s). This could include, but is not limited to, natural disasters (e.g. hurricanes, tornadoes, floods, earthquakes, tsunamis), human-induced events (e.g. acts of terrorism, chemical spills), and other events such as economic downturns and pandemic outbreaks. (Community & Regional Resilience Institute)

## CRITICAL FACILITIES

structures the community identifies as essential to the health and welfare of the population and that are especially important following a disaster; examples include police stations, fire and rescue facilities, hospitals, shelters, schools, nursing homes, water supply and waste treatment facilities, among others. The type and location of a private business may raise its status to a Critical Facility, such as a grocery or gas station, if it survives a disaster and becomes the only point for food and gas in the community. (Louisiana Sea Grant Law and Policy Program)

## D

## DELTA

a fan-shaped deposition of silt, sand, gravel or other fine materials from a stream or river. These occur when the hydraulic gradient lessens abruptly, as in the discharge of a stream into a lake, or a river into an ocean. (U.S. Environmental Protection Agency)

## DESIGN STANDARDS/DESIGN GUIDELINES

the standards, including policies, guidelines, and criteria, governing the size, shape, and relationship of spaces in and around a building or development area, intended to guide development toward a desired level of quality through the design of the physical environment. Also refers to a document, or an object for physical comparison, for defining product characteristics, products, or processes. (U.S. Dept. of Housing and Urban Development)

## DETENTION

Stormwater Management: the temporary storage of stormwater to control discharge rates, allow for infiltration, and improve water quality. (see also: wet detention pond, retention, filter strips) (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## DIGITAL FLOOD INSURANCE RATE MAP (DFIRM)

a digital version of the FEMA flood insurance rate map that is designed for use with digital mapping and analysis software. (Federal Emergency Management Agency)

## DISCHARGE

the volume of water that passes a given location within a given period of time. Usually expressed in cubic feet per second. (U.S. Geological Survey)

## DISTRICT (ZONING DISTRICT)

in municipalities and parishes where zoning is used, a district is a portion of a community identified on the locality's zoning map within which one or more principal land uses are permitted along with their accessory uses and any special land uses permitted by the zoning provisions for the district. (Pace University School of Law)

## DISTURBANCE

a relatively discrete event in time coming from outside a system that disrupts ecosystems, communities or populations; changes substrates and resource availability; and creates opportunities for new individuals or colonies to become established. (Smith, 1990, Harber Collins)

## DECENTRALIZATION

often used in climate change adaptation and emergency management, allows for parts of a system to continue operation even if other parts of the system are down. (The Center for Climate Strategies)

## DIVIDE (DRAINAGE DIVIDE)

the line drawn through the highest elevated points within a watershed. It forms the limits of a single watershed and the boundary between two or more watersheds. (U.S. Geological Survey)

## DRAINAGE BASIN

see: watershed

## DREDGING

the act of using of motorized equipment to clean, deepen, or widen areas inundated with water. (U.S. National Park Service)

# E

## ECOLOGY

the study of the interrelationships between organisms and their environment. (Millennium Ecosystem Assessment)

## ECOSYSTEM

a dynamic complex of plant, animal, human and microorganism communities and the nonliving environment, interacting as a functional unit. Ecosystems vary enormously in size; a temporary pond in a tree hollow and an ocean basin can both be ecosystems. Well-defined ecosystems have strong interactions among their components and weak interactions across their boundaries where a number of discontinuities occur, such as in the distribution of organisms, soil types, drainage basins or water depth. (Millennium Ecosystem Assessment)

## ECOSYSTEM SERVICES

the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation and disease; supporting services, such as soil formation and nutrient cycling; and cultural services, such as recreational, spiritual, religious and other non-material benefits. (Millennium Ecosystem Assessment)

## ENVIRONMENTALLY SENSITIVE AREA

an area of environmental importance having natural resources which if degraded may lead to significant adverse, social, economic or ecological consequences. These could be areas in or adjacent to aquatic ecosystems, drinking water sources, unique or declining species habitat, and

other similar sites. (U.S. Dept. of Transportation Federal Highway Administration)

## EROSION

the wearing away of the land surface by water, waves, wind or moving ice, as well as by processes due to gravity, mass wasting or corrosion (solution and other chemical processes). The term "geologic erosion" refers to natural erosion occurring over long (geologic) time spans. "Accelerated erosion" generically refers to erosion that exceeds what is presumed or estimated to be naturally occurring levels, and which is a direct result of human activities, such as cultivation and logging. (U.S. Natural Resources Conservation Services)

## ESTUARY

a partially enclosed body of water along the coast where freshwater from rivers and streams meet and mix with salt water from the ocean. Estuaries and the lands surrounding them are places of transition from land to sea and freshwater to salt water, typically protected from the full force of ocean waves, winds and storms by landforms, such as barrier islands or peninsulas. These ecosystems support unique communities of plants and animals. (U.S. Environmental Protection Agency)

## ESTUARINE ENVIRONMENT

areas that are among the most productive on earth, creating more organic matter each year than similarly-sized forests, grasslands or agricultural lands. (U.S. Environmental Protection Agency)

## EUCLIDEAN/USE-BASED ZONING

the most common method of controlling the development of a municipality in the United States, through land use classifications and dimensional standards. Land uses, such as single-family and multi-family residential, commercial, institutional, industrial and recreational, are divided into zoning districts and arranged on a zoning map. Each land use must comply with the dimensional standards that regulate the height, bulk and area of structures. These dimensional standards typically take the form of setbacks, sideyards, height limits, minimum lot sizes and lot coverage limits. Dividing zoning districts by land use is designed to separate incompatible uses. Euclidean zoning has been criticized for its



lack of flexibility and divergence from traditional forms of towns and cities where uses were mixed within neighborhoods, which created vibrant, diverse and walkable communities. (Kendig Keast Collaborative & T. Baker Smith/LJC Poole; Philadelphia Zoning Code Commission)

## EUTROPHICATION

the process by which a body of water acquires a high concentration of nutrients (i.e. becomes eutrophic), especially phosphates and nitrates. These nutrients typically promote excessive growth of algae followed by an algal die-off when nutrients are depleted. Settling of the dead algae stimulates an increase in biological oxygen demand as populations of microorganisms expand and consume dead algae, thereby reducing oxygen concentrations in the water column. Such changes can cause adverse impacts to fisheries, recreation and public health. Eutrophication is a natural, slow aging process for a water body, but it can also be the result of human activity, such as anthropogenic eutrophication from fertilizer runoff and sewage discharge. (U.S. National Oceanic and Atmospheric Administration)

## EXPOSURE

the degree, duration and/or extent to which a system is in contact with or subjected to perturbation, such as significant climatic variations. (Adger, 2006, Global Environmental Change)

## EXOTIC SPECIES

see: nonindigenous, invasive species

# F

## FENS

peat-forming wetlands that receive nutrients from sources other than precipitation, usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement. Fens differ from bogs because they are less acidic and have higher nutrient levels. Fens are not common in Louisiana, but found in northeastern and northern plains states and Canada. (U.S. Environmental Protection Agency)

## FILTER STRIPS

created areas of vegetation designed to remove sediment and pollutants from surface water runoff by different processes (e.g. filtration, deposition, infiltration, adsorption, decomposition, volatilization, etc.); often located between a pollution source and downstream receiving water bodies. (U.S. Environmental Protection Agency)

## FILTRATION

the removal of particulate matter from water due to obstruction and reduced water velocity. (U.S. National Park Service)

## FLEXIBILITY

individual or organizational systems that are able to effectively respond to shifting and unpredictable circumstances and contribute to each situation (i.e. during a disaster or catastrophic event). This would include collaborative multi-sector approaches to planning, execution and recovery, since no one sector has a monopoly on a particular impact; thus, an understanding of the overlaps and gaps between sectors is critical to achieve flexibility within a system. (The Center for Climate Strategies)

## FLOOD

a general, temporary condition when water partially or completely covers or inundates two or more acres of normally dry land or two or more properties due to one of the following: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; mudflow; collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or water currents. (Federal Emergency Management Agency)

## FLOOD DISASTER PROTECTION ACT OF 1973 (FDPA)

a federal act of congress which made the purchase of flood insurance mandatory for the protection of property located in Special Flood Hazard Areas. (Federal Emergency Management Agency)

## FLOOD HAZARD BOUNDARY MAP (FHBM)

the official map of a community issued by the Federal Insurance Administrator that designates the boundaries of flood, mudflow and related erosion areas having special hazards. (Federal Emergency Management Agency)

## FLOOD INSURANCE RATE MAP (FIRM)

the official map of a community on which FEMA has delineated areas prone to flooding, including both the special hazard areas and the risk premium zones applicable to the community. (Federal Emergency Management Agency)

## FLOOD ZONE

a geographical area shown on a Flood Hazard Boundary Map or a Flood Insurance Rate Map that reflects the severity or type of flooding in the area. (Federal Emergency Management Agency)

## FLOODPLAIN

any land area susceptible to being inundated by floodwaters from any source, often on the sides of a stream, river or other watercourse, or along the coastline. (Federal Emergency Management Agency) U.S. Department of Homeland Security. Federal Emergency Management Agency (n.d.). Glossary of the National Flood Insurance Program. Retrieved from [http://www.floodsmart.gov/floodsmart/pages/glossary\\_A-I.jsp](http://www.floodsmart.gov/floodsmart/pages/glossary_A-I.jsp).

## FLOODPLAIN MANAGEMENT

the operation of a community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms and generally include emergency preparedness plans, flood control works and regulations through zoning, subdivision or building, and special-purpose floodplain ordinances. (Federal Emergency Management Agency)

## FLOODPROOFING

any combination of structural and nonstructural additions, changes or adjustments to structures which reduce or eliminate flood damage to real estate or that improve water and sanitary facilities, property, structures or their contents. (Louisiana Sea Grant Law and Policy Program)

## FLOODWAY

the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without causing any cumulative increase in the water surface elevation. The floodway is intended to carry away dangerous and fast-moving water. (Louisiana Sea Grant Law and Policy Program)

## FORM-BASED CODE

a form of land use controls developed as an alternative to Euclidean zoning. Form-based codes help cities and developers achieve predictable built results in a high-quality public realm by using physical form rather than the separation of uses as the basis for deciding what is appropriate for a certain location. The SmartCode, developed by Andres Duany, is a form-based land use code that utilizes six Transect Zones instead of use-based zoning districts. Form-based codes are used to preserve or create community character, so the term is sometimes used interchangeably with character-based code. Not all character-based codes are strictly form-based codes, as some also regulate use. (Qualls, R. (Performer), & City of Cincinnati Department of Planning and Buildings, (Producer); Center for Applied Transect Studies)

## FRESHWATER

water that contains less than 1,000 milligrams per liter of dissolved solids; generally, more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses. Freshwater resources include lakes and ponds, rivers and streams, reservoirs, wetlands and groundwater; these provide the majority of the nation's water for drinking, agriculture, industry, and sanitation, as well as food for fish and shellfish. (U.S. Geological Survey; U.S. Environmental Protection Agency)

## FRESHWATER MARSH

any place holding water that has non-woody vegetation growing and with a salinity range of 0-2 ppt. Southeastern Louisiana freshwater marshes contain a very high diversity of plant species (e.g., cattail, water lilies, irises, duckweed, cutgrass, wild rice, bullwhip, bulltongue) and wildlife (e.g. alligators, snakes, turtles, mink, raccoons, otters, nutria, egrets, herons, ducks, bass, bluegills, grass shrimp and many insects). Freshwater marshes differ from swamps in that they do not have woody vegetation. (America's Wetlands Foundation)

## G

### GEOGRAPHIC INFORMATION SYSTEMS (GIS)

a system that integrates hardware, software and data for capturing, managing, analyzing and displaying all forms of geographically referenced information. GIS allows us to view, understand, question, interpret and visualize data in many ways that reveal spatial relationships, patterns and trends in the form of maps, globes, reports and charts. (Esri)

### GLOBAL WARMING

the recent and ongoing global average increase in temperature near the Earth's surface caused by excessive amounts of carbon dioxide, methane and other greenhouse gases in the atmosphere. (U.S. Environmental Protection Agency; The Center for Climate Strategies)

### GRADING

altering a land surface by cutting, filling and/or smoothing to meet a designated form and function. (U.S. National Park Service)

### GREEN INFRASTRUCTURE

generally defined in two ways. First, it refers to a collection of open spaces that are tied together in a network - typically a system of hubs and links - that supports ecosystem health, which in turn supports human health and provides spaces for outdoor recreation. Second it refers to sites that perform functions similar to built infrastructure, such as flood control and stormwater management systems. These types of sites are generally located within the built environment, as opposed to strictly rural areas, and are designed or engineered to perform functions of ecological processes. (Bartley et al., 2008, Worcester Polytechnic Institute)

### GREENWAY

a linear network of land that is planned, designed and managed for multiple purposes, including ecological, recreational, cultural, aesthetic or other purposes compatible with the concept of sustainable land use. Greenways can be used to create connected networks of open space that

include traditional parks and natural areas. (Fabos and Ahern, 1996, Elsevier Press; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

### GREENHOUSE GASES

the gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself and clouds, and which contribute to the Earth's natural greenhouse effect. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons and others. (Intergovernmental Panel on Climate Change)

### GREENHOUSE EFFECT

the process in which some of the infrared radiation that is radiated from the Earth's surface is absorbed by greenhouse gases in the atmosphere and re-radiated back toward the Earth's surface, warming the atmosphere near the Earth's surface (troposphere). This process may be amplified if the atmospheric concentrations of greenhouse gases increases, such as from anthropogenic activities, resulting in a gradual increase in the average temperature of the lower atmosphere. (Intergovernmental Panel on Climate Change)

### GROUNDWATER

the water that flows or seeps downward and saturates underlying soil and porous spaces between soil and rock fractures; water supplying springs and wells and that is stored in aquifers. (U.S. Geological Survey)

## H

### HAZARD

the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, services and environmental resources. (Intergovernmental Panel on Climate Change)

### HEADWATER(S)

the source and upper reaches of a stream or

reservoir. Can also refer to the collection of small streams that come together to form a river. (U.S. Geological Survey)

## HISTORIC DISTRICT

a regulatory overlay zone within which new developments must be compatible with the architecture of the district's historic structures. Alterations and improvements of historic structures must involve minimum interference with the historic features of the buildings. The local legislature establishes standards that a historic preservation commission uses to permit, condition or deny projects proposed in historic districts. (Pace University School of Law)

## HYDROLOGY

the science that deals with the cycling of water in the natural environment that relates specifically with water movement and processes on land (the physical and chemical processes among the various pathways of continental water at all scales) and in the global water balance (the spatial and temporal features of water transfer between all components of the global system, including the atmosphere, land and ocean). (Brutsaert, 2005, Cambridge University Press)

## IMPACT FEE

a fee or tax imposed on developers to help pay for the community's cost of providing services to a new development. (Cowlitz County, Washington, Dept. of Building & Planning)

## IMPERVIOUS SURFACE

any natural or artificial surface in the landscape that cannot effectively allow the absorption and infiltration of rainwater into the ground, thus increasing the quantity and rate of surface runoff. These areas are major contributors to the urban non-point source pollution problems that impair water quality. (U.S. Dept. of Housing and Urban Development)

## IMPLEMENTATION PLAN

a plan which coordinates all the related strategies that are to be carried out to achieve the objectives

contained in the comprehensive plan. An implementation plan answers the questions who, what, where, when and how. (Pace University School of Law)

## INDIGENOUS SPECIES

refers to a species that is native to a geographic area; used interchangeably with native species. (U.S. National Park Service)

## INCENTIVE ZONING

a system by which zoning incentives are provided to developers on the condition that specific physical, social, environmental or cultural benefits are provided to the community. The system allows for more flexibility than standard land use ordinances to achieve the goals of developers and local governments. Incentives include increases in the permissible number of residential units or gross square footage of development, or waivers of the height, setback, use, or area provisions of the zoning ordinance. The benefits to the community provided in exchange may include affordable housing, recreational facilities, open space, day-care facilities, infrastructure, or cash in lieu thereof. (Pace University School of Law; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## INFILL DEVELOPMENT

new construction on previously developed land in cities or established suburbs, in close proximity of existing streets, infrastructure, and other development. The term often refers to redevelopment of small residential, commercial, or industrial properties. Important aspects of many infill development projects are the enhancement of the built environment with open space and parks, and the remediation and redevelopment of brownfield properties. (U.S. Environmental Protection Agency)

## INFILTRATION

the downward flow of water from the land surface into the soil through porous material. Infiltration is restricted by impervious materials, both man-made and natural. (U.S. National Park Service; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## INFRASTRUCTURE

the utilities and improvements needed to support development in a community. Among these are water and sewage systems, lighting, drainage, parks, public buildings, utilities, roads, and transportation facilities. (Pace University School of Law)

## INLET

a short, narrow waterway connecting a bay, lagoon, or similar body of water with a larger parent body of water; an arm of the sea or other body of water that is long compared to its width and that may extend a considerable distance inland. (U.S. Environmental Protection Agency)

## INTEGRATED WATER RESOURCE MANAGEMENT

the process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. (Global Water Partnership)

## INTERMEDIATE MARSH

a marsh with a salinity range of 0.5-5 ppt, which is less saline than a brackish marsh but more saline than a freshwater marsh. This type of wetland (also called oligohaline marsh) is unique to Louisiana. It is characterized by a collection of plant species common to freshwater marsh and more saline marshes closer to the sea. It contains Wire Grass (*Spartina patens*), a plant not found in freshwater marsh, which is easily identifiable with its characteristic wind-swept looking clusters of three foot long grass-like leaves. Intermediate marshes can therefore be identified by a combination of freshwater plant species (especially cattails, cut grass, and water lilies) and Wire Grass. Animal life is less diverse than in a freshwater marsh, but can include a variety of ducks and other water birds, snakes, alligators, a few turtles, muskrats, raccoons, nutria, and other fur-bearing mammals. (U.S. Fish and Wildlife Service; America's Wetlands Foundation)

## INVASIVE SPECIES

a species that is not native to an ecosystem. The introduction of this species to the ecosystem can cause economic, human or environmental harm; for example, it can remove native species by introducing new competition. Examples of invasive species in Louisiana include nutria and Chinese Tallow trees. (The Invasive Species Advisory Committee; Tulane University, Xavier University and Center for Bioenvironmental Research)

## L

## LANDSCAPE

a mix of local ecosystems or land use types over an area of land. Landscapes comprise the basic elements of a region. (Forman, 1995, Cambridge University Press)

## LAND BANK

a governmental or nongovernmental nonprofit entity that focuses on the conversion of vacant, abandoned properties into productive use. A land bank 1) acquires legal title to vacant, abandoned and tax-foreclosed properties, 2) eliminates barriers to development, and 3) transfers property to a new owner in a way that supports community needs and priorities. Land banks often provide marketable title to properties previously impossible to redevelop; therefore, they act as powerful locational incentives and long-term planning tools by encouraging redevelopment in older communities that generally have little available land and neighborhoods that have been blighted by out-migration of residents and businesses. (U.S. Dept. of Housing and Urban Development; Smart Growth America)

## LAND TRUST

a not-for-profit organization, typically private in nature, organized to preserve and protect the natural and man-made environment by, among other techniques, holding conservation easements that restrict the use of real property. Land trusts have also been used as a tool for urban redevelopment and affordable housing creation. After Hurricane Katrina, the State of Louisiana formed the Louisiana Land Trust for the purposes of post-disaster redevelopment (Louisiana RS

40:600.66). The Louisiana Land Trust is very similar to a land bank. (Pace University School of Law)

## LAND USE

activities that occur on property that is associated with specific classes or classifications of use, such as agriculture, industrial, utilities, commercial, residential and institutional. (Cowlitz County, Washington, Dept. of Building & Planning)

## LAND USE PLANNING

the systematic assessment of land and water potential, examining alternatives for land use and economic and social conditions in order to select and adopt the best land use options based on the need for change, improved management or a different pattern of land use dictated by changing circumstances. Its purpose is to select and put into practice those land uses that will best meet the needs of the people while safeguarding resources for the future. (Food and Agriculture Organizations of the United Nations, Soil Resources, Management, and Conservation Service)

## LAND USE REGULATION (LAND USE ORDINANCE)

laws enacted by the local legislature for the regulation of any aspect of land use and community resource protection, including zoning, subdivision, special use permits or site plan regulation, or any other regulation that prescribes the appropriate use of property, including the scale, location or intensity of development. (Pace University School of Law)

## LEVEE

a natural or man-made structure, typically an earthen embankment, along the edge of a stream, lake or river to contain, control or divert the flow of water so as to provide protection from temporary flooding. (Federal Emergency Management Agency)

## LINES OF DEFENSE

the natural and man-made features, organized along a gradient, that protect Louisiana communities from storm surge. These can include barrier islands, bays, sounds, marsh land bridges,

natural ridges, manmade ridges, flood gates, flood levees, pump stations, non-structural measures (i.e., home and building elevations, flood proofing), and evacuation routes. Identification of these Lines of Defense on a map allows hydrologists, levee district managers, emergency management personnel, etc., to evaluate, abate and monitor flood risks and other storm impacts. (see also: Multiple Lines of Defense Strategy) (Save our Coast Lake Pontchartrain Basin Foundation and Coalition to Restore Coastal Louisiana)

## LOW IMPACT DEVELOPMENT (LID)

an approach to land development that is cost-effective and that helps to mitigate potential environmental impacts. More specifically, it uses various land planning and design practices and technologies to simultaneously conserve and protect natural resource systems and reduce infrastructure costs. Similar approaches have emerged in other countries, including Sustainable Urban Drainage Systems (SUDS) in the United Kingdom; Water Sensitive Urban Design (WSUD) in Australia; and Low Impact Urban Design and Development (LIUDD) in New Zealand. (U.S. Dept. of Housing and Urban Development)

## M

## MANUFACTURED HOME

another term for mobile home; describes a structure built on a permanent chassis and transported to its site in one or more sections and affixed to a permanent foundation; designed so it can be used with or without a permanent foundation when attached to required utilities. (Federal Emergency Management Agency)

## MARSH

a type of wetland frequently or continually inundated with water and characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions. There are many different kinds of marshes based on such characteristics as tidal influence, geography, salinity and ecology. (U.S. Environmental Protection Agency)

## MASTER PLAN

In general land use planning: a government entity's

plan for the overall utilization of a particular area, including its allocation for residential, commercial or manufacturing uses and the corresponding environmental impacts. Often used as the basis for a comprehensive zoning ordinance. The terms “master plan” and “comprehensive plan” are often used interchangeably, but some state or local laws may distinguish the two terms as describing different kinds of plans. (Webster’s New World Law Dictionary)

In Louisiana: a master plan is a plan for the development of the municipality, as described in 33:106 of the Louisiana Revised Statutes. An officially adopted master plan has the legal power to guide new development, ordinances, and policies in the municipality. (Louisiana Revised Statutes 33:109)

## MEASURE OF EFFECTIVENESS

benchmarks or tests which reflect the degree of attainment of particular objectives. (U.S. Dept. of Transportation Federal Highway Administration)

## METROPOLITAN PLANNING ORGANIZATION (MPO)

a regional policy body required by federal law in urbanized areas with populations over 50,000 and designated by local officials and the governor of the state. A MPO develops transportation plans and programs for a metropolitan area and is responsible for carrying out the metropolitan transportation planning requirements of federal highway and transit legislation in cooperation with the state and other transportation providers. (U.S. Dept. of Transportation Federal Highway Administration)

## MITIGATION (ECOLOGY)

restoring, replacing or creating ecological habitats (usually wetlands) in one area to compensate for loss of natural habitats in another area due to development. Syn: compensatory restoration. Also refers to actions taken to avoid, minimize or reduce ecosystem losses. (U.S. National Park Service)

## MITIGATION (HAZARD MITIGATION)

any ongoing or sustained action to reduce the

probability of or lessen the impact of an adverse incident, which may be implemented before, during or after an incident. Mitigation can be accomplished through the use of zoning and building codes, floodplain buyouts, risk insurance, data-driven planning, outreach, and other structural and nonstructural measures. FEMA and DHS distinguish mitigation, referring to actions that have long-term impacts, from actions that are more closely associated with preparedness for, immediate response to, and short-term recovery from a specific event. (U.S. Dept. of Homeland Security)

## MITIGATION (CLIMATE)

strategies to reduce the anthropogenic forcing of the climate system by reducing greenhouse gas emissions that contribute to an amplified greenhouse effect, including actions to enhance greenhouse gas sinks (i.e. carbon sinks). (Intergovernmental Panel on Climate Change)

## MITIGATION BANK

a wetland, stream or other aquatic area that has been restored, established, enhanced or preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources permitted under Section 404 of the Clean Water Act or a similar state or local wetland regulation. A mitigation bank may be created when a government agency, corporation, nonprofit organization or other entity undertakes these activities under a formal agreement with a regulatory agency. Mitigation banks are a form of “third-party” compensatory mitigation, in which the responsibility for compensatory, mitigation, implementation, and success is assumed by a party other than the permittee. (U.S. Environmental Protection Agency)

## MITIGATION CONDITIONS

conditions imposed by a reviewing or regulating body on a proposed development project to reduce its adverse impact on the environment. (Pace University School of Law)

## MITIGATION MEASURES

actions that can be taken to reduce property damage and the threat to life and public health from flooding and other hazards, typically

grouped into two categories: structural and nonstructural measures. (Louisiana Sea Grant Law and Policy Program)

### MIXED USE

a zoning ordinance or particular zoning district that allows for and encourages a diversity of compatible land uses, which may include any combination of residential, office, retail, recreational, light manufacturing, and other miscellaneous uses in the same district. Often a mixed-use zoning district permits multiple principal uses to coexist on a single parcel of land; for example, apartments may be developed over retail space in neighborhood commercial districts. (Pace University School of Law; Cowlitz County, Washington, Dept. of Building & Planning)

### MODE

Transportation: a specific form of transportation, such as automobile, subway, bus, rail, pedestrian, or air. (U.S. Dept. of Transportation Federal Highway Administration)

### MULTIMODAL

the availability of transportation options using different modes within a system or corridor. (U.S. Dept. of Transportation Federal Highway Administration)

### MULTIPLE LINES OF DEFENSE STRATEGY

a methodology used to design flood control and wetland restoration projects in coastal Louisiana under the premise that coastal Louisiana must be protected from hurricane storm surge by both man-made features, such as levees, and by the natural coastal wetland buffer. The strategy has been adopted by the State of Louisiana and incorporated into its Coastal Master Plan. (see also: Lines of Defense) (Save our Coast Lake Pontchartrain Basin Foundation and Coalition to Restore Coastal Louisiana)

## N

### NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

a federal program enabling property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to federal disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. (Federal Emergency Management Agency)

### NATIONAL FLOOD INSURANCE REFORM ACT (NFIRA)

the purpose of the National Flood Insurance Reform Act of 1994 is to improve the financial condition of the NFIP and reduce expenditures for disaster assistance to flood-damaged properties. The act affects every part of the NFIP, insurance, mapping, and floodplain management. NFIRA also gives lenders tools with which to enforce requirements for flood insurance coverage mandated under the Flood Disaster Protection Act of 1973. (Federal Emergency Management Agency)

### NATIVE SPECIES

a species that is part of an area's original biota; used interchangeably with indigenous species. (U.S. Environmental Protection Agency)

### NATURALIZED

refers to a previously nonindigenous or foreign species which has become established in and conformed to an ecosystem. Naturalized species are not regarded as a threat to native plants or animals, unlike nonindigenous or invasive species. (U.S. National Park Service)

### NATURAL LEVEE

naturally formed high ground that parallels the course of a waterway. Natural levees are built up over time by seasonal flooding of uncontained waterways. (America's Wetlands Foundation)



## NO ADVERSE IMPACT (NAI)

essentially a “do-no-harm” policy, a resilient floodplain management strategy whereby the actions of one property owner are not allowed to adversely affect the rights of other property owners. It is based on the concept that everyone benefits when the actions of every community or property owner do not adversely affect others’ properties. NAI involves anticipating and proactively addressing the potential negative effects of any development or flood-control action on other people, their property and the environment. The principal can be applied to municipalities or entire watersheds. (Association of State Floodplain Managers)

## NONINDIGENOUS SPECIES

an organism (plant, animal, microorganism) living beyond its historic native range, which is usually defined as the area where it evolved to its present form. The term nonindigenous can be used interchangeably with exotic, non-native, and alien species. (National Oceanic and Atmospheric Administration)

## NONPOINT SOURCE POLLUTION

pollution discharged over a wide land area, not from one specific location. The term “nonpoint source” is considered any source of water pollution that does not meet the legal definition of “point source” in section 502(14) of the Clean Water Act. This type of pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. (U.S. Environmental Protection Agency; U.S. Geological Survey)

## NONSTRUCTURAL MEASURES

approaches that reduce human susceptibility to flooding or modify the adverse impacts of flooding (see Hazard Mitigation); examples include acquisition and relocation, floodplain regulations and building codes, floodproofing and elevating buildings, and flood insurance. (Louisiana Sea Grant Law and Policy Program)

## NUTRIENTS

the elements, or compounds, that are essential raw materials for the growth and development of organisms. Important nutrients for wetlands

include carbon, oxygen, nitrogen, phosphorus, and others. Humans can greatly alter the supply of nutrients in water bodies. An overabundance or lack of nutrients in an ecosystem can have major impacts on plant, bacteria, and animal communities. (see also: Eutrophication) (U.S. Environmental Protection Agency)



## ONE PERCENT ANNUAL CHANCE FLOOD (100-YEAR FLOOD)

a flood having a one percent chance of being equaled or exceeded in any given year; also referred to as the “base flood” or “100-year flood”. (see also: base flood) (Federal Emergency Management Agency)

## OPEN SPACE

a land use category for areas that have no development, are preserved for environmental or aesthetic reasons, or with minimum development use types, such as golf courses, parks, agriculture, and forestry. Can also refer to a segment of land set aside for public or private use within a larger development. (Cowlitz County, Washington, Dept. of Building & Planning; Prince George’s County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## ORDINANCE

a legislative enactment of a county/parish or city to adopt a statute or regulation. (Cowlitz County, Washington, Dept. of Building & Planning)

## OUTFALL

the place where a sewer, drain, or stream discharges. In municipal sewer systems, the term “outfall” specifically refers to the physical outlet or structure through which reclaimed water or treated effluent is finally discharged to a receiving water body. (U.S. Geological Survey)

## OVERLAY DISTRICT

a zoning district in which additional special regulatory standards are superimposed on existing zoning districts. Overlay districts are often used to implement special historic preservation,

urban design, or habitat conservation regulations that only apply to certain areas of a municipality. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## OVERLAY ZONING

a regulatory tool that creates a special zoning district, placed over existing base zones, that identifies special provisions in addition to those in the underlying base zones. The overlay district can share common boundaries with the base zone or cut across base zone boundaries. Regulations or incentives are attached to the overlay district to protect a specific resource or guide development within a special area in a particular manner. (Center for Land Use Education)

## P

## PERMEABLE/PREVIOUS MATERIALS

soil or other material that allows for the infiltration or passage of water or other liquids. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## PLANNED UNIT DEVELOPMENT (PUD)

a land use control provision that allows land to be developed in a manner that does not conform with existing requirements of any of the standard zoning districts; often taking the form of an overlay district. The PUD allows greater flexibility and innovation than conventional standards because the parcels contained in the planned unit are regulated as one unit instead of each lot being regulated separately. PUD is used as a tool to facilitate mixed use development, or a variety of housing types in a single neighborhood, when those uses are not permitted as-of-right by the municipality's zoning ordinance. (Pace University School of Law; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## PLANNING

the technical and political process concerned

with the use of land, protection and use of the environment, public welfare, and the design of infrastructure, systems, networks. The process of planning encourages learning, builds skills, and helps to create resilience. (McGill University)

## PLANNING COMMISSION

a group of citizens, typically appointed by the mayor or parish/county leaders, to research, survey, analyze, and make recommendations for current and long-range land development policies, resource management, implementing ordinances, and administrative decisions such as subdivision plots, shoreline permits, or rezoning requests. Louisiana law gives planning commissions the power to draft, adopt, enforce municipal or parish master plans and act as municipal or parish zoning commissions, as described in the Louisiana Revised Statutes sections 33:106, 33:107, 33:108, 33:109, 33:110, 33:118. Alternatively, some parishes employ police juries (RS 33:120.5) or parish development boards (RS 33:121) instead of planning commissions. (Cowlitz County, Washington, Department of Building & Planning; Louisiana State Legislature)

## PLANS FOR FAILURE

a method of planning and designing for the future under the premise that the unpredictable and uncertain nature of climate risks and responses will ultimately lead to failure of some element(s) of a system. In some cases, returning to a pre-existing state will not be possible or appropriate. Incremental failures and planning for failures allow for real-time response and revision while limiting social, environmental, and economic costs. An example of a plan for failure is when floodgates break, they do so in a way that channels floodwaters to uninhabited flood zones, perhaps damaging property but protecting human lives. (The Center for Climate Strategies)

## POINT SOURCE POLLUTION

water pollution coming from a single point or source; more specifically, any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. Point source pollution

is controlled by the National Pollutant Discharge Elimination System, under the Clean Water Act. This term does not include stormwater runoff, agricultural stormwater discharges or return flows from irrigated agriculture. (see also: nonpoint source pollution). (U.S. Geological Survey; U.S. Environmental Protection Agency)

## PREVENTION

prescribed proactive measures put in place to reduce adverse effects of a natural or man-made disaster on the safety, security, or continuity of a nation (or community), its critical infrastructure, and its citizens. Prevention can be undertaken at the scale of the federal, state, or local government, or by organizations and private citizens. (U.S. Dept. of Homeland Security)

## PUBLIC TRANSIT

passenger transportation services that are available to any person who pays a prescribed fare. They can be local, regional, or national in scope. Public transit systems operate on established schedules along designated routes or lines with specific stops and are designed to move relatively large numbers of people at one time. (U.S. Dept. of Transportation Federal Highway Administration)

## PURCHASE OF DEVELOPMENT RIGHTS

a voluntary program, where a government-run land trust or some other agency, makes an offer to a landowner to buy the development rights on the parcel, while leaving all the remaining property rights as before. The landowner is free to turn down the offer, or to try to negotiate a higher price. Once an agreement is made, a permanent deed restriction, retiring the development rights of the parcel, is placed on the property which restricts the type of activities that may take place on the land in perpetuity. In this way, a legally binding guarantee is achieved to ensure that the parcel will remain agricultural or as open (green) space forever. PDR programs are often called PACE (purchase of agricultural conservation easements) programs. (see: conservation easement). (The Ohio State University Extension Office, Dept. of Community Development)

# R

## RAIN BARREL

barrels designed to collect and store a certain volume of rooftop runoff, often with an overflow pipe to provide some detention beyond the retention capacity of the rain barrel; one of many low-impact integrated management practices that can be implemented on a local or site scale. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## RECHARGE AREA

pervious land areas where surface water infiltrates the soil and reaches the zone of saturation or groundwater table. Protection of the recharge area is critical, as impervious surfaces and pollution threaten the quality and quantity of drinking water for communities dependent upon groundwater. (Maryland Dept. of Environmental Resources, Programs and Planning Division)

## REDUNDANCY

the extent to which elements, systems, or other units of analysis exist that are substitutable, i.e. capable of satisfying functional requirements in the event of disruption, degradation, or loss of functionality. This includes redundancy of processes, capacities, and response pathways within an institution, community, or system to allow for partial failure within a system or institution without complete collapse. (The Center for Climate Strategies)

## REMEDIATION

the process of correcting environmental degradation; may not involve a complete return of a system to its pre-disturbance state, but will improve its ecological function. (see also: restoration) (U.S. National Park Service)

## RESILIENCE (COMMUNITY)

Community: the capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change; a resilient community should be able to avoid the cascading system failures to help minimize a disaster's disruption to everyday life

and the local economy. (Community & Regional Resilience Institute)

## RESILIENCE (ECOLOGY)

the capacity of linked social-ecological systems to absorb recurrent disturbances, such as hurricanes or floods, so as to retain essential structures, processes, and feedbacks. (Adger et al., 2005, Global Environmental Change)

## RESOURCEFULNESS

the capacity to identify problems, establish priorities, and mobilize resources when conditions exist that threaten to disrupt some element, system, or other unit of analysis. It also consists of the ability to apply human and material resources in order to address priorities and achieve goals. This would include a multi-faceted skill set, including abilities that enable thorough preparation, such as comprehensiveness and detail-orientation, survival, such as quick decision-making and resourcefulness; and rapid recovery, such as innovation and diligence. (The Center for Climate Strategies)

## RESTORATION

the act of altering an area in such a way as to reestablish an ecosystem's structure and function, ideally returning it to the pre-disturbance state. If returning an ecosystem to its original state is impossible or impractical, remediation or mitigation actions can often be undertaken instead. (U.S. National Park Service; Urbanska et al., 1997)

## RETENTION

the indefinite storage of stormwater in a structure or landscape. (Harris County Flood Control District)

## RETENTION BASIN

a basin, or pond, used for the storage and treatment of stormwater with a permanent pool of water (with the exception of water lost to evaporation and the volume absorbed into the soils). Retention basins treat incoming stormwater runoff by allowing particles to settle and algae to take in nutrients. Can be designed with drainage features (see also: wet detention pond); and is a commonly used best management practice in

suburban and rural areas. (U.S. Environmental Protection Agency)

## REZONING

an act of the local legislature that changes the principal uses permitted on one or more parcels of land or throughout one or more zoning districts. Rezoning includes the amendment of the zoning map and of the use provisions in the district regulations applicable to the land that is rezoned. (Pace University School of Law)

## RIGHT OF WAY

a strip or parcel of land over which a public road, power line, railway line, or similar type of infrastructure passes. In terms of infrastructure, a right of way requires full ownership of the land, unlike an easement. The width of a right of way varies from road to road and usually includes the width of the pavement including curb & gutter and an additional 10-20 feet for the roadway shoulder. A pipeline right-of-way is a strip of land over and around pipelines where some of the property owner's legal rights have been granted to a pipeline company. (Cobb County, Georgia Dept. of Transportation)

## RIPARIAN AREA (RIPARIAN CORRIDOR)

the vegetated ecosystems along a water body through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## RISK

probabilistic in nature, relating either to (i) the probability of occurrence of a hazard that acts to trigger a disaster or series of events with an undesirable outcome, or (ii) the probability of a disaster or outcome, combining the probability of the hazard event with a consideration of the likely consequences of the hazard. (Adger et al., 2004, Tyndall Centre for Climate Change Research)

## ROBUSTNESS

the strength or ability of elements, systems, and other units of analysis to withstand a given level of

stress or demand without suffering degradation or loss of function. (The Center for Climate Strategies)

## RUNOFF

the portion of precipitation, snow melt, or irrigation that flows over the land surface and appears in uncontrolled surface streams, rivers, drains or sewers. Runoff may be classified according to speed of appearance after rainfall or melting snow as direct runoff or base runoff, as well as according to source, such as surface runoff, storm interflow, or groundwater runoff. Can also refer to the total discharge described above during a specified period of time. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division; U.S. Geological Survey)

## S

## SALINE WATER

water that contains significant amounts of dissolved solids, usually salts. Many organisms can only survive within a particular salinity range; therefore, the intrusion of sea water into freshwater wetlands or the diversion of river water into salt marshes can significantly change the ecology of an area. USGS parameters for salinity specify fresh water as having less than 1 ppt of dissolved salts, slightly saline water as 1-3 ppt, moderately saline water as 3-10 ppt, and highly saline water as 10-35 ppt, although exact ranges can vary. (U.S. Geological Survey)

## SALT MARSH

the low area adjacent to the sea that is covered with salt-tolerant vegetation and that is regularly flooded by high tides; includes similar inland areas near saline springs or lakes, although these may not be regularly flooded. The principal plant species of Louisiana salt marshes is Oyster Grass (*Spartina alterniflora*), with very few other species, such as Black Mangrove. Animal biodiversity is also very limited but includes economically important shellfish, such as crabs and oysters (America's Wetlands Foundations). Most coastal salt marshes are classified as polyhaline, having a salinity range of 18-30 ppt. (U.S. Fish and Wildlife Service)

## SEA WATER (OCEAN WATER)

the water found in open seas and oceans. The average salinity of open ocean water is 35 ppt, but ranges between 33 ppt and 38 ppt across the globe. Outside forces, such as rivers or melting glaciers, may decrease the salinity of sea water. High rates of evaporation, lack of freshwater inputs, or physical enclosure may cause the salinity of sea water to be higher (e.g. the Red Sea and Dead Sea). (U.S. Geological Survey)

## SEDIMENT

the material, both mineral and organic, in suspension in water or recently deposited from suspension. In the plural, the term is applied to all kinds of deposits from the waters of streams, lakes, rivers, or seas, such as particulates, rocks, rock fragments, soil, etc. (U.S. Geological Survey)

## SEDIMENT LOAD

all the material (sediment) in suspension and/or in transport in a stream or river. (Minnesota Dept. of Natural Resources)

## SEDIMENTATION

the deposition and compaction of sediments, which occurs when water movement slows or ceases allowing for sediments to settle on the bed of the water body. Sedimentation is an essential process in Louisiana's wetlands, as it builds lands and combats subsidence, sea-level rise, and erosion. The accretion of sediments as a result of deposition after floods allows the elevation of land to increase (or remain constant) despite the forces that often lead to land loss. (Minnesota Dept. of Natural Resources)

## SENSITIVITY

the degree to which a system is modified or affected, either adversely or beneficially, by a disturbance or perturbation. Sensitivity often refers to the impacts of climate change on a community or ecosystem, but is not limited to climate science. (Adger, 2006, *Global Environmental Change; Economy and Environment Program for Southeast Asia*)

## SEPTIC TANK

a tank used to detain domestic waste to allow the settling and treatment of solids prior to distri-

bution to a leach field for soil absorption. Septic tanks are used when a sewer line is not available to carry wastewater to a treatment plant. Many municipalities lack strong regulations for septic tanks; therefore, poorly maintained septic tanks are often a source of water pollution. (U.S. Geological Survey)

## SEWER TREATMENT PLANT

a facility designed to receive the wastewater from domestic and commercial sources, and to remove materials that reduce water quality and threaten public and environmental health when discharged into receiving streams or bodies of water. (U.S. Geological Survey)

## SITE PLAN

a map and all necessary supporting material showing the proposed development and use of a single parcel of land. (Pace University School of Law)

## SMARTCODE

a model form-based unified land development ordinance for planning and urban design. Developed by Duany Plater-Zyberk & Company and available as an open-source document online, SmartCode folds zoning, subdivision regulations, urban design, and optional architectural standards into one compact document which can be customized to fit a community's vision. It does not, however, replace a community's building code (SmartCode Complete). The SmartCode replaces traditional use-based zoning districts with six Transect Zones (T-Zones) ranging from rural to urban, which vary by the ratio and level of intensity of their natural, built, and social components. The goal of the SmartCode is to provide an alternative to traditional land use controls and to provide a tool for creating good neighborhood structure that incorporates walkable streets, mixed use development, and diverse transportation and housing options. (Center for Applied Transect Studies)

## SMART GROWTH

a set of policies and programs design to protect, preserve, and economically develop established communities and valuable natural and cultural resources (FHWA,2012). Ten basic principles of Smart Growth include: 1) mixed land uses; 2)

compact building design; 3) a range of housing opportunities and choices; 4) walkable neighborhoods; 5) distinctive, attractive communities with a strong sense of place; 6) open space, farmland, natural beauty, and critical environmental areas; 7) development concentrated in existing communities; 8) a variety of transportation choices; 9) development decisions that are predictable, fair, and cost effective; and 10) community and stakeholder collaboration in development decisions. (U.S. Environmental Protection Agency; U.S. Dept. of Transportation Federal Highway Administration)

## SPECIAL FLOOD HAZARD AREA (SFHA)

land areas that are at high risk of flooding. These areas are indicated on Flood Insurance Rate Maps (FIRMs) as land areas that would be inundated by a base flood (the 100-year flood or 1% chance annual flood) and, thus, where floodplain management regulations and mandatory flood insurance apply. A structure located within an SFHA has a 26 percent chance of suffering flood damage during the term of a 30-year mortgage. (Federal Emergency Management Agency)

## SPRAWL (URBAN SPRAWL)

a type of development pattern whereby rural land is quickly converted to urban use to house new residents and support new businesses, resulting in an inefficient use of infrastructure. Sprawl is characterized as urbanized residential and commercial development radiating outward from a city center that includes a large acreage of low-density residential development, rigid separation between residential and commercial uses, minimal support for non-motorized transportation methods, and a lack of integrated transportation and land use planning. Problems associated with sprawl include: long commutes, loss of community identity, degradation of environmental resources, loss of open space and rural character, increased stormwater runoff, lack of coordinated planning for infrastructure (discontinuous and disjointed streets and sidewalks), overwhelmed public services and utilities, lack of affordability and accessibility, and increased traffic congestion. (Kendig Keast Collaborative & T. Baker Smith/LJC Poole; Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## SOCIAL-ECOLOGICAL SYSTEM

an integrated system in which the dynamics of the social and ecosystem domains are strongly linked and of equal weight. (Resilience Alliance)

## STAKEHOLDER

a person or group either perceiving to be or actually affected by a plan, program, or project; can also be defined as residents of affected geographical areas. (U.S. Dept. of Transportation Federal Highway Administration)

## STORMWATER

the water from precipitation and snowmelt events. The term “stormwater” often implies “stormwater runoff,” which is generated when precipitation flows over land or impervious surfaces and does not percolate into the ground. In the process of flowing over the land or impervious surfaces, stormwater can accumulate debris, chemicals, sediment, or other pollutants that can adversely affect water quality if the runoff is discharged into streams or lakes untreated. (U.S. Environmental Protection Agency)

## STRESS

the conditions resulting from any environmental change, natural or man-made, that disturbs the normal functioning of an organism or community to such an extent that its chances for survival are reduced. (U.S. Environmental Protection Agency)

## STRUCTURAL MEASURES

physical, engineering-based approaches for flood control (see: hazard mitigation, nonstructural measures). Examples of structural measures include dams and reservoirs; dikes, levees and floodwalls; channel alterations; high flow diversions and spillways; and land treatment measures. (Louisiana Sea Grant Law and Policy Program)

## SUBDIVISION

the process of the legal division of a parcel into a number of lots, along with roads, open space, and utilities, for the purpose of development and sale or lease. The subdivision process and development of individual parcels must conform to the provisions of local zoning and subdivision regulations. (Pace University School of Law;

Prince George’s County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## SUBSIDENCE

the process of sinking or downward displacement of a land surface relative to its standard position. Subsidence occurs due to natural or artificial (i.e. anthropogenic) causes, including (1) tectonic processes related to the structure and evolution of the underlying lithosphere, (2) sediment compaction due to physical, biological, and chemical processes, (3) sediment loading, (4) glacial isostatic adjustment, (5) subsurface fluid (i.e. oil, water) withdrawal, and (6) surface water drainage and management. In Louisiana, natural subsidence occurs as floods begin to dry out and deposit sediment. Under natural conditions, subsidence is often balanced by the deposition of new sediment with each flood event. Because of flood controls, however, subsidence continues without sediment re-nourishment. Dredging, erosion, and sea level change have also contributed to subsidence in Louisiana. (America’s Wetlands Foundation)

## SUBSTANTIAL DAMAGE

damage of any origin sustained by a structure whereby the cost of restoring the structure to its pre-damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred. The market value of the structure does not include the value of the land the structure stands upon or any improvements to the land, such as swimming pools or paving. The costs include all structural, labor, and finish costs, including owner’s labor, and appliances, lighting, carpeting, cabinets, tile, and any required demolition. (Federal Emergency Management Agency; Louisiana Sea Grant Law and Policy Program)

## SUBSTRATE

the bottom material of a waterway; the base or substance upon which an organism is growing. The substrate may simply provide structural support or water and nutrients. A substrate may be inorganic, such as rocks and soils, or it may be organic, such as woody materials. (U.S. Environmental Protection Agency)

## SUSTAINABLE DEVELOPMENT

development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This type of development additionally aims to create and maintain prosperous social, economic, and ecological systems. (Folk et al., 2002, Ambio)

## SUSTAINABILITY

as defined in the Louisiana Revised Statute 38:3097.2.11, development and use of groundwater (or any natural resource) in a manner that can be maintained for the present and future without causing unacceptable environmental, economic, social, or health consequences. (Louisiana State Legislature)

## SWALE

an open drainage channel designed to detain or infiltrate stormwater runoff. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

## SWAMP

any wetland dominated by woody plants, characterized by saturated soils during the growing season and standing water during certain times of the year. The two major classes include forested swamps and shrub swamps. Examples of common forested swamp communities in Louisiana include cypress-tupelo swamps; bottomland hardwood forests, which are only flooded periodically; shrub marshes, which do not have large trees and may occur in freshwater or saltwater environments; and mangroves, which are saltwater swamps. (America's Wetlands Foundation; U.S. Environmental Protection Agency; U.S. Geological Survey)

# T

## TAX INCREMENT FINANCING (TIF)

a finance mechanism which enables local government to collect the property tax revenue attributable to increased assessed value resulting from new investments within a designated area (TIF district). Once a TIF district is established the property tax revenue attributable to new assessed

value within the district accrues to the redevelopment district rather than the traditional taxing units (schools, civil city, township, county etc). The new revenue can be used to pay for infrastructure or other improvements within the designated area. Typically, TIF revenue is used to retire debt incurred to fund infrastructure or other improvements but it has also been used on a cash basis. While the majority of TIF districts incur debt, many communities have used any additional TIF revenue beyond that necessary for bond service to make further infrastructure investment in the TIF district. (State of Indiana, Dept. of Transportation)

## TIDE

the alternate rising and falling of water levels, which occurs twice each lunar day, due to the gravitational attraction of the moon and sun in conjunction with the earth's rotational force. (U.S. Environmental Protection Agency)

## TOLERANCE (ECOLOGY)

the relative capability of an organism adapt to an unfavorable environmental factor or condition. (U.S. Environmental Protection Agency)

## TOLERANCE RANGE

the range of one or more environmental conditions within which an organism or species can function and survive. (U.S. Environmental Protection Agency)

## TRANSFER OF DEVELOPMENT RIGHTS (TDR)

provisions in a zoning law that allow for the purchase of the right to develop land located in a sending area and the transfer or sale of those rights to land located in a receiving area. (Pace University School of Law)

## TRANSFORMABILITY

the capacity to create a fundamentally new system when ecological, social, and/or economic conditions make the existing system untenable. (Walker et al., 2004, Ecology and Society)



## TRANSPORTATION

### IMPROVEMENT PLAN (TIP)

the regionally agreed upon list of priority transportation projects, as required by federal law (ISTEA, TEA-21, SAFETEA LU). Created by a region's Metropolitan Planning Organization (MPO), the TIP document must list all projects that intend to use federal funds, along with all non-federally funded projects that are regionally significant. The TIP can also include state-funded capital projects. The transportation projects in the TIP are multi-modal; that is, they include bicycle, pedestrian, ITS, and freight related projects, as well as the more traditional highway and public transit projects. (Delaware Valley Regional Planning Commission; Southwestern Pennsylvania Commission)

## U

### UNIFIED DEVELOPMENT CODE (UDC)

a single legal document that includes all development-related regulations, including zoning and subdivision regulation, for a municipality. (U.S. Environmental Protection Agency)

### URBANIZATION

the change of land use from rural characteristics to urban (city-like) characteristics (Prince George's County, MD Department of Environmental Resources, 1999); a process whereby an increasing proportion of a population lives and becomes concentrated in relatively small areas. (Organisation for Economic Co-Operation and Development)

## V

### VISIONING

a variety of techniques that can be used to identify goals. (U.S. Dept. of Transportation Federal Highway Administration)

## VULNERABILITY

the degree to which a system is susceptible to, or unable to cope with, the impact of disturbances (natural, social, or economic). Vulnerability is a function of the character, magnitude, and rate of the disturbance to which a system is exposed and the system's sensitivity and adaptive capacity. (McCarthy et al., 2001, Cambridge University Press)

## W

### WATERSHED

an area of land that drains all the streams and rainfall incidents upon it to a common outlet (stream or river), mouth of a bay, or to any point along a stream channel (lake, pond). The watershed consists of surface water-lakes, streams, reservoirs, and wetlands-and all the underlying groundwater. The term is sometimes used interchangeably with drainage basin, river basin, or catchment area. Generally, watershed, catchment, and drainage area are used for small streams and rivers, while drainage basin and river basin are used for large river systems with numerous sub-watersheds or sub-catchments nested within it. Large watersheds may contain many smaller watersheds. (U.S. Geological Survey; U.S. National Park Service)

### WET DETENTION POND

a pond that consists of a permanent pool of water into which stormwater runoff is directed. Runoff from each rain event is detained and treated in the pond until displaced by runoff from the next storm. Drainage structures, such as pipes and spillways, are included in the design of wet detention ponds. By capturing and retaining runoff, wet detention ponds control both stormwater quantity and quality, and thus are considered a commonly used stormwater management best practice. The pond's natural physical, biological, and chemical processes work to remove pollutants. Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake. (U.S. Environmental Protection Agency)

## WETLANDS

the transitional lands between terrestrial and aquatic ecosystems where the water table is usually at or near the surface, or the land is permanently or periodically covered by shallow water (USFWS, 1979). Wetlands may be dominated by fresh, intermediate, brackish, or salt waters and can be found in inland, riverine, estuarine, and coastal environments. Swamps, marshes, and mangroves are types of wetlands found in Louisiana. Wetlands provide numerous benefits for human and environmental health and property (see also: ecosystem services, lines of defense). Generally, wetlands are protected and regulated by federal, state, or local laws. (U.S. National Park Service; Pace University School of Law)

## Z

### ZONING

regulations that govern the use, placement, spacing, and size of land and buildings within a specific area. Zoning regulations include a map and descriptive text components. (Prince George's County, Maryland Dept. of Environmental Resources, Programs and Planning Division)

### ZONING ENFORCEMENT OFFICER (CODE ENFORCEMENT OFFICER)

the local administrative official who is responsible for enforcing and interpreting the zoning law. Land use applications are submitted to the zoning enforcement officer, who then determines whether proposals are in conformance with the use and dimensional requirements of the zoning law. (Pace University School of Law)

### ZONING MAP

a map implemented through the zoning text that constitutes a blueprint for the development of the community over time. It is approved by the local legislature as part of the zoning ordinance. On this map, the zoning district lines are overlaid on a street map of the community. The map divides the community into districts. Each district will carry a designation that refers to the zoning code regulations for that district. By referring to the map, it is possible to identify the use district within which any parcel of land is located. By referring

to the text of the zoning code, it is possible to discover the uses that are permitted within that district and the dimensional restrictions that apply for building on that land. (Pace University School of Law)



