

**RESILIENCE: LIVING WITH WATER AND NATURAL HAZARDS**

<b>GOAL</b>	<b>POLICIES FOR DECISION MAKERS</b>	<b>FOR MORE INFORMATION, SEE PAGE:</b>
<b>1</b> <i>A holistic community standard of resilience from flooding and other hazards</i>	1.A. Create an effective community process and collaboration with the Army Corps of Engineers, regional stakeholders, and the state to have a dialogue about storm probabilities, risk, protection levels, and hazard mitigation options in order to reach a community consensus on resilience standards.	12.8
	1.B. Advocate for a minimum 500 year flood protection level and comprehensive coastal wetlands restoration.	12.9
	1.C. Expand the coordination and implementation of coastal restoration efforts in Orleans Parish.	12.10
	1.D. Develop a Storm water Management Plan that will provide technical expertise, identify best management practices and establish minimum requirements to control the adverse effects of storm water runoff for all new development and capital improvements.	12.12
<b>2</b> <i>A resilient city working toward a future in which evacuation would rarely be necessary</i>	2.A. Create an Office of Coastal and Environmental Affairs by expanding the current agency and strengthen hazard mitigation and floodplain management capacity.	12.17
	2.B. Adapt building regulations to respond to hazard risks.	12.18
	2.C. Adopt regulations to make new development hazard resistant and resilient.	12.18
	2.D. Secure additional funding to assist property owners with costs of flood and storm proofing.	12.19
	2.E. The 2010 Hazard Mitigation Plan Update, including all future updates, shall be utilized in concert with the Master Plan with regards to hazard mitigation planning.	12.20

## FINDINGS

- New Orleans has always faced the risk of flooding from three sources: the Mississippi River, heavy rains, and hurricane storm surge.
- Hurricane storm surge poses the greatest threat of catastrophic flooding in New Orleans.
- Risk of flood damage has been modulated by several factors: increased structural flood protection in the form of flood gates and levees; increased development in low-lying, vulnerable areas; soil subsidence; and coastal erosion.
- Global sea level rise and the risk of stronger, more frequent hurricanes as a result of global warming may also be contributing to increased risk.
- The Army Corps of Engineers, in coordination with local levee districts, is upgrading the region’s hurricane protection system to withstand a “1-in-100-year” storm by 2011. This is less protection than was promised after Hurricane Betsy.
- The Dutch provide a 1-in-10,000-year level of protection for high-density urban areas, 1-in-4,000-year level of protection for medium-density areas, and 1-in-2,500-year level for rural areas.
- Significant funds have been appropriated to implement coastal restoration and urban mitigation projects, but more is required.
- The city has established a professional hazard mitigation unit in the Office of Homeland Security and Emergency Preparedness and it is updating its Hazard Mitigation Plan in 2009.

## CHALLENGES

- Raising public awareness about the realities of environmental hazards, probability, risk and mitigation options after 40 years of reliance on external levees as a guarantee of protection.
- Completing the 100-year flood protection system by 2011, given the scale of the needed improvements.
- Securing additional funding for more robust storm surge protection beyond a 1-in-100-year level of protection.
- Securing adequate funding on an accelerated basis for further coastal restoration efforts.
- Implementing citywide flood elevation, land use, and building requirements appropriate to different parts of the city to establish a higher overall level of community resilience.
- Addressing the increased cost of retrofitting structures and building new structures to be more resilient to flooding.
- Balancing expedient building and re-building practices against the city’s long term security.
- Retrofitting the city’s drainage infrastructure to improve water management practices and to better incorporate water into the urban landscape.
- Coordination between local, state, and federal efforts to make the city more resilient.

### Acronyms

To aid in reading this section, below is a list of acronyms used within the text:

<b>CAO</b>	Chief Administrative Officer	<b>NORA</b>	New Orleans Redevelopment Authority
<b>CPC</b>	City Planning Commission	<b>EPA</b>	U.S. Environmental Protection Agency
<b>FEMA</b>	Federal Emergency Management Agency	<b>CZO</b>	Comprehensive Zoning Ordinance
<b>GIS</b>	Geographic Information Systems	<b>DFIRM</b>	Digital Flood Insurance Rate Map
<b>ACE</b>	Army Corps of Engineers	<b>IPET</b>	Interagency Performance Evaluation Task Force
<b>LACPR or CPRA</b>	Louisiana Coastal Protection and Restoration Authority	<b>DNR</b>	Louisiana Department of Natural Resources
		<b>ABFE</b>	Advisory Base Flood Elevation

## **A** Introduction

**N**ew Orleans has always depended for its existence and prosperity on its location in a place prone to storms, floods, and other natural challenges. Understanding and managing risks to secure opportunity and value was critical to the city's growth and cultural development, allowing it to become one of the world's great cities. Hazard mitigation is legally defined as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards." To be effective, hazard mitigation must be targeted to all classes and types of hazards and it must be comprehensive in its approach, integrated in its implementation, and mindful of the community interests it wants to protect or enhance. In the 21st century, the language of hazard mitigation is coupled with the concept of "resilience." Resilience is shown by a community's ability to anticipate hazards, to reduce overall vulnerability, and to respond and recover from hazard events. In addition, resilient communities also need to be able to learn and adapt to changing conditions and risks.

The Master Plan focuses especially on storm and flood hazards, as the most significant facing New Orleans. The City has begun to develop its own expertise on hazard mitigation and resilience and must expand this capacity. Technical expertise within city government must be combined with broad community dialogue and understanding about probabilities, managing risks, and the interrelated responsibilities of individual households, city government, and state and federal governments.

# A Implementation Strategies

A recommendations **Summary** linking goals, strategies and actions appears below and is followed by one or more early-action items under the heading **Getting Started**. The **Narrative** follows, providing a detailed description of how the strategies and actions further the goals. Background and existing conditions discussion to inform understanding of the goals, policies, strategies and actions are included in Volume 3, Chapter 12.

## Summary

**FIRST FIVE YEARS:** 2010–2014    **MEDIUM TERM:** 2015–2019    **LONG TERM:** 2020–2030

GOAL	RECOMMENDED STRATEGY	RECOMMENDED ACTIONS				
		HOW	WHO	WHEN	RESOURCES	FOR MORE INFORMATION SEE PAGE:
1. Holistic community standards of resilience from hurricanes and other hazards	1.A. Create an effective community process and collaboration with the Army Corps of Engineers, regional stakeholders, and the state to have a dialogue about storm probabilities, risk, protection levels, and hazard mitigation options in order to reach a community consensus on resilience standards.	1. In conjunction with the Corps of Engineers and the Coastal Protection and Restoration Authority (CPRA), devise appropriate standards for public building, neighborhood and infrastructure resilience.	Updated Hazard Mitigation Plan; Hazard Mitigation Unit; CPC; Safety and Permits; CAO's office	First five years	Federal funds (FEMA grants)	12.8
		2. Account for climate change and anticipated global sea level rise in adopting standards and techniques to meet new community standards for resilience.	Updated Hazard Mitigation Plan; Hazard Mitigation Unit; Coastal and Environmental Affairs	First five years	FEMA grants	12.8
	1.B. Advocate for a minimum 500-year flood protection level and comprehensive coastal wetlands restoration.	1. Coordinate with the Corps of Engineers and local levee boards to promote the completion of 100-year protection by 2011.	City and state leadership; Coastal and Environmental Affairs; Hazard Mitigation Unit	First five years	Staff time	12.9
		2. Advocate for funding and the expeditious implementation of flood protection system that can with stand a 500 year storm or stronger event.	City and state leadership	First five years	Staff time	12.9
		3. Advocate for increased state and federal funding and strengthened regulatory policies to bolster regional coastal restoration efforts.	City and State leadership	First five years	Staff time	12.9
		4. Support and strengthen the Office of Coastal and Environmental Affairs' current efforts to improve efficiency and sustainability.	Office of Coastal and Environmental Affairs, City departments	First five years	Staff time	12.10

**FIRST FIVE YEARS:** 2010–2014    **MEDIUM TERM:** 2015–2019    **LONG TERM:** 2020–2030

GOAL	RECOMMENDED STRATEGY	RECOMMENDED ACTIONS				
		HOW	WHO	WHEN	RESOURCES	FOR MORE INFORMATION SEE PAGE:
1. Holistic community standards of resilience from hurricanes and other hazards	1.C. Expand the coordination and implementation of coastal restoration efforts in Orleans Parish.	1. Improve coordination in coastal restoration matters between the City of New Orleans and other state, local and federal agencies	Coastal and Environmental affairs	First five years	Staff time	12.10
		2. Secure funding for and support the implementation of locally driven coastal restoration efforts.	Coastal and Environmental affairs	First five years	Federal, state, or nonprofit funds	12.10
		3. Secure funding for and support the implementation of innovative, locally driven wetlands restoration projects, such as the Wetland Assimilation Project currently directed by the Sewerage and Water Board.	Coastal and Environmental Affairs; Office of Technology; Louisiana Coastal Wetlands and Restoration Task Force	First five years	Staff time	12.11
		4. With the assistance of NORA, facilitate the acquisition of paper subdivisions in undeveloped areas to assemble land for conservation and coastal restoration projects.	Coastal and Environmental Affairs; Office of Technology; CPC; NORA	Medium term	State coastal restoration funds	12.11
		5. Include in the city's property database a legal inventory of property and parcel boundaries outside of the hurricane protection system in Orleans Parish.	Assessor's office; Conveyances; CNOGIS	First five years	Staff time	12.12
		6. Ensure consistency between the CPRA plan, the Bayou Sauvage Master Plan, the City's Master Plan and land use regulation.	CPC, CPRA, Coastal and Environmental Affairs	First five years	Staff time	12.12
		7. Update the Coastal Management Plan.	Office of Coastal and Environmental Affairs	First five years	Grants	12.12
		8. Create a new local wetlands protection ordinance.	Coastal and Environmental Affairs; City Council	First five years	Staff time	12.12
		9. Create an improved inventory of wetlands in Orleans Parish to inform land use policies and coastal restoration efforts.	Coastal and Environmental Affairs	First five years	Staff time; state coastal restoration funds	12.13

**FIRST FIVE YEARS:** 2010–2014    **MEDIUM TERM:** 2015–2019    **LONG TERM:** 2020–2030

GOAL	RECOMMENDED STRATEGY	RECOMMENDED ACTIONS				
		HOW	WHO	WHEN	RESOURCES	FOR MORE INFORMATION SEE PAGE:
1. Holistic community standards of resilience from hurricanes and other hazards	1.D. Develop a Storm water Management Plan that will provide technical expertise, identify best management practices, and establish minimum requirements to control the adverse effects of storm water runoff for all new development and capital improvements.	1. Convene a working group of city agencies to coauthor the storm water management plan.	CPC; DPW; SW&B; Parks and Parkways; DS&P; Office of Coastal and Environmental Affairs	First five years	Federal grants (FEMA; EPA); bond funds	12.13
		2. Establish storm water management best practices in design and construction of public buildings, including pervious materials and green roofs.	CAO's office; Project Delivery Unit	First five years	Recovery funds; capital funds	12.13
		3. Create a storm water management unit in the Sewerage and Water Board.	S&WB	First five years	Staff time	12.13
		4. Retrofit parks, playgrounds, and neutral grounds to function as storm water retention and ground water filtration infrastructure.	Parks and Parkways	Medium term	EPA storm water management grants	12.14
		5. Replace most lawn areas in neutral grounds and street swales with shrubs and ground cover.	Parks and Parkways	Medium term	EPA storm water management grants	12.14
		6. Examine the feasibility of utilizing the Mississippi River as a potential source for managing groundwater levels and reducing subsidence.	S&WB	Medium term	Federal Grant	12.14
		7. Incorporate natural drainage systems, create rain gardens and small scale water management infrastructure to reduce runoff and increase the permeability of the urban landscape.	S&WB; DPW; Parks and Parkways	First five years	Staff time	12.14
		8. Retrofit existing public buildings and design new public buildings to include storm water management infrastructure to reduce runoff and increase the permeability of the urban landscape.	CAO; Property Management	Medium term	Capital funds	12.14
		9. Determine the feasibility and cost of retrofitting drainage canals into landscape amenities ("blueways") that are accessible to adjacent neighborhoods.	Levee District	First five years	Levee District revenues	12.16
		10. Advocate that the Corps provide full pumping capacity for the city's out fall canals at the proposed flood gates near Lake Pontchartrain.	Army Corps of Engineers	First five years	Federal funds	12.16
		11. Modify zoning and subdivision regulations to encourage on-site storage and filtration of storm water.	CPC	First five years	CZO rewrite project	12.16

**FIRST FIVE YEARS: 2010–2014**

**MEDIUM TERM: 2015–2019**

**LONG TERM: 2020–2030**

GOAL	RECOMMENDED STRATEGY	RECOMMENDED ACTIONS				
		HOW	WHO	WHEN	RESOURCES	FOR MORE INFORMATION SEE PAGE:
2. A resilient city working towards a future in which evacuation would rarely be necessary	2.A. Continue to support and strengthen the city's Office of Coastal and Environmental Affairs relationship with Hazard Mitigation Division of Office of Homeland Security and Emergency Preparedness in order to improve the city's participation in various flood protection and hazard mitigation efforts.*	1. Expand the responsibilities, staffing and funding of the city's Coastal and Environmental Affairs agency to serve as the central policy development office for the city's resilience and other environmental strategies.	Mayor's Office	First five years	General fund; state and federal grants	12.17
		2. Support and strengthen the city's professional Hazard Mitigation Unit.	Mayor's Office; CAO	First five years	General fund; FEMA grants	12.17
		3. Continue to support and strengthen the City's Office of Coastal and Environmental Affairs relationship with the Hazard Mitigation Division of the Office of Homeland Security and Emergency Preparedness	Mayor's Office; CAO	Ongoing	General fund; FEMA grants, State and Federal Grants, cooperative endeavor	12.18
		4. Strengthen the city's floodplain management capacity in the Department of Safety and Permits.	Mayor's Office; CAO	First five years	General fund; FEMA grants	12.18
	2.B. Adapt building regulations to respond to hazard risks.	1. Design new public facilities and retrofit existing facilities to make them hardened and resilient to wind and flooding.	CAO's office; Project Delivery Unit	First five years	Recovery funds; capital funds	12.18
		2. "Harden" existing critical, public facilities against possible storm damage.	CAO	First five years	Capital Funds	12.18
		3. Ensure that new public facilities are built with flood and wind resilience incorporated into their design and construction.	CAO	First five years	Capital Funds	12.18
	2.C. Adopt regulations to make new development hazard resistant and resilient.	1. Continue to work with FEMA to ensure that DFIRM requirements after 100-year protection is complete accurately reflect risk.	Hazard Mitigation Unit;	First five years	FEMA grants	12.18
		2. Subject to analysis, supplement DFIRM requirements with more stringent local mandates, where appropriate.	Hazard Mitigation Unit; Safety and Permits; CPC	First five years	FEMA grants; staff time	12.19
	2.D. Secure additional funding to assist property owners with costs of flood and storm proofing.	1. Address the cost gaps and programmatic difficulties in existing programs to support building elevations.	Hazard Mitigation Unit	First five years	FEMA grants	12.19
	2.E. Utilize the "2010 Hazard Mitigation Plan Update" and all future updates in concert with the Master Plan with regard to hazard mitigation planning.	1. Utilize the "Orleans Parish 2010 Hazard Mitigation Plan Update" in the appendix of the Master Plan.	Office of Homeland Security & Emergency Preparedness – Hazard Mitigation; City departments	Ongoing	Staff time	12.20

## Getting Started

This item is a short-term action that will help lay the groundwork for the longer-term actions that follow.

- Ensure that the community education program accompanying the Hazard Mitigation Plan Update is a comprehensive community conversation about storm probabilities, risk levels, building standards, and land use practices, with information on specific ways that individual households can manage their risk, and prepare a continuing community outreach and media program after the update is complete.

## Narrative

Below is a more detailed narrative of the various goals, strategies and actions highlighted in the “Summary” chart.

### GOAL 1

## Holistic community standards of resilience from hurricanes and other hazards

### 1.A Create an effective community process and collaboration with the Army Corps of Engineers, regional stakeholders, and the state to have a dialogue about storm probabilities, risk, protection levels, and hazard mitigation options in order to reach a community consensus on resilience standards.

#### RECOMMENDED ACTIONS

1. *In conjunction with the Corps of Engineers and the Coastal Protection and Restoration Authority (CPRA), devise appropriate standards for public building, neighborhood, and infrastructure resilience.*  
**Who:** Updated Hazard Mitigation Plan; Hazard Mitigation Unit; CPC; Safety and Permits; CAO's Office  
**When:** First five years  
**Resources:** Federal funds (FEMA grants)

Through the hazard mitigation planning process (an update is underway in fall 2009), the community must have a frank discussion about the risks the city faces from multiple hazards and the hard choices, investments, and trade-offs that will necessarily accompany one standard or another. Following the National Academy of Sciences reviews, which noted that heavily populated areas need more than a 1-in-100-year standard, this Master Plan suggests aiming for a 1-in-500-year standard as the minimum level of risk the city should accept in all respects: flood control, infrastructure resilience, utility service, and the robustness of its buildings. This level of resilience can give residents, businesses, institutions, and government the confidence and security to make major investments in New Orleans' future. To achieve this goal, the city should:

- > *Ensure that there is adequate education and outreach to the public about current risk levels from hurricanes and other hazards.* This process has begun through the Hazard Mitigation Plan Update.
  - > *Develop clearly articulated aims for revised building standards, building techniques, community facilities investments, and land use practices to reflect the new community standard for resilience.*
2. *Account for climate change and anticipated global sea level rise in adopting standards and techniques to meet new community standards for resilience.*  
**Who:** Updated Hazard Mitigation Plan; Hazard Mitigation Unit; Office of Coastal and Environmental Affairs  
**When:** First five years  
**Resources:** Federal funds (FEMA grants)

New Orleans and the state of Louisiana can begin to lead the national and even international dialogue on combating climate change. At the same time, the City, state, and federal



government need to coordinate responses to potential changes in global sea level in outlining hurricane protection, coastal restoration, and land use strategies. To the extent possible, the City should incorporate information about projected climate change impacts in adaptive resilience strategies.

### **1.B Advocate for a much higher level of flood protection and for comprehensive wetlands restoration.**

The National Academy of Sciences reviews of the IPET reports and LACPR study called for higher protection standards for dense urban areas like New Orleans and a more coordinated and comprehensive multiple lines of defense strategy.

#### **RECOMMENDED ACTIONS**

1. *Coordinate with the Corps of Engineers and local levee boards to promote the completion of 100-year flood protection by 2011.*

**Who:** City and State leadership; Hazard Mitigation Unit; Office of Coastal and Environmental Affairs

**When:** First five years

**Resources:** Staff time

The City must work to promote consistent, systematic coordination and regular project updates between the Corps of Engineers, Orleans Levee District, regional levee authorities, and city government, and so that the 2011 target is met.

2. *Advocate for funding and the expeditious implementation of flood protection system that can withstand a 500-year storm or stronger event.*

**Who:** City and State leadership

**When:** First five years

**Resources:** Staff time

A 500-year standard would provide a much greater margin for safety; and it would give residents and businesses confidence in the city's enduring safety.

- > *Advocate for the comprehensive plan and recommended priority actions that did not emerge from the Army Corps of Engineers LACPR.*

The original directive from Congress that authorized the study was for the Corps to present a unified work program of flood protection and coastal restoration improvements to protect the New Orleans Metropolitan Area from storms significantly greater than the 1-in-100-year level.

- > *Following the recommendations of the study, create a regional coalition to advocate for federal funding for the implementation of a more robust (e.g., 500-year protection or stronger) hurricane protection system, including a full range of non-structural measures.*
- > *Study feasibility of implementing a polder system to continue flooding in a storm event.*

3. *Advocate for increased state and federal funding and strengthened regulatory policies to bolster regional coastal restoration efforts.*

**Who:** City and State leadership

**When:** First five years

**Resources:** Staff time

There is consensus that increased funding, expedited review processes, and expedited implementation are needed to slow coastal land loss.

- > *Advocate for an expedited release of funds to Louisiana through the federal-state royalty agreement for offshore oil leases passed in 2007.*

The state should either borrow against this future revenue stream (to begin in 2017) or renegotiate the terms of the royalty sharing agreement with the federal government to obtain

substantially more funding for coastal restoration in the coming 10 years.

- > *Ensure that there is adequate state and federal funding and administrative support to fully implement the Louisiana Coastal Protection and Restoration Authority Master Plan<sup>1</sup> on an expedited basis.*

A long-term federal/state cost sharing agreement and funding strategy (estimated total costs range from \$30 to \$45 billion) are needed to ensure its implementation.

- > *Advocate for strengthened local, federal and state wetlands permitting procedures to limit development and invasive activities in sensitive wetlands areas.*

Current regulatory guidelines do not go far enough to enjoin activities that are widely recognized as being extremely harmful to wetlands areas. Commercial coastal activities are estimated to have disturbed nearly 9,000 acres or 14 square miles of wetlands since 1987. Permitting for private commercial activities cannot be working at cross purposes.

4. *Support and strengthen the Office of Coastal and Environmental Affairs' current efforts to improve efficiency and sustainability through cooperation with all relevant City departments.*

*Who: Office of Coastal and Environmental Affairs*

*When: First five years*

*Resources: Staff time*

## **I.C Expand the coordination and implementation of coastal restoration efforts in Orleans Parish.**

### **RECOMMENDED ACTIONS**

1. *Improve coordination in coastal restoration matters between the City of New Orleans and other state, local, and federal agencies.*

*Who: Office of Coastal and Environmental Affairs*

*When: First five years*

*Resources: Staff time*

The permitting process for development activity in a wetlands or coastal area is extremely complicated. Depending on the nature of the application, a property owner may have to go through three or more layers of approvals, including a Corps of Engineers/EPA “Section 404” review, a Coastal Use Permit review conducted by the Louisiana Department of Natural Resources (DNR), the State Department of Health and Hospitals (in Lake Catherine and Irish Bayou), and local zoning and subdivision regulations. Closer coordination and more well defined protocols would lead to more informed decisions and a more expeditious, predictable, and fair process for both developers and concerned members of the community.

- > *Establish streamlined protocols for policy coordination among the Department of Natural Resources, US Army Corps of Engineers, parish governments, and coastal zone/floodplain managers.*

2. *Secure funding for and support the implementation of locally driven coastal restoration efforts.*

- > *Identify innovative financing techniques to fund coastal restoration projects in Orleans Parish such as carbon sequestration dollars.*

*Who: Office of Coastal and Environmental Affairs*

*When: First five years*

*Resources: Federal, state or nonprofit funds*

A “cap and trade” system allowing carbon polluters to offset their emissions with carbon sequestration or mitigation projects appears to be an imminent possibility. The Obama administration has signaled its strong support for such an initiative by including anticipated

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1 The official name of the plan is Louisiana’s Comprehensive Master Plan for a Sustainable Coast, 2007

revenue from a cap and trade system in their 2010 budget proposal. Wetlands restoration projects have the potential to receive substantial funding as carbon sequestration projects. The City should work closely with the Louisiana Coastal Protection and Restoration Authority (CPRA) to identify the specific mechanism by which coastal restoration activities can become eligible and can be marketed to interested parties.

3. *Secure funding for and support the implementation of innovative, locally driven wetlands restoration projects, such as the Wetland Assimilation Project currently directed by the Sewerage and Water Board.*

*Who: Office of Coastal and Environmental Affairs; Office of Technology; Louisiana Coastal Wetlands and Restoration Task Force*

*When: First five years*

*Resources: Staff time*

There are a number of locally driven restoration projects underway, such as the Wetland Assimilation Project at Bayou Bienvenue, directed by the New Orleans Sewerage and Water Board. The city should work with the Corps of Engineers and CPRA to identify other projects that are of an appropriate scale and cost and that could be undertaken by local government. Funding sources, whether through carbon sequestration proceeds or other sources, must then be identified to facilitate their implementation.

4. *With the assistance of the New Orleans Redevelopment Authority (NORA), facilitate the acquisition of “paper subdivisions” in undeveloped area to assemble land for conservation and coastal restoration projects.*

*Who: Office of Coastal and Environmental Affairs; Office of Technology; CPC; NORA*

*When: Medium term*

*Resources: State coastal restoration funds*

So called “paper subdivisions of small lots that were created prior to modern subdivision regulations and that have never been developed—are an occasional stumbling block to coastal restoration projects. The Office of Coastal and Environmental Affairs should work closely with CPRA and with the New Orleans Redevelopment Authority to identify critical coastal restoration projects that require the assembly of these assembly and consolidation of these paper subdivisions. The City could then acquire and land bank these properties in order to facilitate restoration projects. FEMA Hazard Mitigation Grants may be a funding source.



***Berm surrounding a neighborhood park in suburban Jefferson Parish which has been re-designed to store stormwater in the event of a heavy rainfall.***



***Streetscape improvements can include bioswales, rain gardens and other features to allow for water storage and groundwater filtration.***

5. *Include in the city's property database a legal inventory of property and parcel boundaries outside of the hurricane protection system in Orleans Parish.*

**Who:** Assessor's Office; Conveyances; CNOGIS

**When:** First five years

**Resources:** Staff time

A thorough GIS property database available to all city agencies and eventually to the public is a fundamental recommendation of this Master Plan. Determining property ownership outside of the levees is frequently difficult and can be a hindrance to coastal preservation and restoration efforts.

6. *Ensure consistency between the CPRA plan, the Bayou Sauvage Master Plan, the City's Master Plan, the City's Coastal Management Plan and the City's land use regulations in coastal restoration policies, phasing, funding and recommendations.*

**Who:** CPC; CPRA; Office of Coastal and Environmental Affairs

**When:** First five years

**Resources:** Staff time

All of these documents have an important role in guiding how the city's wetlands are managed, protected, and restored. It is critical that there is consistency among all of these documents to ensure that well-meaning policies are not working at cross-purposes with outmoded regulations.

7. *Update the Coastal Management Plan.*

**Who:** Office of Coastal and Environmental Affairs

**When:** First five years

**Resources:** Grants

The City's Coastal Management Plan dates from 1985 and does not take into account the myriad changes in the city's and region's economy, land use patterns, coastal environment, and vulnerability to tropical events and the regional guidance outlined in the CPRA Master Plan of 2007.

8. *Create a new local wetlands protection ordinance that is specific to wetland areas and that reflects development constraints and challenges.*

**Who:** Office of Coastal and Environmental Affairs; City Council

**When:** First five years

**Resources:** Staff time

While both federal and state agencies can potentially be involved in permitting activities in coastal and wetlands areas, they do not have the power to supersede local land use regulations. Local ordinances, zoning and subdivision regulations represent the first defense in protecting the health of New Orleans' wetlands. Enforcement by Office of Coastal and Environmental Affairs would probably be most appropriate due to its expertise in wetlands issues, however, this should be further discussed during the creation of the ordinance.



**Unlike cities such as Amsterdam, New Orleans has for the most part hidden its drainage canals underground or behind large retaining walls, thereby missing an opportunity to create a tremendous aesthetic amenity” (Image of Amsterdam by Tracy Vierra, from Flickr creative commons)**



**Bayou St. John is a wonderful example of how water can be used as a neighborhood and recreational amenity. Drainage canals could be designed to add value to the city.**



**The ultimate location of New Orleans' drainage pumps will play a major role in determining whether the city's drainage canals can be retrofitted for recreational use.**

9. Create an improved inventory of wetlands in Orleans Parish to inform land use policies and coastal restoration efforts by working with state government, the Army Corps of Engineers and with universities in the region to compile an improved inventory and detailed digital maps of wetlands in Orleans Parish.

**Who:** Office of Coastal and Environmental Affairs

**When:** First five years

**Resources:** Staff time; state coastal restoration funds

**I.D Develop a Storm water Management Plan that will provide technical expertise, identify best management practices, and establish minimum requirements to control the adverse effects of storm water runoff for all new development and capital improvements.**

**RECOMMENDED ACTIONS**

1. Convene a working group of city agencies, including the Department of Public Works, the Sewerage and Water Board, the City Planning Commission, Parks and Parkways, the Department of Safety and Permits, and the Office of Office of Coastal and Environmental Affairs to coauthor the storm water management plan.

**Who:** CPC; DPW; SW&B; Parks and Parkways; DS&P; Office of Coastal and Environmental Affairs

**When:** First five years

**Resources:** Federal grants (FEMA; EPA); bond funds

2. Establish storm water management best practices in design and construction of public buildings, including pervious material and green roofs.

**Who:** CAO's office; Project Delivery Unit

**When:** First five years

**Resources:** Recovery funds; capital funds

Innovative storm water management techniques that rely on natural drainage can reduce the costs of hard infrastructure and mitigate flooding from rain events.

3. Create a storm water management unit in the Sewerage and Water Board.

**Who:** S&WB

**When:** First five years

**Resources:** Staff time

4. *Retrofit parks, playgrounds, and neutral grounds to function as storm water retention and groundwater filtration infrastructure.*

**Who:** Parks and Parkways

**When:** Medium term

**Resources:** EPA storm water management grants

New Orleans has a wealth of playgrounds, parks, and neutral grounds that are not incorporated into the city's storm water management system. All of these assets could be used to retain water in the event of a heavy rainstorm, and rain gardens and groundwater filtration infrastructure could be incorporated into their re-design.

5. *Replace most lawn areas in neutral grounds and street swales with shrubs and ground cover.*

**Who:** Parks and Parkways

**When:** Medium term

**Resources:** EPA storm water management grants

Storm water engineering increasingly is adapting the lessons of natural systems to controlling and filtering runoff. These techniques can be applied at any scale, from backyard rain gardens to streets and city parks. Rain gardens are small areas that are lower in elevation than their surroundings and are filled with plantings. They capture storm water from roofs and other drains and allow the water to seep into the ground. Lawns are only marginally superior to paved areas in retaining storm water, particularly when soils are compacted, so less lawn and more ground cover, shrubs and trees in the neutral grounds will help the city manage water, mitigate flooding, and reduce subsidence. This planting strategy can coexist with the use of neutral grounds for walking and bike paths. On the neighborhood streets where there are no curbs or catch basins, plantings in drainage ditches ("swales") improve storm water management by enhancing absorption of water and reducing the velocity of storm water.<sup>2</sup>

6. *Examine the feasibility of utilizing the Mississippi River as a potential source for managing groundwater levels and reducing subsidence.*

**Who:** S&WB

**When:** Medium term

**Resources:** Federal grants

The desiccation of New Orleans' soils over time is a principal reason why the city has experienced such a severe rate of subsidence. Dutch engineers and landscape architects who visited New Orleans and have suggested that the Mississippi River could potentially be used to maintain groundwater levels.

7. *Incorporate natural drainage systems, create rain gardens and small scale water management infrastructure to reduce runoff and increase the permeability of the urban landscape.*

**Who:** S&WB; DPW; Parks and Parkways

**When:** First five years

**Resources:** Federal Grant

8. *Retrofit existing public buildings and design new public buildings to include storm water management best practices including the use of pervious materials and green roofs.*

**Who:** CAO; Property Management

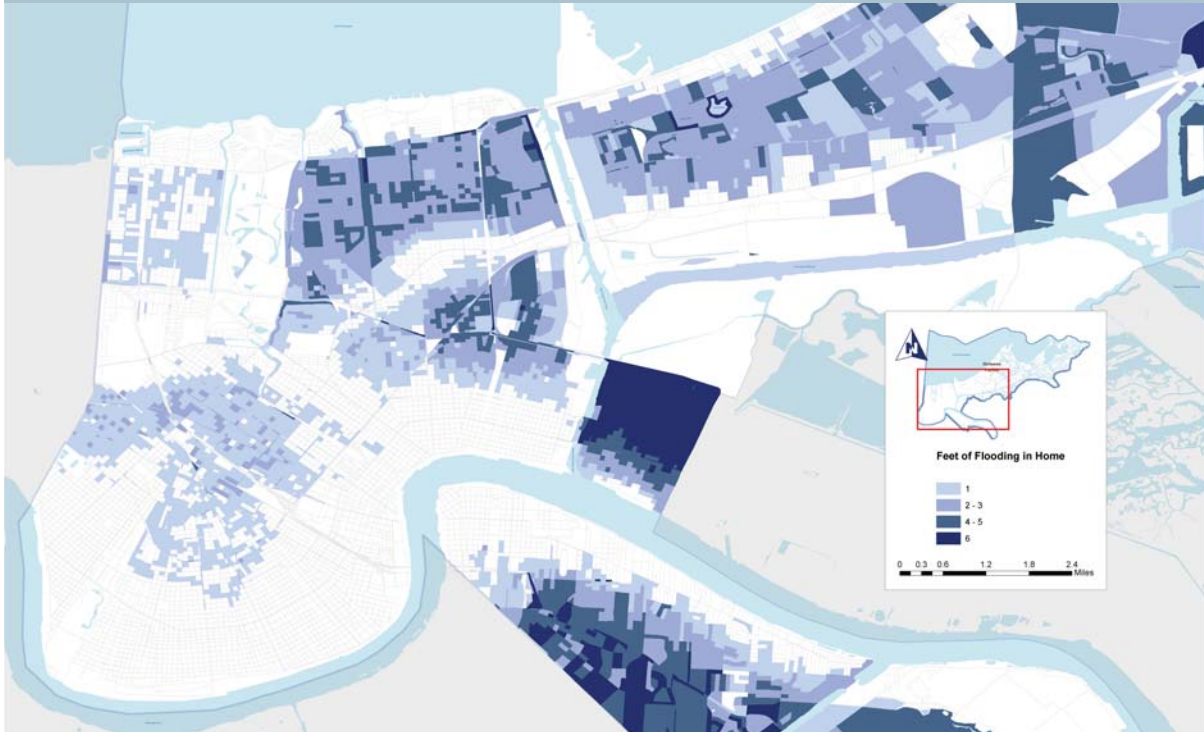
**When:** Medium term

**Resources:** Capital funds

The many new and renovated public buildings underway during recovery present tremendous opportunity for the city government, New Orleans Public Schools, and other public bodies to pursue green building practices that will retain storm water on-site rather than adding to runoff.

<sup>2</sup> See The Center for Watershed Protection, <http://www.cwp.org>

**MAP 12.1: AMOUNT OF FLOODING IN ABFE-COMPLIANT HOMES ACCORDING TO 2007 RISK OF 1-IN-100-YEAR STORM**



**MAP 12.2: AMOUNT OF FLOODING IN ABFE-COMPLIANT HOMES FROM A 1-IN-500-YEAR STORM IN 2011**



*The maps highlight those blocks that must be elevated beyond existing Advisory Base Flood Elevation (ABFE) Requirements to avoid flooding. The map on the top highlights those blocks whose houses must be elevated to avoid flooding from a 100-year storm with the current level of flood protection in place. The map on the bottom highlights the areas that will need to be elevated beyond ABFE's to avoid flooding from a 500 year storm in 2011 and thereafter.*



**Increased resilience against storms will come from both collective and individual measures. The City can advocate for increased flood protection from the Army Corps of Engineers and other federal sources while also upholding building code regulations that require individuals to raise buildings above flood levels.**

9. Determine the feasibility and cost of retrofitting drainage canals into landscape amenities (“blueways”) that are accessible to adjacent neighborhoods.

**Who:** Levee District

**When:** First five years

**Resources:** Levee District revenues

Much of the city’s drainage infrastructure is currently hidden from view. Water is whisked away into storm drains which feed sub-surface drainage canals and ultimately tie into drainage out fall canals that are hidden from view. Instead of hiding drainage infrastructure behind mammoth concrete walls, or within underground culverts, the city could “daylight” more of its drainage infrastructure, thereby creating a new component of the city’s aesthetic identity. The New Orleans East Bank Levee Board is pursuing a feasibility study.

10. Advocate that the Corps provide full pumping capacity for the city’s out fall canals at the proposed flood gates near Lake Pontchartrain, obviating the need for walled canals.

**Who:** Army Corps of Engineers

**When:** First five years

**Resources:** Federal funds

The location of the city’s pumping stations at the center of the city requires water levels and canal walls that lie substantially above adjacent streets and buildings. If the pumping stations were to be permanently relocated to the mouths of the out fall canals, a water level and overall aesthetic that is more akin to Bayou St. John would be possible. The Corps of Engineers recently released a study that recommended that, because of lower costs, the principal pumping capacity should remain at the existing pumping stations in the heart of the city and that a series of gates and supplemental pumps should be maintained at the mouths of the city’s out fall canals. City leaders are advocating that safety and aesthetic considerations favor the relocation of all pumping capacity to the mouths of the out fall canals.

11. Modify zoning and subdivision regulations to encourage on-site storage and filtration of storm water.

**Who:** CPC

**When:** First five years

**Resources:** CZO rewrite project

Aside from public buildings and public infrastructure, the other principal mechanism at the city’s disposal to manage storm water and runoff is to permit and promote storm water best practices on private property.

- > Encourage the use of green roofs, porous paving materials, and other techniques to encourage on-site storage of rainwater and to enhance groundwater filtration.

Local building code regulations and zoning regulations should be adapted to permit green roofs, cisterns, rain gardens, porous paving materials and other on-site storm water management techniques. Given the unique climatic challenges that New Orleans faces



(mosquitoes, torrential rains, searing summer temperatures, and occasional tropical events), these guidelines must be carefully crafted to account for the exigencies of local conditions. The city should also actively encourage the use of these techniques through conditions attached to the disposition of publicly owned property and the use of public development subsidies.

## GOAL 2

### A resilient city working toward a future in which evacuation would rarely be necessary

#### **2.A Continue to support and strengthen the city's Office of Coastal and Environmental Affairs relationship with Hazard Mitigation Division of Office of Homeland Security and Emergency Preparedness in order to improve the city's participation in various flood protection and hazard mitigation efforts.**

Meeting the challenge of creating a resilient New Orleans will require that the city have a strong agency that functions as the central point of expertise, information and coordination on the multiple lines of defense approach to protection from natural hazards, as well as adaptation to environmental change, and other environmental issues. The Mayor's Office of Coastal and Environmental Affairs in 2009, with responsibilities for the city's programs of coastal management, brownfields, and climate protection, has one professional and very limited funding. A number of the activities that in many cities are brought together under a department of the environment are scattered throughout many New Orleans departments. While in the long term it may prove worthwhile to bring these agencies into a strong Office of Coastal and Environmental Affairs, an enhanced Office of Coastal and Environmental Affairs is needed now to make sure that there is one place in city government where an understanding of the interrelationships of myriad activities both within and outside of city government resides. This agency would be the liaison between the city and the multiple federal, state and local entities working on environmentally related issues affecting the city, from the multiple lines of defense approach to storm protection and climate change, to waste reduction and energy efficiency. While the city's Hazard Mitigation Unit is currently located in the Office of Homeland Security and Emergency Preparedness, it may ultimately prove worthwhile to move it to an enhanced Office of Coastal and Environmental Affairs agency.

#### **RECOMMENDED ACTIONS**

1. *Expand the responsibilities, staffing and funding of the city's Office of Coastal and Environmental Affairs agency, so it can serve as the central policy development office for the city's resilience and other environmental strategies.*

**Who:** *Mayors office*

**When:** *First five years*

**Resources:** *General fund; state and federal grant*

2. *Support and strengthen the city's professional Hazard Mitigation Unit in order to assure continued planning, implementation of stormwater management strategies, and acquisition of grant funds to assist residents and other property owners to protect against environmental hazards.*

**Who:** *Mayors office; CAO*

**When:** *First five years*

**Resources:** *General fund; FEMA grants*

3. *Continue to support and strengthen the city's Office of Coastal and Environmental Affairs relationship with Hazard Mitigation Division of Office of Homeland Security and Emergency Preparedness in order to improve the city's participation in various flood protection and hazard mitigation efforts.*

**Who:** Mayor's office; CAO

**When:** Ongoing

**Resources:** General Fund, FEMA Grants, State and Federal Grants, cooperative endeavor

Although this department is the city's designated floodplain manager, until recently it had no certified floodplain management personnel (there are now 3). Staffing constraints continue to make it difficult to implement floodplain management inspections and other activities at the level to be desired.

4. *Strengthen the city's floodplain management capacity in the Department of Safety and Permits.*

**Who:** Mayor's office; CAO

**When:** First five years

**Resources:** General fund; FEMA grant

## **2.B Adapt building regulations and techniques to more accurately respond to risks from wind and flooding, including the risk of levee overtopping.**

### **RECOMMENDED ACTIONS**

1. *Design new public facilities and retrofit existing public facilities to make them resilient to wind and flooding.*

**Who:** CAO's office; Project Delivery Unit

**When:** First five years

**Resources:** FEMA grants

New Orleans has a unique opportunity to largely re-work its public infrastructure to make it much more resilient to flooding and wind damage. All public buildings should be renovated or built to a standard such that they will be able to withstand a 1-in-500-year storm after the completion of the hurricane protection system in 2011. Wind resistant materials must be used. Buildings and building systems (Heating, Ventilation, and Air Conditioning *etc.*) must be elevated to a sufficiently safe height. When building elevations are difficult or impossible, building materials and construction techniques must be employed such that the rapid recovery and use of the building is possible following a major storm event.

2. *"Harden" existing critical, public facilities against possible storm damage by elevating buildings, utilizing robust materials, installing back-up generator capacity, and protecting building systems against flooding.*

**Who:** CAO

**When:** First five years

**Resources:** Capital funds

3. *Ensure that new public facilities are built with flood and wind resilience incorporated into their design and construction.*

**Who:** CAO

**When:** Ongoing

**Resources:** Capital funds

## **2.C Ensure that sufficiently robust regulatory measures are in place to make new development and construction resilient to flooding.**

In addition to implementing higher standards for public facilities, the city must adopt and evenly enforce more stringent standards for private construction and development to ensure the city's long-term resilience. The loss of private housing and workforce is just as damaging to the

entire community as the loss of critical public facilities after a major storm. The city’s regulatory framework must be consistent with a 1-in-500-year standard for the resilience of the city.

#### **RECOMMENDED ACTIONS**

1. *Continue to work with FEMA to ensure that building elevation requirements under DFIRM maps accurately reflect the risk from hurricane and storm surge flooding.*

**Who:** Hazard Mitigation Unit

**When:** First five years

**Resources:** FEMA grants

The City has been working with FEMA on the Digital Flood Insurance Rate Map (DFIRM) process and plans to commission an independent review of the maps to be released after the 100-year protection work is complete.

2. *Subject to analysis and in accordance with agreed upon community resilience standards, supplement DFIRM requirements, where appropriate, with local “freeboard” elevation requirements to mandate greater building elevations.*

**Who:** Hazard Mitigation Unit; Safety and Permits; CPC

**When:** First five years

**Resources:** FEMA grants; staff time

The present Advisory Base Flood Elevation maps do not offer adequate protection to all areas of the city prior to the completion of the 100-year flood protection system in 2011. Based on the adjacent maps, the following areas should be considered for an additional “freeboard” requirement:

- > Algiers
- > Lower 9th Ward
- > Mid-City
- > Broadmoor
- > Hollygrove
- > Lakeview
- > New Orleans East

In some cases, an elevation requirement of only one foot above the existing Advisory Base Flood Elevations is all that would be needed to ensure an unprecedented level of flood protection in these areas. Following the completion of the 100 year hurricane protection system in 2011, the city should ensure—either through FEMA Base Flood Elevations and, if necessary, through supplemental, local freeboard requirements—that all new structures are built to a 1-in-500-year elevation.

#### **2.D Secure additional funding to assist property owners with the cost of elevating and storm proofing structures.**

##### **RECOMMENDED ACTION**

1. *Address the cost gaps and programmatic difficulties in existing programs to support building elevations.*

**Who:** Hazard Mitigation Unit

**When:** First five years

**Resources:** FEMA grants

**2.E Utilize the “2010 Hazard Mitigation Plan Update” and all future updates in concert with the Master Plan with regard to hazard mitigation planning.**

**RECOMMENDED ACTION**

1. Utilize the “Orleans Parish 2010 Hazard Mitigation Plan Update,” in the appendix of the Master Plan.  
*Who:* Office of Homeland Security and Emergency Preparedness – Hazard Mitigation, City departments  
*When:* Ongoing  
*Resources:* Staff time