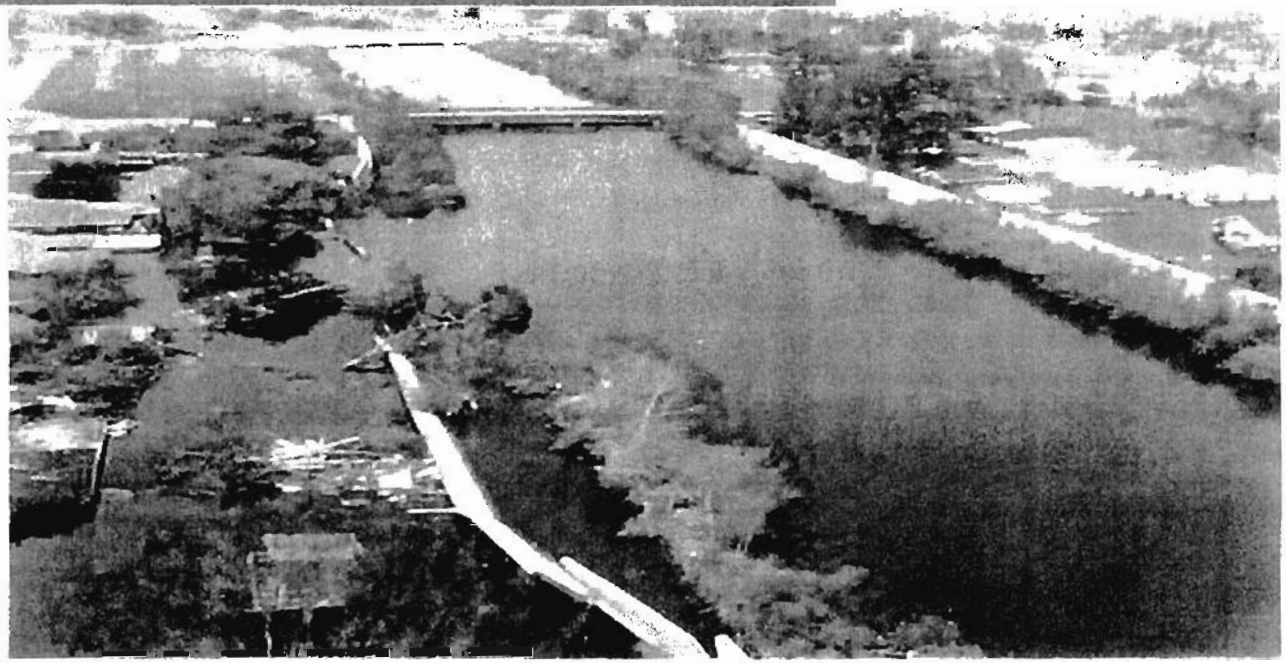
Orleans Parish Hazard Mitigation Plan



New Orleans Office Of Homeland Security and Public Safety

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SECTION 1 – INTRODUCTION

On August 29, 2005, Hurricane Katrina, a powerful category 4 storm at landfall, slammed into the Gulf Coast near the border of Louisiana and Mississippi. Initially, it was believed that Orleans Parish had escaped the brunt of the storm with the hurricane eye to the east of New Orleans, but that was not the case. The effects of the storm set off a series of catastrophic events, the most dramatic being the failures in the levee system that is vital to the protection of the city. Massive flooding then followed as saucer shaped New Orleans began filling up. Federal officials later called it the greatest disaster in the history of the United States. New Orleans is one of the most important cities in the United States for historical, cultural and economic reasons. It is also one of the most vulnerable to natural disasters.

PURPOSE OF PLAN

This hazard mitigation plan outlines New Orleans' strategy to help lessen the effects of hazards on people and property. In accordance with the requirements of the Disaster Mitigation Act of 2000, this Plan examines all hazards that might affect New Orleans, focuses on hazards that are most prevalent, estimates the location and the extent of possible losses to life and property from these hazards, identifies and prioritizes mitigation strategies, and plans ways to implement these strategies.

This plan relates to hazard mitigation in Orleans Parish, and should not be thought of as an emergency operations plan. The City of New Orleans Comprehensive Emergency Management Plan establishes the framework to prepare for, respond to, and recover from a wide variety of emergencies and disasters. Additionally, this plan does not specifically address everything that the Parish is doing to mitigate the effects of a disaster. For example, the Parish performs maintenance on components of the infrastructure that lessens the potential impact of a natural disaster (i.e. local storm collection system). Generally, this plan relates to reducing vulnerabilities and enhancing property protection to both public and private facilities, as well as Parish infrastructure; however, some mitigation action items also serve to protect human and animal life as well.

Hazard mitigation planning is important to all communities. Every year, local governments and individuals across the U.S. must spend time, energy, and money to recover from natural and man-made disasters. The costs of disaster recovery are high and frequently state and federal aid is insufficient to cover the full extent of damages. Hazard mitigation planning can help lower the overall costs of damage from disasters, lessen their impact, and speed the response and recovery process.

Because it is located in Southeastern Louisiana, New Orleans is vulnerable to many natural hazards, such as hurricanes and strong storms. New Orleans is also vulnerable to many man-made hazards, such as chemical leaks because of its proximity to petroleum plants and because of the number of major transportation routes that pass through it. The information in this Plan provides a detailed picture of the risks that face New Orleans. Based on this information, mitigation strategies specifically tailored to New Orleans have

been created. By implementing these strategies, New Orleans will improve its ability to cope with the hazards that faces it.

ORGANIZATION OF PLAN

The remainder of this section contains a community profile of New Orleans to help set the context for the other information in the Plan. Section 1 is an introduction to the plan and presents the purpose and organization of the plan, as well as a community profile. Section 2 describes public participation in the planning process. Section 3 contains a Risk Assessment, including a description of the trends in land use in New Orleans. The Risk Assessment describes the hazards that threaten New Orleans and the damages that are likely to occur with each hazard. Section 4 outlines the existing policies and programs that might play a role in hazard mitigation in New Orleans. It also presents the mitigation Goals, Objectives and Strategies that were developed based on the Risk Assessment. Section 5 contains the Mitigation Action Plan Methodology and the Action Plan. The Maps section contains maps that were developed as part of the Risk Assessment.

Requirement 201.6(c)(5):

[The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council)...

An adoption resolution for the City of New Orleans will be included in the plan to satisfy this requirement. The inclusion of the adoption resolution is intended to confirm the commitment of the City of New Orleans to follow through with the implementation of the plan.

COMMUNITY PROFILE

Location and Topography

Orleans Parish is located in Southeast Louisiana at 30.07 degrees North latitude and 89.93 degrees West longitude. The City sits between the Mississippi River to the south and Lake Pontchartrain to the north. It is bordered by Jefferson, Plaquemines, St. Bernard, and St. Tammany Parishes. The land area of the Parish is 180.6 square miles. The boundaries of the City of New Orleans and Orleans Parish are coterminous. Because of this, the names "New Orleans," "City of New Orleans," and "Orleans Parish" are used interchangeably throughout the Plan.

The topography of New Orleans consists of mostly flat land with elevations across the Parish close to sea level. Although there are a few ridges in New Orleans, such as the Metairie Ridge and Gentilly Ridge, the highest spots in the City are still only a few feet above sea level. With the exception of the easternmost section of the Parish, all of Orleans Parish is surrounded by levees. These levees along the Mississippi River and Lake Pontchartrain result in a topography that is similar to a saucer. An interesting and

somewhat unique result of this topography is that all rain that falls in New Orleans must be pumped out of the city by New Orleans' extensive network of pumps.

Water figures prominently in the topography of New Orleans. In addition to being located between the Mississippi River and Lake Pontchartrain, New Orleans also contains a large area of marshland. Twenty-five percent of the Parish is marshland.[1] While most of this area is uninhabited, the marshes provide recreation areas for people and habitat areas for wildlife. The marshes also help protect Southeast Louisiana from the effects of coastal storms.

One unique feature of New Orleans' geography that often surprises visitors is that the Mississippi River is actually higher than the surrounding land. This phenomenon is due to the large amount of silt deposited on the river bottom over time. To people on the dry side of the Mississippi River levees, ships on the River appear to float above them. Because of the height of the levees, this difference in height does not pose an imminent threat to the City.

Climate

New Orleans has a subtropical climate and enjoys pleasant weather for much of the year. Summers are long and hot with average high temperatures running into the low 90s. Hot summer days are made worse by the high levels of humidity that are common in New Orleans. Winters tend to be very mild with average high temperatures in the low 60s from December to February and average low temperatures in the 40s.

New Orleans' subtropical climate also results in high rainfall rates throughout the year. In fact, the average monthly rainfall for all months except October and November is between five and six inches. The annual average rainfall is 62 inches per year.

History

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

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

[1] Louisiana Department of Wildlife and Fisheries, Fur and Refuge Division, and the U.S. Geological Survey Biological Resources Division National Wetlands Research Center. "1997 Louisiana Coastal Marsh Vegetation Map."

In the early 20th Century, many of the swampy areas of in New Orleans were drained. This allowed development to continue toward Lake Pontchartrain, in Gentilly and Lakeview. Further increasing development in parts of town not along the Mississippi River was the addition of 2,000 acres of reclaimed land, created by the Levee Board after building a seawall that extended 3,000 feet into Lake Pontchartrain in 1927.

Like many major U.S. cities, New Orleans' growth was outpaced by the growth of its surrounding suburbs during the last half the 20th Century. Commerce and industry followed the population movement to the suburbs. New Orleans' economy was further weakened by the oil bust of the late 1970s and early 1980s. However, the rate at which New Orleans is losing population has slowed over 13 years and City officials have begun efforts to diversify New Orleans' economy.

Economy

The New Orleans economy has historically been centered around manufacturing and shipping. As discussed below, New Orleans is home to a major U.S. port and an extensive network of ground transportation routes. Some of the major imports that pass through New Orleans include coffee, sugar, bananas, and bauxite. Exports include oil, petroleum products, grains, and textiles.

In recent years, the service sector has become a large part of the New Orleans economy. Service jobs accounted for 48 percent of all jobs in New Orleans in 2000 and retail trade accounted for another 16 percent. The tourism and hospitality industry accounts for many jobs in the service sector. New Orleans also has a growing medical district.

Although the poverty rate and the number of persons below the poverty level in New Orleans has declined in the past decade, there are still a significant number of persons below the poverty level in the Parish. According to the 2000 Census, the population living below the poverty level in Orleans Parish was 130,896 or 27.9 percent of the population.

The catastrophic flooding that occurred in August 2005 following Hurricane Katrina and the levee failures had a devastating impact on all aspects of New Orleans' economy and will take a long time to fully recover. As the recovery process progresses, there will be changes in the economy and revenue sources for the City.

Transportation

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

Aviation

The Louis Armstrong New Orleans International Airport (LANOIA), the largest airport in the region, is owned and operated by the City of New Orleans. However, the LANOIA is located in Jefferson Parish, the Parish directly west of Orleans Parish. The only airport for fixed-wing aircraft in Orleans Parish is Lakefront Airport. Located on the South Shore of Lake Pontchartrain, Lakefront Airport serves mostly private and military aircraft. The City also has sites designated for helicopter landing.

Rail

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

Ports and Waterways

New Orleans is located in the heart of the world's busiest port complex – Louisiana's Lower Mississippi River. The Port of New Orleans is one of America's leading cargo ports and is ranked number one in the country in terms of import steel, natural rubber, plywood, and coffee handled. The Port of New Orleans is also the only deepwater port in the U.S. served by six Class 1 railroads. The Julia Street Cruise Ship Terminal located at the Port of New Orleans, serves 500,000 cruise ship passengers per year.

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

The waterways around New Orleans also provide its citizens and visitors with transportation by ferry boat. The ferry at Canal Street on the Mississippi River connects to Algiers and moves approximately 130,000 pedestrians and 16,000 vehicles each month (prior to Katrina). There are other ferries that connect New Orleans to nearby communities in other parishes such as Gretna and Chalmette. In addition to the ferries, New Orleans also has several commercial paddlewheel riverboats that provide thousands of residents and visitors each year with recreation.

Roads and Highways

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

Traffic is a major problem during an evacuation. While several major highways pass through the Parish, there are a limited number of routes out of the City. Interstate 10 runs east-west through New Orleans and is the major route for evacuations. US Highway 90, which runs east-west, and US Highway 61, an evacuation route to the west, are the only other alternatives. Compounding the problem is the fact that surrounding parishes must evacuate through New Orleans. The most feasible evacuation routes for many citizens in St. Bernard and Plaquemines Parish to the south is to pass through Orleans Parish. Also, people who are heading east to avoid a storm and vice versa will travel through New

Orleans on I-10, creating congestion for New Orleans residents trying to evacuate. US Highway 11, which crosses Lake Pontchartrain to the east, provides an alternate route to other Interstate Highways, specifically I-12 and 1-59. The Lake Pontchartrain Causeway provides another route for residents to head north during an evacuation. This 23 mile bridge gives residents access to I-12 which connects to other evacuation highways. The contra flow plan executed prior to Hurricane Katrina was successful in evacuating residents who wanted to leave.

Transit

Public transportation in New Orleans is operated by the Regional Transit Authority (RTA). RTA operates bus lines throughout the Parish. RTA also operates New Orleans' famous street cars. Currently, streetcars operate along the entire length of St. Charles Avenue, along the riverfront through the French Quarter and Central Business District, and along Canal Street with a spur on Carrollton Avenue. RTA is also examining the possibility of opening another line that will run from the French Quarter east to the Industrial Canal, as well as a light rail line from the Central Business District west to the Airport and to Baton Rouge.

Community Assets

New Orleans has a unique cultural heritage and many residents take pride in their city's historic neighborhoods, its music and art, and its diversity of lifestyles. Although New Orleans is perhaps best known for the French Quarter and the historic architecture throughout the city, there is much more to the city.

The Riverfront along the Mississippi River is the location of the Convention Center, the Riverwalk, the Moonwalk, and Woldenburg Park. Other main attractions downtown include the Superdome, the New Orleans Arena, the New Orleans Centre (shopping), and Canal Place (shopping). The New Orleans Medical District, home to several hospitals and clinics, is located downtown.

New Orleans also offers many opportunities for recreation. Lake Pontchartrain and Bayou Sauvage National Wildlife Refuge provide access to outdoor and wilderness recreation. New Orleans' major parks include City Park, Audubon Park, Audubon Zoo, Brechtel Park, and Armstrong Park (soon to become the home of the National Jazz Historical Park). Six Flags New Orleans in New Orleans East is one of the largest amusement parks in the region.

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

Culturally, New Orleans is a very rich city. It has a unique history, many community assets, and an advantageous location for commerce. Through hazard mitigation planning,

the citizens and officials of New Orleans can help protect the city that they call home.

SECTION 2 – PLANNING PROCESS AND PUBLIC PARTICIPATION

PLANNING PROCESS

Development of the Hazard Mitigation Plan was initially led by a planning consulting firm, GCR & Associates. At the staff level, the Orleans Parish Hazard Mitigation Plan development was led by the Director of the Office of Emergency Preparedness. The Planning Team provided specific input on the mission statement and hazards identification. The Planning Team also reviewed early Plan drafts and provided input on recommended changes to the Plan. The Steering Committee was responsible for oversight of the planning process. The Steering Committee also met on a regular basis to develop the details of the risk assessment, goals, objectives and strategies, and the Mitigation Action Plan.

Organization – The planning consultant worked with the Office of Emergency Preparedness in coordinating the Planning Team and Steering Committee. The final submission of this Hazard Mitigation Plan was done by the New Orleans Office of Homeland Security and Public Safety approximately 3 months after Hurricanes Katrina and Rita devastated the Parish. Following the hurricanes, many of the original Planning Team and Steering Committee members were no longer available to provide input; however, their contributions were not removed from the plan's contents unless the 2005 disasters negated the factual accuracy. For example, the earlier draft reports stated that Orleans Parish had never suffered a levee failure; obviously, this was no longer a factual statement.

In an effort to expeditiously move the plan forward after the 2005 hurricanes, representatives from the Mayor's Office, the New Orleans Office of Homeland Security, City Planning Commission, Neighborhood 1, Safety and Permits department, Sewerage and Water Board, Public works and others collaborated on a review of the overall plan and specifically the Mitigation Action items found in Section 5. The plan was broadened to include preliminary information on the recent disaster events, including the devastating failures of the levee system. It was the intention of the latter group to maintain the contributions of the original Planning Team and Steering Committee and to only adjust components of the report that had been outdated by recent events. Other changes to the earlier draft plan were requested by the Louisiana State Office of Homeland Security and Emergency Preparedness because they were needed or in some cases not required in a Hazard Mitigation Plan.

Coordination – Prior to the first Planning Team meeting, all relevant local and state agencies as well as the general public and business community were notified of the meeting and the planning process.

Identification of Hazards – Hazards were identified at the first Planning Team meeting. GCR provided a presentation on the planning process and facilitated the identification of hazards in Orleans Parish.

Assessment of Risks – The risk assessment was prepared by the consultant with the direction and input of the Steering Committee and the Office of Emergency Preparedness. The risk assessment was also available during the planning process at Parish libraries. Contact information was provided so that all comments and suggestions could be easily provided to the planning consultant.

Creation of Goals, Objectives and Mitigation Actions – The consultant (GCR) held a series of meetings with the Steering Committee to identify the goals, objectives and mitigation actions for the Hazard Mitigation Plan. The goals, objectives and mitigation actions document was made available during the planning process at Parish libraries. Contact information was provided so that all comments and suggestions could be easily provided to the planning consultant.

Development of the Action Plan – The Action Plan was originally prepared with the input and direction of the Steering Committee members. The Action Plan document was made available during the planning process at Parish libraries. Contact information was provided so that all comments and suggestions could easily be provided to the planning consultant. Following the 2005 hurricanes the action plan was updated to include more items needed to mitigate identified hazards.

Draft Plan Public Meeting – A meeting was held to present the Draft Hazard Mitigation Plan to the Planning Team and the general public. All participants were encouraged to provide input on the Draft Plan. Contact information was provided so that participants could contact the consultant with any comments and recommendations (See Appendix F).

To best reflect the needs and desires of all segments of the population of New Orleans, the Plan was developed with input from many sources. A Planning Team and Steering Committee were established at the beginning of the planning process to provide normal input on the Plan. Also, public input was solicited throughout the planning process.

Integration with Existing Plans and Programs

The following existing Plans and Programs were evaluated for integration into the New Orleans Hazard Mitigation Plan:

City of New Orleans Comprehensive Emergency Management Plan – The New Orleans Office of Emergency Preparedness is responsible for producing and maintaining the City's Comprehensive Emergency Management Plan. The CEMP addresses mitigation of, preparation for, and recovery from a wide variety of emergencies and disasters.

City of New Orleans Zoning Ordinance – The Zoning Ordinance was reviewed for land use regulations and hazard identification. The Zoning Ordinance controls the uses and densities of various land uses throughout the Parish.

City of New Orleans Land Use Plan – The 1999 Land Use Plan for the City of New Orleans outlines a structure for the city's development potential for the next thirty years. It indicates a desired development pattern expected to support and encourage the city's future

growth toward a community which is livable for all residents. The plan was used to identify land use patterns in the City.

City of New Orleans Transportation Plan – A component of the City's Master Plan, this resource will be used to determine critical facilities such as roads, highways, and bridges for the Hazard Mitigation Plan.

City of New Orleans Building Code – The Building Code of City of New Orleans was amended to read as set forth in the International Building Code, 2000 Edition. The building code was reviewed for assessment in the hazard mitigation analysis.

Southeast Louisiana (SELA) Drainage Projects – This project targets urban flooding problems in Orleans, Jefferson and St. Tammany Parishes. For Orleans Parish, it is administered by the New Orleans Sewerage and Water Board, in conjunction with the New Orleans District of the U.S. Army Corps of Engineers. Initiated in May 1995, under the Federal Energy and Water Appropriation Act, this project focuses on enhancing area drainage systems. Several projects have been completed, while others are still being planned.

State of Louisiana Hazard Mitigation Plan – The purpose of this hazard mitigation plan is to implement actions which eliminate the risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions are both short-term and long-term activities which reduce the cause or occurrence of hazards; reduce exposure to hazards; or reduce effects through various means to include preparedness, response, and recovery measures. The Plan was used for hazard identification.

May 1995 Post Flood Report Flood Damage Assessment – This report covered the flooding that occurred in Southeast Louisiana between May 8 and May 10, 1995 and resulted in the declaration of a Federal Disaster Area. Data and recommendations were identified from this report.

PLANNING PROCESS PARTICIPANTS

To best reflect the needs and desires of all segments of the population of Orleans Parish, the Plan was developed with input from many sources. This was accomplished through the formation of a Planning Team and Steering Committee, both of which included representatives from all sections of the community. Public input was also solicited throughout the planning process.

Plan Development and Hazard Mitigation Plan Facilitator – The Orleans Parish Hazard Mitigation Plan planning process was led GCR & Associates, Inc., a planning and technology consultant located in New Orleans, Louisiana. GCR served as project manager and worked with the City of New Orleans Office of Emergency Preparedness in providing technical assistance during the planning process.

Throughout the planning process, an effort was made to incorporate information from existing plans, studies, and reports. The Reference section lists the major documents that were used at various phases of the planning process.

Orleans Parish Hazard Mitigation Plan Planning Team

A Planning Team was formed to oversee the writing of the Plan and to provide feedback throughout the planning process, and consisted of the general public and broader interested parties who chose to attend the larger Planning Team meetings. Invitations to attend the first meeting of the Planning Team were sent to 270 community organizations, including neighborhood associations, business associations, and local non-profits. Press releases announcing the meeting were sent to 48 press contacts in the New Orleans area to notify the general public and invite them to provide input on planning issues and plan development. The Team included representatives from local and state government, local businesses, local nonprofit organizations, academic institutions, and private industry (See Appendix D).

Planning Team Membership

Name	Organization
Ray Nagin	Mayor, City of New Orleans
Terry Tullier	City of New Orleans Office of Emergency Preparedness
Kimberly Williamson Butler	Chief Administrative Office
Beth James	Economic Development
Terry Ebbert	Homeland Security and Public Safety
Collette Creppel	City Planning Commission
Harold Gorman	Sewerage and Water Board
Charles Parent	New Orleans Fire Department
Edwin Compass	New Orleans Police Department
Greg O'Brien	University of New Orleans
Alan Artibise	University of New Orleans
Max Hearn	Orleans Levee District
Dan Packer	Entergy
Conrad Gruber	Atmos Energy
Barbara Johnson	New Orleans Regional Chamber of Commerce
Paul Coriel	LSU Cooperative Extension Services
Elizabeth Gamble	Jackson Barracks
Elhrei Thibodeaux	Historic District Landmarks Commission
Lary Hesdorffer	Vieux Carre Commission
Walter Brooks	Regional Planning Commission
Col. Peter Rowan	Corps of Engineers
William Deville	Regional Transit Authority
Mark Treadway	Homebuilders Association
Kay Wilkins	American Red Cross
Dan Falanga	Louisiana Office of Emergency Preparedness

Planning Team meetings occurred twice during the planning process to provide input on the Plan and review the Plan documents. The first meeting took place on April 9, 2003, at

the beginning of the planning process. At this meeting the Planning Team established the Mission Statement for the Plan and determined the hazards to be covered by the Plan. The Planning Team met again on September 24, 2003, to review the final draft of the Plan. Based on comments received at this meeting, final changes were made to the Plan.

Orleans Parish Hazard Mitigation Plan Steering Committee

The Steering Committee was established at the beginning of the planning process to provide formal input on the Plan, and consisted of representatives from local and state government agencies, the business community, emergency management officials, Parish residents and elected officials (See Appendix D). The purpose of the Committee was to provide leadership in the creation of the Plan by overseeing the planning process, and developing the specific details of the risk assessment, the mitigation strategies, and the action plan.

Steering Committee Membership

First Name	Last Name	Organization
Terry	Tullier	New Orleans Office of Emergency Preparedness
Lou	Reese	New Orleans Office of Emergency Preparedness
Simeon	Wildman	Mayor's Office of Economic Development
Collette	Creppell	New Orleans City Planning Commission
Victoria	Caridas	New Orleans City Planning Commission
Edwin	Holmes	New Orleans Fire Department
Joseph	Matthews	New Orleans Fire Department
Daniel	Lawless	New Orleans Police Department
Shirley	Laska	University of New Orleans
Alan	Artibise	College of Urban and Public Affairs
Jim	Amdal	UNO/CUPA ITPIC
Stevan	Spencer	Orleans Levee District
Chris	Laborde	New Orleans Regional Chamber of Commerce
Pat	Skinner	LSU Cooperative Extension Service
Jamie	Roy	LSU Cooperative Extension Service
Walter	Gallas	Historic District Landmarks Commission
Lary	Headorffer	Vieux Carre Commission
Johnny	Bordelon	Regional Planning Commission
Jerry	Colletti	U.S. Army Corp of Engineers
Michael	Lowe	U.S. Army Corp of Engineers
Al	Hamilton	American Red Cross
Bruce	Cuber	American Red Cross
Steve	Zimmer	Delgado Community College WBC
Merlin	Heydel	City Park Improvement Association
Robert	Claypool	ComputerCC
Kevin	Hemenger	Green Fields Real Estate
Edward	Dalferes	Gentilly/Sugar Hill
Cynthia	Sacks	English Turn Property Owners' Association
Mark	Treadway	Greater New Orleans Homebuilders' Association
Scott	Coulombe	Greater New Orleans Homebuilders' Association

The Steering Committee held several working meetings throughout the planning process. Below are summaries of the meetings:

On May 13, 2003, the Steering Committee met to discuss the Risk Assessment portion of the Plan. Draft materials presented to the Steering Committee included hazard profiles for four hazards (floods, hurricanes, strong storms/hail, and tornados) and maps showing the locations of critical facilities and repetitive loss structures. Possible additional sources of information for the hazard event profiles were discussed by the Steering Committee. Also, methodology for the loss estimation portion of the Plan was discussed.

On June 19, 2003, the Steering Committee met to review the final draft of the Risk Assessment. The Committee members made suggestions about additional information that should be included in the final version of the Risk Assessment. Also on the agenda for this meeting was the formulation of Goals and Objectives. However, many members of the Steering Committee were unable to attend this meeting due to heavy afternoon thunderstorms that resulted in street flooding throughout New Orleans. As a result, the Goals and Objectives were developed through e-mail communication between Committee members and the July meeting was lengthened to allow for extra discussion the next time the full committee met.

On July 25, 2003, the Steering Committee met to review and prioritize the Goals, Objectives, and Strategies for the Plan. Strategies for each of the Goals and Objectives were presented and discussed. Steering Committee members added four strategies to those prepared in advance. After discussing all strategies, Committee members were asked to evaluate each strategy according to the STAPLEE method recommended by FEMA in *How-To Guide #3: Developing the Mitigation Plan.*[1] Once they had evaluated each strategy on the STAPLEE criteria, Committee members prioritized the strategies through multi-voting.[2] Those Committee members who were not present at the meeting were given an opportunity to vote by e-mail after the meeting.

Outreach to Stakeholders

A Web site was set up as a resource for the public to learn about the Plan. The site, *www.hazardmitigation.org*, went live in April 2003. Throughout the planning process, the Web site provided information about hazard mitigation planning in general, the time-line for the Orleans Parish Plan, members of the Planning Team and Steering Committee and transcripts/summaries from committee meetings. When the draft version of the Risk

[1] STAPLEE is an evaluation method designed to allow systematic consideration of the opportunities and constraints of an action across the following areas: social, technical, administrative, political, legal, economic, and environmental.

[2] Multi-voting is a method that gives each participant multiple votes. In this case, each Committee member was given 13 votes, half of the total number of strategies under consideration. Committee members used these votes to indicate which strategies they thought should be given priority.

Assessment portion of the Plan was completed in June 2003, a copy for public comments was placed on the Web Site along with information about where to send any comments. Also, a draft version of the Goals and Objectives were posted to the Web Site in June for public comment.

Additional community outreach was conducted by mail. A list of 270 community organizations maintained by the City Planning Commission was used for mailings. This list included groups such as neighborhood associations, civic organizations, community development corporations, nonprofit organizations, churches, and business and professional organizations. In March 2003, invitations to attend the first meetings of the Planning Team were sent to the organizations on the Planning Commission's list. Flyers were mailed on March 21 announcing the meeting on April 9. In June, another flyer publicizing the Web site for the Plan was mailed to these organizations. This flyer also announced the public comment period for the Risk Assessment and Goals and Objectives portions of the plan. Flyers were mailed on June 25 and the public comment period was scheduled to end on July 11. The public comment period was subsequently extended to July 18. In September, a third flyer was mailed to the community organizations discussed above. This flyer announced that the Draft version of the Plan was complete and available online for public comment. Flyers were mailed on September 11 and the public comment period was scheduled to end September 30. The last two flyers also included information on how to receive hard copies of the Plan for those persons who do not have access to the Web.

An article about the Plan ran in the Times-Picayune during the public comment period for the Draft Plan. This article appeared on the cover of the "New Orleans" section. It described the Plan and briefly listed the mitigation strategies that were given highest and moderate priority in the Plan. Because the article ran late in the final public comment period (September 26), the decision was made to accept comments after September 30. A message on the website for the Plan indicated that comments were still accepted even though the official comment period had ended.

The comments received from the public almost uniformly expressed concerns about flooding, especially street flooding. These concerns confirmed that the emphasis placed on flooding by the Steering Committee reflected the thoughts and beliefs of the people of New Orleans. One organization, the Committee for a Better New Orleans, submitted a lengthy series of comments on the Plan. These comments and the responses to them have been included in Appendix F.

As elected representatives of the citizens of New Orleans, the members of the New Orleans City Council were identified as particularly significant stakeholders. Council members were sent memos informing them about the planning process and inviting them to attend the Steering Committee meetings. They were also notified when the draft versions of the Risk Assessment and Goals and Objectives was posted to the Web site for public comment. Finally, they received hard copies of the Draft version of the Plan in September 2003.

SECTION 3 – RISK ASSESSMENT

INTRODUCTION

The Risk Assessment section profiles all hazards that pose a threat to New Orleans based on a variety of factors, including its history, topography, and its land development patterns. The list of hazards to be profiled in the Plan was developed based on information from a variety of sources including: recent events, historical records, existing emergency management plans, and the knowledge of local residents and experts.

Eleven hazards were identified as part of the Orleans Parish Hazard Mitigation Plan, including Floods, Hurricanes, Tornados, Hail, Thunderstorms/Lightning, Subsidence, Chemical Spills/Accidents, Terrorism, Levee Failure, Severe Winter Storms, and Drought. Hazards not selected for this Plan include Avalanche, Dam Failure, Earthquake, Land-slide, Tsunami, Volcano, Wildfire, and Erosion. The Avalanche and Volcano hazards were not selected due to the topography of the Orleans Parish region. These hazards do not pose any threat to Orleans Parish. An examination of USGS landslide hazard information indicates that Orleans Parish is at a low risk for landslides; therefore landslide hazards are not addressed in this Plan. New Orleans is at a very low risk for earthquakes. A review of the U.S. Geological Survey National Seismic Hazard Data Mapping Project and the State of Louisiana Hazard Mitigation plan indicate a 1 percent gravity (1%g) peak acceleration, which indicates a very low probability of occurrence. The earthquake hazard is not profiled in the risk assessment due to this low probability, combined with no history of previous occurrence of earthquakes. There are no dams located in Orleans Parish; therefore, Dam Failure is not relevant and not included in the Risk Assessment. New Orleans is not located on the West Coast and is not a Pacific Island or a Caribbean Island and the tsunami is not profiled in the State of Louisiana Plan. Therefore, New Orleans is not at risk and the tsunami hazard is not profiled in the risk assessment. A review of the Observed Fire Danger Class Map indicated that New Orleans is at a low risk of wildfire danger. This observation, combined with the fact that New Orleans is not located near forest, grasslands, or densely wooded areas, is the reason that the wildfire hazard is not profiled in the risk assessment.

The original Hazard Mitigation Plan submitted by Orleans Parish included a hazard specifically relating to erosion. This hazard, which is a slow creeping event, is not specifically cited as a hazard in this revised plan for two primary reasons. The section on "Levee Failure" details the impact and hazards that erosion has on the levees, which are vital to the protection of Orleans Parish. It would be redundant to repeat this information under another separate hazard. Additionally, the hazard identified as "Subsidence" in this plan, which is a significant threat to Orleans Parish and all Southern Louisiana Parishes, is related to erosion. Subsidence should be considered the hazard and the effect is erosion. To have a section on both erosion and subsidence would be redundant.

This section consists of five parts: Hazard Event Description, Location and Extent, Previous Occurrence, Vulnerability Assessments and Hazard Impacts for each hazard addressed by the plan. Hazard event descriptions and location and extent descriptions are descriptions of a typical occurrence of a given hazard. They describe the conditions that

will likely be present when a hazard occurs and answer the question "How bad can things get?" for different hazards. The profiles describe past incidences of hazards in Orleans Parish and the probability of future events.

Hazard event descriptions and location and extent analysis are important because they describe how Orleans Parish is likely to be affected by each hazard. The effects from each of the hazards covered by the Plan vary dramatically. Furthermore, any given hazard may affect Orleans Parish differently than it would affect another community. Because occurrences of a given hazard can vary in terms of magnitude, duration, and intensity, it is important to specify the conditions that each hazard is likely to create in Orleans Parish.

Following each of the hazard profiles is a vulnerability assessment and hazard impact. The vulnerability assessments were created by combining information from the hazard profiles with asset inventories for Orleans Parish. Each vulnerability assessment gives a detailed picture of Orleans Parish's risk from that hazard.

Section 3 ends with a discussion of the trends in land use in Orleans Parish. The description of these trends helps identify areas where the vulnerability of people and property may change in the near future due to changes in land use patterns.

HAZARDS COVERED BY PLAN

Hazard	How Identified	Why Identified
Floods	• Review of past disaster declarations • Historical records • Input from public • Review of FIRMS	• One of the highest numbers of repetitive loss structures in U.S. • Frequent floods in the Parish
Hurricanes	• Review of past disaster declarations • Historical records	• Close proximity to Gulf Coast
Tornados	• Historical records • Location in an area of the U.S. at risk for tornados	• Related to thunderstorm frequency • Related to hurricane frequency
Hail	• Location in an area of the U.S. at risk for hail • Historical records	• Recent losses due to hail storms

Thunderstorms/Lightning	• Location in an area of the U.S at risk for thunderstorms and lightning • Historical records	• Related to thunderstorm frequency
Subsidence	• Historical Records • Research by government and non-government entities	• Property damage incurred as a result of subsidence
Chemical Spills/Accidents	• New Orleans Fire Department records • Newspaper articles	• Many major transportation routes throughout Parish • Numerous facilities with hazardous chemicals in Parish
Terrorism	• Recent events • Input from Planning Team	• Heightened awareness of threat since September 2001
Levee Failure	• Newspaper articles • Existing plans • Previous Occurrence	• Levees surround most developed areas of Parish
Severe Winter Storms	• Input from Planning Team	• Infrequency of storms means limited capacity to cope with them
Drought	• Input from Planning Team	• Past Occurrence

HAZARDS

Floods

Hazard Event Description

A flood is a natural event for rivers and streams. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers, lakes and oceans that are subject to recurring floods. Hundreds of floods occur each year, making them one of the most common hazards in all 50 states and US territories. Floods are also the most widespread of all natural disasters – except fire. Most communities in the United States have experienced some kind of flooding, after spring rains, heavy thunderstorms, or winter snow thaws.

Flood waters can be slow, or fast rising, but generally develop over a period of days. Flooding tends to occur in the summer and early fall because of the monsoon rains and is typified by increased humidity and high summer temperatures. Floods kill an average of 150 people a year nationwide. They can occur at any time of the year, in any part of the country, and at any time of day or night.

Floodplains in the U.S. are home to over 9 million households. Most injuries and deaths occur when people are swept away by flood currents, and most property damage results from inundation by sediment-filled water. Fortunately, most of the known floodplains in the United States have been mapped by FEMA, which administers the NFIP. When a flood study is completed by the NFIP, the information and maps are assembled into a Flood Insurance Study (FIS). An FIS is a compilation and presentation of flood risk data for specific water courses, lakes, and coastal flood hazard areas within a community and includes causes of flooding. The FIS report and associated maps delineate Special Flood Hazard Areas (SFHAs), designate flood risk zones, and establish base flood elevations (BFEs), based on the flood that has a 1% chance of occurring annually, or the 100-year flood.

This section addresses flooding from rain events, including those that are the result of a hurricane or tropical storm. In Orleans Parish, heavy rains can occur at any time of the year, although the rainiest months are June, July, and August, when tropical moisture is plentiful along the Gulf Coast.

Location and Extent

Sixty-nine percent of all structures in Orleans Parish, or 95,197 structures, lie within the 100-year flood plain. Heavy rains are common in New Orleans and since a large portion of the city lies within the 100-year flood plain a major flood will result in much property damage to residential and non-residential structures and much disruption to the lives of people who live and work in New Orleans. According to the National Flood Insurance Program, Orleans Parish ranks second in the country in terms of repetitive loss structures. A repetitive loss structure is defined as a structure covered by flood insurance that has incurred flood-related damages at least twice in a ten-year period, for which the cost of repairing the damage was at least 25 percent of the market value of the structure at the time of the flood event.[2] Table 1 gives information on RLS in Orleans Parish over an 18-year period.

Table 1: Orleans Parish Repetitive Loss Structures, 1978-1995[3]

Repetitive Loss Structures	Cumulative Losses	Total Payments on Losses
4,023	12,427	$129,135,382

Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration. A large amount of rainfall over a short time span can result in flash flood conditions. A small amount of rain can also result in floods in locations where the soil is saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas. Topography and ground cover are also contributing factors for floods. Water runoff is greater in areas with steep slopes and little or no vegetative

[2] New Orleans ranks second in Louisiana in the number of Target Repetitive Loss Structures. Target RLS are defined a structures with four or more losses and/or structures with two or more losses where cumulative payments have exceeded the property value. Map 7 shows Target RLS in Orleans Parish.
[3] National Wildlife Federation. "Higher Ground: Voluntary Property Buyouts in the Nation's Floodplains, A common Ground Solution Serving People at Risk, Taxpayers and the Environment."

ground cover. Frequency of inundation depends on the climate, soil, and channel slope. In regions where substantial precipitation occurs in a particular season each year, or in regions where annual flooding is derived principally from snowmelt, the floodplains may be inundated nearly every year. In areas where flooding is caused by melting snow, and occasionally compounded by rainfall, the flood season is spring or early summer.

Across most of the Parish, elevations vary by a few feet at most. Thus, when rain falls, it tends to pool in place. Most of Orleans Parish is below sea level and/or surrounded by flood levees. Elevations below sea level combined with little slope in topography and an extensive levee system mean that rain water cannot flow out of the Parish, but must be pumped out. Flooding as an effect of levee failure, as Orleans Parish suffered as a result of Hurricane Katrina, is also a hazard, but this is addressed thoroughly under the "Levee Failure" section.

Previous Occurrence

Big rain events are fairly common in Orleans Parish and have caused much property damage in the area. In the last 25 years, there have been 12 rain events that resulted in more than 6 inches of rain falling in one day somewhere in the Parish. Since 1991, 4 of these events resulted in more than 11 inches of rain falling in one day somewhere in the Parish. All 14 Federally Declared Disasters that have occurred in Orleans Parish since 1965 have involved a rain event.

One of the heaviest rain events in Orleans Parish in recent history occurred May 8-9, 1995. During this storm, as much as 17 inches of rain fell in parts of Orleans Parish over a 48-hour period. Four people drowned in this flood and one person died of a heart attack as a result of pushing his flooded car. Ultimately, $388 million in damages were documented in New Orleans. Actual damages likely exceeded this amount.

A breakdown of damages shows how wide-spread the devastation from this flood was[1]:

- City buildings suffered an estimated $1 million in damages;
- Touro Hospital closed temporarily on May 8 as a result of the flooding;
- Charity Hospital, Mercy + Baptist Medical Center, and United Medical Center each suffered damages ranging from $50,000 to $250 million;
- Orleans Parish Prison had to move 750 inmates to the Louisiana State Penitentiary;
- Public schools suffered an estimated $9 million in damages;
- 46 of 124 schools incurred some damages;
- 11 public schools remained closed through at least May 12;
- Early estimates showed that between 10,000 and 30,000 housing units were damaged.

On August 29, 2005, Hurricane Katrina stuck the Gulf Coast near the Louisiana and Mississippi border. The storm, arguably the largest disaster in U. S. History, caused approximately 80% of the City of New Orleans to be flooded from rising water as a result

[1] All figures taken from articles that appeared in the *Times-Picayune* from May 10 to May 12, 1995.

of levee failures. Many structures had flood waters to the roof and hundreds of persons died. Considering that the flooding was the effect created by Hurricane Katrina and the levee failures, in order to avoid redundancy, this event is discussed more fully under the Previous Occurrence sections for both Levee Failure and Hurricanes.

Vulnerability Assessment

Orleans Parish is more vulnerable to flooding than to any other disaster, natural or man-made. (Maps 1-7- show New Orleans flood zones). Several factors contribute to this vulnerability. First, Orleans Parish is flat. Across most of the Parish, elevations vary by a few feet at most. Thus when rain falls, it tends to pool in place. Second, most of Orleans Parish is below sea level and/or surrounded by flood levees. Elevations below sea level combined with little slope in the topography and an extensive levee system mean that rain water cannot flow out of the Parish but must be pumped out. New Orleans has 21 drainage pumping stations and 15 underpass pumping stations that pump water out of the city and into Lake Ponchartrain or canals. The pumps can handle about 3 inches of water every 5 hours. However, when heavy rain falls for an extended period, the pumps cannot keep up. A third factor that contributes to Orleans Parish's vulnerability to floods is the problem of clogged storm drains. As of March 2003, the City of New Orleans Public Works Department's list of clogged catch basins numbered 2,649. The catch basins become clogged with leaves, mud, trash and other debris, preventing the storm water from flowing into the large, underground collection boxes that are part of the storm water system. The problems mentioned above are compounded by the climate of Orleans Parish. Big rain events are fairly common in Orleans Parish and have caused much property damage in the area.

A major project is currently underway in Orleans Parish to help limit the damages from floods in the future. The Southeast Louisiana Drainage Program (SELA) was developed after the May 1995 flood. Works planned as part of SELA include upgrades to pumping stations and the addition of drainage canals throughout Southeast Louisiana. SELA's goal is to contain water from a 10-year flood within canals. Construction of SELA projects began in Orleans Parish in 1998. The Sewerage and Water Board is working on additional projects with the goals of minimizing structural damage from a 100-year flood and of providing self-supporting power to all pumping stations. Table 15 provides more information on potential projects to reduce flooding.

Hazard Impact

Flooding can take many forms, including coastal floods, urban floods, and flash floods. The most likely event for serious flooding would be flash flooding due to storm water drainage backup caused by a large amount of rain from a thunderstorm. It is possible that injuries and death could occur due to severe flash flooding in the area.

In the pamphlet "State and Local Mitigation Planning How-To guide: Understanding Your Risks," FEMA recommends a methodology for estimating losses from hazard events. This methodology was used to estimate the losses to property and economic losses from a 100-year flood. (See Appendix 1 for a full description of the methodology used.) Table 2 shows a summary of the number and the value of structures that could be damaged and the number of jobs that could be affected by a 100-year flood in Orleans Parish.

Table 2: Loss Estimation-Flooding

Summary of Structures and Persons in Hazard Area for Flooding

	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	91,761	69%	18,784,973	12,961,631	69%	484,674	334,425	69%	4,277,336
Commercial	3,433	2,369	69%	4,377,092	3,020,193	69%	238,771	164,752	69%	986,663
Industrial	634	437	69%	643,993	444,355	69%	31,988	22,072	69%	146,637
Agriculture	13	9	69%	2,933	2,024	69%	N/A	N/A	N/A	668
Religion	397	274	69%	446,724	308,240	69%	N/A	N/A	N/A	67,813
Government	29	20	69%	527,894	364,247	69%	N/A	N/A	N/A	101,719
Education	226	156	69%	321,714	221,983	69%	N/A	N/A	N/A	48,836
Critical Facilities	213	147	69%	5,305,572	3,660,845	69%	N/A	N/A	N/A	73,254
Infrastructure	35	24	69%	2,368,200	1,647,858	69%	N/A	N/A	N/A	543,793
Total	137,719	95,197	69%	30,410,895	22,631,376	74%	N/A	N/A	N/A	6,256,721

Probability of Future Events

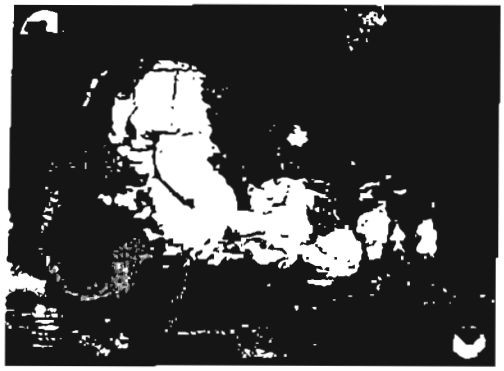
There have been seven Presidential Flood Declarations in Orleans Parish. The associated maps show the extent of the 100-year and 500-year floodplains in Orleans Parish. Areas that lie within the 100-year floodplain have a 1 percent chance of flooding in any given year. The areas that lie within the 500-year floodplain have a 0.2 percent chance of flooding in any given year or are protected by levees from 100-year flooding. Flood probabilities are predictions and realistically there is no perfect certainty that the percentages will be exact. Floods can occur more or less frequently than the probabilities predict, especially in Orleans Parish when more than one hazard could result in flooding. The climate of the area and the topography of the Parish mean that flooding will continue to be the greatest threat to Orleans Parish for some time to come.

Hurricanes

Hazard Event Description

Hurricanes are tropical cyclones that have maximum sustained winds of at least 74 miles per hour. In addition to strong winds, they are capable of producing heavy rains, high waves, and storm surges. Orleans Parish is threatened by hurricanes that develop in the Atlantic Ocean and the Gulf of Mexico. The greatest threat to Orleans Parish comes during the Atlantic Ocean/Gulf Hurricane season, which runs from June 1 to November

30. Hurricanes generate several hazards that can cause extensive damage. High winds, large rainfall amounts, tornados and storm surge are all associated hazards. Storm surge, a dome of water pushed ashore by a hurricane, is commonly the greatest threat to property and human life. The area's low elevations and network of levees make it especially vulnerable to the surge of a hurricane. The effects of a strong hurricane can be catastrophic to any location, however, New Orleans is especially vulnerable because of the threat to a system of levees that channel and hold the waters of canals, Lake Pontchartrain and the Mississippi River. This specific hazard is discussed thoroughly under the "Levee Failure" section.



Location and Extent

All of Orleans Parish is vulnerable to the effects of a hurricane. The strength of hurricanes is measured using the Saffir-Simpson scale (Table 3). This scale classifies a hurricane based on its maximum sustained winds and describes typical damage for each category.

Table 3: The Saffir-Simpson Scale

Category	Winds (mph)	Typical Damage
1	74-95	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.
2	96-110	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings.
3	111-130	Some structural damage to small residences and utility buildings, with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
4	131-155	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.

5	156+	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline.

The winds associated with a hurricane cause many devastating effects. In addition to causing wind-blown related structural damage, winds increase the storm surge as they grow stronger. A category 1 hurricane with winds 74-95 mph may have storm surge of 4-5 feet above normal. A category 3 hurricane (winds 111-130) generally has a storm surge of 9-12 feet. A category 5 storm (winds greater than 155) could have storm surge 18 feet or more above normal. Generally, the higher the storm surge, the further inland flooding will spread and the greater the destruction. Other factors impact the severity of the storm surge. Topography of both the affected land mass and the floor of the body of water can greatly increase the extent of the surge. Generally, the flatter the land masses and the floor of the body of water are, the greater the surge and devastation. The topography of the land masses and bodies of water (Gulf of Mexico, Lake Borgne and Lake Pontchartrain) that surround Orleans Parish are generally flat.

Additionally, wind direction impacts the storm surge. The winds on right side of the eye of a hurricane are the strongest, therefore land masses and urban areas on that side of the storm will experience greater storm surge. Orleans Parish is extremely vulnerable simply because it is not only near the Gulf of Mexico; it also has two massive, relatively flat, and shallow lakes adjacent to it, Lake Pontchartrain and Lake Borgne. These bodies of water can all have a significant surge impact on New Orleans.

Property damage associated with hurricane force winds increases greatly with the wind strength of the hurricane. A category 1 storm may cause little or no damage to permanent buildings. Most damage will be to mobile homes, trees, shrubs and signs. A category 3 storm will cause some structural damage to homes, down trees, and destroy signs. Winds from a category 5 storm will be devastating to buildings. There will be complete roof failure on many residences and commercial buildings.

In July 2004, FEMA, Louisiana Homeland Security and Emergency Preparedness, and Louisiana State University conducted a training exercise named Hurricane Pam. The scenario presented a model of a category 3 storm that would track just to the west of Orleans Parish. The exercise used realistic weather and damage information developed by the National Weather Service and other entities involved in the training. The Pam model showed a storm surge that topped the 17' levees in Orleans Parish and caused massive flooding. Hurricane Katrina, approximately one year later, demonstrated that the exercise was realistic and that catastrophic damage can occur when storm surge and other hurricane related effects overwhelm the levee system that protects the Parish.

Prior to Hurricane Katrina, a study was conducted to evaluate potential flooding in Orleans Parish caused by the storm surge of a hurricane. The Southeast Louisiana Hurricane Study illustrated what the inundation would be for categories 1-5 hurricanes.

The study did not take into account the levee failure which happened during Katrina. Maps 16-21 from the study depicts flooding in a non-levee failure storm surge event.

Previous Occurrence

New Orleans has been affected by numerous hurricanes throughout its history. Since 1965, five hurricanes have caused enough damages that the Parish was declared a disaster area: Hurricane Betsy in 1965 (category 3), Hurricane Camille in 1969 (one of only two category 5 hurricanes to ever make landfall in the U.S.), Hurricane Juan in 1985 (category 1), Hurricane Andrew in 1992 (category 3 when it made landfall in Louisiana), Hurricane Georges in 1998 (category 3), Hurricane Katrina in August 2005 (category 4), and Hurricane Rita in September 2005(category 3). Many other hurricanes and tropical storms have caused damages in Orleans Parish due to heavy rains or high winds.

Hurricane Betsy not only hit New Orleans with winds of at least 125 mph, but also flooded large parts of the city. When all of the damage in the United States was totaled, it came to more than $1 billion in 1965 dollars, making Betsy the first billion dollar hurricane. Betsy was blamed for 75 deaths, which ranks it 18th among the deadliest US storms from 1900 through at least September 2003. As Hurricane Betsy moved ashore south of New Orleans it destroyed almost every building in Grand Isle, where the Coast Guard station reported gusts up to 160 mph. Winds up to 125 mph were measured in New Orleans. Betsy drove storm surge into Lake Pontchartrain, which is just north of the city and is connected to the Gulf of Mexico, pushing water over levees around the lake. Flood water reached the roofs of houses in some places in the city.

After a month of off-and-on battering from tropical storms starting in mid-August 1998, Orleans Parish watched the long, destructive journey of Hurricane Georges from the eastern Atlantic Ocean, across the Virgin Islands and Hispaniola and into the Gulf of Mexico. By Saturday, Sept. 26, the hurricane was moving toward the New Orleans area, causing hundreds of thousands of residents to flee and thousands more to evacuate into shelters, including the Superdome. A last-minute bobble took the storm to the east, sideswiping Greater New Orleans and smashing straight into the Mississippi coast. In New Orleans, the mass evacuation, citywide curfews and major damage to lakefront areas and outlying parishes give weight to experts' predictions that a direct hit on the City could bring catastrophe. Flooding, property damage and power outages were reported from Louisiana to the Florida Panhandle as the wide, lumbering storm neared the Gulf Coast. Twenty inches of rain fell in the Florida Panhandle, with 10 inches reported in southern Alabama. A wind gust of 172 mph was reported near Biloxi, MS, about 55 miles east of New Orleans.

Tropical Storm Allison was the first named storm of the 2001 Atlantic Hurricane Season. The storm brought the heaviest rains Louisiana had seen in many years. In Louisiana, the governor declared states of emergency in 20 of the State's 64 parishes where more than 500 homes were damaged by flood waters. Over the duration of the storm, rainfall amounts ranged from 8 to 20 inches in the southern parishes, with an estimated two feet of rain recorded in areas around New Orleans.

In late August 2005, Hurricane Katrina struck the Gulf Coast near the border between the States of Mississippi and Louisiana. Katrina, considered to cause the largest disaster in U.S. history, was one of the most powerful category 5 storms ever recorded with winds reaching 175 mph. It made landfall in Louisiana on August 29, 2005, as a category 4 storm where its effects devastated Southeast Louisiana and Coastal Mississippi areas. On September 3rd, Homeland Security Secretary Michael Chertoff described the aftermath of Hurricane Katrina as "probably the worst catastrophe, or set of catastrophes" in the country's history, referring to the hurricane itself, plus the flooding of New Orleans caused mostly by levee failures. Katrina claimed approximately 1,300 lives and damage estimates have been estimated to exceed over $100 billion. Over a million persons were displaced and some news accounts called it a "humanitarian crisis on a scale unseen in the U.S. since the Great Depression." The elaborate system of levees that were designed to protect Orleans Parish from the canal waters failed and caused massive flooding over approximately 80% of the City of New Orleans. Orleans Parish suffered great human and structure losses from rising water and high winds that damaged homes and businesses. Within one month of Hurricane Katrina, New Orleans again suffered losses. Hurricane Rita's surge caused the already compromised Industrial Canal Levee to breach allowing flood waters to flow back into the lower 9th Ward of Orleans Parish. These events are also discussed under the Previous Occurrences section of the Levee Failure hazard.

Following Hurricane Katrina, FEMA began updating its flood frequency analysis of the Mississippi and Louisiana Gulf Coast Region. Even though the studies are ongoing and the data is not yet available for all areas, it is apparent that the previous utilized Advisory Base Flood Elevations (ABFEs) were outdated. Preliminary studies of storm surge related to Katrina for the Mississippi Gulf Coast revealed that the ABFEs "are generally 5-12 feet higher than the base flood elevations" shown in pre-Katrina models.
It is anticipated that these ABFEs will be raised for most areas of southeastern Louisiana, including Orleans Parish, when the studies are done and FEMA issues its complete Hurricane Katrina Recovery Advisory for the state. This information will be included in Plan updates.

Vulnerability Assessment
The vulnerability of Orleans Parish to hurricanes varies depending on the strength and path of the hurricane. This vulnerability assessment assumes a category 3 hurricane following the path that Hurricane Georges was predicted to follow. This scenario involves the most common type of major hurricane, a category 3, and one of the biggest threats from a hurricane, a high storm surge in Lake Pontchartrain.

With few exceptions, all of Orleans Parish is protected by floodwalls and levees. Levees and floodwalls are located along the Mississippi River, Lake Pontchartrain, the Intracoastal Waterway, and smaller canals. The largest developed areas of the Parish outside of the levee system are the communities of Venetian Isles and Lake Catherine. Located in far Eastern Orleans Parish, Venetian Isles has a population of 1,883 persons and Lake Catherine has a population of 1,760. The structures of these communities are unprotected from storm surges. Another area that is outside the levee system is

immediately adjacent to Lake Pontchartrain. A small cluster of houses along the lake at the western edge of the Parish lies outside the levee.

New Orleans has been protected by levees since the City's earliest days. The last major upgrade to the levee system came in 1965 after Hurricane Betsy caused some of the worst flooding in decades. Currently, the levee system around New Orleans is one of the most extensive flood protection systems in the world. The levees were allegedly designed to protect the City from a category 3 hurricane. Recent analysis has shown that a category 3 storm could cause a storm surge of 14 feet along the south shore of Lake Pontchartrain (allowing for the lake's normal level of one foot above sea level). The levees along the lake would be able to stop most of this storm surge, but many waves would likely top the levees. As described in the Levee Failure section, the extensive levee system that protects Orleans Parish was damaged during Hurricane Katrina and is undergoing repairs. Additionally, the structural soundness of the levee walls before Katrina is under investigation.

Based on the evidence from Hurricane Georges in 1998, the storm surge from a category 3 hurricane could cause considerable flooding. Georges was a category 2 storm when it brushed New Orleans. It produced a storm surge of 7 feet above sea level in Lake Pontchartrain. Debris from some 70 fishing camp structures that were destroyed by Georges shows that the waves came within one foot of the top of the levee.

While the levees in Orleans Parish along Lake Pontchartrain are expected to hold a 14-foot storm surge, there is the possibility of extensive flooding in Orleans Parish from a category 3 storm due to inflow of water from other parishes. A model created by scientists at LSU shows that had Georges continued on its original path, water from St. Charles Parish could have reached Orleans Parish[4]. The lower levees along St. Charles Parish could be topped by a category 3 storm. Because of the topography of the area, the water coming over those levees would flow eastward along a path that runs south of the Louis Armstrong New Orleans International Airport. This water would collect in areas of Orleans Parish. The worst flooding, over eight feet of water, would be in neighborhoods to the west and east of City Park. Almost all of New Orleans between Lake Pontchartrain and Claiborne Avenue would receive four to eight feet of water. (See Maps 8-13[5]).

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[4] The model was created by Joseph Suhayda and Vibhas Aravamuthan. The results were shown in *Times-Picayune*, "Going Under", a graphics special included in "Special Report – Washing Away". 2002 <http://www.nola.com/hurricane/index.ssf?/washingaway/goingunder.html>

[5] It is important to note that the model used to create these maps was based on what could have happened if Hurricane Georges had continued on the track forecast by the National Hurricane Center on Saturday, September 26, 1998, at 4:00 a.m. The model has the center of the eye of the hurricane passing just to the east of Lakefront Airport. In such a scenario, the levees in New Orleans East would not be subjected to the highest storm surge. Thus, no flooding was expected within the areas of New Orleans East that are protected by levees. (Areas outside of the levees would be expected to flood; however, no flooding heights were calculated by this model.)

However it would be incorrect to assume from these maps that New Orleans East does not face the threat of flooding from a major hurricane. There are levees in New Orleans East along the lakefront that are 13.5 feet, the same height as the levee located in St. Charles Parish that is topped in the LSU model. A different storm track would subject these levees to a surge that potentially would be high enough to top the levees and cause flooding within the levee-protected areas of New Orleans East.

Evacuation and shelter of New Orleans residents has had a major impact on injuries and deaths from a major hurricane. Evacuation difficulties arise from residents who cannot evacuate and from those who will not. First, many residents of New Orleans do not have access to a car and rely on public transportation. According to the 2000 Census, 51,435 households in the City did not have access to a vehicle. The City's Transportation Master Plan says the areas with the people least likely to have access to an automobile are Mid-City, Central City, Florida/ Desire/ Bywater, French Quarter, Lower 9th Ward and residents in Public Housing.

Second, many residents who have access to vehicles choose not to evacuate. After Hurricane Georges, the University of New Orleans Survey Research Center conducted a survey of residents' evacuation behaviors during the storm. During Hurricane Georges, only 44 percent of registered voters in Orleans Parish evacuated and only 27 percent of registered voters evacuated to some location out of Orleans and Jefferson Parishes. Evacuation rates were closely linked to income: residents with lower incomes were less likely to have evacuated. Also, residents 45 years and older were much less likely to have evacuated. Many evacuees left relatively late given the time constraints of evacuating a city the size of New Orleans. Sixty-nine percent of evacuees who evacuated to some place outside of Orleans and Jefferson Parishes left within 36 hours of landfall. Emergency Preparedness officials estimate that it would take 72 hours to fully evacuate New Orleans. If a large-scale evacuation were required, residents would have to begin leaving much earlier than they did for Georges.

Shelter for those residents who do not evacuate is problematic. Several years ago the Red Cross decided that it was too dangerous to provide hurricane shelters south of I-10 or I-12 during a category 4 or 5 hurricane.[6] The City, however, knowing that some people just do not evacuate despite all the warnings, has provided shelters of last resort in recent years for residents who do stay behind. During Hurricane Lili, the City opened shelters in three area schools. During Hurricane Georges, the City opened several last-resort shelters, including an infirmary in the Superdome. After the storm, City officials said that "the demand for special medical care in shelters took them by surprise."[7] Another problem with shelter for residents who stay is that "vertical evacuation" is no longer considered as safe as it once was. Recent research indicates that wind speed in hurricanes gets stronger with height. Winds that have a speed of 155 mph at ground level may have a speed of over 200 mph at 100 feet above sea level.[8] Thus, vertical evacuation is not a practical method of sheltering many people.

Hazard Impact

In the pamphlet "State and Local Mitigation Planning How-To Guide: Understanding Your Risks," FEMA recommends a methodology for loss estimation for hazard events.

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[6] Louisiana Coastal Wetlands Conservation and Restoration Task Force. 2001. *The 2000 Evaluation Report to the U.S. Congress on the Effectiveness of Louisiana Coastal Wetland Restoration Projects.* Baton rouge, LA: Louisiana Department of Natural Resources.

[7] Coyle, Pamela. "Shelters Grapple with Problems of Bedridden, II." *Times-Picayune,* Sept. 29, 1998.

[8] *Times-Picayune,* "The Big One," a part of "Special Report – Washing Away." 2002.

This methodology was used to estimate the losses to property and economic losses from a category 3 hurricane. (See Appendix 1 for a full description of the methodology used.) Table 4 shows a summary of the number and the value of structures that could be damaged by a category 3 hurricane in New Orleans. Fifty-six percent of all structures in Orleans Parish, or 77,261 structures, could be damaged by flooding from such a hurricane. As Maps 8-13 show, a category 3 hurricane passing directly over New Orleans would have a tremendous impact on the City. The damages from a category 3 hurricane like that profiled would be extraordinary.

Table 4: Loss Estimation-Hurricanes

Summary of Structures and Persons in Hazard Area for Hurricanes

	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	74,473	56%	18,784,873	10,519,564	56%	484,674	271,417	56%	6,101,359
Commercial	3,433	1,922	56%	4,377,092	2,451,172	56%	238,771	133,712	56%	1,421,679
Industrial	634	355	56%	643,993	360,636	56%	31,988	17,913	56%	209,169
Agriculture	13	7	54%	2,933	1,642	56%	N/A	N/A	N/A	952
Religion	397	222	56%	446,724	250,165	56%	N/A	N/A	N/A	140,092
Government	29	16	55%	527,894	295,621	56%	N/A	N/A	N/A	171,460
Education	226	127	56%	321,714	180,160	56%	N/A	N/A	N/A	104,493
Critical Facilities	213	119	56%	5,305,572	2,971,120	56%	N/A	N/A	N/A	1,723,249
Infrastructure	35	20	57%	2,388,200	1,337,392	56%	N/A	N/A	N/A	775,687
Total	137,719	77,261	56%	30,410,895	18,367	60%	N/A	N/A	N/A	10,648,140

Probability of Future Events

The frequency of hurricanes passing within 80 miles of New Orleans is summarized in the following table:

Intensity	Frequency
Category 1	8 years
Category 2	19 years
Category 3	32 years
Category 4	70 years
Category 5	180 years

Source: USGS, "Environmental Atlas of Lake Pontchartrain"

Based on historical data, a tropical storm or hurricane can be expected to land in Louisiana every 1.2 years. A storm landing in Louisiana will likely have an impact on Orleans Parish.

While the damages that a future hurricane might cause to Orleans Parish are uncertain, it is certain that Orleans Parish will face hurricanes in the future. Hurricane Katrina proved that even a glancing blow from a category 3-5 storm could lead to catastrophic devastation. A recent study calculated the chances that a hurricane will pass within 75 miles of Orleans Parish. In any year, there is a 12.5 percent chance that a hurricane will pass within this distance of Orleans Parish and there is a 3.2 percent chance that a major hurricane (category 3 or higher) will pass this close.[9] Another way to interpret these

[9] Sheets, Bob and Jack Williams. *Hurricane Watch: Forecasting the Deadliest Storms on Earth.* July 2001.

figures is that Orleans Parish is likely to experience 12.5 hurricanes of any strength and 3.2 major hurricanes in a 100-year period. The term "major hurricane" includes all hurricanes that are category 3 or higher; however, category 4 and 5 storms are rare. From 1900 to 2000, only 3 category 5 storms and 14 category 4 storms made landfall anywhere in the U.S. However, Hurricanes Katrina and Rita, both striking Louisiana in August and September of 2005, provided strong evidence that powerful Gulf storms can strike anytime during the hurricane months and probability factors are not precise indicators.

Although the probability analysis indicates that Orleans Parish will be hit by another category 4 or 5 storm soon is low, risk from any size hurricane is greater now than it was in the past. Furthermore, probability forecasting is not a certainty and the fact remains that Orleans Parish could face another powerful storm during any upcoming hurricane season. Subsidence and erosion of coastal lands around Orleans Parish mean that storms can cause greater damage further inland. The Mississippi River Delta has sunk as much as three feet over the past century. Consequently, flood waters from storms are that much higher and they spread over greater areas. Erosion of barrier islands and marshes has resulted in less vegetation to produce a drag on moving storms. Analysis from hurricane Andrew shows that the storm surge decreased by 3.1 inches for every mile of marsh it traveled over. Thus, for every four miles of marsh lost to erosion, storm surges are one foot higher. As the natural defenses against storms erode, the threat to New Orleans grows. One effect of every hurricane is storm surge even though the severity can vary depending on factors mentioned.

Tornados

Hazard Event Description

Tornados are areas of strong, rotating winds caused by the convergence of a warm air mass and a cold air mass. They can be spawned by thunderstorms or hurricanes. Although certain conditions are more likely to produce tornados, it is impossible to predict when a tornado will occur and where it will travel once it has formed.

A tornado is a violently rotating column of air extending between, and in contact with, a cloud and the surface of the earth. The most violent tornados are capable of tremendous destruction with wind speeds of 250 miles per hour or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

Tornados are the most hazardous when they occur in populated areas. Tornados can topple mobile homes, lift cars, snap trees, and turn objects into destructive missiles. Among the most unpredictable of weather phenomena, tornados can occur at any time of day, in any state in the union, and in any season. In Louisiana, tornados have a higher frequency in the spring months of March, April, and May. While the majority of tornados cause little or no damage, some are capable of tremendous destruction. Additionally, tornados are often generated from hurricanes so the entire hurricane season has to be viewed as risk period for this hazard.

Location and Extent

Because there is no defined geographic boundary, all people and property in New Orleans are exposed to the risk of damage from tornados. Tornado intensity is measured by the Fujita Scale, which links wind speed to damage done by the tornado. Table 5 shows the Fujita Scale ratings for tornados from F0 to F5.

Table 5: Fujita Scale

Fujita Rating	Wind Speed (mph)	Type of Damage Done
FO	40-72	Light damage. Some damage to chimneys. Breaks branches off trees. Pushes over shallow-rooted trees. Damages sign boards.
F1	73-112	Moderate damage. The lower limit is the beginning of hurricane wind speed. Peels surface off roofs. Mobile homes pushed off foundations or overturned. Moving autos pushed off roads. Attached garages may be destroyed.
F2	113-157	Considerable damage. Roofs torn off frame houses. Mobile homes demolished. Boxcars pushed over. Large trees snapped or uprooted. Light object missiles generated.
F3	158-206	Severe damage. Roof and some walls torn off well-constructed houses. Trains overturned. Most trees in forest uprooted.
F4	207-260	Devastating damage. Well-constructed houses leveled. Structures with weak foundations blown off some distance. Cars thrown and large missiles generated.
F5	261-318	Incredible damage. Strong frame houses lifted off foundations and carried considerable distances to disintegrate. Automobile size missiles fly through the air in excess of 100 meters. Trees debarked. Steel reinforced concrete structures badly damaged.

Another useful gauge of how intense tornados are likely to be in an area is the design wind speeds for community shelters recommended by the American Society of Civil Engineers (ASCE). The ASCE divides the U.S. into Wind Zones based on 40 years of tornado history and 100 years of hurricane history. Orleans Parish is in Wind Zone III, meaning community shelters should be designed to withstand 200 mph winds. This corresponds approximately to the highest wind speed of an F3 tornado or a strong category 5 hurricane.

Previous Occurrence

From 1950 to 1995, 11 tornados were recorded in Orleans Parish. Of these, two were rated F0; five were rated F1; and four were rated F2. There has not been a tornado stronger than an F2 in Orleans Parish in at least 50 years. In addition, Orleans Parish has not experienced a tornado-related fatality in over 50 years. Since 1950, only three tornados in Orleans Parish have caused more than $25,000 worth of damage.[10] In 1953

[10] In 1953 damages totaling $250,000 were reported following a tornado. Two other tornados, in 1964 and 1971, each caused $2,500,000 in damages; however, the records of the National Climatic Data Center are

an F2 tornado caused $250,000 in damage. In 1964, Orleans Parish had an F2 tornado that caused $2.5 million in property damage. In 1971, Orleans Parish had two tornados – one (F1) causing $25,000 worth of damage and another (F2) causing $2.5 million in property damage.

Vulnerability Assessment

Because of the nature of tornado events, it is impossible to say where in Orleans Parish a tornado is likely to occur or how much damage a tornado is likely to cause. Generally, the length of the path traveled by a tornado and the width of the path cut by a tornado increase as the F-rating increases. Since Orleans Parish is most likely to experience weak tornados, any tornado in the Parish will probably have a relatively short and narrow path. Path lengths for weak tornados typically are less than 10 miles and less than 175 yards wide.[11]

Effective January 2004, New Orleans adopted the International Building Code, which requires new structures to be able to withstand winds up to 140 mph. Previously, New Orleans had followed the Standard Building Codes created by the Southern Building Code Congress International, which was established in 1940. This building code requires buildings to withstand 110-mph winds. Buildings constructed to fit these guidelines would be able to withstand an F0- or an F1 tornado. However, structures built before 1940 were built under a different building code or no code at all.

Approximately 30 percent of the housing units in Orleans Parish, or 63,779 units, were built before 1940. Most of the housing units south of I-610 and west of the Industrial Canal were built before 1940. It is difficult to know how vulnerable older houses are to tornados. Many older houses were built with heavier materials, such as plaster and larger timbers, which allow them to withstand higher winds than many newer houses can withstand. On the other hand, there is no way to know the quality of the workmanship that went into the construction of these houses or how well older houses have aged.

The major commercial and government buildings in Orleans Parish are newer than the housing stock. Fourteen of the 18 Class A office buildings in the New Orleans Central Business District were built after 1980. Many other major structures, such as the University of New Orleans and the Superdome, also date from the second half of the last century. Because much of the stock of major commercial and governmental buildings was built under modern business codes, the typical tornado in Orleans Parish should cause minimal damage to these structures and result in little functional downtime for businesses.

Hazard Impact

The level of damage expected from a tornado in south Louisiana is low. Property damages associated with tornados in Orleans Parish have historically been minimal (less

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unclear about whether these damages were confined to Orleans Parish or whether the figures represent damages across all parishes affected by the tornados.

[11] Stormfax Weather Almanac. "Fujita-Pearson Tornado Scale (FPP scale)." <www.stormfax.com/fujita.htm>

than 1%). The expected damage from a tornado is assumed to be 1% of the value of structures exposed to a tornado. The overall threat to human life is minimal due to advanced warning techniques now available. The following table shows the at-risk structures, persons, and critical facilities and a projected loss estimation for a tornado event in Orleans Parish.

Table 6: Tornado Exposure and Loss Estimation

Summary of Structures and Persons in Hazard Area for Tornados

	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	1,330	1%	18,784,973	187,850	1%	484,674	4,847	1%	1,879
Commercial	3,433	34	1%	4,377,092	43,771	1%	238,771	2,388	1%	438
Industrial	634	6	1%	643,993	6,440	1%	31,998	320	1%	64
Agriculture	13	0	0%	2,933	29	1%	N/A	N/A	N/A	0
Religion	397	4	1%	446,724	4,467	1%	N/A	N/A	N/A	45
Government	29	1	3%	527,894	5,279	1%	N/A	N/A	N/A	53
Education	226	2	1%	321,714	3,217	1%	N/A	N/A	N/A	32
Critical Facilities	213	2	1%	5,305,572	53,056	1%	N/A	N/A	N/A	531
Infrastructure	35	1	3%	2,388,200	23,882	1%	N/A	N/A	N/A	239
Total	137,719	1,380	1%	30,410,895	327,991	1%	N/A	N/A	N/A	3,281

Probability of Future Events

From 1953 to 1993, Texas experienced the highest average annual number of tornadoes with 128, followed by Oklahoma (52), Kansas (47), Florida (46), and Nebraska (38). Louisiana has more than 25, but less than Nebraska's 38. In Louisiana, peak tornado occurrence is in March through May, and in November.

Based on past occurrences, it is likely that Orleans Parish will experience tornados in the future. From 1950 to 1995, a tornado occurred in Orleans Parish once very 3.75 years on average. However, it is unlikely that Orleans Parish will be struck by a *violent* tornado (defined as an F4 or F5). Historically, tornados in Orleans Parish have not been violent and few have been *strong* (defined as an F2 or F3).

Hail

Hazard Event Description

Large hail results in nearly $1 billion in damage annually to property and crops in the United States. Hail is made up of spherical balls of ice. It is a product of thunderstorms or intense showers. It is generally white and translucent, consisting of liquid or snow particles encased with layers of ice. Hail is formed within the high tops of a well-organized thunderstorm. An updraft will sometimes throw rain droplets high up into the tops of a cloud. There, the temperature is well below freezing, and the droplets freeze. The droplet then falls and can become caught in another updraft. This time, a second coating of ice is added, making the hail stone larger. This cycle continues until the hailstone is too heavy to be lifted again, and it then falls as hail. The stronger the updraft, the longer the hail develops, and the bigger the hailstone is when it falls. Hail is not to be confused with sleet, which is frozen raindrops that fall during winter storms. Hail can be smaller than a pea or as large as a softball and can be very destructive to plants, cars,

homes, buildings, crops, and animals. Large hailstones which fall at speeds faster than 100 mph can be very dangerous.

Location and Extent

Because there is no defined geographic boundary, all property in New Orleans is exposed to the risk of damage from hail. The development and maturation of hailstones are very complex processes. Numerous factors impact the resultant size of the hailstones including updraft strength, storm scale wind profile, height of the freezing level, and the mean temperature and relative humidity of downdraft air. The complexities of hail formation and sub-cloud processes make utilizing Doppler radar data to forecast the occurrence of large hail difficult. Verification of hail events is also important, but is a cumbersome process due to the limited temporal and spatial distribution of the event.

Previous Occurrence

In January 2000, Orleans Parish experienced a storm that brought some of the largest hail ever recorded in the area. Hail 1.75 inches in diameter fell over a swath of New Orleans that was 5 miles long and 1 mile wide. As shown in Table 7, on January 23, 2000, a hailstorm caused significant damage to property in the New Orleans metropolitan area. Ranging from dime to golf ball-size, the hail damaged roofs, windows, and vehicles, resulting in nearly 42,000 homeowner and 37,500 auto insurance claims at an estimated cost of $353 million. The Institute for Building and Home Safety (IBHS) identified this storm as the eighth most damaging storm in the nation in the period from 1994 to 2000.

Table 7: Top 10 National Hailstorm Events, 1994-2000

Rank	Date	Primary location	Loss Amount
1	5-15-98	Minn.-St. Paul, MN	$1.73 billion
2	5-5-95	Ft. Worth, TX	$929 million
3	4-19-96	Indianapolis, IN	$658 million
4	5-18-00	Chicago suburbs, IL	$572 million
5	4-25-94	Dallas-Ft. Worth, TX	$542 million
6	4-23-99	Northern Virginia	$394 million
7	7-7-00	Minn.-St. Paul, MN	$381 million
8	1-23-00	New Orleans, LA	$353 million
9	5-3-96	Louisville, KY	$339 million
10	4-16-98	Bowling Green, KY	$290 million

Source: IBHS 2002 Annual Conference, "Hailstorm Loss Database," PowerPoint Presentation, November 12, 2002

Since 1944 Orleans Parish has experienced 15 storms with hail over .75 inches in diameter. This includes events with golf ball-sized hail in 1962, 1964, 1977, 1982, and 2000.

Vulnerability Assessment

Hailstorms generally occur more frequently during the late spring and early summer, a period of extreme variation between ground surface temperatures and jet stream temperatures, producing the strong updraft winds needed for hail development.

Hazard Impact

Property damage is the primary result of a hail storm. Damage to roofs, windows, and vehicles would be the primary impact of a hail storm. Historical hail storm data indicates that the impact of a hailstorm results in an averages loss of 1% of the value of the structures in the hazard area, which is assumed to be 5% of all structures. Hail is not considered a threat to the lives of the population in Orleans Parish. Table 8 shows a summary of the number and the value of structures that could be damaged by hail in Orleans Parish.

Table 8: Hail Storm Exposure and Loss Estimation

Summary of Structures and persons in Hazard Area for Hail

	Number of Structures			Value of Structures (in 000s)			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	6,649	5%	18,784,973	939,249	5%	9,392
Commercial	3,433	172	5%	4,377,092	218,855	5%	2,189
Industrial	634	32	5%	643,993	32,200	5%	322
Agriculture	13	1	8%	2,933	147	5%	1
Religion	397	20	5%	446,724	22,336	5%	223
Government	29	1	3%	527,894	26,395	5%	264
Education	226	11	5%	321,714	16,086	5%	161
Critical Facilities	213	11	5%	5,305,572	265,279	5%	2,653
Infrastructure	35	2	6%	2,388,200	119,410	5%	1,194
Total	137,719	1,380	5%	30,410,695	1,639,957	5%	16,399

Probability of Future Events

The State of Louisiana's Hazard Profile indicates that Louisiana has experienced an average of 17 hailstorms annually since 1955. There is a 0.10% probability of hail of any size in any given year in Orleans Parish, according to the State of Louisiana Hazard Profile.

Thunderstorms/Lightning

Hazard Event Description

Many thunderstorms occur in Orleans Parish each year. This is largely due to its proximity to the Gulf of Mexico, a rich source of the low-level moisture needed for the development of thunderstorms. Thunderstorms can be accompanied by high winds, heavy rains, lightning, hail, and occasionally tornados.

Thunderstorms typically occur when dense cold air overlies warm moist air and uplift is initiated by one of several possible factors such as solar heating, orographic (topographic) effects or fronts and troughs. Strong localized upward currents of air can develop as the heat energy stored in moist warm air is converted to kinetic energy high in the clouds. During this process, condensation of the moist air occurs at altitude, together with separation of positive and negative electrical charges, leading to the generation of lightning. Hail is formed by the freezing of raindrops at very high levels. These are then thought to grow steadily in size while being recirculated throughout the storm by powerful updrafts and downdrafts. When the weight of the circulating water and ice can no longer be supported by the updrafts, they fall to earth in concentrated shafts, dragging the surrounding air downwards and causing strong "downburst" winds at the surface. When conditions are favorable, mature thunderstorms can form in very short periods of

time and have highly organized motion comprising complementary up and down drafts. Sometimes, practical warnings for such events are not possible.

Wind is defined as the motion of air relative to the earth's surface. In the mainland United States, the mean annual wind speed is reported to be eight to 12 mph. High winds can result from thunderstorm inflow and outflow, or downburst winds when the storm cloud collapses, and can result from strong frontal systems, or gradient winds from high or low pressure systems moving across the state. High winds are speeds reaching 50 mph or greater, either sustaining or gusting. A downburst wind is defined as a strong downdraft resulting in an outward burst of damaging winds on or near the ground. Downburst winds can produce damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

Lightning, which occurs during all thunderstorms, can strike anywhere. Generated by the buildup of charged ions in a thundercloud, the discharge of a lightning bolt interacts with the best conducting object or surface on the ground. The air in the channel of a lightning strike reaches temperature higher than 50,000 degrees F. The rapid heating and cooling of the air near the channel causes a shock wave, which produces thunder. Lightning can kill or injure humans and animals. It can also destroy property, including buildings and equipment items.

High winds associated with hurricanes and tornados are discussed is separate sections relating to those specific hazards.

Location and Extent

All of Orleans Parish is at risk to strong thunderstorms and associated winds and lightning. The extent of thunderstorms may be measured by the cell intensity: ordinary cell, multicellular, and supercell. The most common type of thunderstorm is termed the *ordinary* cell, which is limited in size and lifespan, but can produce short bursts of severe weather. *Multi-cellular* storms are more persistent and larger in impact, formed by successive cell generation on the forward left flank, allowing them to move transverse to the prevailing wind and to present a broader impact front. High winds can result from thunderstorm inflow and outflow, or downburst winds when the storm cloud collapses, and can result from strong frontal systems, or gradient winds from high or low pressure systems moving across the state. High winds are speeds reaching 50 mph or greater, either sustaining or gusting. A downburst wind is defined as a strong downdraft resulting in an outward burst of damaging winds on or near the ground. Downburst winds can

produce damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder. A downdraft wind is defined as a small-scale column of air that rapidly sinks toward the ground, usually accompanied by precipitation as in a shower or thunderstorm. A downburst is the result of a strong downdraft.

Several other variants also exist, but the most dangerous form is termed the *super cell* thunderstorm. The *super cell* is typically an isolated form and always has the potential to be severe because of its strong and persistent rotating updraft, which dissipates at the upper levels forming the characteristic anvil and overshoot of clouds. Vertical wind shear (i.e. wind speed increasing with height) is important in the development of severe storms such as *super cells.* The shearing effect serves to separate the updrafts from the downdrafts, thus creating a circulation. In a normal thunderstorm, the downdraft tends to fall back into the updraft, effectively dissipating the storm's energy. Hail and heavy rain are associated with the downdraft zones and under some specific conditions may also form a tornado towards the left rear flank of the storm cell. This small but rapidly rotating column of air descends below the cloud base, reaching the surface with devastating consequences. As the storms translate at speeds typically in the range of 40 to 50 km/h, these relatively narrow impact widths become long swaths of potentially very high damage. *Super cells* may have a lifespan of several hours and present an impact front as wide as 40 km. Records of damage generally indicate "pulsing" whereby the ground level impacts tend to fluctuate, probably depending on the supply of material held aloft by the updrafts. Very severe *super cells* can exhibit almost continuous damage fronts for several hours as combinations of wind, rain, and hail.

Previous Occurrences

Orleans Parish usually has between 60 and 75 thunderstorms per year. Although such storms occur year round, they are more common in the summer months, averaging 10-15 per month, than in the winter months, averaging 2 per month. Thunderstorms in Orleans Parish frequently result in one to four inches of rain. Table 9 shows thunderstorms since 1995 that caused property damage and the location of the damage.

Table 9: Thunderstorms Since 1995 with Reported Property Damage

Location	Date	Property Damage
New Orleans	May 8, 1995	$750,000
New Orleans	February 13, 1997	1,000
Lakefront Airport	April 26, 1997	50,000
New Orleans	June 21, 1998	1,000
Lake Catherine	January 2, 1999	1,000
New Orleans	July 14, 2000	1,000
New Orleans	July 22, 2000	10,000
Algiers	August 20, 2000	5,000
Lakefront Airport	September 1, 2000	1,000
New Orleans	November 6, 2000	50,000
New Orleans	June 5, 2001	15,000
Parish-wide	April 8, 2002	25,000

New Orleans	July 7, 2002	4,000
New Orleans	July 17, 2003	3,000

Source: National Climatic Data Center

Orleans Parish has also experienced property damage due to lightning in recent years. Table 10 shows lightning events since 1995 and associated property damage.

Table 10: Orleans Parish Lightning Events

Location	Date	Type	Deaths	Injuries	Property Damage
Algiers	6/17/1994	Lightning	0	0	50k
Algiers	5/30/1995	Lightning	0	2	0
New Orleans Lakefront	4/14/1996	Lightning	0	0	0
New Orleans Lakefront	4/17/1996	Lightning	1	0	0
New Orleans	6/21/1998	Lightning	0	0	120k
Algiers	9/6/1999	Lightning	0	0	50k
New Orleans	6/4/2000	Lightning	2	0	0

Source: National Climatic Data Center

Vulnerability Assessment

Based on past occurrences, it is likely that Orleans Parish will experience strong thunderstorms and lightning in the future. Several strong storms are likely each year.

Hazard Impact

Property damages associated with strong thunderstorms and lightning in Orleans Parish have historically been minimal (less than 1%). The expected damage is assumed to be 1% of the value of a structure in the hazard area exposed to a strong thunderstorm and lightning. The overall threat to human life is minimal, although there have been 2 deaths associated with lightning strikes since 1994 in Orleans Parish. The following table shows that at-risk structures and persons to strong thunderstorms and lightning.

Table 11: Strong Thunderstorm/Lightning Exposure and Loss Estimation

	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	6,649	5%	18,784,973	939,249	5%	484,674	24,234	5%	9,392
Commercial	3,433	172	5%	4,377,092	218,855	5%	238,771	11,939	5%	2,189
Industrial	634	32	5%	643,993	32,200	5%	31,986	1,599	5%	322
Agriculture	13	1	8%	2,933	147	5%	N/A	N/A	N/A	1
Religion	397	20	5%	446,724	22,328	5%	N/A	N/A	N/A	223
Government	29	1	3%	527,894	26,395	5%	N/A	N/A	N/A	264
Education	226	11	5%	321,714	16,086	5%	N/A	N/A	N/A	161
Critical Facilities	213	11	5%	5,305,572	265,279	5%	N/A	N/A	N/A	2,653
Infrastructure	36	2	6%	2,388,200	119,410	5%	N/A	N/A	N/A	1,194

Total	137,719	1,380	5%	30,410,895	1,639,957	5%	N/A	N/A	N/A	16,399

Probability of Future Events

The probability of severe thunderstorm occurring in a specific region depends on certain atmospheric and climatic conditions. Duration and frequency can be used as indicators of potential severity. The geographic areas with a high density of lightning strikes are at a greater risk of damage or potential loss of life during a thunder event.

South Florida has the greatest number of thunderstorms, with an annual average of 100 to 130, and an average duration of 80 to 100 minutes. Louisiana has an annual average of 100 – 110 thunderstorms lasting from 90 to 100 minutes.

The lighting hazard component of thunderstorms is measured as the mean annual ground flash density (flashes per square kilometer). Review of data shows that the central Florida region has over 18 flashes/km^2, the highest density in the U.S. mainland. Louisiana has from 8 to 12 flashes/km^2.

As previously stated, historically Orleans Parish has between 60 and 75 thunderstorms per year, with an average of 10-15 a month during the summer months and 2 per month in the winter. These averages will likely remain constant in the future.

Subsidence

Hazard Event Description

Subsidence is the sinking of large portions of the Earth's crust. The New Orleans region has been experiencing high rates of subsidence for the past several decades. Subsidence in the region is due to natural processes, such as the natural compaction of soils, as well as to the activities of humans, such as oil and gas extraction. Erosion of land mass is the effect of subsidence.

The single most important factor that has contributed to subsidence in the region is the change to the hydrology of Southeast Louisiana, including Orleans Parish. River deltas naturally undergo accretion and subsidence. Accretion is the process by which sediments accumulate through flooding of the banks and natural levees. Subsidence occurs as these sediments compact over time. Prior to the 20th Century, the accretion process equaled or exceeded the subsidence process in the Mississippi River Delta. However, the creation of flood-protection levees along the Mississippi River has stopped the accretion process in recent decades. Thus, there is nothing to counteract the natural subsidence that occurs in this area.

Location and Extent

The sinking problem in Louisiana, as a result of subsidence, has run anywhere from 6 to 20 inches over the past 20 years. This results in recurring maintenance to address infrastructure problems. Subsidence continues to be a problem for the Greater New Orleans Area, including all of Orleans Parish. Most of these areas are built on Mississippi River silt, and the silt is slowly settling and compacting. Houses not built on

deep pilings are tipping and cracking. Subsidence is also responsible for infrastructure problems, including ruptured water and sewer lines. However, it is coastal subsidence that poses the greatest threat to New Orleans. Loss of land masses makes the City more vulnerable to the effects of hurricanes, including high winds and storm surge.

Previous Occurrence
Subsidence is an ongoing hazard affecting Orleans Parish, but is being intensified due to human intervention.

Vulnerability Assessment
All states with low-lying coasts are vulnerable to land mass loss and sea-level rise, but the coastal Parishes of Louisiana, including Orleans Parish, are much more so because of the subsidence associated with the Mississippi River Delta. Until humans intervened, the surface elevation of the broad delta kept pace with rising sea level for several thousand years, largely because the river built delta lobes and nourished wetland vegetation. The rates of natural subsidence and sea-level rise along the Louisiana coast have been exacerbated by human modifications, primarily levees which have isolated the Mississippi River from a delta complex that depends on an annual flooding cycle. These modifications cut off the delta-building process of the river.

Louisiana's coastal system has also been heavily impacted by channels dug for navigation and mineral extraction, which have allowed high-salinity Gulf waters to migrate inland. Over one million acres of coastal land have been lost since the 1930s, and between 25 and 35 square miles continue to be lost each year.

Louisiana is clearly a state at risk from further sea-level rise. New Orleans is perhaps the most sensitive and susceptible major city in the US to climate change. Louisiana's rate of relative sea-level rise is the highest in the US due to the subsidence of the Mississippi River deposits. Rising sea-levels caused by global warming, combined with Louisiana's already sinking coastline could result in the Gulf of Mexico rising by more than 3 feet in the next century. This would drown remaining wetlands and increase the risk of hurricane storm surges for New Orleans and coastal towns. When added to current rates of subsidence the prediction of sea-level rise for most of the Gulf Coast is 15 inches. In Louisiana, where subsidence is occurring faster, the water could be as much as 44 inches.

Subsidence combined with continuing sea-level rise will perpetuate and even exacerbate Louisiana's alarming rates of wetland loss. Absent major intervention, a continuation of current trends is projected to cause loss of more than 400,000 acres over the next 50 years. These fragile land masses serve as extremely important barriers between the Gulf of Mexico and southeastern Louisiana Parishes, including Orleans.

Hazard Impact
While the effects on property in the New Orleans metropolitan area can be significant, subsidence is a creeping hazard event, one with chronic, not acute impacts. Subsidence is a constant process that cannot be easily mitigated through comprehensive mitigation actions. Subsidence problems are addressed on an individual basis as problems are

discovered. Therefore, no personal loss estimation can be made for this hazard. However, in the long term, the loss of coastal land masses that provide some protection for the City of New Orleans from hurricanes is vitally important. The loss of this important natural barrier will have a tremendous impact on all of New Orleans and surrounding parishes by making them more vulnerable, especially to powerful hurricanes.

Probability of Future Events

Subsidence occurs slowly and continuously over time or on abrupt occasions, as in the case of sudden formation of sinkholes. Coastal Louisiana wetlands erosion is continuing due to subsidence largely related to the Mississippi River's drainage. This loss of land mass is expected to continue unless a tremendous amount of government resources are applied.

Chemical Spills/Accidents

Hazard Event Description

Orleans Parish faces the threat of a hazardous material spill/accident from a variety of sources. The Parish has many facilities that use or store toxic chemicals. A leak at one of these facilities could cause health problems for residents, property damage, and economic losses due to downtime at businesses that are evacuated. New Orleans also faces threats from chemicals transported through the city on highways, railways, and waterways. Interstate 10, a major east-west corridor, runs through New Orleans. Because of its proximity to several major ports (including Jacksonville, New Orleans, Houston, Los Angeles), I-10 serves as a major transportation route for may freight trucks. Six major freight rail companies operate in the New Orleans area, including Illinois Central, CSX, Norfolk Southern, Kansas City Southern, BNSF, and Union Pacific. Many toxic chemicals are transported by rail through New Orleans routinely. New Orleans also has an extensive system of navigable waterways, including the Mississippi River and the Industrial Canal. More than one-third of all industrial chemicals transported on the nation's inland waterway system pass through the New Orleans Industrial Canal.[12] Also, because of the many modes of transportation that can be found in New Orleans, there is reason to believe that chemicals are traveling on the City's streets as part of the imtermodal transportation of these products.

Location and Extent

The Emergency Planning and Community Right-to-Know Act of 1986 requires certain facilities, known as Tier II facilities, to submit reports detailing the type and amount of certain chemicals to the State Emergency Response Commission, the Local Emergency Planning Committee, and the local fire department. Map 14 shows the location of Tier II facilities in New Orleans. As of 1999, companies of all sizes that use certain flammable and toxic substances are required to submit a Risk Management Plan to the Environmental Protection Agency. Each RMP must include a description of the "worst-case" scenario for the facility. Map 15 shows areas covered by the worst-case scenarios for two facilities in New Orleans.[13] The buffers on the map show the "miles to

[12] Taxpayers for Common Sense and the National Wildlife Federation. "Troubled Waters." March 2000.

[13] The worst-case scenarios for these two facilities are taken from a report by Greenpeace based on the Risk management Plans provided by individual companies to the EPA. The full database of Risk Management

endpoint", which is the distance within which exposure to high concentrations of the chemical at that facility may lead to injury or death. While the exact areas that are at risk will vary depending on meteorological conditions at the time of a release, these maps give a general idea of the areas of Orleans Parish that could be affected by a chemical accident.

The researchers conclude that the extent of the damage from a chemical accident will depend on factors that cannot be predicted: the specific chemical involved in the accident, the amount of chemical involved, and the meteorological conditions at the time of the accident. Furthermore, the effects of a chemical spill will vary depending on which chemical is involved and which environmental medium the chemical is emitted into (i.e., land, air, water, or underground injection).

Previous Occurrence

Like most cities its size, New Orleans has a history of small chemical spills and accidents. The New Orleans Fire Department HazMat unit responds to all hazardous materials calls whether from a fixed-site or on a transportation route. During the first six months of 2003, the NOFD HazMat unit responded to 131 hazardous materials calls.[14] New Orleans has also experienced at least one major chemical spill. In 1987, a railcar filled with butadiene spilled, ignited, and exploded in a Gentilly neighborhood. A total of 19,000 residents were evacuated from their homes for three days as the fire burned. No one was killed in the incident, but many residents complained of respiratory ailments and other health problems.

Vulnerability Assessment

A general understanding of New Orleans' vulnerability to chemical accidents can be gained by looking at the location of facilities that use or store hazardous chemicals. The Emergency Planning and Community Right-to-Know Act of 1986 requires certain facilities, known as Tier II facilities, to submit reports detailing the type and amount of certain chemicals to the State Emergency Response Commission, the Local Emergency Planning Committee, and the local fire department. Map 14 shows the location of Tier II facilities in New Orleans. As of 1999, companies of all sizes that use certain flammable and toxic substances are required to submit a Risk Management Plan to the Environmental Protection Agency. Each RMP must include a description of the "worst-case" scenario for the facility. Map 15 shows areas covered by the worst-case scenarios for two facilities in New Orleans.[15] The buffers on the map show the "miles to endpoint", which is the distance within which exposure to high concentrations of the chemical at that facility may lead to injury or death.

Plans is not available to the public following the events of September 11, 2001. The Greenpeace report can be found at <http://www.greenpeaceusa.org/graphics/toxics/maps/accident_scenarios.htm>

[14] Based on data on the number of HazMat team responses from 1999-2001, this appears to be slightly less than the average number of responses during a six month period. Data for 2002 was unavailable.

[15] The worst-case scenarios for these two facilities are taken from a report by Greenpeace based on the Risk management Plans provided by individual companies to the EPA. The full database of Risk Management Plans is not available to the public following the events of September 11, 2001. The Greenpeace report can be found at <http://www.greenpeaceusa.org/graphics/toxics/maps/accident_scenarios.htm>

New Orleans' vulnerability to chemical accidents along transportation routes is more difficult to gauge because hazardous chemicals are not located at a fixed site and because many different chemicals are transported through New Orleans. A recent study analyzed the potential effects of a chemical leak along the southern Mississippi River rail corridors using the Areal Locations of Hazardous Atmospheres (ALOHA) model available from the Environmental Protection Agency.[16] The researchers modeled two leaks from a railcar, a large breach and a small hole, for five different meteorological conditions. Simulations were run on 46 "extremely hazardous substances", as defined by the EPA, which are transported along the Mississippi River corridor. The researchers identified vulnerability zones for each chemical under each set of meteorological conditions. A vulnerability zone is defined as the "total area where any time following an accident the concentration of a given chemical meets or exceeds the level which is 'Immediately Dangerous to Life and health'". The results of the model showed that 15 chemicals that are transported along rail lines in the region have vulnerability zones of less than one mile, six chemicals have vulnerability zones of between one mile and less than six miles, and five chemicals have vulnerability zones of six miles or more under some conditions.

Models such as those described above would also be useful in predicting the possible consequences of leaks from pipelines. While many of the pipelines running through New Orleans carry natural gas and oil rather than chemicals, a leak in one of these pipelines could have effects similar to those caused by a chemical leak. However, data on what materials are being transported through the City in pipelines is difficult to find.

New Orleans also faces a possible threat to its water supply in the event of chemical or hazardous material spill. A direct discharge into the Mississippi River or run-off into the River could cause the City's drinking water intakes to be closed. Closing the water intakes would not only make drinking water unavailable to the residents of the City, but it would also limit the availability of water for fighting fires. The length of time that the intakes would have to be closed would depend on how quickly any contaminates can be cleaned up or how long it would take the River to naturally wash them downstream.

The study of the transportation of hazardous substances along the southern Mississippi River corridor reaches conclusions that apply to all chemical accidents.

Hazard Impact

Potential impact from a chemical spill or leak can have a wide range of consequences. Evacuations of populated areas to mass casualties are all possible depending on the type and quantity of the toxic substance contaminating the environment. Many other factors enter into the level of impact of the hazard as well, including population density and even wind direction at the time of the accident. Considering Orleans Parish is a heavily populated area, any significant spill/leak of hazardous materials would likely impact some of the population regardless of the wind direction at the time.

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[16] Pine, John, Erno Sajo, and Rebecca East. "An Assessment of Transportation of Extremely Hazardous Substances for the Southern Mississippi River Corridors." January 1998. <http://www.risk.lsu.edu/Documents/MS_Rail_Study.pdf>

Probability of Future Events

As previous hazardous materials incidents in Orleans Parish have shown, the release of materials can lead to injuries or evacuation of thousands of nearby residents. On average, the State of Louisiana receives about 5,000 reports of accidental hazardous materials spills annually. Most accidental releases have occurred while chemicals were being transported along major highways. Orleans Parish will continue to experience accidental hazardous materials spills on an annual basis. The severity of a hazardous materials release depends upon the type of material released, the amount of the release, the proximity to populations, or sensitive areas like wetlands or waterways. The potential for a large chemical accident exists in New Orleans; however, based on previous experiences, probability that such an accident will occur is relatively low.

Terrorism

Hazard Event Description

Terrorism can be defined as an act of violence or a threat of violence designed to frighten or coerce. In today's world, the threat of terrorism takes many forms. Some terrorist attacks are aimed at causing property damage while others are designed to injure or kill people. From domestic extremists to loosely affiliated groups of foreign terrorists, from conventional arms to bio-chemical weapons, the possible scenarios for terrorism are almost unlimited. Concerning terrorism, mitigation planning involves what is known as *antiterrorism.* Antiterrorism refers to defensive measures used to reduce the vulnerability of people and property to terrorist attacks. Such measures must be based on the most likely scenarios for a terrorist attack in a given area.

Location and Extent

Fortunately, terrorism attacks in the U.S. have been rare occurrences. Nevertheless, terrorism is a genuine threat to a large, high-profile city such as New Orleans. New Orleans has one of the top five seaports and is one of the top ten tourist destinations in the U.S. As a major business, shipping, and tourism center, New Orleans contains many targets that would be attractive to terrorists.

Previous Occurrence

Orleans Parish has not had any occurrences of terrorism.

Vulnerability Assessment

While any place is vulnerable to terrorism, high-profile locations and locations where many people are present are more likely targets. New Orleans has many locations that are high-profile and/or have high concentrations of people. The Superdome and the New Orleans Arena, with a combined capacity of 90,000, host a variety of sporting events, concerts, and other special events throughout the year. New Orleans has hosted more Superbowls than any U.S city, and annually hosts the Sugar Bowl. The Ernest N. Morial Convention Center is one of the largest convention facilities in the U.S. New Orleans is also home to the offices of many federal agencies and governments contractors, including the U.S. Army Corp of Engineers District Headquarters; the U.S. Coast Guard Eight District Headquarters; The U.S. Marine Corps Reserve Headquarters; the Fourth Marine Division Headquarters; the Fourth Circuit Court of Appeals; The Federal District Court;

Federal Bureau of Investigation District Field Headquarters; the U.S. Department of Agriculture Southern Regional Research Laboratory; a U.S. Department of Agriculture computer facility that handles personnel records and payroll; NASA Michoud Assembly Facility; Avondale Industries; Boland Marine; Bollinger Shipyards; and Halter Marine. New Orleans is also home to the headquarters of the Louisiana National Guard.

Areas that tend to have high concentrations of people present include the Central Business District and the French Quarter. New Orleans is also home to many universities, including the University of New Orleans, with an enrollment of 17,000 students; Tulane University, with an enrollment of 12,000 students; and Delgado Community College, with an enrollment of 15,000 students. Two events each year also draw large crowds: Mardi Gras and the New Orleans Jazz and Heritage Festival (Jazz Fest).

Since the September 11 2001 attacks, security has been tightened in all large U.S. cities. In addition, even more stringent security measures have been put in place when the nation's terror alert level has been raised to yellow. In New Orleans, some of the measures that have been implemented recently include searches of cars and trucks before boarding the ferries on the Mississippi River, helicopter patrols by the Coast Guard over the City and along the River, searches of individuals during events such as the Super Bowl, and increased police presence on the streets during events such as the Super Bowl and Mardi Gras. Emergency operations personnel have also participated in mock disaster drills over the past two years to prepare for a possible terrorist attack.

Hazard Impact

Potential losses from a terrorist attack are difficult to calculate. Should a terrorism attack happen in New Orleans, the nature of the attack would have an impact on the losses. Some attacks might damage or destroy physical structures, such as the Superdome or office buildings. Any type of terrorist attack would likely cause economic losses due to a drop in tourism and convention business. After the September 11 2001 attacks, New Orleans suffered the third biggest drop in hotel occupancy of all major U.S. Cities.[17] New Orleans is particularly susceptible to economic losses from terrorism because tourism and convention business represents such a large part of our economy.

Probability of Future Events

Terrorist attacks in the U.S. have been rare occurrences. This rarity, however, makes it much more difficult to predict the nature, frequency, or severity of future terrorist attacks than it is to predict natural hazards. While the overall probability of a terrorist attack in Orleans Parish is very low, terrorism is a genuine threat to Orleans Parish.

[17] Meetingsnet.com "Hardest-Hit and Least Affected Cities." January 14, 2002. <http://911.meetingsnet.com/microsites/newsarticle.asp?mode=print&newsarticleid=274144>

Levee Failure

Hazard Event Description

Levees play a vital role in protecting Orleans Parish. A failure of any of these levees will dump water into Orleans Parish and endanger not only property, but human and animal life. New Orleans sits in a shallow "saucer" with much of the city below sea level. This further increases the risks and potential for catastrophic losses because incoming water would rise as the "saucer" fills.

Location and Extent

A complex system of levees hold back waters that are designed to keep Orleans Parish safe from Lake Ponchartrain, the Mississippi River and a network of canals that are used for drainage and industrial purposes. A breach of one or more levees would cause massive flooding in Orleans Parish. Additionally, much of New Orleans is below sea level and once a breach of a levee occurs, it becomes very difficult, time consuming and costly to remove the water from the effected area. Effected structures and infrastructure will remain submerged in flood waters for lengthy periods of time until the breach can be repaired and the water pumped from flooded areas. A breach in any levee is possible at any time from either natural or man made causes and the resulting flooding would be catastrophic to the Parish.

Previous Occurrences

On August 29, 2005, Hurricane Katrina, a powerful category 4 storm at landfall, hit the Gulf Coast near the border of Louisiana and Mississippi. It initiated what has been called the greatest disaster in U.S. history due to a series of catastrophic effects. One effect was that the City of New Orleans flooded as a result of several levee breaks that occurred during or soon after the storm hit. Even though the causes of the breaks are under investigation by several entities, most certainly the powerful storm surge, strong winds and excess water contributed to the levee failures. Additionally, once the water dumped into Orleans Parish, there was no expeditious way for it to be removed other than by pumping it out. As a result, the flood waters remained in Orleans Parish, as well as neighboring parishes, for several weeks causing catastrophic damage to businesses, residences, vehicles and infrastructure. Over one thousand persons died in Louisiana as a result of the effects created by Katrina and a large number of them perished in Orleans Parish as a direct result of rising water from the levee breaks.

As the storm passed through the New Orleans area, the first levee break was reported on the Industrial Canal near the Orleans and St. Bernard Parish Line. This break permitted the waters from the canal to pour into the 9th Ward. Following the report of a break on the Industrial Canal, it was reported that the 17th Street Canal had been compromised and that a levee wall had failed. The 17th Street Canal connects to Lake Ponchartrain and is on the border between Orleans and Jefferson Parishes. The break on this canal was on the Orleans Parish side. Then in addition to the 9th Ward, water was dumping into Orleans Parish from the west and flooding homes, businesses, vehicles, infrastructure and endangering lives of humans and animals. Water from the 17th Street Canal moved into portions of Lakeview, Mid-City, Carrollton, Uptown, the Central Business District and the French Quarter. There were other breaches of the levee system including the London

Avenue Canal. Water dumped into New Orleans and moved to most parts of the city. Generally, only the areas nearest the Mississippi River where there were some elevated areas near or above sea level were spared.

The levee breaches stranded survivors on roof tops and in attics who had to be rescued by helicopters and boats. Many citizens, who were trapped in attics and unable to escape, died from drowning or other disaster related causes. The Orleans Parish infrastructure was devastated. Roads and bridges were damaged, electricity and gas lines destroyed and water mains disrupted. It was estimated that 75-80% of Orleans Parish properties, over 100,000, received some flood damage from the compromised levees. The monetary cost to taxpayers, insurance companies and Orleans Parish citizens has been estimated to be between 50-100 billion dollars. Hundreds of thousands of Orleans Parish residents had to abandon their flooded homes and relocate to other areas of the country that were then in turn impacted by the homeless New Orleans residents. Some citizens will never return to Orleans Parish. The economic and social climate of Orleans Parish was severely altered. The Parish's revenue sources, largely dependant on the tourism industry, were devastated and will take a long time to recover. Following the levee breaks and subsequent flooding, civil unrest broke out and looting became rampant. The New Orleans Police Department and other public service departments were devastated with the loss of vehicles and other equipment items needed to perform their duties.

Shortly after Hurricane Katrina, Orleans Parish again suffered the effects of water pouring through a levee break. On September 23, 2005, as powerful Hurricane Rita prepared to make landfall at the border of Texas and Louisiana, surging water began pouring through the previously damaged Industrial Canal wall. Once again the 9th Ward flooded with some areas receiving as much as 8 feet of water.

Vulnerability Assessment

Even though it is possible to have a levee failure from an event unrelated to natural causes, strong storms undoubtedly pose the greatest threat and make Orleans Parish most vulnerable. The levee failures that occurred during Hurricane Katrina proved that the levees are vulnerable to powerful hurricanes and that the effects of a break can be devastating. Since the Katrina disaster, the causes of the breaks have been debated and will be analyzed and investigated by government and non-government entities in the

future. Some claims have been made that the levees were originally built with sub-standard materials and others claim the soil beneath the levees was never suitable for construction. There is some evidence being examined to determine whether or not the levee failure occurred as a result of erosion. Regardless of the findings, presently the levee system in Orleans Parish is more vulnerable than before Katrina. The damage to the levee system extends beyond where the breaks occurred. Other areas were also damaged even though not totally compromised. There are some areas where the levees were overtopped causing a variable amount of damage and loss of design elevation. Additionally, notches were intentionally cut in the levees to allow water to drain from flooded areas. Most experts feel that even a glancing blow to Orleans Parish from a minimal hurricane (category 1or 2) could further compromise the integrity of the levee system.

Hazard Impact

The devastation that occurred in Orleans Parish as a result of the levee breaks associated with Hurricane Katrina provided alarming evidence of the impact potential of this hazard. An occurrence of this hazard again would likely create many of the same consequences. Thousands of homes and businesses would be severely damaged, or destroyed, and much of the Parish's infrastructure would be devastated. The monetary loss to the Federal, State and Local government would be staggering. Lives would be disrupted and some citizens would more than likely die. The economic and tax structure of the Parish would be severely negatively impacted and cause significant damage to Orleans Parish's ability to meet its payroll and other governmental financial obligations. Furthermore, the Parish's vital role as an import and export port for the nation would be affected as seen with the levee breaks related to Hurricane Katrina.

Table 12: Levee Failure Exposure and Loss Estimation

Summary of Structures and Persons in Hazard Area for Levee Failure

	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000s)
Occupancy of Structure	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ loss (Structure+ Contents)
Residential	132,987	91,761	69%	18,784,973	12,961,631	69%	484,674	334,425	69%	4,277,336
Commercial	3,433	2,369	69%	4,377,092	3,020,193	69%	238,771	164,752	69%	996,663
Industrial	634	437	69%	643,993	444,355	69%	31,986	22,072	69%	146,637
Agriculture	13	9	69%	2,933	2,024	69%	N/A	N/A	N/A	668
Religion	397	274	69%	446,724	308,240	69%	N/A	N/A	N/A	67,813
Government	29	20	69%	527,894	364,247	69%	N/A	N/A	N/A	101,719
Education	226	156	69%	321,714	221,983	69%	N/A	N/A	N/A	48,836
Critical Facilities	213	147	69%	5,305,572	3,660,845	69%	N/A	N/A	N/A	73
Infrastructure	35	24	69%	2,388,200	1,647,858	69%	N/A	N/A	N/A	543,793
Total	137,719	95,197	69%	30,410,895	22,631,376	74%	N/A	N/A	N/A	6,256,721

Probability of Future Events

The probability of a levee failure unrelated to a natural event is minimal, but cannot be totally ignored. Even though there is no history of terrorist organizations targeting levees, it is not out of the realm of possibilities. Terrorist organizations, such as Al

Qaeda, prefer events that yield the greatest amount of human, social and economic devastation. The levee failures in Orleans Parish demonstrated that all of these factors could be achieved in such an event. Additionally, human error could cause a breach in a levee. A ship or barge in an industrial waterway could lose control and create a levee break. However, both of these hazards are believed to be low probability since neither has occurred in the past.

The greatest probability of levee failure will continue to be hurricanes. The frequency of hurricanes passing within 80 miles of New Orleans is summarized in the following table:

Intensity	Frequency
Category 1	8 years
Category 2	19 years
Category 3	32 years
Category 4	70 years
Category 5	180 years

Source: USGS, "Environmental Atlas of Lake Ponchartrain"

Based on historical data, a tropical storm or hurricane can be expected to land in Louisiana every 1.2 years. A storm landing in Louisiana will likely have some impact on Orleans Parish.

Severe Winter Storms

Hazard Event Description

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

Because severe winter storm events are relatively rare in Louisiana, compared to more northern states where winter events are expected and states tend to be better equipped to handle them, occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice extremely hazardous to motorists and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents; collapsed roofs from fallen trees and limbs and heavy ice and snow loads; and felled trees, telephone poles and lines, electrical wires, and communication towers. As a result of severe ice storms, telecommunications and power can be disrupted for days.

Severe winter weather in New Orleans (as indicated by activation of the City of New Orleans Freeze Plan) can be defined as when the outside temperature or wind chill reaches 38 degrees or below. Severe winter weather in New Orleans may also consist of freezing temperatures and heavy precipitation in the form of rain, freezing rain, or sleet, but rarely in the form of snow. Severe winter storm events are relatively rare in Louisiana and New Orleans.

Because of its warmer climate, Orleans Parish is rarely affected by winter storms. The average low temperature during the month of January is 43° F. The last major freeze was in 1989 during one of the most significant cold spells in the South in a century. Temperatures in New Orleans dropped below freezing for 64 consecutive hours; the lowest temperature recorded in New Orleans during this cold spell was 11°F. While icy roads were a problem, the biggest impact of this cold spell was the breakage of water pipes throughout the city.

Location and Extent

Because there is no defined geographic boundary, all people and property in New Orleans are exposed to the risk of damage from severe winter storms. Winters in Orleans Parish are mild and the risk of winter storms is low. In south Louisiana, including Orleans Parish, the coldest months of the year are December through February. During this time, low temperatures average 45 degrees. However, cold fronts that move through the region can drop temperatures below freezing. The entire Parish would be affected by a severe winter storm. The threat from winter storms in Orleans Parish is low. Cold spells are rare in New Orleans and they seldom last for extended periods of time. Winter precipitation is also rare. The following table provides the average temperature extent for New Orleans:

Table 13: Average New Orleans Temperatures

Summary

	Temp. (°F)	Relative	Humidity	Extreme (Days Per	Temperature Month)	Rain Inches	(Days	Cloudiness Per	Month)
	Average	A.M.	P.M.	Below 32°	Above 90°	Average	Clear	Partly Cloudy	Cloudy
January	51.3	85%	68%	5	0	5.1	7	7	17
February	54.3	84%	65%	3	0	6.0	8	6	14
March	61.6	85%	63%	0	0	4.9	8	8	15
April	68.5	87%	61%	n/a	n/a	4.5	8	10	12
May	74.8	89%	62%	0	4	4.6	9	11	11
June	80.0	90%	64%	0	16	5.8	8	13	9
July	81.9	91%	67%	0	21	6.1	5	15	12
August	81.5	91%	67%	0	21	6.2	7	14	10
September	78.1	89%	66%	0	9	5.5	10	11	10
October	69.1	87%	61%	0	1	3.1	14	8	9
November	61.1	86%	63%	1	0	4.4	10	8	12
December	54.5	85%	67%	3	0	5.8	8	7	16
Annual	68.1	87%	65%	13	72	61.9	101	118	146

Previous Occurrence

The last severe winter storm to occur in Orleans Parish on December 25, 2004 when approximately half an inch of sleet and snow accumulated in New Orleans. Since severe winter storms are rare in New Orleans the storm caused several transportation issues. As

a result of icy bridges, overpasses, and elevated roadways there were transportation accidents and many road closures. The New Orleans International Airport was also shut down for several hours due to ice on the runways.

Vulnerability Assessment

As a state situated in the southern United States and near the Gulf of Mexico, winter weather is not typically thought of as a frequent weather hazard in Louisiana. But, winter weather, ranging from extreme cold to freezing rain, snow and dense fog, can move across Louisiana.

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

Other hazards created by winter cold include the improper use of space heaters and poorly maintained heating systems. These can create a fire and/or carbon monoxide hazard potentially resulting in injuries and fatalities.

Hazard Impact

In Orleans Parish, where the climate is subtropical, severe winter storms are rare and pose a minimal threat to life and property. Therefore, due to the low risk of severe winter storms and minimal potential impact to life and property, the Severe Winter Storm hazard is not considered for loss estimation.

Probability of Future Events

While Louisiana is far less likely to have heavy snow and ice accumulation than most other states in the U.S., winter weather is expected to occur at least once each winter. According to data from the National Climatic Data Center, Louisiana is in the lowest category of probable snow depth, 0 – 25 cm snow depth with a 5% chance of being equaled or exceeded in any given year. Louisiana winter storms that have had severe consequences for the state, have generally delivered between one and three inches of ice accumulations. Due to its geographic location in the southeastern part of the state, Orleans Parish is at minimal risk to have a severe winter storm.

Drought

Hazard Event Description

Drought originates from a deficiency of precipitation over an extended period of time, occurring any time of the year, resulting in a water shortage for some activity, group, or environmental sector. Its impact is far reaching; including potential for fires, destruction of agricultural crops, and reduction of surface and subsurface water supplies. Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected

resulting from natural climatic variability) and the demand people place on water supply. Human beings often exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this "natural" hazard.

Location and Extent
Because there is no defined geographic boundary, all property in Orleans Parish is exposed to the risk of drought. The probability of a drought occurring in any specific region depends on certain atmospheric and climatic conditions. Duration and frequency can be used as indicators of potential severity. Effects seen in different regions vary depending on normal meteorological conditions such as precipitation and temperature, as well as geological conditions such as soil type and subsurface moisture.

Previous Occurrences
There have been no federally declared disasters from drought in Orleans Parish. However, the 1988 drought in the upper Midwest and High Plains resulted in record low river stages in the lower Mississippi River, even though rainfall in Louisiana was above normal for that year. Waterway traffic along the Mississippi was brought to a near standstill for several weeks, and water supplies for several river-dependant parishes were threatened by low flows and salt water intrusion. A drought event of this nature and magnitude would greatly impact the Port of New Orleans which is dependant on the water flow of the Mississippi River for international imports and exports. This would also greatly impact the United States, which is greatly dependant on the Mississippi River and its ports for commercial shipping.

Dry spells do occur in Southeast Louisiana even though the area is considered to generally have a wet climate. In 2000, much of Southeast Louisiana, including Orleans Parish, was impacted by an extreme drought rated at below -4.0 on the Palmer Index (long term). More recently, in October 2005, the State of Louisiana had its second lowest amount of rainfall since 1895 with very little measurable precipitation (NOAA Palmer Index Chart).

Vulnerability Assessment
Drought is an insidious hazard of nature and even areas such as Orleans Parish, with 57" of average rainfall and a normally humid subtropical climate, can be severely impacted. Climatic factors such as high temperatures, high wind, and low humidity can significantly aggravate the severity. Even though droughts in Louisiana are more common in the Northern parishes, the southern parishes, including Orleans, can be negatively impacted during periods of low rainfall amounts.

Hazard Impact
Drought produces a complex web of impacts that spans many sectors of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services. Drought impacts are commonly referred to as direct or indirect. Reduced crop productivity,

increased fire hazard, reduced water levels, and damage to wildlife and fish habitat are a few examples of direct impacts. Drought can cause extensive damage to commercial and residential structures' foundations, framing and walls, levees, roads, bridges, pipelines and other integral infrastructure. Indirect impacts of drought include increased prices for food, unemployment, and reduced tax revenues because of reduced supplies of agriculture products dependant upon on rainfall.

Probability of Future Events

The probability of severe long term drought conditions occurring in Orleans Parish is low. An analysis of the Palmer Index statistics reveals that long and short term dry spells are normally followed with wet periods. Droughts requiring the population to undergo water restrictions are rare.

TRENDS IN LAND USE

Population

The population of Orleans Parish has steadily declined over several decades, falling from 625,000 in 1960 to 485,000 in 2000. The largest factor of the decline is the out migration from Orleans Parish to surrounding parishes St. Tammany, Jefferson and Plaquemines. Despite the city-wide populations decrease before Hurricanes Katrina and Rita certain neighborhoods within New Orleans did experience slight increases in population. They include the French Quarter, Mid City, Lakeview and Gentilly. However, the highest concentration of residents could be found in New Orleans East comprising of Planning Districts 9, 10 & 11 with approximately 89,537 residents.

Land Use

Understanding the physical character of New Orleans is of critical importance when developing a mitigation strategy. At the heart of New Orleans are its 74 neighborhoods all of which are grouped into 13 Planning Districts in the New Century New Orleans Land Use Master Plan. Land use in most of these districts is mixed comprising of residential, neighborhood commercial, regional commercial, institutional and industrial type uses. The density of land uses in New Orleans is fairly consistent and is characterized as low-rise, low-density single and two-family homes. Planning districts east of the City are less dense and contain more green space, while planning districts that encompass the downtown area are the most heavily developed with the least amount of open space. Approximately one fourth to one-third (figure varies) of the City's 116,176 acres of land is classified as wetlands. This high percentage of wetlands describes statistically the unusual topographic facts of this City, which is largely lies below sea-level and is built among swamps.

Prior to Hurricane Katrina few major changes to the land use patterns in New Orleans were expected. This projection was based on several factors. First, much of Orleans Parish is already developed, and most of the undeveloped land lies outside of the hurricane levee protection system. The parts of the Parish within the levee system that are undeveloped lie in far eastern New Orleans. Thus, there is little land that is suitable for development and that has a desirable location. Second, in 1999 the New Orleans City

Planning Commission adopted a new Land Use Plan. For almost all planning districts and almost all land uses, the Land Use Plan calls for minor changes. The only major change from existing land uses in the plan is centralization of industrial land uses near Industrial Canal, the Desire/Agriculture Street Landfill area, and the Intracoastal Waterway. Land that previously had been used for heavy industry in Central City and along former rail corridors has been downgraded to light industry and regional commercial.

Impact on Hazard Mitigation

Due to Hurricane Katrina planning studies are taking place utilizing the damage assessments from Katrina, and changes in land use planning are anticipated and will be provided in the plan update. As residents return to the City so does the process of rebuilding. To reduce the risk posed by some hazards, future land use changes will most likely go beyond centralizing commercial and industrial land uses to appropriate corridors. Projection of future population trends, an investigation of the failed levee system and the issuance advisory flood base elevation report will have a significant impact on future land uses in New Orleans.

multiple flood areas i. East Commission plan to buy out middle tier into pond/city park.

SECTION 4 – MITIGATION STRATEGY

INTRODUCTION

Section 4 and 5 together contain the blueprint for New Orleans' Hazard Mitigation Strategy. Section 4 describes the existing conditions that might influence the ability of Orleans Parish to implement hazard mitigation actions. The first part of this section identifies New Orleans' administrative capabilities with respect to hazard mitigation. The second part identifies possible funding sources for mitigation activities. The final part of this section sets forth the mitigation Goals and Objectives. Section 5 is the Hazard Mitigation Action Plan.

COMMUNITY CAPABILITIES

This section describes New Orleans' administrative capacity to implement the mitigation actions proposed in this Plan. The City of New Orleans is a Home Rule City, as defined by the Louisiana Constitution. Among other things, it has the power to adopt and implement regulations for land use, zoning, and historic preservation and to adopt standards for the use, construction, demolition, and modification of areas and structures.

The City of New Orleans is currently in the process of updating many of the regulations that govern its application of these powers. The City is in the process of drafting and adopting a new Comprehensive Zoning Ordinance. The two major goals of the new CZO are to protect neighborhoods from unwanted change and to sponsor beneficial economic growth. In 2005, the City formally adopted the Transportation Element of the *Master Plan*. In 2002, the City formally adopted five elements of the *New Century New Orleans Master Plan:* Parks, Recreation, and Open Space; Arts and Culture; Tourism Management; Historic Preservation; and Economic Development. A new Land Use Plan, the first part of the *Master Plan,* was adopted in 1999.

The Hazard Mitigation Plan builds on these plans and other existing regulations. The sections below describe how this plan fits in with the current administrative organization of the City of New Orleans. Existing authorities, policies, and programs related to hazard mitigation in New Orleans are detailed in the first section below. After that, possible sources of funding other than city revenues are described.

Departments, Boards, and Commissions

Many City departments, boards, and commissions perform functions related to hazard mitigation. The organizations listed below are those that are most likely to be involved in mitigation activities or to facilitate other organizations in that capacity.

New Orleans Office of Homeland Security – In cooperation with the U.S. Office of Homeland Security, this office is charged with developing and coordinating the implementation of a comprehensive national strategy to secure the United States from terrorist threats or attacks.

New Orleans Office of Emergency Preparedness – The OEP is responsible for responding to disasters and coordinating those actions needed to protect the lives and

property of the citizens of New Orleans from natural or man-made disasters. The OEP is also responsible for emergency planning for the City of New Orleans. Requests for federal disaster assistance and federal funding subsequent to disaster declarations are made through this office.

New Orleans Police Department – The NOPD is responsible for enforcing all City and State laws and for protecting the lives, property, rights, and liberties of the people of New Orleans. NOPD is normally a first responder to "calls for service" whether it is for an emergency or non-emergency event.

New Orleans Fire Department – The NOFD is responsible for extinguishing, investigating, and preventing fires and for enforcing regulations relating to fire safety. The NOFD also responds to hazardous materials incidents and to other emergency situations involving the safety of persons or property. NOFD, along with NOPD, serves as a first responder to many incidents involving public safety, particularly when fire is involved, or, persons have been injured.

Mayor's Office of Intergovernmental Relations- This office oversees Federal and State programs and grant monitoring. This office coordinates and works directly with Federal, State and local agencies to secure funding for the city.

New Orleans Neighborhood 1 - The Neighborhood 1 Office is devoted to housing and neighborhood development. This office coordinates with other departments within the city as well as outside agencies, such as the Federal Housing and Urban Development, to bring a better quality of life to Orleans residents.

Orleans Parish Communication District – The OPCD provides the infrastructure for and administers the 911 emergency communication system.

Health Department – The New Orleans Health Department is responsible for adopting and enforcing local health and sanitary regulations, making health inspections, and operating and providing emergency medical services. The Health Department also provides other valuable services including disease mapping, prevention and health maintenance. During an evacuation situation the Health Department is in charge of implementing the evacuation plan for special needs citizens.

Public Works – Generally, the Public Works Department is responsible for designing, constructing, paving, and maintaining streets, bridges, the local storm sewer, and related structures. They have the responsibility for Parking Enforcement, towing abandoned cars and vehicles, and clearing catch basins. During a hurricane evacuation, Public Works is in charge of making emergency road repairs as needed.

Mayor's Office of Communications – The Office of Communications is responsible for coordinating all external communications that come from the Mayor.

Safety and Permits Departments – The Safety and Permits Department is responsible for issuing the permits needed for all new construction, renovations, additions, use, and special events. The Building Division of Safety and Permits is responsible for inspecting buildings to insure that new construction or alterations to existing structures are done according to the minimum standards provided in the Building Code. The Building Division also conducts flood compliance reviews and inspections. The Director of Safety and Permits also serves as the Flood Plain Manager.

Sanitation Department – The Sanitation Department is responsible for the collection of refuse and keeping city streets clean.

Chief Administrative Office – Serving as the administrative arm of the mayor, this office oversee departments and the city budget. The office is also responsible for capital projects and other important city initiatives.

City Planning Commission – The City Planning Commission is responsible for developing the City's zoning ordinance, land use plan, master plan, and subdivision regulations. It is also in charge of plans for the "re-planning, improvement, and reconstruction of neighborhood and community centers and of areas or districts destroyed or seriously damaged by fire, earthquake, flood, or other disaster".

City Council – The City Council serves as the legislative body of the city and consists of seven members. They enact laws to protect the safety and welfare of the citizens of New Orleans. The Council has the authority to levy taxes (subject to state law) and to adopt the New Orleans' annual capital and operating budgets. Ordinances of the Council may be vetoed by the Mayor, and vetoes may be overridden by a two-thirds vote of the Council. The Council employs the Clerk of Council, research and fiscal offices, and a utility regulatory staff.

Orleans Levee District – The Orleans Levee District is responsible for maintaining the levee system and associated drainage. It must also issue a permit or letter or "No Objection" to any work or structures intended to occur in the vicinity of the levee system. As part of the maintenance program for the levees, a joint inspection of the hurricane levees is conducted each May by the U.S. Army Corps of Engineers, the Louisiana State Department of Transportation and Development, the New Orleans Office of Emergency Preparedness, and the Orleans Levee District. Each October or November, the same parties conduct an inspection of the Mississippi River levee system. Furthermore, the Operations and Maintenance Director for the Orleans Levee District is required to make biweekly checks of all levees for unusual conditions.

Sewerage and Water Board – The mission of the Sewerage and Water Board is to provide New Orleans with adequate drainage, sewerage collection, and drinking water. The Board is responsible for operating pumping stations throughout the City to pump out storm water.

Regional Planning Commission – The RPC, created by the State legislature, includes Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany Parishes. Its mission is to promote the general welfare and prosperity of the entire region by harmonizing the activities of federal, state, parish, municipal, and other governmental agencies in the region.

Mosquito and Termite Control Board – The Mosquito and Termite Control Board is responsible for administering and evaluating mosquito and termite activities and monitoring the population of disease and virus transmitting mosquitoes.

Regional Transit Authority – The RTA operates public buses and street cars in New Orleans. Current plans call for RTA to provide transit to persons without other transportation during an evacuation of the City in advance of a hurricane.

Vieux Carre Commission – The VCC is responsible for preserving the buildings in the Vieux Carre. Specifically, the VCC reviews all plans for the erection of any new building or alteration, addition to, painting, or demolishing of any building in the Vieux Carre.

Historic District Landmarks Commission – The HDLC is responsible for preserving and protecting the architectural character of New Orleans through the regulation of thirteen designated historic districts and separate landmark structures. The HDLC must issue a Certificate of Appropriateness for alterations to any private structure within a district under their control.

Funding Sources

The City of New Orleans has the capacity to fund some mitigation activities from City revenues. The City adopts two different budgets every year, the Operating Budget and The Capital Budget. The Chief Administrative Officer prepares the budget proposals and the Mayor presents them to the City Council. The City Council may increase, decrease, or delete any budget item; it may also add budget items under certain conditions. Money in both the Operating Budget and the Capital Budget could be used to pay for mitigation activities.

In the case of the Operating Budget, some revenues must be used to predetermined purposes while other revenues are unrestricted. Tax revenues make up slightly less than half of the City's total operating revenues in most years. All sales tax revenue and approximately one-third of property tax revenue goes into the City's unrestricted General Fund and may be used at the City's discretion to provide public services. Of the restricted sources of revenue, the Economic Development Trust Fund and the Housing Trust Fund could possibly be used to fund mitigation activities.

There are also a number of State and Federal programs that provide funds for disaster mitigation activities before a disaster or as part of the recovery efforts after a disaster. The programs listed below are some of the major external sources of funding for mitigation activities in the City of New Orleans.

The devastating effects created by Hurricane Katrina severely impacted the City's funding sources. It will take a lengthy recovery period to restore the City's normal revenue base.

Hazard Mitigation Grant Program (HMGP) – The HMGP is a post-disaster program designed to encourage mitigation activities to reduce or eliminate losses from future disasters. HMGP funds are available only after a Presidential declaration of disaster. States and Local governments and certain non-profit organizations are eligible to apply for funds under HMGP. Projects completed under this program must provide long-term solutions to the threats posed by hazards. HMGP provides 75 percent of a project's cost; the other 25 percent must be covered by non-federal funds. (Individuals should contact their local Office of Emergency Preparedness for more information on this program.)

Flood Mitigation Assistance Program (FMAP) – FMAP funds are available to state and local governments that participate in the National Flood Insurance Program and have an approved Flood Mitigation Plan. Funds may be used for pre-disaster mitigation projects that correspond to mitigation activities outlined in the community's Flood Mitigation Plan. FEMA places particular emphasis on target repetitive loss structures in awarding FMAP funds. FMAP provides 75 percent of a project's cost; the other 25 percent must be covered by non-federal funds.

Pre-Disaster Hazard Mitigation Program – The Pre-Disaster Hazard Mitigation Program was authorized by the Disaster Mitigation Act of 2000. It provides funding to state and local governments for mitigation activities aimed at a variety of hazards. The Pre-Disaster Hazard Mitigation Program funds 75 percent of a project's cost; the other 25 percent must be covered by non-federal funds.

Louisiana Statewide Flood Control Program (SFCP) – This program provides funds to Parish governments, municipal governments, levee boards, and drainage districts for projects that have a total construction cost of at least $100,000. SFCP funds may cover up to 90 percent of the cost of construction for projects that reduce existing flood damages, do not encourage additional development in flood prone areas, and do not increase upstream or downstream flooding.

Community Development Block Grant (CDBG) – CDBG grants are made to state and local governments by the U.S. Department of Housing and Urban Development. CDBG funds can be used for mitigation activities in two ways. First, CDBG grants may be used to carry out a wide range of community development activities directed toward revitalizing neighborhoods, economic development, and providing improved community facilities and services. Mitigation measures can be combined with some of these activities. For example, the construction of a new community center to serve a low-income community would be allowed under CDBG rules. This community center could also be constructed according to specifications that would allow it to serve as a shelter during a hazard. Second, additional CDBG funds are sometimes made available to state and local governments as part of a Disaster Recovery grant following a Presidential

disaster declaration. Grantees may use CDBG Disaster Recovery funds for recovery efforts involving housing, economic development, infrastructure, and prevention of further damage to affected areas, as long as such use does not duplicate funding available from the Federal Emergency Management Agency, the Small Business Administration, and the U.S. Army Corps of Engineers.

Other Programs – In addition to the programs described above, the Federal Emergency Management Agency and the Small Business Administration offer other programs that can fund mitigation activities. Programs such as Public Assistance (FEMA), Community Assistance Program (FEMA), Home and Personal Property Disaster Loans (SBA), and Physical Disaster Business Loans (SBA) make specific provisions for mitigation activities. While all of these programs provide post-disaster funding, mitigation against future hazards can be incorporated into recovery efforts funded by these programs. Additionally, the Increased Cost of Compliance (ICC) program, a component of the FEMA National Flood Insurance Program, provides risk reduction options to enable individuals to comply with floodplain requirement. These include elevation, relocation, demolition and flood proofing.

Private Funding Sources – Some private sources of hazard mitigation funding exist. Insurance company foundations are one particular source of mitigation grant programs. Many private mitigation funds are targeted to non-profit agencies.

GOALS AND OBJECTIVES

Goals

The primary goal of all local governments is to promote the public health, safety, and welfare of the citizens of the community. In keeping with this standard, the City of New Orleans has developed four goal statements for local hazard mitigation planning. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more specific objectives and mitigation actions. Consistent implementation of objectives and actions will over time ensure that community goals are achieved.

Goal #1 Identify and pursue preventive measures to reduce losses to existing and and future properties due to hazards.

Goal #2 Enhance public awareness and understanding of disaster preparedness in order to protect the health and well-being of people in Orleans Parish from the negative effects of hazards.

Goal #3 Ensure the ability of emergency services providers and facilities, including essential facilities, to continue operating during hazard events.

Goal #4 Promote Regional cooperation between parishes with regard to hazard mitigation activities.

Objectives

Mitigation objectives are designed to support community goals while further defining parameters for development of mitigation actions. Objectives are numbered to correspond with the goal that each supports.

Objective 1.1	Target FEMA/National Flood Insurance Program repetitive loss structures for property protection measures.
Objective 1.2	Evaluate existing regulations that might impact the vulnerability of property and persons to hazards and how well those regulations are enforced.
Objective 1.3	Encourage property protection and structural measures as a means of hazard mitigation.
Objective 2.1	Increase awareness of the need to evacuate, if possible, in the case of a hazard event and what to do if evacuation is not possible.
Objective 2.2	Protect the health and safety of the residents of New Orleans during a hazard event.
Objective 3.1	Enhance property protection measures at emergency services facilities and other critical facilities.
Objective 3.2	Evaluate the interdependencies between emergency providers during hazard events.
Objective 4.1	Encourage Federal and Regional cooperation in hazard mitigation in order to address improvements to governmental infrastructure assets such as levees, pumping stations and drainage systems.

Section 5- Mitigation Actions and Plan

MITIGATION ACTION PLAN METHODOLOGY

The City of New Orleans has developed the mitigation actions described in Table 14. Many of these mitigation actions will have a positive effect on mitigating potential damages from most, if not all, natural hazards. In developing actions, the City of New Orleans relied on the following six mitigation policy categories provided by FEMA:

1. **Prevention (P) Measures**
   Preventative measures are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or where capital improvements have not been substantial. Examples of prevention measures include:
   (a) Comprehensive land use planning
   (b) Zoning regulations
   (c) Subdivision regulations
   (d) Building code
   (e) Floodplain development regulations

2. **Property Protection (PP) Measures**
   Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous locations. Examples of property protection measure include:
   (a) Building relocation
   (b) Acquisition and clearance
   (c) Building elevation
   (d) Building retrofit

3. **Natural Resource (NR) Protection**
   Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigative functions. Such areas include floodplains, wetlands, and dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:
   (a) Wetland protection
   (b) Habitat protection
   (c) Erosion and sedimentation control
   (d) Best Management Practices (BMPs)

4. **Emergency Services (ES) Measures**
   Although not typically considered a mitigation technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:
   (a) Hazard warning system
   (b) Emergency response plan

(c) Critical facilities protection
(d) Health and safety maintenance
(e) Post-disaster mitigation

5. **Structural (S) Projects**
Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event. The projects are usually designed by engineers and managed or maintained by public works staff. Examples include:
   (a) Reservoirs, retention, and detention basins
   (b) Levees and floodwalls
   (c) Channel modifications
   (d) Channel maintenance

6. **Public Information (PI) Measures**
Public information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques that the public can use to protect themselves and their property. Examples of measures to educate and inform the public include:
   (a) Map information
   (b) Outreach projects
   (c) Library
   (d) Technical assistance
   (e) Real estate disclosure
   (f) Environmental education

MITIGATION ACTION PLAN

The Mitigation Action Plan is found on Tables 14 and 15. Table 15 relates solely to pumping and drainage projects that are critical to mitigate flooding. The mitigation action items with highest priority (H) were the most cost effective and most compatible with the communities' social and cultural values. The bottom line for determining if a project would work was if it was cost effective. The Steering Committee defined High, Medium, and Low priorities in the Action Plan to be as follows:

- High: Meets five of the seven STAPLEE criteria
- Medium: Meets four of the seven STAPLEE criteria
- Low: Meets three of the seven STAPLEE criteria

The process of identifying the priority ratings was an informal process and whether or not the project will be cost effective was the driving factor. The priorities assigned to each action by the Steering Committee will serve as a guide to those agencies responsible for implementation. Actions will be considered for implementation according to the priorities given in this Plan.

IMPLEMENTATION

The New Orleans Office of Emergency Preparedness will oversee the broad implementation of the Action Pan found in Tables 14 and 15. This plan also outlines the other agencies that will be involved in implementation, approximate timeframes, and funding information for each of the strategies. Before implementation of any action, the lead agency will conduct a benefit-cost review. Such review will ensure that the City is optimizing the benefits to the community. For mitigation actions that call for a study to be completed, it is assumed that the costs and benefits of the actions being studied will be calculated as part of the study. For those strategies that call for an action (including public outreach) to be undertaken, a cost-benefit review will be completed by the agency or department responsible for implementation of the strategy prior to implementation. Projects with a benefit-cost ratio of greater than one will be considered appropriate for implementation; projects with a benefit-cost ratio of equal to or less than one will not be considered appropriate for implementation.

NOOEP will be responsible for general management of the implementation of the mitigation strategies in the Plan. Accordingly, NOOEP will have the authority to divide projects into phases to facilitate implementation. NOOEP will also contact local universities and colleges for assistance with mitigation activities when appropriate.

In addition, NOOEP will be responsible for preparing a strategy to implement the mitigation actions in the Plan as part of a disaster recovery process. Frequently, a disaster is followed by a very large infusion of Federal and State development capital for local jurisdictions. Combining mitigation actions with the recovery process can achieve many of a community's mitigation goals; however, communities often have difficulty combining mitigation and recovery actions if they have not prepared to do so in advance. Following final approval of the Plan, NOOEP will identify the mitigation actions in the Plan that would be most appropriate to implement as part of a disaster recovery process. For example, mitigation actions that require a large amount of capital and are eligible activities under the major flood recovery programs are good candidates to be combined with recovery activities.

INTEGRATION WITH EXISTING PROGRAMS

Once adopted, the Orleans Parish Hazard Mitigation Plan will serve as the main statement of mitigation policy for the City of New Orleans. Because the City of New Orleans and Orleans Parish are coterminous, this Plan, once adopted, will apply to all parts of the Parish. Since there are no independent jurisdictions within Orleans Parish, there is no need for any other governmental organization to adopt the Plan.

While the Plan was written to stand on its own, it is understood that the people of New Orleans will be best served by a coordinated effort to address the risks that face the City. One avenue for the Plan to be integrated with related efforts in the Parish is through the Office of Homeland Security. The New Orleans Office of Homeland Security is currently in the process of developing a Risk Assessment for City operations. The New Orleans Office of Emergency Preparedness will be responsible for ensuring that the

information in the Hazard Mitigation Plan is available to the Office of Homeland Security for inclusion in the Risk Assessment in this Plan.

Another existing plan that relates to hazard mitigation is the New Orleans Comprehensive Emergency Management Plan (CEMP). The New Orleans Office of Emergency Preparedness is responsible for producing and maintaining the CEMP. The CEMP addresses mitigation of, preparation for, and recovery from a wide variety of emergencies and disasters. Once the Hazard Mitigation Plan has been adopted, it will become an annex to the CEMP.

Perhaps the widest-reaching plan that relates to hazard mitigation is the New Orleans Master Plan. The City Planning Commission is responsible for producing and maintaining the City's Master Plan. The Master Plan contains development goals, objectives, and policies for all areas of New Orleans. Once the Hazard Mitigation Plan has been adopted, the City Planning Commission will be responsible reviewing the elements of the Master Plan and identifying ways that the Master Plan can incorporate the mitigation strategies in the Hazard Mitigation Plan. This review will be done as part of any regularly scheduled update of the Master Plan.

PLAN MONITORING AND MAINTENANCE

Recognizing that this Plan must be updated on a regular basis to remain an effective tool, the Plan will be monitored by the Director of Emergency Preparedness in the Orleans Parish Office of Emergency Preparedness. To meet this requirement Orleans Parish has developed a timeline and process for updating the Plan. The Plan will be updated annually during the off-season for hurricanes (December through May). NOOEP will be responsible for all Plan updates.

Previously mentioned was the fact that Hurricane Katrina greatly impacted the composition of the original Steering Committee designated to this plan and it is not anticipated that this group will meet again in the future to address it. The NOOEP staff will continue providing coordination with representatives from the respective agencies and departments of the Parish who are considered "stake holders" and leaders in the hazard mitigation process.

The following agencies will be involved in the annual monitoring of the Plan and report on the progress of implementation actions that fall under that agency's direction.

Annual Plan Monitoring and Evaluation Participating Agencies

Chief Administrative Officer
Public Works Department
Economic Development Office
Emergency Preparedness Office
Safety and Permits Department
Mayor's Office
Mayor's Office of Intergovernmental Relations
Mayor's Office of Technology

City Planning Commission
Neighborhood 1
Sewerage and Water Board
Regional Transit Authority
New Orleans Public Schools

During these reviews, the Plan will be evaluated to ensure that the Risk Assessment portion of the Plan is current. Any major changes to the hazards that threaten New Orleans or to the vulnerability of persons or property in New Orleans will be noted. The Plan review will consider issues such as changes to the distribution of the population or the value of property in the Parish, changes in vulnerability due to the completion of mitigation projects, and new information about hazards. Also, the Goals and Objectives will be reviewed to determine their relevance to current conditions in the Parish. When needed, the Goals, Objectives, and Strategies will be changed to reflect shifting needs and wants of the community. Further, the agencies and departments responsible for implementation of any current or recently completed mitigation activities will report on the status of the activities. The review of current and recently completed mitigation activities will address, among other things, difficulties encountered in the implementation process, the accuracy of cost-benefit estimates, and the availability of resources for implementation.

The plan will be reviewed, revised and updated every five years from the date of FEMA's approval. If a disaster occurs or as action items are met, the plan will be reviewed, revised, and updated sooner than the required five years, via the process outlined above. With adoption in 2006, the Plan will enter the review and update cycle in 2009, with adoption of the revisions in 2010. The Plan will be sent back to FEMA for re-approval within the five-year cycle. The Steering Committee will be convened to conduct the comprehensive evaluation and update.

Orleans Parish will involve the public in the plan maintenance process and during the major comprehensive review to the Plan in the same ways used during the original plan development. The public will be notified when the revision process is started and will be provided with the opportunity to review and comment on the changes to the Plan. Appropriate public workshops will be held and the public hearing process associated with Council adoption of the Plan revisions will be conducted.

As a result of this plan's submission being during the recovery period after the 2005 hurricane related disasters, some of the data contained in the text and the Appendices maybe outdated. For example, Appendix C contains a list of critical facilities identified in the city prior to the 2005 hurricane season. Some of these facilities are no longer in use and may never return as functional critical facilities. As more information becomes available this Plan will be updated.

Continued Public Involvement

Since the conditions that affect New Orleans' vulnerability to hazards can change at any time, the New Orleans Office of Emergency Preparedness will accept public feedback on

the Plan on an ongoing basis. The chief method of soliciting feedback will be NOOEP's Website. The Website currently contains links to seven hazard plans for the City of New Orleans. Once the Hazard Mitigation Plan is approved, it will be posted to the Website as well. Over time, all updates to the Plan will be posted on the Webpage. Information on where to send comments and how to view hard copies of the Plan will also be provided on the Website. Copies of the Plan will also be catalogued at the New Orleans Public main library. Information on where to send comments is as follows:

Direct all comments to:

City of New Orleans
Office of Emergency Preparedness
1300 Perdido St
Suite 9E06
New Orleans, LA 70112

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Goal #1- Identify and pursue preventive measures to reduce losses to existing and future property due to hazards.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Implement a program to coordinate with US Army Corps of Engineers and Orleans Levee District to restore the damaged levee system to withstand a Category 3 Hurricane. Includes participating in the reviews of the levee system failures. **Benefits: Greatly reduces the risk that Orleans Parish will be flooded because of a levee break during a hurricane.**	4.1	3.1 billion: Federal Budget Parish Budget/ US Army Corps of Engineers (USACOE)	Hurricanes, Floods, Levee Failure	2006	USACOE, Orleans Parish Levee District	P, PP, S	E, N
2	H	Implement a program to coordinate with the US Army Corps of Engineers and the Orleans Levee District to enhance the levee system to withstand a Category 5 Hurricane. **Benefits: Greatly reduces the risk that Orleans Parish will be flooded because of a levee break during a powerful hurricane.**	4.1	20 Billion: Federal Budget/ USACOE/ State Budget/ Parish Budget	Hurricanes, Floods, Levee Failure	2007-2016	USACOE, Orleans Parish Levee District	P, PP, S	E, N
3	H	Implement the Sewerage and Water Board's proposed mitigation projects with a goal of reaching a pumping/drainage capacity of 1" of water per hour (presently at 3" per 5 hours). **Benefits: Greatly reduces the Parish's vulnerability to flooding.** *See Table 15 (pages ...) for specific details of projects.*	4.1	See Table 15	Hurricanes, Floods, Levee Failure	2006-2009	Sewerage and Water Board of New Orleans	P, PP, S	E, N
4	H	Establish a Parish capability to review the maintenance and strength levels of the levee system. **Benefits: Provides added protection and gives residents and city officials current information on levee system.**	4.1	Parish Budget/ FEMA MT Grant Money	Levee Failures, Hurricanes	2006	Mayor's Office of Technology	P, PP, S	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost/Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
5	H	Develop a program including changing city code that is consistent with FEMA Grant and Assistance Guidelines and Louisiana Recovery Authority's priorities. **Benefits: Reduces future losses due to flooding.**	1.2	Staff Time/ Parish Budget	Hurricanes, Floods, Levee Failures	2006	Safety and Permits	P, PP	E, N
6	H	Develop programs for severe and repetitive loss structures as well as substantially damaged structures to seek funding to support and enforce building requirements to reduce future flood losses through the implementation of mitigation actions to include elevation, relocation, demolition/rebuild, retrofitting or flood proofing. Encourage and promote mitigation actions when building requirements can not be enforced. **Benefits: Reduces future losses due to flooding.**	1.2	TBD: FEMA MT Grant Money	Hurricanes, Floods, Levee Failures	2006-2007	Homeland Security/ Neighborhood 1	P, PP	E, N
7	M	Develop and maintain a comprehensive Geographic Information System that includes data such as all properties/parcels in the City, hazard areas, service districts, public works facilities, transportation infrastructure, and special needs residents. **Benefits: Provides city officials with valuable data to plan, prepare and recover from a disaster.**	1.1	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	ES, PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
8	M	Initiate, develop, and maintain a database of all properties that sustain damage as a result of a hazard. Include information about the nature and extent of the damage. Incorporate this database into the City's Geographic Information System. **Benefits: Provides city officials with valuable data to plan, prepare and recover from a disaster.**	1.1	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	P, PP	E, N
9	M	Amend New Century New Orleans Plan, which contains the guiding principles for both public and private development in the Parish, to include hazard mitigation goals and action plan. Ensure compliance with this document for all capitol projects. Amend Comprehensive Zoning Ordinance, which is the governing land use regulatory document to implement the policies and principles of the Master Plan to implement hazard mitigation goals and action plan. To the extent that some regulatory tools may be included in the Code of the City of New Orleans amend such to be consistent with the above referenced document. **Benefits: Provide Parish with a consolidated plan to reduce future losses by incorporating mitigation actions.**	1.3	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	P, PP	E, N
10	L	Initiate and implement Parish policy changes to require the use of roofing materials that are less susceptible to damage by severe weather in the construction and renovation of critical and parish facilities. **Benefits: Reduces losses to parish owned properties.**	1.3	TBD: Parish Budget	Hurricanes, Hail, Tornadoes, Thunderstorms/ Lightning, Severe Winter Storm	2006	Capital Projects	P, PP, S	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
11	L	Initiate and implement a Parish ordinance that addresses infrastructure repair techniques that mitigate hazards caused by drought and land subsidence, including water pipe shifts and breakage. **Benefits: Reduces damage to vital Parish infrastructure.**	1.2	Parish Budget	Drought, Subsidence	2006	Sewerage and Water Board of New Orleans	P, PP	E, N

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Goal #2 - Enhanced public awareness and understanding of disaster preparedness in order to protect the health and well being of the people of Orleans Parish from negative effects of hazards.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Develop a public service campaign to encourage home and business owners, who are not otherwise mandated to meet flood hazard standards to voluntarily upgrade protection, especially in repetitive loss areas. **Benefits: Reduces the loss of lives and property.**	1.3	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures	2006-2007	NOOEP	ES	E, N
2	H	Develop a program to promote by public service announcements the purchase of Flood Insurance. Advertise the availability, cost, and coverage of Flood Insurance through the National Flood Insurance Program (NFIP). **Benefits: Enables homeowners to financially recover from the devastating effects of flooding as rapidly as possible. Serves to educate area residents that any homeowner, regardless of location, can purchase flood insurance.**	1.1	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures	2006-2007	NOOEP	PP, PI	E, N
3	H	Develop a hurricane awareness brochure that includes hazard information, evacuation information, and mitigation information and distribute to residents and visitors at facilities throughout the City. **Benefits: Increase public awareness and preparedness.**	2.1	$75K: Parish Funding/ FEMA MT Grant Money	Hurricanes	2006	NOOEP	PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
4	H	Develop educational campaigns utilizing public access TV, the internet, and print media to notify the public of information regarding hazard mitigation and for the dissemination of hazard information. **Benefits: Increases public awareness and preparedness.**	2.2	TBD: Parish Budget/ FEMA MT Grant Money	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Drought, Chemical Spills, Terrorist, Levee Failure	2006	NOOEP	PI	E, N
5	H	Establish a Last Resort Shelter/ Resource Center in each of the 13 City's Planning Districts that will perform the following mitigation functions: a) Serve as a rendezvous point, staging area, and bus pickup location for evacuations during emergency situations such as an approaching hurricane. b) Be a last resort shelter for persons unable to evacuate. Facilities would be elevated, built to withstand strong storms and fitted with secondary power sources. c) Be a year round resource center for the public to gain information on hazard mitigation, including evacuation plans, disaster preparedness, and property loss reduction strategies. Centers would be used by the New Orleans Office of Emergency Preparedness (NOOEP) as a place to register persons who will need special assistance during evacuations. Centers would also be used by NOOEP to hold public briefings to provide information on hazard mitigation and emergency operating procedures. **Benefits: Increases opportunities to provide services, information, and options available to citizens during mandatory evacuations.**	2.1	TBD: Parish Budget/ CDBG/ FEMA MT Grant Money	Flood, Levee Failure, Hurricanes	2006-2009	Neighborhood 1	ES, PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
6	M	Evaluate the implementation of a voluntary incentive and reward program that encourages builders and contractors to go beyond adopted minimum building code requirements to make buildings better able to withstand the forces of natural hazards. **Benefits: Reduces the risk of loss by construction methods.**	1.3	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures, Hurricanes, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms	2006-2007	Safety and Permits/ Mayor's Office of Technology	P, PP	N
7	M	Speakers Bureau to provide information on topics such as types of natural and man made disasters, how to develop a family disaster plan, how to develop a business continuity plan, and simple types of mitigation projects for homeowners. Offer these engagements to civic groups, church groups, business groups, and others throughout the City of New Orleans. **Benefits: Increases public awareness and preparedness.**	2.1	Staff Time/ Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2007-2008	NOOEP	PI	E, N

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Goal #3-Ensure the ability of emergency services providers and facilities, including essential facilities, to continue operating during hazard events.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Initiate a comprehensive program to protect vital records maintained by the Parish, to include removing records from low areas, installing protection devices and developing backup data systems. **Benefits: Protects the Parish from the loss of vital records.**	1.3	Parish Budget	Hurricanes, Levee Failures, Floods, Tornadoes	2006-2007	Mayor's Office of Technology	P	N/A
2	H	Upgrade the Parish Emergency Operations Center to permit operations to continue during and after disaster events, includes hardening the structure to withstand high winds, adding fixed elevated generators, enhancing communications system, and adding self containment equipment and supplies. **Benefits: Reduces the risks of loss by allowing the Emergency Operations Center to operate during a disaster.**	1.3	TBD: Parish Budget/ FEMA MT Grant Money	Hurricanes, Levee Failures, Floods, Tornadoes	2006-2007	NOOEP	ES	E, N
3	M	Install emergency generators at all emergency shelters and critical facilities. **Benefits: Provides power source during outages to enable emergency facilities to function and to provide safety.**	3.1	TBD: Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2007-2008	NOOEP	PP	E, N

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Goal #4-Promote regional cooperation between parishes with regard to hazard mitigation activities.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Identify, coordinate, and implement key unfunded components of Southeast Louisiana Urban Flood Control Projects (SELA) relating to regional projects. **Benefit: Overall flood loss reduction.**	4.1	TBD: Federal Budget/ State Budget/ Parish Budget/ USACOE	Floods, levee failure	2005-2006	Sewerage and Water Board of New Orleans	NR	E, N
2	L	Participate and contribute in all regional and statewide efforts for continued funding of Coastal Wetlands Planning, Protection, and Restoration Act projects. **Benefits: Allows the parish to participate in vital regional anti-subsidence initiatives.**	4.1	Staff Time/ Parish Budget	Subsidence, Floods, Hurricanes	2009-2010	Mayor's Office	NR, P, PP	E, N

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Goal #1- Identify and pursue preventive measures to reduce losses to existing and future property due to hazards.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Implement a program to coordinate with US Army Corps of Engineers and Orleans Levee District to restore the damaged levee system to withstand a Category 3 Hurricane. Includes participating in the reviews of the levee system failures. **Benefits: Greatly reduces the risk that Orleans Parish will be flooded because of a levee break during a hurricane.**	4.1	3.1 billion: Federal Budget Parish Budget/ US Army Corps of Engineers (USACOE)	Hurricanes, Floods, Levee Failure	2006	USACOE, Orleans Parish Levee District	P, PP, S	E, N
2	H	Implement a program to coordinate with the US Army Corps of Engineers and the Orleans Levee District to enhance the levee system to withstand a Category 5 Hurricane. **Benefits: Greatly reduces the risk that Orleans Parish will be flooded because of a levee break during a powerful hurricane.**	4.1	20 Billion: Federal Budget/ USACOE/ State Budget/ Parish Budget	Hurricanes, Floods, Levee Failure	2007-2016	USACOE, Orleans Parish Levee District	P, PP, S	E, N
3	H	Implement the Sewerage and Water Board's proposed mitigation projects with a goal of reaching a pumping/drainage capacity of 1" of water per hour (presently at 3" per 5 hours). **Benefits: Greatly reduces the Parish's vulnerability to flooding.** *See Table 15 (pages 76-78) for specific details of projects.*	4.1	See Table 15	Hurricanes, Floods, Levee Failure	2006-2009	Sewerage and Water Board of New Orleans	P, PP, S	E, N
4	H	Establish a Parish capability to review the maintenance and strength levels of the levee system. **Benefits: Provides added protection and gives residents and city officials current information on levee system.**	4.1	Parish Budget/ FEMA MT Grant Money	Levee Failures, Hurricanes	2006	Mayor's Office of Technology	P, PP, S	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost/Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
5	H	Develop a program including changing city code that is consistent with FEMA Grant and Assistance Guidelines and Louisiana Recovery Authority's priorities. **Benefits: Reduces future losses due to flooding.**	1.2	Staff Time/ Parish Budget	Hurricanes, Floods, Levee Failures	2006	Safety and Permits	P, PP	E, N
6	H	Develop programs for severe and repetitive loss structures as well as substantially damaged structures to seek funding to support and enforce building requirements to reduce future flood losses through the implementation of mitigation actions to include elevation, relocation, demolition/rebuild, retrofitting or flood proofing. Encourage and promote mitigation actions when building requirements can not be enforced. **Benefits: Reduces future losses due to flooding.**	1.2	TBD: FEMA MT Grant Money	Hurricanes, Floods, Levee Failures	2006-2007	Homeland Security/ Neighborhood 1	P, PP	E, N
7	M	Develop and maintain a comprehensive Geographic Information System that includes data such as all properties/parcels in the City, hazard areas, service districts, public works facilities, transportation infrastructure, and special needs residents. **Benefits: Provides city officials with valuable data to plan, prepare and recover from a disaster.**	1.1	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	ES, PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
8	M	Initiate, develop, and maintain a database of all properties that sustain damage as a result of a hazard. Include information about the nature and extent of the damage. Incorporate this database into the City's Geographic Information System. **Benefits: Provides city officials with valuable data to plan, prepare and recover from a disaster.**	1.1	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	P, PP	E, N
9	M	Amend New Century New Orleans Plan, which contains the guiding principles for both public and private development in the Parish, to include hazard mitigation goals and action plan. Ensure compliance with this document for all capitol projects. Amend Comprehensive Zoning Ordinance, which is the governing land use regulatory document to implement the policies and principles of the Master Plan to implement hazard mitigation goals and action plan. To the extent that some regulatory tools may be included in the Code of the City of New Orleans amend such to be consistent with the above referenced document. **Benefits: Provide Parish with a consolidated plan to reduce future losses by incorporating mitigation actions.**	1.3	Staff Time/Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2006-2007	Mayor's Office of Technology	P, PP	E, N
10	L	Initiate and implement Parish policy changes to require the use of roofing materials that are less susceptible to damage by severe weather in the construction and renovation of critical and parish facilities. **Benefits: Reduces losses to parish owned properties.**	1.3	TBD: Parish Budget	Hurricanes, Hail, Tornadoes, Thunderstorms/ Lightning, Severe Winter Storm	2006	Capital Projects	P, PP, S	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
11	L	Initiate and implement a Parish ordinance that addresses infrastructure repair techniques that mitigate hazards caused by drought and land subsidence, including water pipe shifts and breakage. **Benefits: Reduces damage to vital Parish infrastructure.**	1.2	Parish Budget	Drought, Subsidence	2006	Sewerage and Water Board of New Orleans	P, PP	E, N

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Goal #2 - Enhanced public awareness and understanding of disaster preparedness in order to protect the health and well being of the people of Orleans Parish from negative effects of hazards.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Develop a public service campaign to encourage home and business owners, who are not otherwise mandated to meet flood hazard standards to voluntarily upgrade protection, especially in repetitive loss areas. **Benefits: Reduces the loss of lives and property.**	1.3	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures	2006-2007	NOOEP	ES	E, N
2	H	Develop a program to promote by public service announcements the purchase of Flood Insurance. Advertise the availability, cost, and coverage of Flood Insurance through the National Flood Insurance Program (NFIP). **Benefits: Enables homeowners to financially recover from the devastating effects of flooding as rapidly as possible. Serves to educate area residents that any homeowner, regardless of location, can purchase flood insurance.**	1.1	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures	2006-2007	NOOEP	PP, PI	E, N
3	H	Develop a hurricane awareness brochure that includes hazard information, evacuation information, and mitigation information and distribute to residents and visitors at facilities throughout the City. **Benefits: Increase public awareness and preparedness.**	2.1	$75K: Parish Funding/ FEMA MT Grant Money	Hurricanes	2006	NOOEP	PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
4	H	Develop educational campaigns utilizing public access TV, the internet, and print media to notify the public of information regarding hazard mitigation and for the dissemination of hazard information. **Benefits: Increases public awareness and preparedness.**	2.2	TBD: Parish Budget/ FEMA MT Grant Money	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Drought, Chemical Spills, Terrorist, Levee Failure	2006	NOOEP	PI	E, N
5	H	Establish a Last Resort Shelter/ Resource Center in each of the 13 City's Planning Districts that will perform the following mitigation functions: a) Serve as a rendezvous point, staging area, and bus pickup location for evacuations during emergency situations such as an approaching hurricane. b) Be a last resort shelter for persons unable to evacuate. Facilities would be elevated, built to withstand strong storms and fitted with secondary power sources. c) Be a year round resource center for the public to gain information on hazard mitigation, including evacuation plans, disaster preparedness, and property loss reduction strategies. Centers would be used by the New Orleans Office of Emergency Preparedness (NOOEP) as a place to register persons who will need special assistance during evacuations. Centers would also be used by NOOEP to hold public briefings to provide information on hazard mitigation and emergency operating procedures. **Benefits: Increases opportunities to provide services, information, and options available to citizens during mandatory evacuations.**	2.1	TBD: Parish Budget/ CDBG/ FEMA MT Grant Money	Flood, Levee Failure, Hurricanes	2006-2009	Neighborhood 1	ES, PI	E, N

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No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
6	M	Evaluate the implementation of a voluntary incentive and reward program that encourages builders and contractors to go beyond adopted minimum building code requirements to make buildings better able to withstand the forces of natural hazards. **Benefits: Reduces the risk of loss by construction methods.**	1.3	Staff Time/ Parish Budget/ FEMA MT Grant Money	Flood, Levee Failures, Hurricanes, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms	2006-2007	Safety and Permits/ Mayor's Office of Technology	P, PP	N
7	M	Speakers Bureau to provide information on topics such as types of natural and man made disasters, how to develop a family disaster plan, how to develop a business continuity plan, and simple types of mitigation projects for homeowners. Offer these engagements to civic groups, church groups, business groups, and others throughout the City of New Orleans. **Benefits: Increases public awareness and preparedness.**	2.1	Staff Time/ Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2007-2008	NOOEP	PI	E, N

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Goal #3-Ensure the ability of emergency services providers and facilities, including essential facilities, to continue operating during hazard events.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Initiate a comprehensive program to protect vital records maintained by the Parish, to include removing records from low areas, installing protection devices and developing backup data systems. **Benefits: Protects the Parish from the loss of vital records.**	1.3	Parish Budget	Hurricanes, Levee Failures, Floods, Tornadoes	2006-2007	Mayor's Office of Technology	P	N/A
2	H	Upgrade the Parish Emergency Operations Center to permit operations to continue during and after disaster events, includes hardening the structure to withstand high winds, adding fixed elevated generators, enhancing communications system, and adding self containment equipment and supplies. **Benefits: Reduces the risks of loss by allowing the Emergency Operations Center to operate during a disaster.**	1.3	TBD: Parish Budget/ FEMA MT Grant Money	Hurricanes, Levee Failures, Floods, Tornadoes	2006-2007	NOOEP	ES	E, N
3	M	Install emergency generators at all emergency shelters and critical facilities. **Benefits: Provides power source during outages to enable emergency facilities to function and to provide safety.**	3.1	TBD: Parish Budget	Hurricanes, Floods, Tornadoes, Thunderstorms/ Lightning, Hail, Severe Winter Storms, Chemical Spills, Terrorist, Levee Failure	2007-2008	NOOEP	PP	E, N

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Goal #4-Promote regional cooperation between parishes with regard to hazard mitigation activities.

No.	Priority	Action Item/Benefits	Objective	Cost Estimate/ Funding Source	Hazards	Timeframe	Lead Manager	FEMA Mitigation Policy Category	Address New (N) Existing (E) Infrastructure and Buildings
1	H	Identify, coordinate, and implement key unfunded components of Southeast Louisiana Urban Flood Control Projects (SELA) relating to regional projects. **Benefit: Overall flood loss reduction.**	4.1	TBD: Federal Budget/ State Budget/ Parish Budget/ USACOE	Floods, levee failure	2005-2006	Sewerage and Water Board of New Orleans	NR	E, N
2	L	Participate and contribute in all regional and statewide efforts for continued funding of Coastal Wetlands Planning, Protection, and Restoration Act projects. **Benefits: Allows the parish to participate in vital regional anti-subsidence initiatives.**	4.1	Staff Time/ Parish Budget	Subsidence, Floods, Hurricanes	2009-2010	Mayor's Office	NR, P, PP	E, N

Table 15

Sewerage and Water Board Flood Mitigation Initiatives							
No.	Priority	Description	Cost Estimate/ Funding Source	Time	Benefits	Lead Manager	Hazards
1	H	Dwyer Intake Canal Construction	9.3 million/ Parish Budget/ USACOE	2006	Improve drainage in Eastern New Orleans	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
2	H	Pump Station Upgrade - Drainage Pumping Station (DPS) #6	8.6M Parish Budget/ Jefferson Parish	2006-2009	Increases the water pumping capacity of Uptown and Lakeview	Sewerage and Water Board of New Orleans, Jefferson Parish	Floods, Hurricanes, Thunderstorms
3	H	Construction of Concrete lined canals on Florida Avenue from DPS #19 to Peoples Avenue	42.7M Parish Budget/ USACOE	2006-2009	Increases drainage of Gentilly, Bywater, and Upper 9th Ward	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
4	H	Jefferson Canal upgrades. Construction of covered Canal in Jefferson Avenue, from Claiborne to Constance Street.	28.5M Parish Budget/ USACOE	2006-2009	Increases drainage of Uptown	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
5	H	Construct new open U Box Canal on Florida Avenue right of way, from Peoples Avenue to Elysian Fields	22.4M Parish Budget/ USACOE	2006-2009	Increases drainage in East New Orleans	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
6	H	Construction of concrete lined Canals on General De Gaulle, from Nolan Canal to Wall Boulevard.	42M USACOE/ Parish Budget	2006-2009	Increases drainage of Algiers	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms

Table 15

Sewerage and Water Board Flood Mitigation Initiatives

No.	Priority	Description	Cost Estimate/ Funding Source	Time	Benefits	Lead Manager	Hazards
7	H	Construction of a new drainage canal on S. Claiborne between Lowerline and Monticello.	32.1M USACOE/ Parish Budget	2006-2009	Increases drainage in Uptown	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
8	H	Construct a covered canal in Orleans Avenue, from S. Scott to DPS #7.	32.6M Parish Budget/ USACOE	2006-2007	Increases drainage of Lakeview/ Lakefront area	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
9	H	Construct a new canal crossing Airline Drive to the Monticello Canal.	1.9M Parish Budget/ Jefferson Parish	2006	Increases drainage of Lakeview/ Lakefront area	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
10	H	Construction of canals in Lousiana Avenue from S. Claiborne to Constance Street.	17.3M Parish Budget/ USACOE	2006-2009	Increases drainage of Uptown	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
11	H	Construction of an open concrete lined Canal in Donner from Pacific Railroad to DPS #13	13.5M Parish Budget/ USACOE	2006-2009	Increases drainage of Algiers	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms

Table 15

Sewerage and Water Board Flood Mitigation Initiatives

No.	Priority	Description	Cost Estimate/ Funding Source	Time	Benefits	Lead Manager	Hazards
12	H	Construction of pipeline in 3rd Street between Tchopitoulas and Constance Street.	1.8M	2006-2007	Increases drainage in Uptown	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms
13	H	Construction of a new drainage pumping station at New Orleans Lakefront Airport.	Parish Budget/ Orleans Levee District	2007	Increases drainage in Lakefront area	Sewerage and Water Board of New Orleans	Floods, Hurricanes, Thunderstorms

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APPENDIX A
METHODOLOGY FOR LOSS ESTIMATION

Persons in Hazard Area

The number of persons whose residences or jobs lie within the hazard area was calculated next. The number of residents and the numbers of commercial and industrial workers in each Census tract was taken from HAZUS99. (Again, in 13 cases the tract information from the two sources did not match.) Once the number of persons in each tract was determined from HAZUS99 data, the number of persons per tract whose residences or jobs are within the hazard area was calculated by multiplying the number of persons in a tract by the percentage of that tract that lies within the hazard area.

These values were summed to give the City-wide total number of persons in the hazard area. For example, the total number of persons whose residences are within the floodplain was determined by adding the number of persons whose residences lie within the floodplain in each Census tract. The results are given in Table 2 and Table 4b.

Value of Structures in Hazard Area

The value of structures in hazard areas was calculated using a different methodology. The first step was to determine the aggregate value of structures by occupancy category for the whole Parish. HAZUS99 provides total square footage of buildings for 6 classes of residential occupancy, 10 classes of commercial occupancy, 6 classes of industrial occupancy, agricultural occupancy, religious occupancy, 2 classes of governmental occupancy, and 2 classes of educational occupancy. HAZUS99 also provides an average cost of building replacement for each of these classes of occupancy. The total value of structures in the Parish for each occupancy classification was determined by multiplying the replacement costs by the total square footage.

The value of structures in hazard areas was calculated by multiplying the aggregate calculated value of structures in the Parish in each occupancy class by the percentage of structures of that class in the Parish in hazard areas. For example, the value of residential structures in the 100-year floodplain was calculated by multiplying the aggregate value of all residential structures in the Parish by the percentage of all residential structures in the Parish that are in the floodplain. Despite the fact that this method assumes an even distribution of structure values throughout the Parish, it provides a rough estimate of the potential damages from hazard events. The results are given in Table 2 and Table 4a.

Hail Storms Loss Estimation Methodology

Determination of Hazard Area

The first step in calculating the loss estimations was to determine the areas of Orleans Parish that would be affected by hail storms. The main impacts of a hail storm on Orleans Parish were determined to be property damage. The entire Parish was determined to be at risk for a hail storm.

Structures, Values and Persons In Hazard Area

Data regarding structures, values, and persons in the hazard areas were calculated using the data developed in the flood and hurricane analysis at the census tract level. All of the census tract data was used in the analysis since 100% of Parish is at risk to the effects of an earthquake. Historical hail storm data indicated that a severe hailstorm would have an

be 5% of the total structures in the Parish. Values were multiplied by .01 to provide an overall loss estimate.

APPENDIX B
STRUCTURE EXPOSURE BY CENSUS TRACT

TOTAL
EDU2
EDU1
GOV2
GOV1
REL1
AGR1
IND5
IND4
IND3
IND2
IND1
COM10
COM9
COM8
COM7
COM6
COM5
COM4
COM3
COM2
COM1
RES6
RES5
RES4
RES3
RES2
RES1
TRAC1

APPENDIX C
CRITICAL FACILITIES

Critical Facilities

* Due to Hurricane Katrina many of these facilities are no longer in use as damage assessments are done changes will be made to this list.

Education/Childcare Facilities
Daycare (240 facilities)
Orleans Parish School Board Central Office
New Orleans Public Schools – Elementary and Secondary (129 facilities)
Private Schools – Elementary and Secondary (91 facilities)
Delgado Community College
Dillard University
Holy Cross College
Loyola University
Southern University at New Orleans
Tulane University
University of New Orleans
Xavier University

Government Facilities – Courts and Criminal Justice
Algiers Courthouse
Civil Courts
Clerk of Criminal Courts
Community Correctional Facility
Conchetta Female Detention Center
District Attorney's Office Building
House of Detention & Central Lockup
Juvenile Courts
Municipal/ Traffic Court Building
Orleans Parish Prison Complex
Rendon Female Detention Center

Government Facilities – Emergency Services
City Park Police
EMD Algiers Fuel Facility
EMD Broad Street Fuel Facility
EMD Central Maintenance Garage and Fuel Facility
EMS Communications
Municipal Training Academy City Park Facility
Municipal Training Academy East
New Orleans Fire Department Headquarters
New Orleans Fire Stations/ Communications - (38 facilities)
New Orleans Police Department Headquarters
New Orleans Police Districts/ Substations/ Etc. - (14 facilities)
Norfolk Southern Corp Police
Orleans Levee Board Police
Parkways/EMD Maintenance Facility

Government Facilities - Libraries
Central Library
New Orleans Libraries (11 facilities)

Government Facilities – Miscellaneous
Algiers Maintenance Facility
Central Maintenance Garage
City Hall
City Health Clinics (7 facilities)
Department of Public Works Administration Building
Ernest N. Morial Convention Center
Finance Warehouse
Historic District Landmarks Commission Offices
Michoud Assembly Facility
Morgue and Offices
Municipal Auditorium
State Office Building
Superdome
Termite, Mosquito and Vector Control Administration Building
Theater of the Performing Arts
Touro Shakespeare Home
Union Passenger Station

Government Facilities – Multi Service Centers
Allie Mae Williams Multi Service Center
Andrew Sanchez Multi Service Center
Arthur Monday Center
Broadmoor Community Center
Carrolton Hollygrove Center
Desire Florida Multi Service Center
Pontchartrain Park Community and Senior Center

HazMat
Agriculture Street Landfill
Airco industrial Gases Boc GRO
Air Prods. & Chemicals Inc
Auto-Chlor System of LA & SOM
Avondale Industries Inc Algiers
Barber Labs Inc
Baroid Drilling Fluids Inc.
BOC Gases
Chemmark of New Orleans
Courtaulds Coating Inc
Crewboats Inc
Deluxe Check Printers Inc
Dixie Brewing Co Inc
Equitable/Halter
Gulf Wire Corporation
Louisiana Coca-Cola Bottling Company
M-I Drilling Fluids Co. New Orleans
Siemens Energy & Automation
Spectrum Control Technology
Textron Marine Sys. Shipyard
USDA/ARS Southern Regional Res
US Marine Inc

Health Care
Charity Hospital of Medical Center of Louisiana
Children's Hospital
DePaul Tulane Behavioral Health
Kindred Hospital
Lakeland Medical Center
Lakeside Hospital
Memorial Medical Center – Baptist Campus
Memorial Medical Center - Mercy Campus (Lindy Boggs)
Methodist Hospital New Orleans Adolescent Hospital
St Charles General Hospital
St Claude Medical Ctr/ Bywater Hospital
Touro Infirmary
Tulane University Hospital & Clinic
University Hospital of Medical Center of Louisiana
VA Medical Center
Nursing Homes (47 facilities)
For City Health Clinics see City Facilities

Port of New Orleans
Alabo Street Wharf
First St Wharf
France Road Berth 1
France Road Berth 4
France Road Berth 5
Governor Nicholls St Wharf
Harmony St Wharf
Henry Clay Ave Wharf
Jourdan Road Terminal
Julia St Cruise Ship Terminals 1 & 2
Louisiana Ave. Wharf
Milan St Wharf
Napoleon Ave
Napoleon Ave Wharf C
Napoleon Ave C Lower Open
Nashville Ave. Wharf – A, B, & C
Perry St Wharf
Poland Avenue Wharf
Port of New Orleans Headquarters
Port of New Orleans – Industrial Tenants (40)
Robin St Wharf
Seventh St Wharf

Rail
Burlington Northern Santa Fe (BNSF)
Canadian National and Illinois Central Railroad (CNIC)
CSX Railroad & Buildings
Kansas City Southern (KCS)
Norfolk Southern Railroad & Buildings
New Orleans Public Belt Railroad & buildings
Union Pacific

Transportation/Lifeline
Earhart Blvd
Franklin Ave.
General de Gaulle Dr.
Gentilly/ Chef Menteur Hwy
I-10
I-510/ Paris Rd
I-610
Jefferson Hwy
N Claiborne Ave
Pontchartrain Expressway
State Hwy 406/ Woodland Hwy
St. Claude Ave
US Hwy 11
US HWY 61/ Airline Hwy/ Tulane Ave
US Hwy 90/ S Claiborne Ave/ N. Broad/ Westbank Expressway

Utilities - Communications
Cox Communications
Bellsouth Communications
Cingular Wireless
Verizon Wireless
Sprint Wireless
World Com

Utilities – Energy/ Gas
Entergy Electric
Entergy Gas

Utilities – Sewerage and Water Board
Algiers Water Plant
Algeirs Water Tank
Algiers Intake 1 & 2
Carrollton Water Plant
Carrollton Intake 1 & 2
Drainage Pumping Stations (21)
East Bank STP
Michoud Water Tank
West Bank Sewerage Treatment Plant (STP)

APPENDIX D
PLANNING TEAM AND STEERING COMMITTEE MEMBERS

Orleans Parish Hazard Mitigation Plan Planning Team- The Planning Team refers to the general public and broader interested parties who chose to attend the larger Planning Team meetings. The purpose to this Planning Team was to provide input on Plan components. This team consisted of the representatives from local and state government, local employers, local organizations, and private industry. This Planning Team met twice during the planning process to provide input on the Plan and to provide review of the Plan documents. The general public was also notified of these meetings and invited to provide input on planning issues and plan development. The Planning Team developed the mission statement, identified hazards, and reviewed and provided input on the risk assessment, the mitigation strategies and the action plan.

Planning Team Membership = 25

Name	Organization
Ray Nagin	Mayor, City of New Orleans
Terry Tullier	City of New Orleans Office of Emergency Preparedness
Kimberly Williamson Butler	Chief Administrative Office
Beth James	Economic Development
Terry Ebbert	Homeland Security and Public Safety
Collette Creppel	City Planning Commission
Harold Gormon	Sewerage and Water Board
Charles Parent	New Orleans Fire Department
Edwin Compass	New Orleans Police Department
Greg O'Brien	University of New Orleans
Alan Artibise	University of New Orleans
Max Heam	Orleans Levee District
Dan Packer	Entergy
Conrad Gruber	Atmos Energy
Barbara Johnson	New Orleans Regional Chamber of Commerce
Paul Coreil	LSU Cooperative Extension Services
Elizabeth Gamble	Jackson Barracks
Elrhel Thibodeaux	Historic District Landmarks Commission
Lary Headorffer	Vieux Carre Commission
Walter Brooks	Regional Planning Commission
Col. Peter Rowen	Corps of Engineers
William Deville	Regional Transit Authority
Mark Treadway	Homebuilders Association
Kay Wilkins	American Red Cross
Dan Falanga	Louisiana Office of Emergency Preparedness

Orleans Parish Hazard Mitigation Plan Steering Committee- The Steering Committee consisted of representatives from local and state government agencies, the business community, emergency management officials, Parish residents and elected

officials. This committee provided leadership in the creation of the Plan by overseeing the planning process and actively participation in the development of the Plan. The Steering Committee developed the specific details of the risk assessment, the mitigation strategies, and the action plan.

Steering Committee = 30

First Name	Last Name	Organization
Terry	Tullier	New Orleans Office of Emergency Preparedness
Lou	Reese	New Orleans Office of Emergency Preparedness
Simeon	Wildman	Mayor's Office of Economic Development
Collette	Creppell	New Orleans City Planning Commission
Victoria	Caridas	New Orleans City Planning Commission
Edwin	Holmes	New Orleans Fire Department
Joseph	Matthews	New Orleans Fire Department
Daniel	Lawless	New Orleans Police Department
Shirley	Laska	University of New Orleans
Alan	Artibise	College of Urban and Public Affairs
Jim	Amdal	UNO/CUPA ITPIC
Stevan	Spencer	Orleans Levee District
Chris	Laborde	New Orleans Regional Chamber of Commerce
Pat	Skinner	LSU Cooperative Extension Service
Jamie	Roy	LSU Cooperative Extension Service
Walter	Gallas	Historic District Landmarks Commission
Lary	Hesdorffer	Vieux Carre Commission
Johnny	Bordelon	Regional Planning Commission
Jerry	Colletti	U.S. Army Corp of Engineers
Michael	Lowe	U.S. Army Corp of Engineers
Al	Hamilton	American Red Cross
Bruce	Cuber	American Red Cross
Steve	Zimmer	Delgado Community College WBC
Merlin	Haydel	City Park Improvement Association
Robert	Claypool	ComputerCC
Kevin	Hemenger	Green Fields Real Estate
Edward	Dalferes	Gentilly/Sugar Hill
Cynthia	Sacks	English Turn Property Owners' Association
Mark	Treadaway	Greater New Orleans Homebuilders' Association
Scott	Coulombe	Greater New Orleans Homebuilders' Association

APPENDIX E
MEETING AGENDAS

New Orleans Hazard Mitigation Plan
Steering Committee Meeting
May 13, 2003

Agenda

- Welcome
- Discussion of Risk Assessment portion of Plan
- Presentation of Risk Assessment maps
- Discussion of loss estimation methodology
- Looking Ahead

New Orleans Hazard Mitigation Plan
Steering Committee Meeting
July 25, 2003

Agenda

- Welcome
- Presentation of public comments received
- Presentation and Discussion of Mitigation Strategies
- Explanation of STAPLEE charts
- Multi-voting
- Looking Ahead

APPENDIX F
SELECTED PUBLIC COMMENTS

sent written comments on the Plan. Furthermore, the Plan was profiled by the Times-Picayune and organizations that first heard about the Plan from the newspaper were given additional time to comment on the Plan. Although there will always be some entities that are not included in a planning effort such as this one, the organizations that provided input to the Plan represent a cross-section of New Orleans.

- The inventory of critical facilities appears to include primarily city-owned facilities. Many more (such as private hospitals) exist, and need to be inventoried and assessed for vulnerability. In turn, this may impact significantly the priorities, goals, objectives, and implementation aspects of the Plan.
- Facilities that will not evacuate, such as hospitals, need to be assessed, along with populations that are more difficult to evacuate, such as the elderly, the handicapped and the incarcerated.

The inventory of critical facilities focused on city-owned facilities for two reasons. First, the City has direct control over these facilities and can implement mitigation measures at-will. The City has no direct means of undertaking mitigation measures in State-owned or private facilities. Second, this abbreviated inventory is intended to demonstrate in a broad sense the potential losses in New Orleans during a hazard event. FEMA guidelines give local communities latitude in determining the scope of critical facilities inventories, recognizing that jurisdictions face time and budget constraints. In cases where more abbreviated inventories are conducted, it is understood that such inventories are the first step in developing a more comprehensive inventory. (The New Office of Homeland Security is currently conducting a Risk Assessment that can be used to supplement the information in this Plan in the future, as well.) While it is true that additional information about other facilities that may be gathered in the future may change some of the priorities, such changes can be incorporated during the annual reviews of the Plan.

- Regional issues need to be addressed (after all, hazards pay no attention to parish boundaries).
- Multi-jurisdictional [evacuation] issues need to be addressed.
- The large number of people who have to travel through the city [during an evacuation], in addition to those leaving from the city itself, needs to be considered, as well as the fact that all evacuees have to travel through other cities, parishes and even states.

Regional issues will be addressed as part of Goal 5. All mitigation strategies that address hazards originating in other parishes must be addressed through cooperation of the Parish governments since Orleans Parish has no jurisdiction in other areas.

Hurricanes

- In Table 5, the column headings indicating the amount of flooding appear to have been reversed. In fact, virtually all the damage calculation tables in the Plan appear to be similarly reversed.

The table headings are correct as shown. As the text below Table 5 states, the table shows insured values of the properties in each hazard area; losses would be a percentage of these values. Expected losses would be a higher percentage of the building values in

would not experience flooding under that scenario), this model nevertheless provides some of the most detailed data available at this time.

- The ability of the railroads to move people [during an evacuation] needs to be referenced and discussed.
- It should be noted that all private transportation equipment (buses, planes, trains) will be protected by their owners in the face of a major storm by moving them out of the city. How does this factor into evacuation planning?

The possible use of railroads and other private modes of transportation will be studied as part of Strategy 2.2.3 "Investigate alternatives to public transit as a means of evacuating persons who do not have their own transportation."

- In discussing the differences in the situation now compared to the last time a major storm hit, the completion of the entire ring of levees is not mentioned. This is a significant factor.

The entire ring of levees in Orleans Parish was completed at the time that the model used in the Plan was created, however, and this model is the basis for forecasting potential losses in the future.

- The need for providing a place for first responders – and their equipment – to ride out a storm must be addressed.

The ability of emergency services providers to continue operating during a hurricane and/or to resume operations immediately after a hurricane is covered generally by Goal 4 and specifically by Strategy 4.1.1 "Complete a study of vulnerabilities of emergency services facilities and other facilities that house essential operations."

Tornadoes

- The discussion of housing stock basically doesn't say anything – more research if necessary.
- The section of commercial buildings overlooks the scattered and often residential locations of businesses in New Orleans.

While the discussion of the building stock in Orleans Parish is somewhat generalized, a more in-depth analysis of the building stock would not add significantly to the Vulnerability Assessment. Because of the nature of tornados, it is impossible to know precisely where a tornado would likely strike. Therefore, a generalized vulnerability assessment for tornados is appropriate.

Hail

- No discussion at all of the types of roofing materials commonly used in New Orleans, and the resulting likely consequences of hail damage.

The data from recent major hailstorms provides specific information about the New Orleans' vulnerability to such events. Information about roofing materials would be generalized and would not add much detail to the vulnerability assessment.

Subsidence

- No discussion of the threat/damage to houses and other structures from subsidence!!!

without water for extended periods is made because past cold spells indicate that the threat of such an occurrence is low.

Epidemics

- This section is incomplete and in some aspects inaccurate.
- The overall trend is an increase in West Nile virus and other insect-borne diseases; despite a reduction this year, there is no evidence yet that the threat has lessened.
- New Orleans' additional vulnerability to disease and epidemics due to the large number of people without access to proper health care (including health and disease information and health insurance) must be considered.
- The statement that "Orleans Parish's vulnerability to an epidemic must be figured on a case-by-case basis" is simply not accurate, for the above-stated reasons as well as others.

The section on epidemics covers a wide variety of diseases: waterborne, foodborne, airborne, vectorborne (such as those carried by mosquitoes or ticks). Because diseases can be transmitted in many different ways and because diseases vary in how easily they are spread, it is difficult if not impossible to quantify the possible effects of an epidemic in Orleans Parish. Sources for the data in this section are included in the footnotes and in the References section.

Erosion

- A significant cause of erosion is industrial activity, particularly the number of canals that have been dug. Yet this is not even mentioned.

Information about this issue has been added to the Plan.

Mitigation Planning

- The list of relevant agencies is incomplete. Examples that should be included are the Department of Health and the Mayor's Office of Communications. Conversely, the relevance of the Vieux Carre Commision, DDD and HDLC is questionable.

The suggested agencies were added to Section 3 of the plan. The Vieux Carre Commission and the Historic District Landmarks Commission were included because they must approve alterations to private structures within their jurisdictions, which impacts owners' ability to undertake mitigation measures such as elevation or floodproofing. The Downtown Development District was included primarily because of the Hospitality Ranger program. The Hospitality Rangers provide information to visitors and local businesses.

- Another source of funding to be considered is grants from insurance companies and their foundations.

Information about these programs has been added to the Plan.

- Does New Orleans have an approved Flood Mitigation Plan?

Yes, it does.

APPENDIX G
LOSS ESTIMATION TABLES

Summary of Structures and Persons in Hazard Area for Flooding

Occupancy of Structure	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000's)
	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ Loss (Structure+Contents)
Residential	132,987	91,781	69%	18,784,973	12,961,631	69%	484,574	334,425	69%	4,277,338
Commercial	3,433	2,369	69%	4,377,092	3,020,193	69%	238,771	164,752	69%	998,853
Industrial	634	437	69%	643,993	444,355	69%	31,988	22,072	69%	146,637
Agriculture	13	9	69%	2,933	2,024	69%	NIA	NIA	NIA	668
Religion	397	274	69%	446,724	308,240	69%	NIA	NIA	NIA	87,813
Government	29	20	69%	527,894	364,247	69%	NIA	NIA	NIA	161,719
Education	226	156	69%	321,714	221,883	69%	NIA	NIA	NIA	48,836
Critical Facilities	213	147	69%	5,305,572	3,660,845	69%	NIA	NIA	NIA	73,254
Infrastructure	35	24	69%	2,388,200	1,647,858	69%	NIA	NIA	NIA	543,793
Total	137,719	95,197	69%	30,410,895	22,631,376	74%	NIA	NIA	NIA	6,256,721

Summary of Structures and Persons in Hazard Area for Hurricanes

Occupancy of Structure	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000's)
	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ Loss (Structure)
Residential	132,987	74,473	56%	18,784,973	10,519,584	56%	484,574	271,417	56%	6,101,359
Commercial	3,433	1,922	56%	4,377,092	2,451,172	56%	238,771	133,712	56%	1,421,679
Industrial	634	355	56%	643,993	360,636	56%	31,988	17,913	56%	209,169
Agriculture	13	7	54%	2,933	1,642	56%	NIA	NIA	NIA	952
Religion	397	222	56%	446,724	250,165	56%	NIA	NIA	NIA	140,092
Government	29	16	55%	527,894	295,621	56%	NIA	NIA	NIA	171,460
Education	226	127	56%	321,714	180,160	56%	NIA	NIA	NIA	164,493
Critical Facilities	213	119	56%	5,305,572	2,971,120	56%	NIA	NIA	NIA	1,723,249
Infrastructure	35	20	57%	2,388,200	1,337,392	56%	NIA	NIA	NIA	775,687
Total	137,719	77,261	56%	30,410,895	18,367,492	60%	NIA	NIA	NIA	10,648,140

Summary of Structures and Persons in Hazard Area for Tornados

Occupancy of Structure	Number of Structures			Value of Structures (in 000s)			Number of Persons/Jobs			Loss Estimation (in 000's)
	# in Parish	# in Hazard Area	% in Hazard Area	$ Value in Parish	$ Value in Hazard Area	% in Hazard Area	# in Parish	# in Hazard Area	% in Hazard Area	$ Loss (Structure)
Residential	132,987	1,330	1%	18,784,973	187,850	1%	484,574	4,847	1%	1,879
Commercial	3,433	34	1%	4,377,092	43,771	1%	238,771	2,388	1%	438
Industrial	634	6	1%	643,993	6,440	1%	31,988	320	1%	64
Agriculture	13	-	0%	2,933	29	1%	NIA	NIA	NIA	0
Religion	397	4	1%	446,724	4,467	1%	NIA	NIA	NIA	45
Government	29	1	3%	527,894	5,279	1%	NIA	NIA	NIA	53
Education	226	2	1%	321,714	3,217	1%	NIA	NIA	NIA	32
Critical Facilities	213	2	1%	5,305,572	53,056	1%				531
Infrastructure	35	1	3%	2,388,200	23,882	1%				239
Total	137,719	1,380	1%	30,410,895	327,991	1%	NIA	NIA	NIA	3,281

Hurricane Surge Mapping

SLOW MOVING STORMS

Orleans Parish
Louisiana

PLATE 1

LEGEND

Hurricane surge

Cat 1
Cat 2
Cat 3
Cat 4
Cat 5

Major Roads

Interstates
U.S. Highways
State Highways
Roads
Levees
Railroads
Rivers & Lakes

Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches

2000 0 2000 4000 6000 Feet

Prepared by: The New Orleans District
U.S. Army Corps of Engineers and the
Federal Emergency Management Agency

Jefferson Parish

St Bernard Parish

Jefferson Parish

Plaquemines Parish

Hurricane Surge Mapping

FAST MOVING STORMS

Orleans Parish Louisiana

PLATE 1

LEGEND

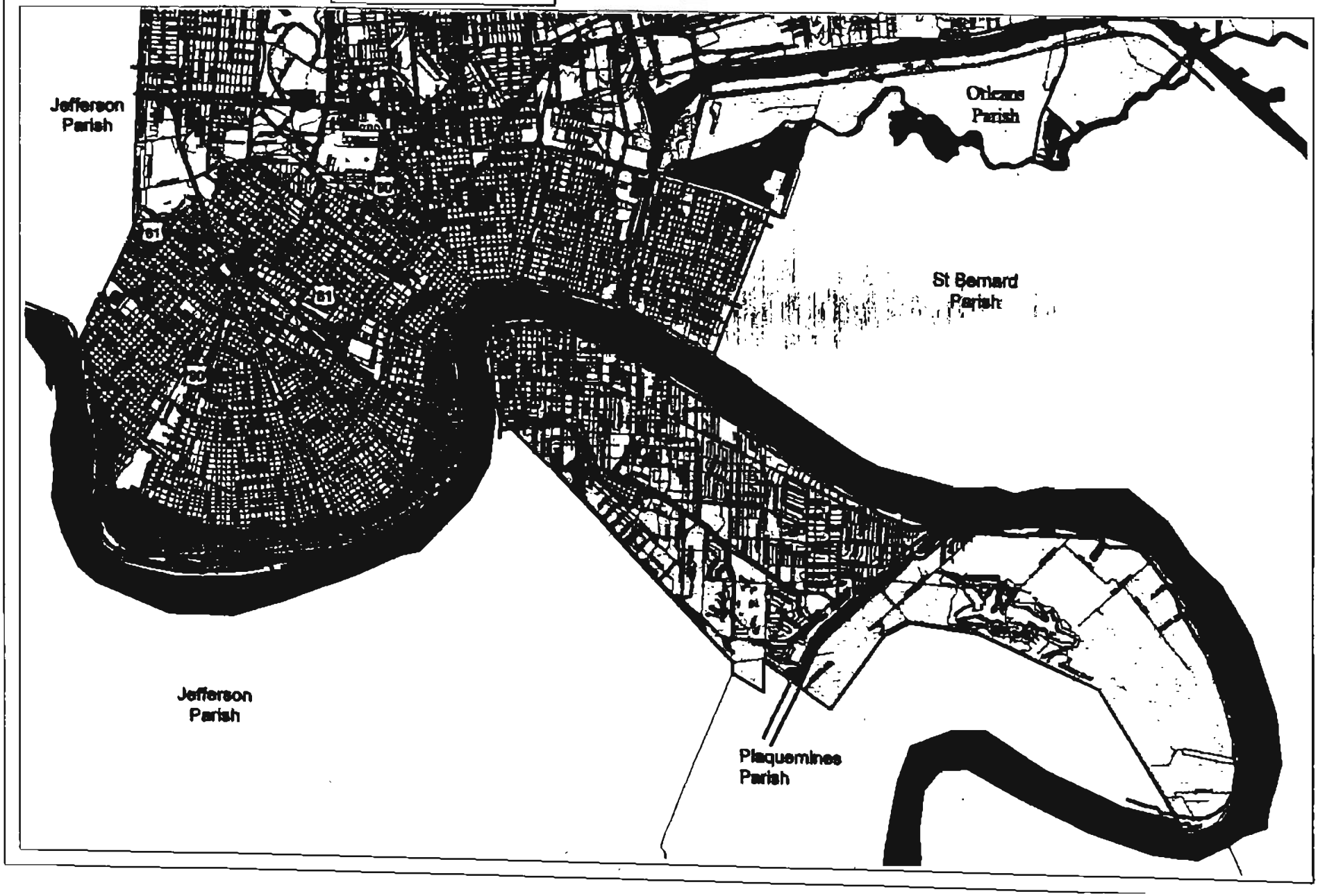
Hurricane surge — Cat 1, Cat 2, Cat 3, Cat 4, Cat 5, Rivers & Lakes

Major Roads — Interstate, U.S. Highways, State Highways, Roads, Levees, Railroads, Streams

Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches

2000 0 2000 4000 6000 Feet

Prepared by: The New Orleans District U.S. Army Corps of Engineers and the Federal Emergency Management Agency



Hurricane Surge Mapping

SLOW MOVING STORMS

Orleans Parish
Louisiana

PLATE 2

LEGEND

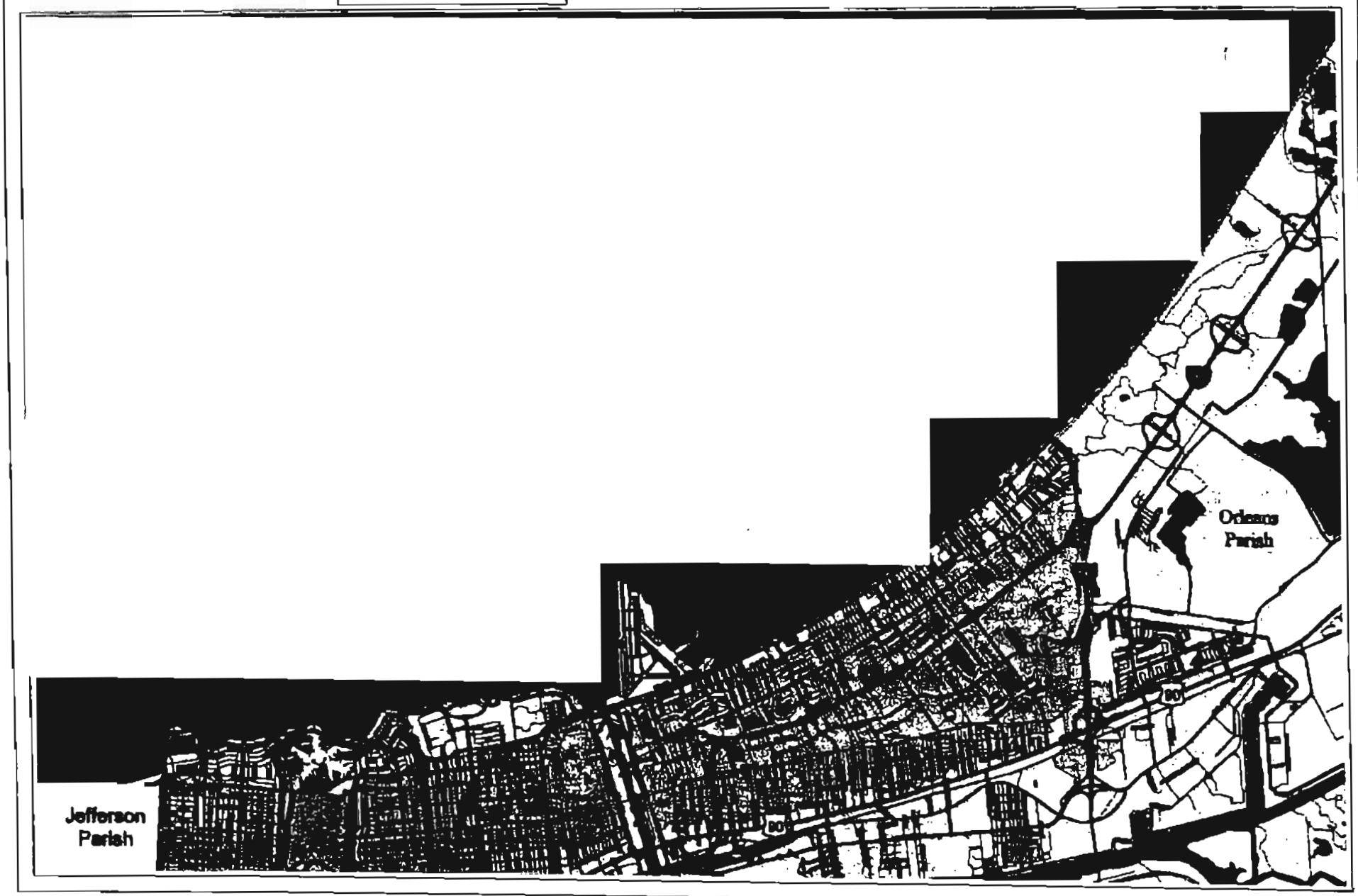
Hurricane surge — Cat 1, Cat 2, Cat 3, Cat 4, Cat 5, Rivers & Lakes

Major Roads — Interstate, U.S. Highways, State Highways, Streets, Railroads, Streams

Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches

2000 0 2000 4000 6000 Feet

Prepared by: The New Orleans District U.S. Army Corps of Engineers and the Federal Emergency Management Agency



Hurricane Surge Mapping

FAST MOVING STORMS

Orleans Parish
Louisiana

PLATE 2

LEGEND

Hurricane Surge
Cat 1
Cat 2
Cat 3
Cat 4
Cat 5
Rivers & Lakes

Major Roads
Interstate
U.S. Highways
State Highways
Roads
Levees
Railroads
Streams

Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches.

2000 0 2000 4000 6000 Feet

Prepared by: The New Orleans District
U.S. Army Corps of Engineers and the
Federal Emergency Management Agency

Orleans Parish

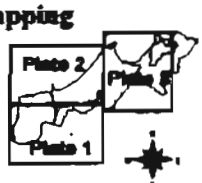
Jefferson Parish

Hurricane Surge Mapping

FAST MOVING STORMS

Orleans Parish
Louisiana

PLATE 3



LEGEND

Hurricane Surge
Cat 1
Cat 2
Cat 3
Cat 4
Cat 5
Rivers & Lakes

Major Roads
Interstates
U.S. Highways
State Highways
Streets
Parishes / Counties
Railroads
Streams

Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches

2000 0 2000 4000 6000 Feet

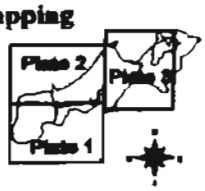
Prepared by: The New Orleans District
U.S. Army Corps of Engineers and the
Federal Emergency Management Agency

Hurricane Surge Mapping

SLOW MOVING STORMS

Orleans Parish
Louisiana

PLATE 3



LEGEND

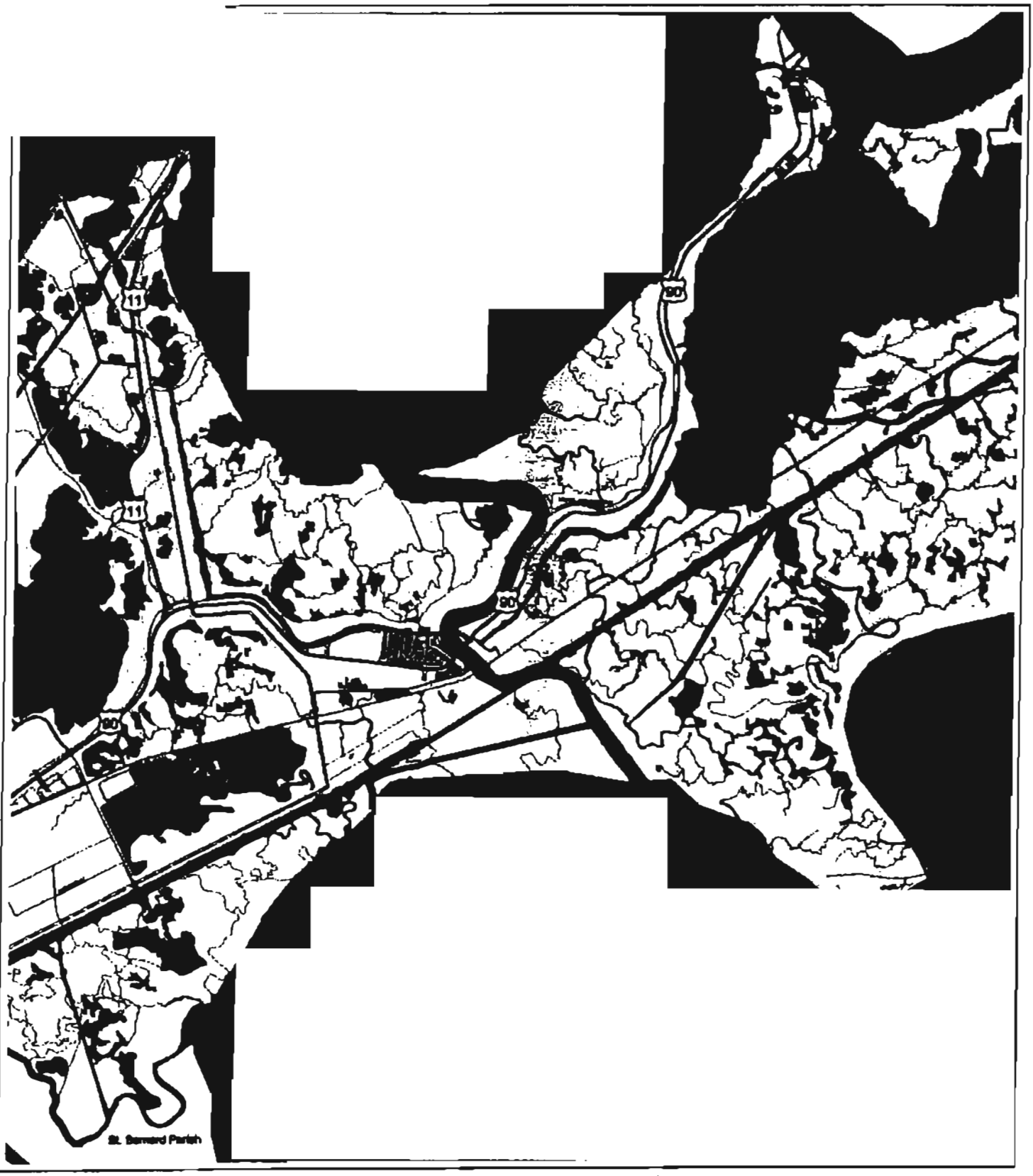
Hurricane surge
Cat 1
Cat 2
Cat 3
Cat 4
Cat 5
Rivers & Lakes

Major Roads
Interstate
U.S. Highways
State Highways
Roads
Levees
Railroads
Streams

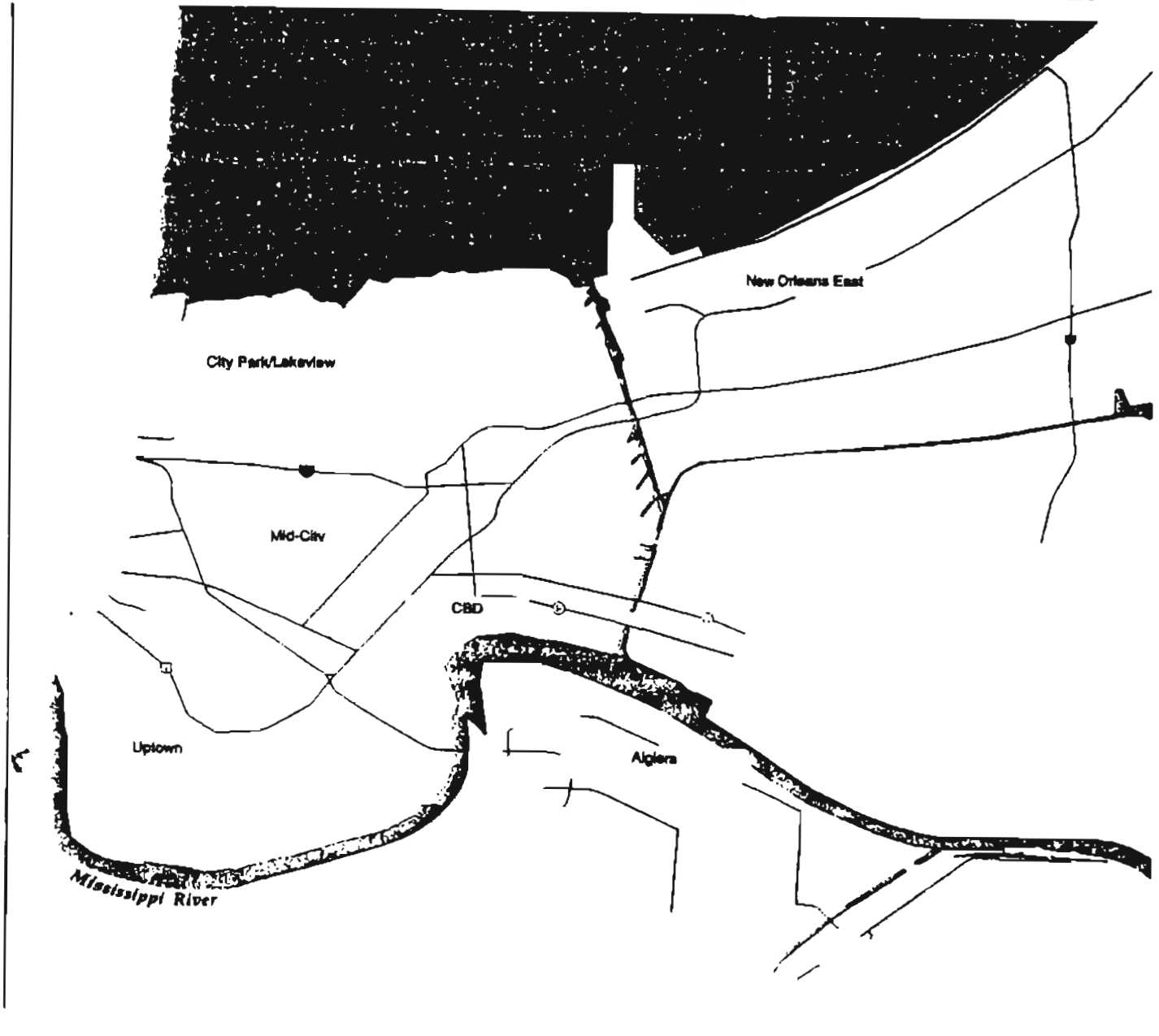
Scale: 1 inch = 4,000 feet
When printed 17 x 22 inches

2000 0 2000 4000 8000 Feet

Prepared by: The New Orleans District
U.S. Army Corps of Engineers and the
Federal Emergency Management Agency



MAP 21



LEGEND

Zone A (100-Yr. Flood Zone)

100-Yr. Flood Zone Structures in this zone have a 1 percent chance of flooding in any given year

Zone 500 (500-Yr. Flood Zone)

500-Yr. Flood Zone Structures in this zone have a 2 percent chance of flooding in any given year

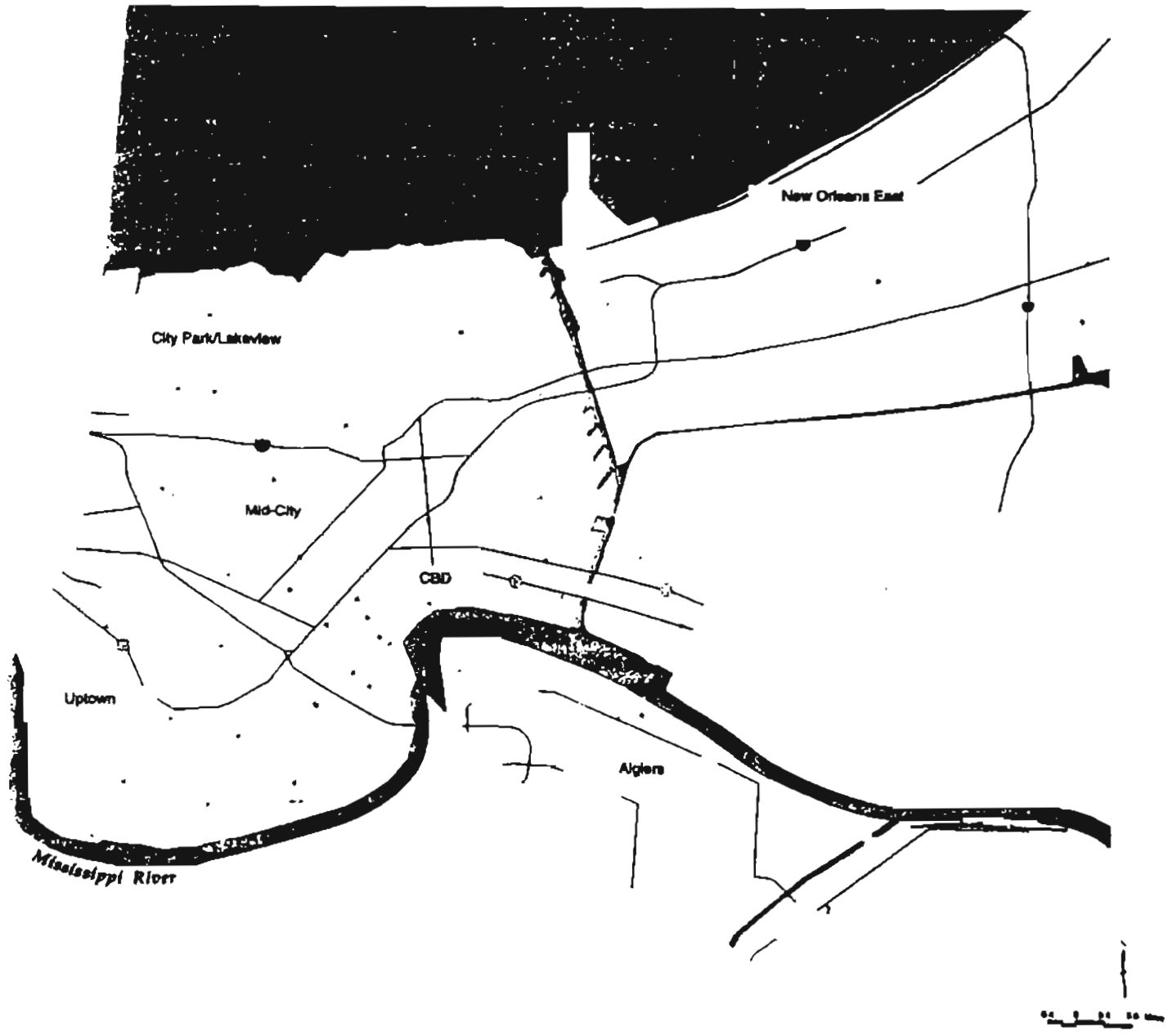
Source: FEMA QD Flood Data

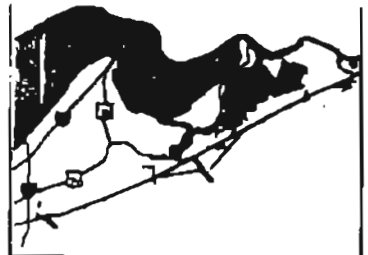
This map shows flood zones for Orleans Parish. All parts of the Parish lie in either the 100-year or the 500-year floodplain.

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 1
Flood Zones

2003 GCR





LEGEND

Zone A (100-Yr. Flood Zone)

100-Yr. Flood Zone: Structures in this zone have a 1 percent chance of flooding in any given year

Zone 500 (500-Yr. Flood Zone)

500-Yr. Flood Zone: Structures in this zone have a .2 percent chance of flooding in any given year

Source: FEMA Q3 Flood Data

☆ **Police Department Facility**

New Orleans Police Department headquarters, substations, and other facilities.

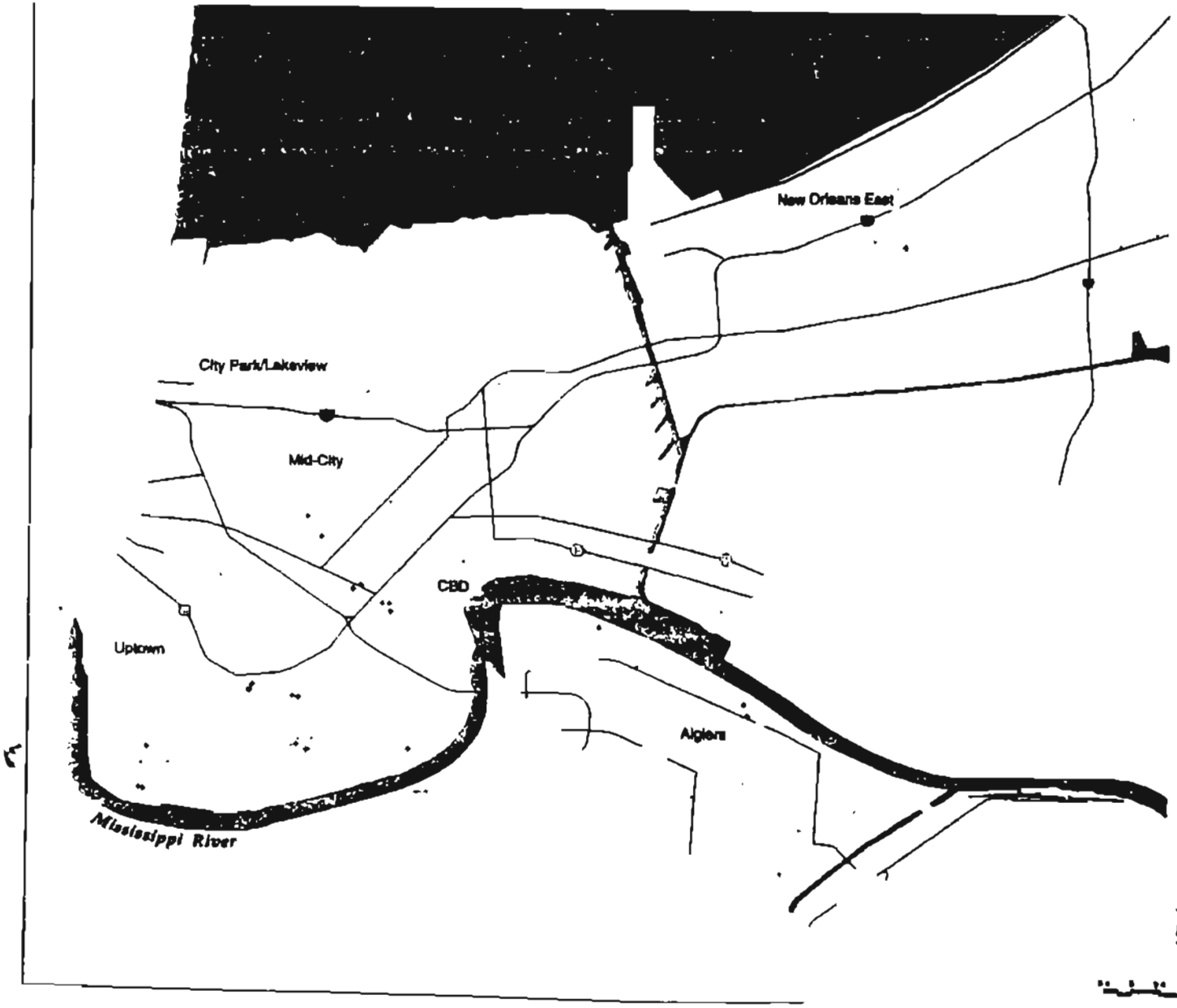
Fire Department Facility

New Orleans Fire Department headquarters, fire houses, and support facilities.

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 3
Flood Zones and
Police and Fire Facilities

2003 gcr



LEGEND

Zone A (100-Yr. Flood Zone)

100-Yr. Flood Zone: Structures in this zone have a 1 percent chance of flooding in any given year

Zone 500 (500-Yr. Flood Zone)

500-Yr. Flood Zone: Structures in this zone have a 2 percent chance of flooding in any given year

Source: FEMA CD Flood Data

Hospital
Major hospitals and medical centers

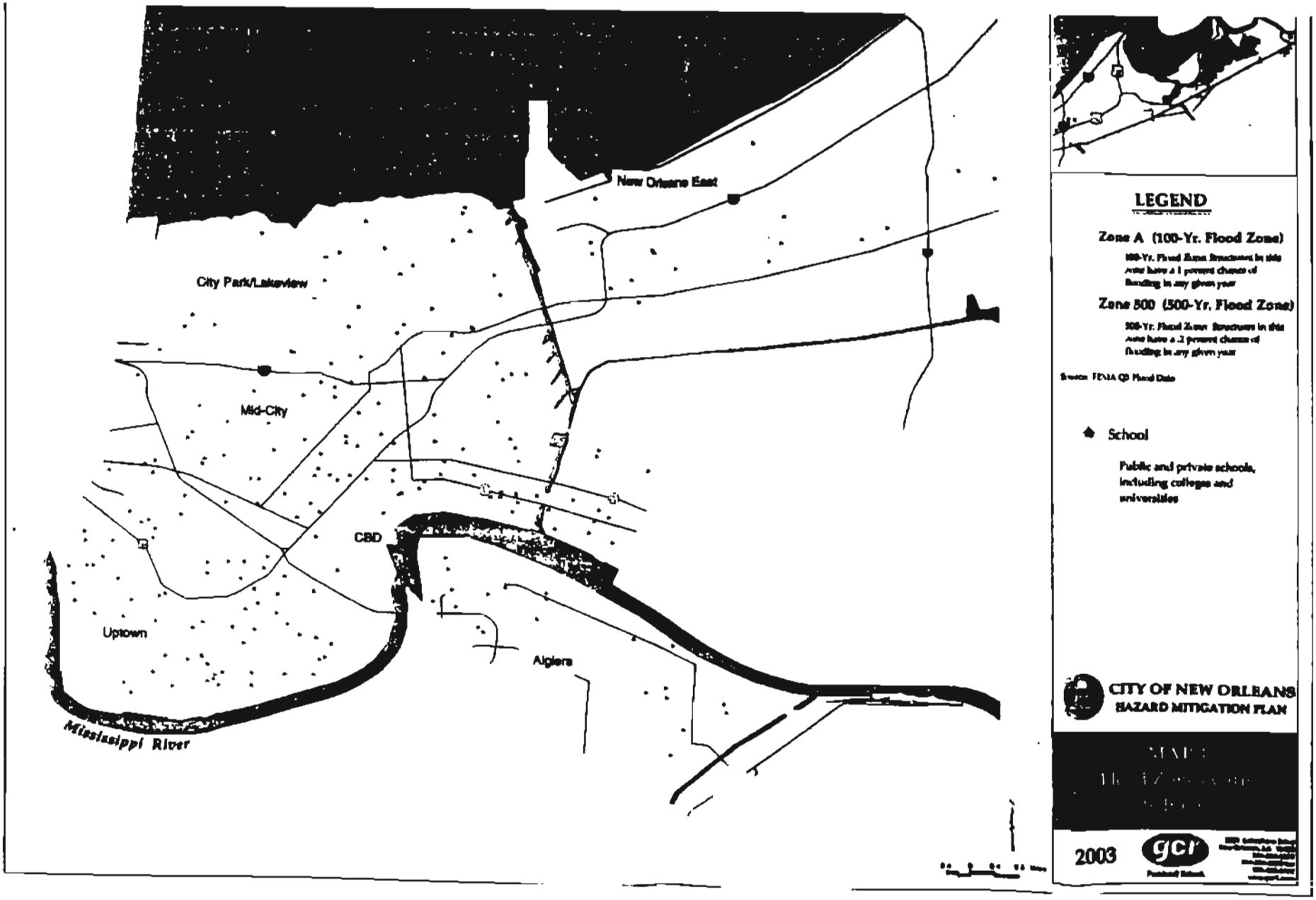
Nursing Home
All Medicare or Medicaid certified nursing homes

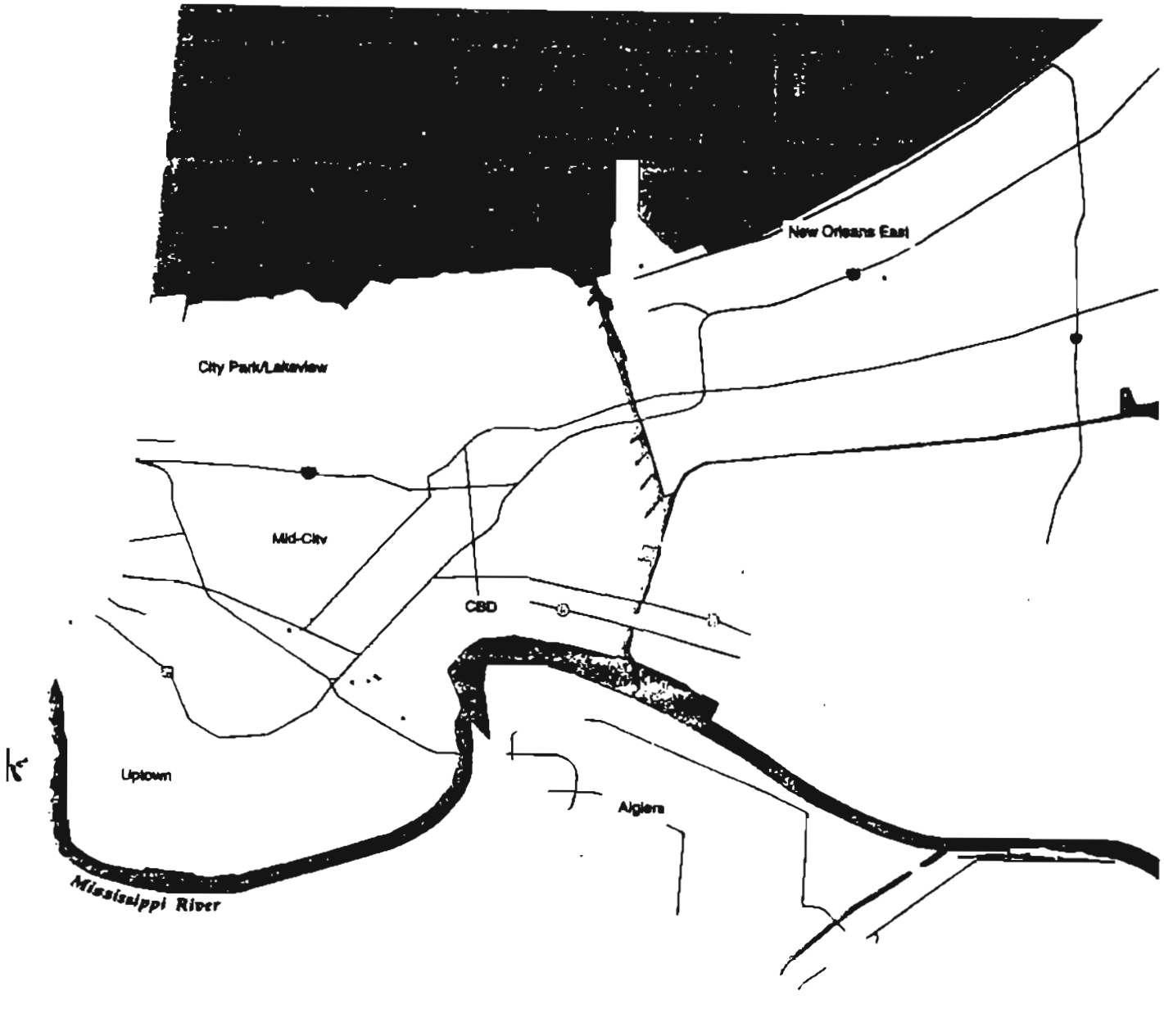
CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 3
Flood Zone with Hospital and Nursing Homes

2003

gcr


New Orleans East
City Park/Lakeview
Mid-City
CBD
Uptown
Algiers
Mississippi River
LEGEND
Zone A (100-Yr. Flood Zone)
Zone 500 (500-Yr. Flood Zone)
School
Public and private schools, including colleges and universities
CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN
2003
gcr



NEW ORLEANS EAST

LEGEND

Zone A (100-Yr. Flood Zone)

100-Yr. Flood Zone: Structures in this zone have a 1 percent chance of flooding in any given year

Zone 500 (500-Yr. Flood Zone)

500-Yr. Flood Zone: Structures in this zone have a .2 percent chance of flooding in any given year

Source: FEMA QD Flood Data

- Critical City Facility

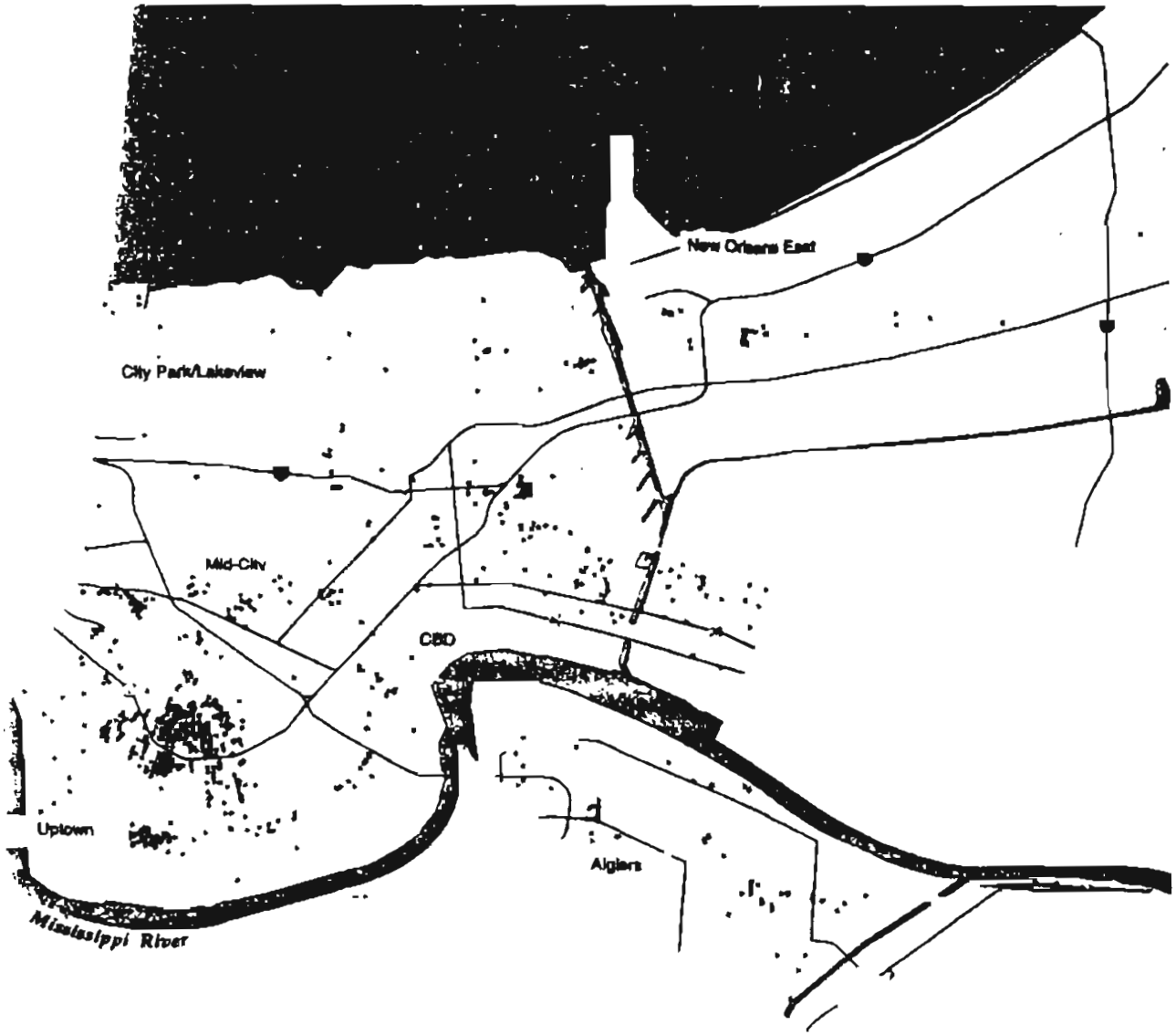
A critical City facility is defined as a facility that fulfills important public safety, emergency response, and/or disaster recovery functions or that allows other organizations to fulfill such functions.

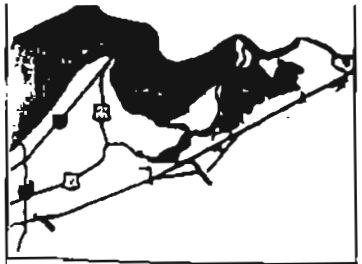
CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 6
Flood Zones with Critical City Facilities

2003

gcr





LEGEND

- **Target Repetitive Loss Structure**

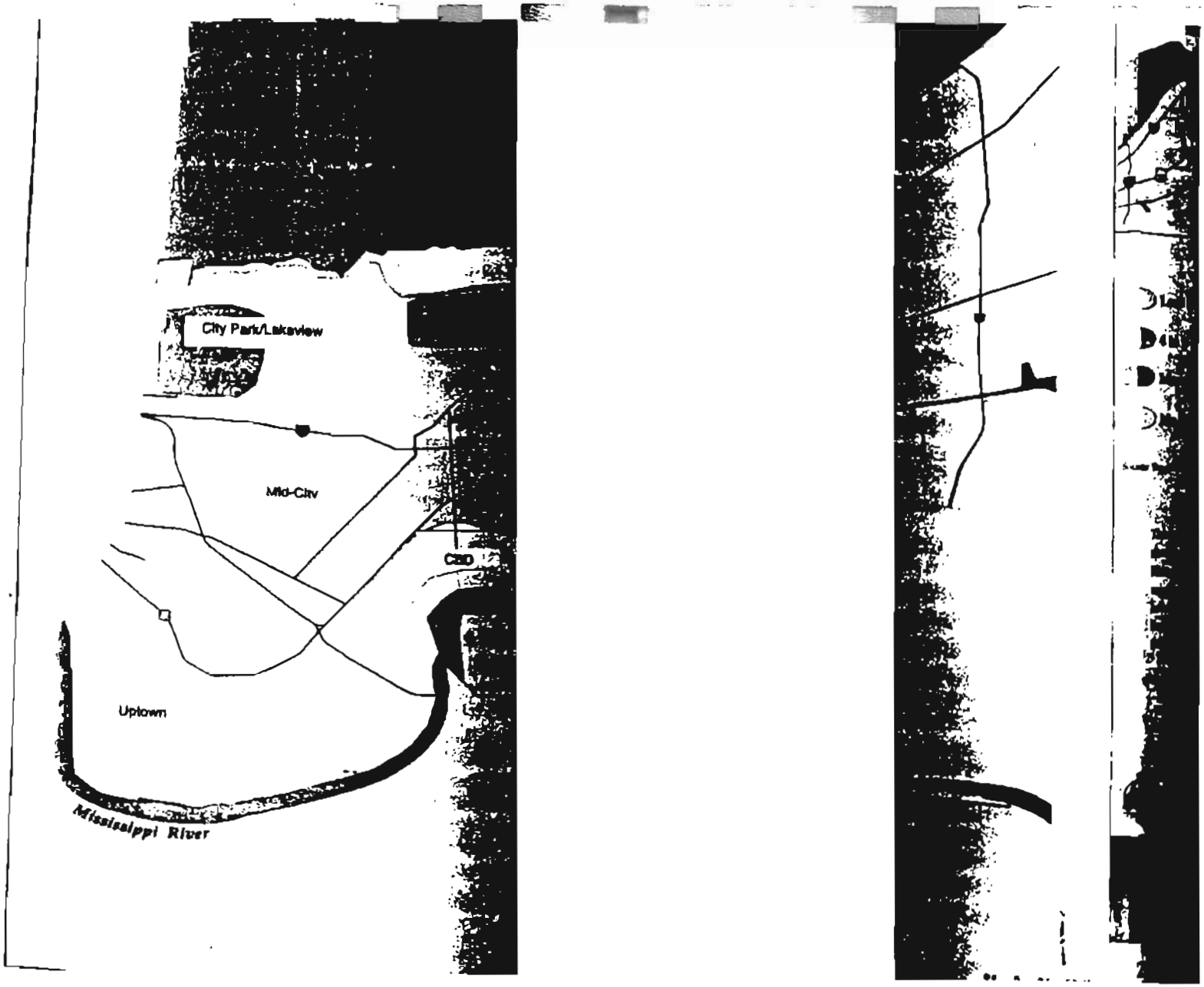
  (a structure covered by flood insurance that has incurred at least four flood-related losses and/or at least two flood-related losses where cumulative payments have exceeded the value of the structure)

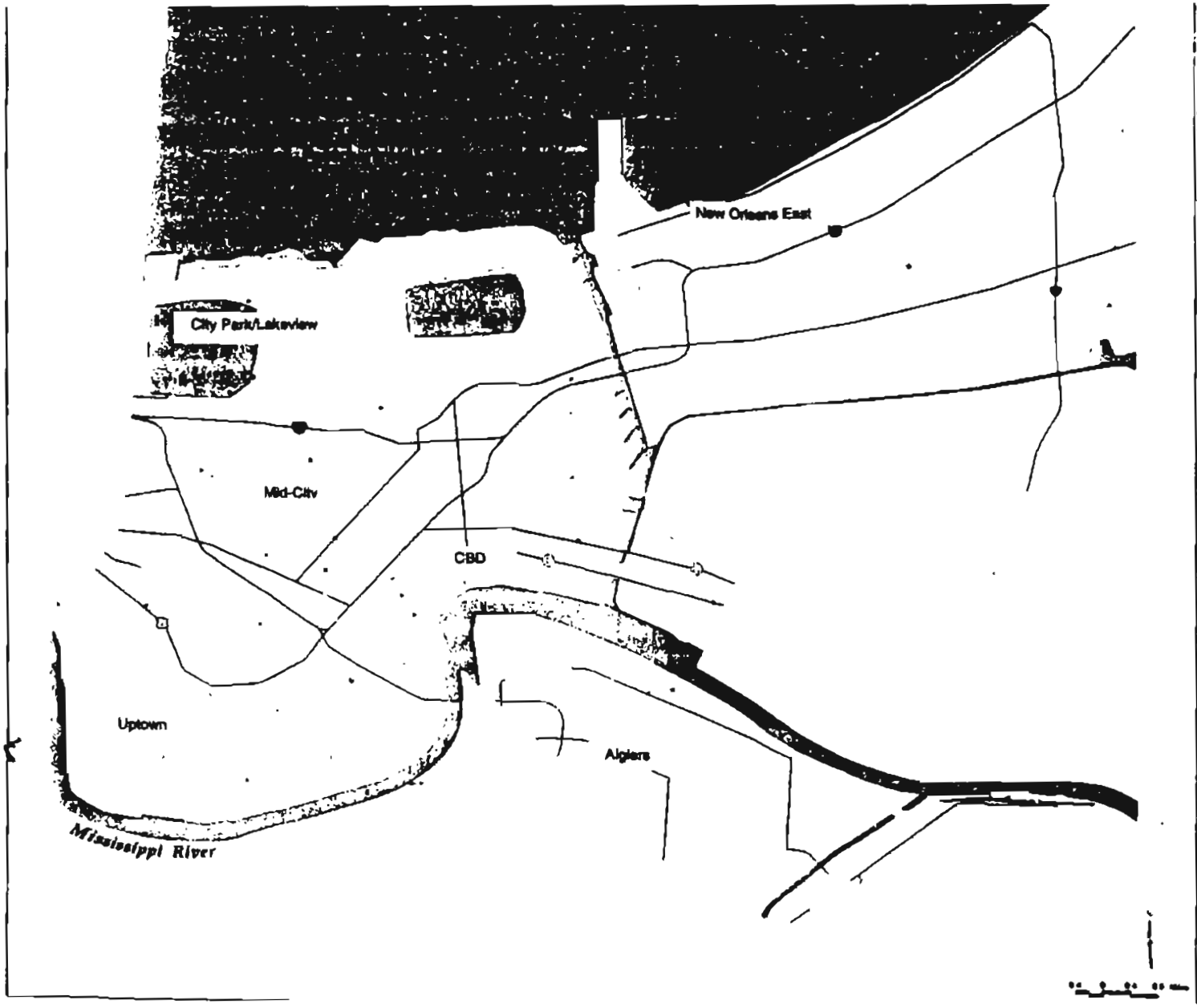
Source: FEMA October 2002

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 7
Repetitive Loss Structures

2003 gcr


City Park/Lakeview
Mid-City
CBD
Uptown
Mississippi River



LEGEND

Less than 4 Feet of Flooding

4 to 8 Feet of Flooding

More than 8 Feet of Flooding

No Flooding

Source: [illegible]

☆ Police Department Facility

New Orleans Police Department headquarters, substations, and other facilities

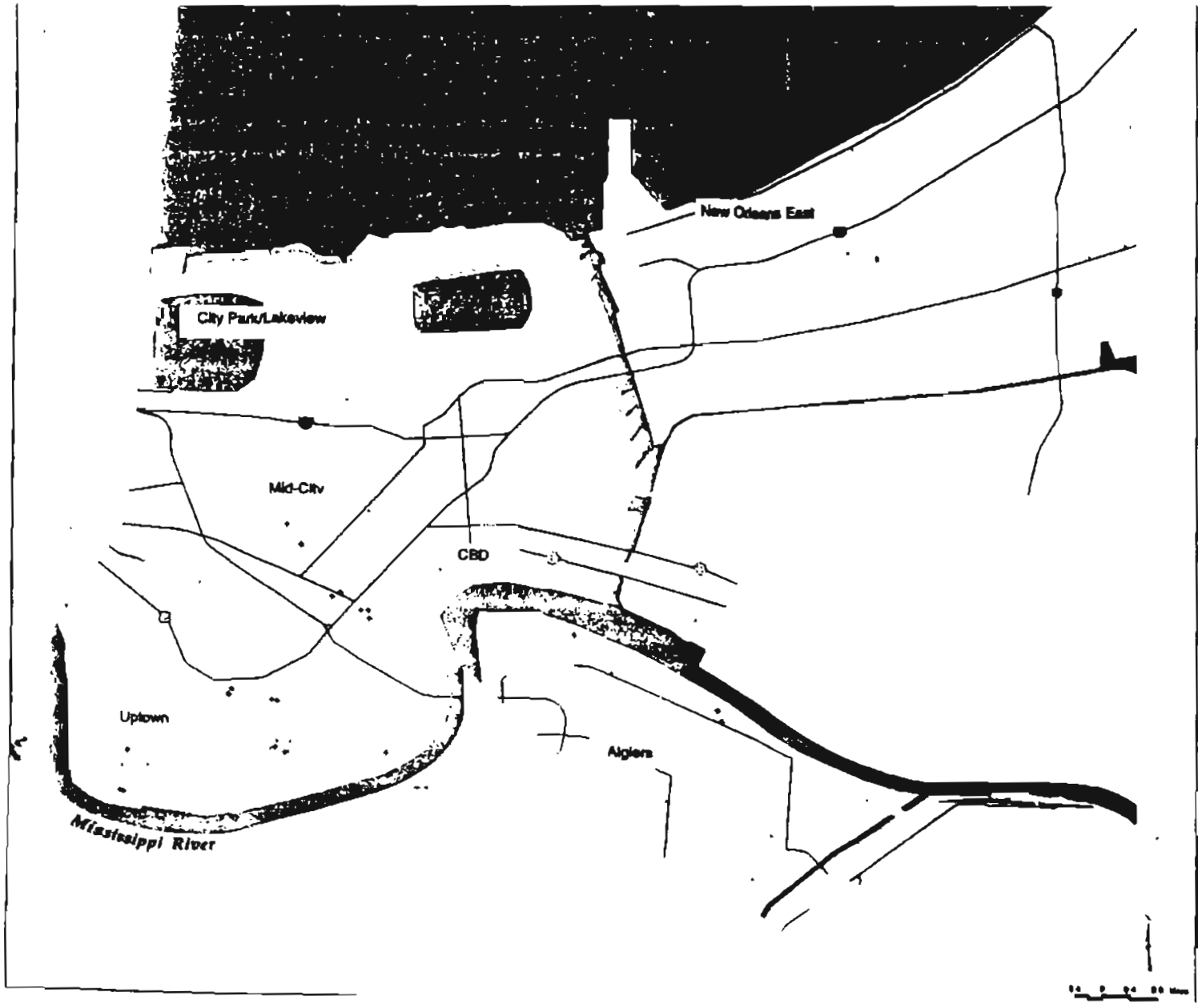
Fire Department Facility

New Orleans Fire Department headquarters, fire houses, and support facilities

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 9
Hurricane Flooding with Police and Fire Stations

2003 gcr



LEGEND

Less than 4 Feet of Flooding

4 to 8 Feet of Flooding

More than 8 Feet of Flooding

No Flooding

Source: [illegible]

✚ Hospital

Major hospitals and medical centers

Nursing Home

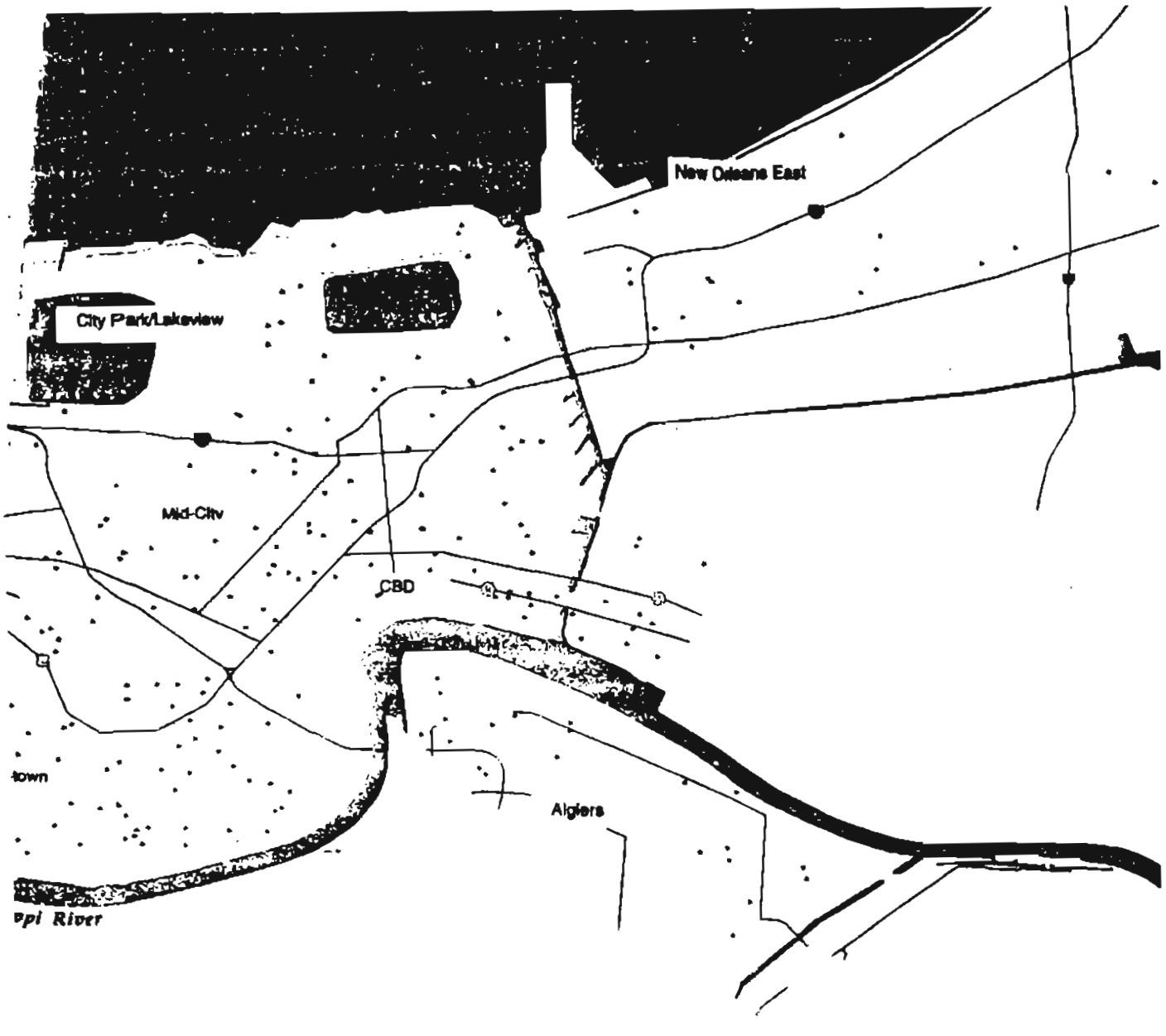
All Medicare or Medicaid certified nursing homes

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

[illegible]

2003

gcr



LEGEND

Less than 4 Feet of Flooding

4 to 8 Feet of Flooding

More than 8 Feet of Flooding

No Flooding

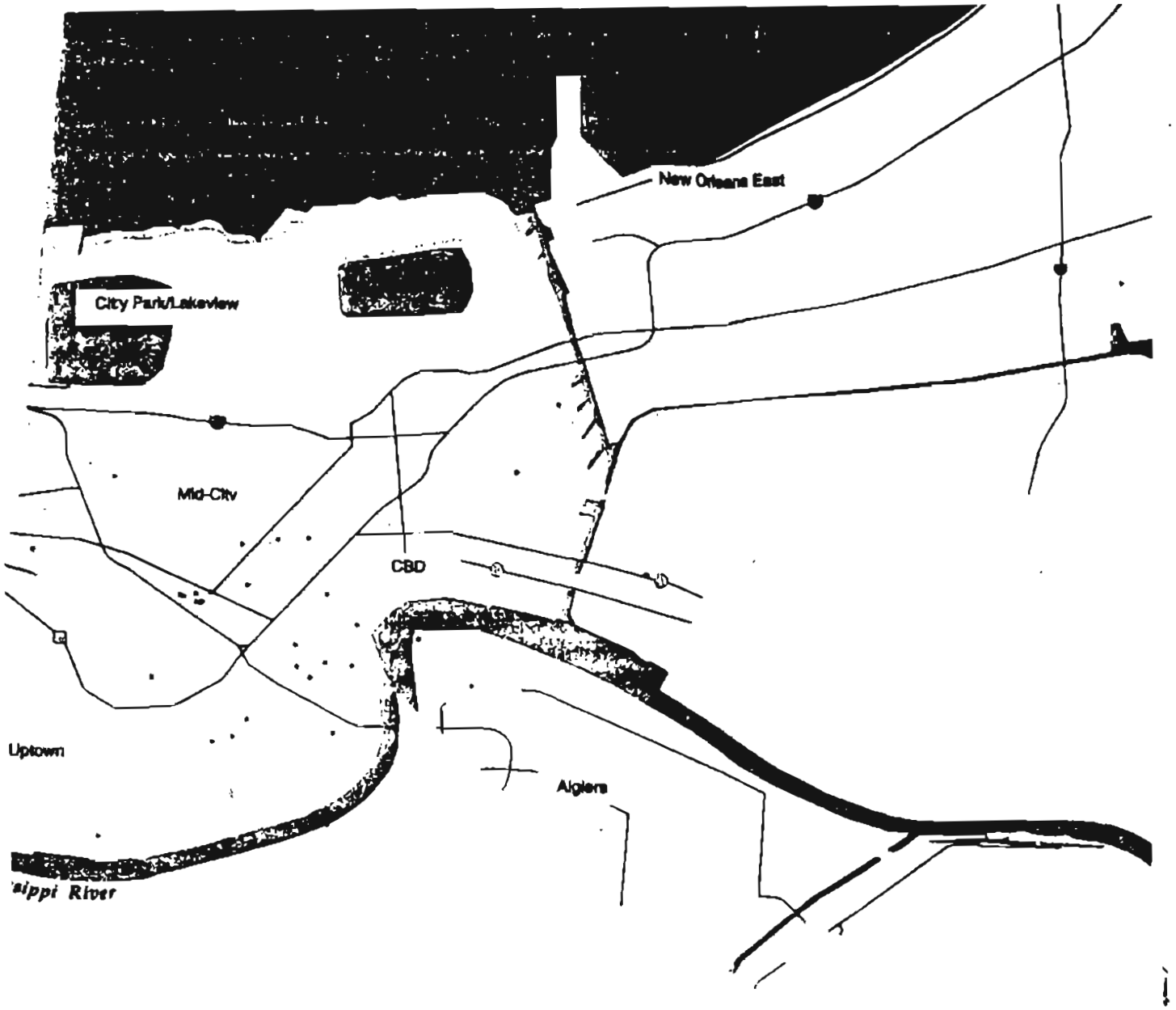
Source: [illegible]

School

Public and private schools, including colleges and universities

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 11
Hurricane Flooding with Schools



LEGEND

Less than 4 Feet of Flooding

4 to 8 Feet of Flooding

More than 8 Feet of Flooding

No Flooding

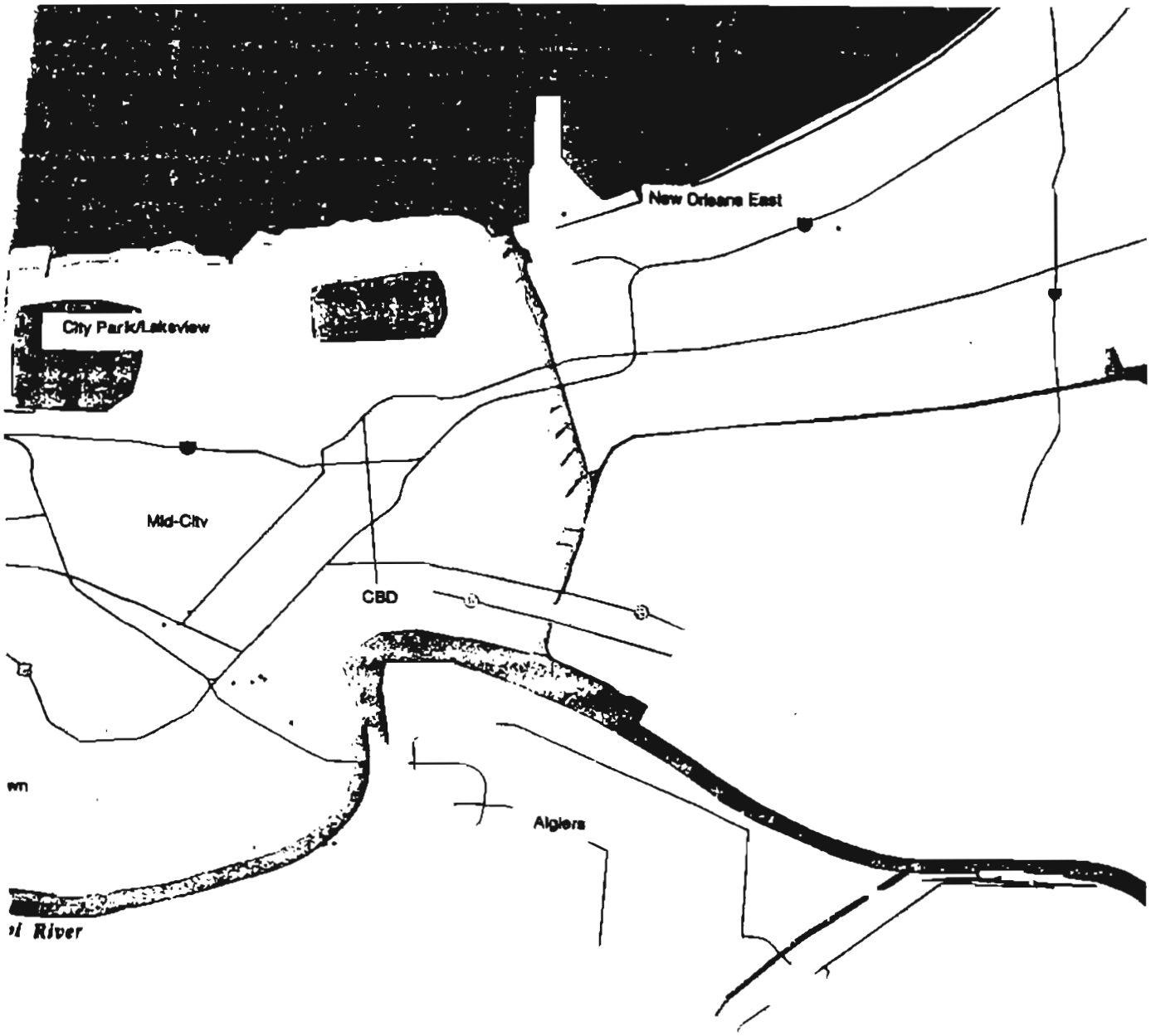
Source: [illegible]

- City Property

City properties maintained by the Department of Property Management and major NOPD and NOFD buildings

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 12
[illegible] Flooding with City Property



LEGEND

Less than 4 Feet of Flooding

4 to 8 Feet of Flooding

More than 8 Feet of Flooding

No Flooding

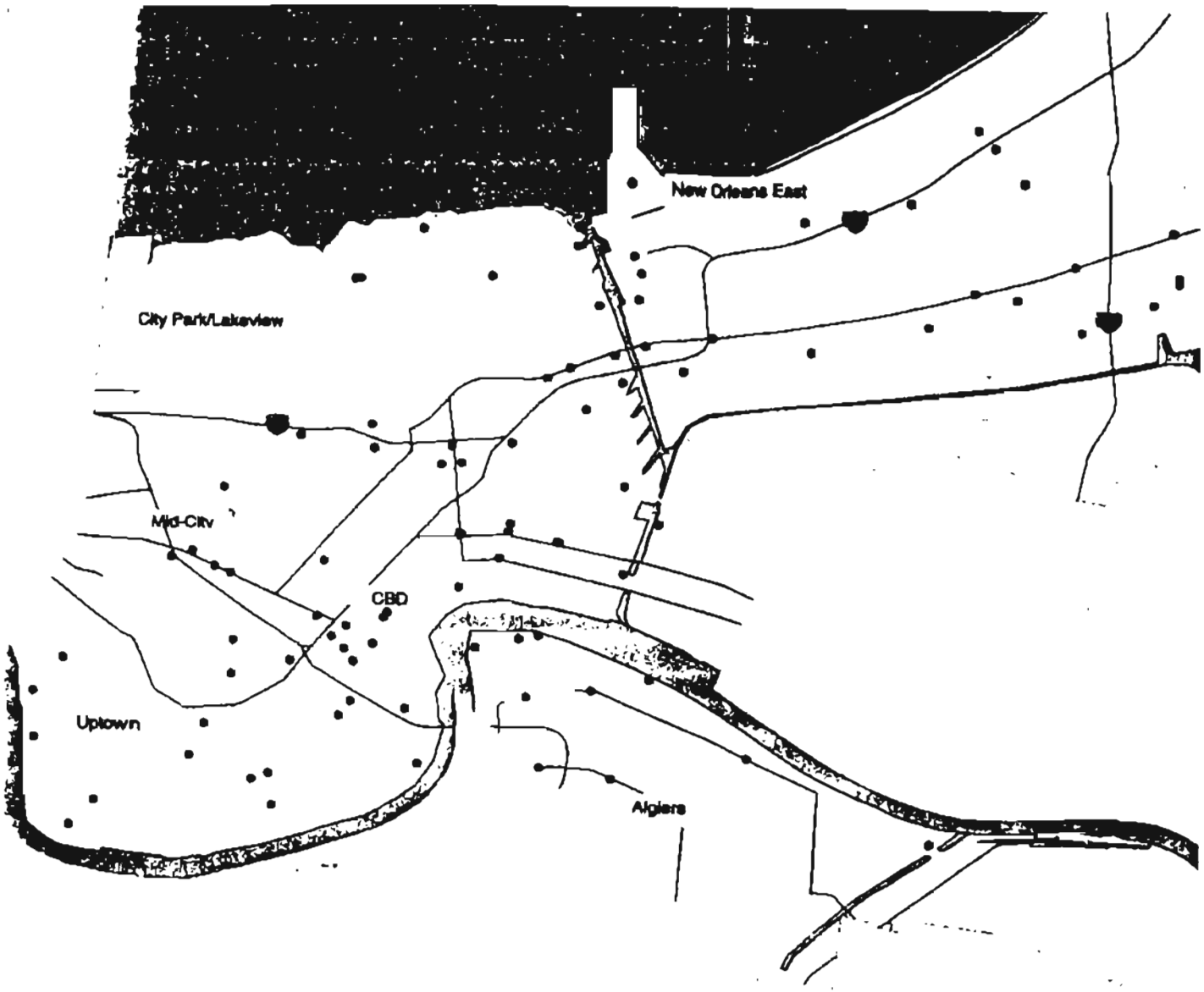
Source: [illegible]

- Critical City Facility

A critical City facility is defined as a facility that fulfills important public safety, emergency response, and/or disaster recovery functions or that allows other organizations to fulfill such functions.

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 35
Hurricane Flooding with Critical City Facilities



LEGEND

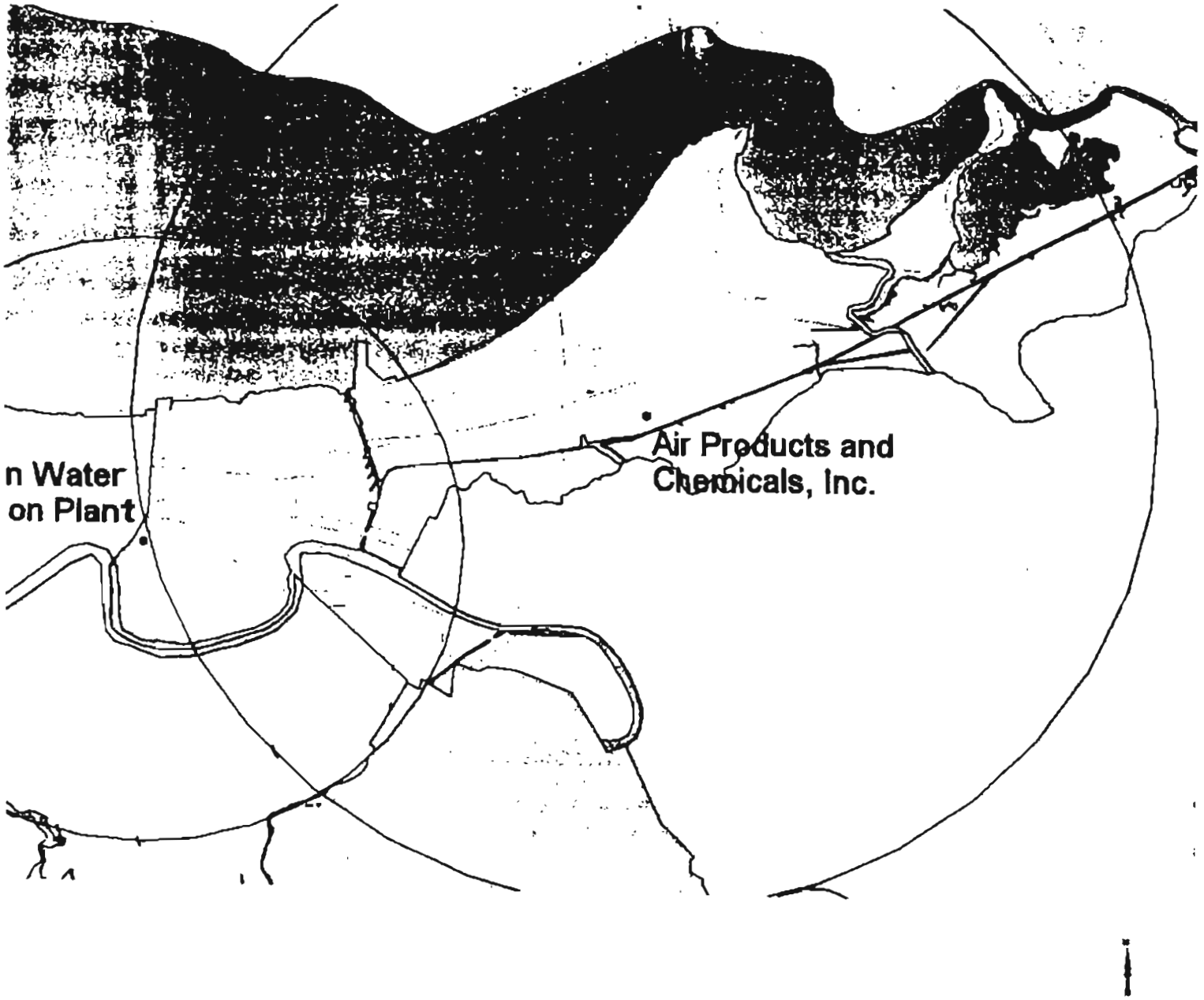
- **Tier II Facility**

  Under the Emergency Planning and Community Right-to-Know Act, a facility must report the presence of certain chemicals if the facility stores more than the threshold amounts of those chemicals.

Source: New Orleans Fire Department

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

Map 11
TIER II FACILITIES



LEGEND

Worst-Case Chemical Accident Scenario

Buffers show miles to endpoint, which is the distance within which exposure to the high chemical concentration of a toxic cloud may lead to severe health effects or death.

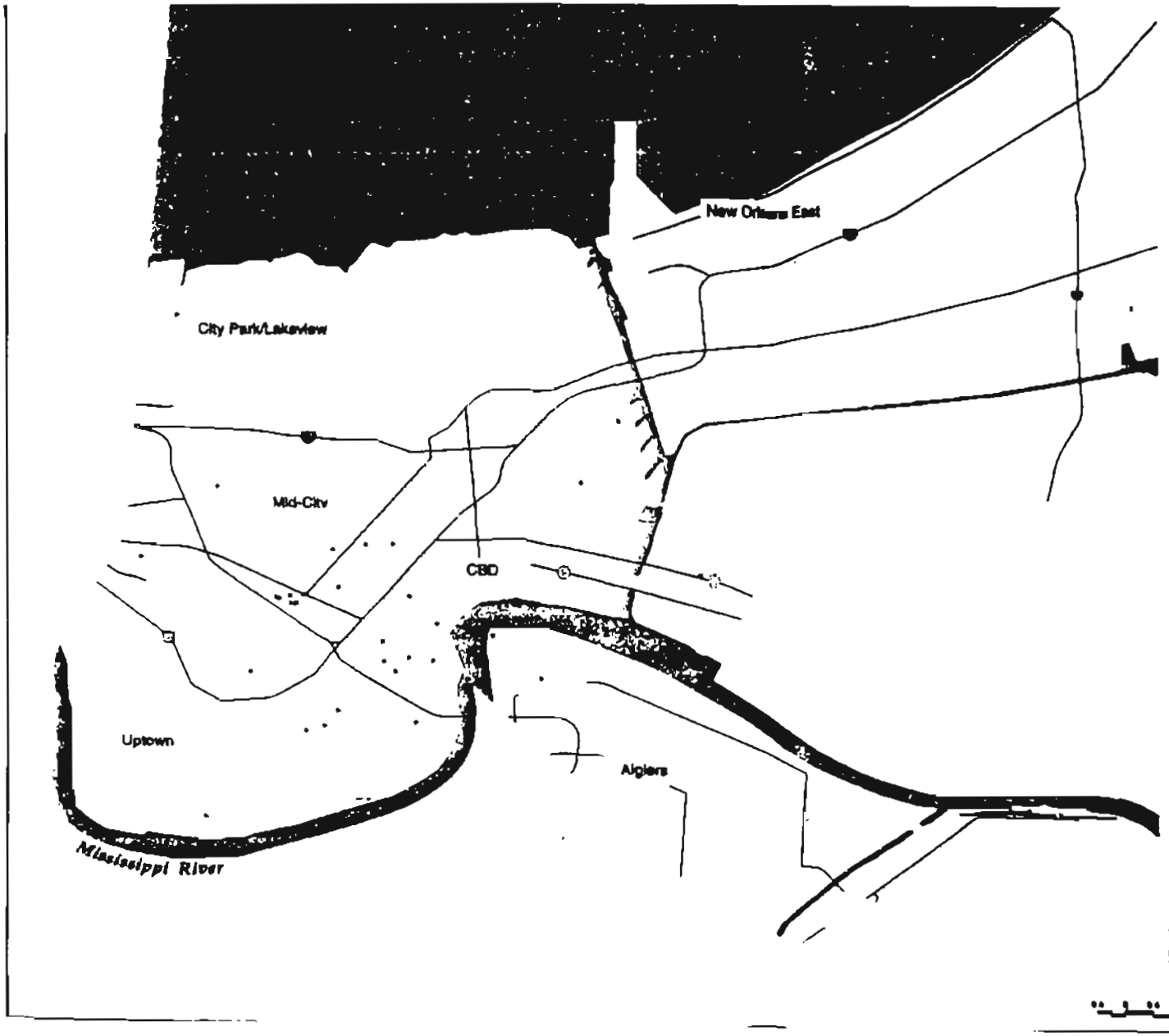
Source: EPA; GreenPeace

Air Products and Chemicals, Inc.
16.0 Miles

Carrollton Water Purification Plant
9.9 Miles

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

Map 15
WORST-CASE SCENARIOS



LEGEND

Zone A (100-Yr. Flood Zone)

100-Yr. Flood Zone: Structures in this zone have a 1 percent chance of flooding in any given year

Zone 500 (500-Yr. Flood Zone)

500-Yr. Flood Zone: Structures in this zone have a 0.2 percent chance of flooding in any given year

Source: FEMA QD Flood Data

- City Property

City properties maintained by the Department of Property Management and major NOPD and NOFD buildings

CITY OF NEW ORLEANS
HAZARD MITIGATION PLAN

MAP 5
Flood Zones and
City Property

2003

gcr

KATHLEEN BABINEAUX BLANCO
GOVERNOR

State of Louisiana

MILITARY DEPARTMENT

OFFICE OF HOMELAND SECURITY
AND
EMERGENCY PREPAREDNESS

BENNETT C. LANDRENEAU
MAJOR GENERAL
THE ADJUTANT GENERAL
DIRECTOR

MICHAEL L. BROWN
Colonel (LA)
Deputy Director
Emergency Preparedness

JADWIN V. MAYEAUX, JR
Colonel (Ret.)
Deputy Director
Homeland Security

January 10, 2005

LANG-HEP-DR

Chief Joseph Matthews
Director, Orleans Parish
Office of Homeland Security/Emergency Preparedness
1300 Perdido, Room 9E06
New Orleans, Louisiana 70737

SUBJECT: Orleans Parish Hazard Mitigation Plan Pending Adoption
FMA 01-071-0001

Dear Mr. Matthews:

Our records indicate that recently the Louisiana Office of Homeland Security and Emergency Preparedness (LOHSEP) along with the Federal Emergency Management Agency (FEMA) have approved your Hazard Mitigation Plan pending adoption. Your plan was determined to be in conformance with the 44 Code of Federal Regulation Section 201.6.

Before FEMA can provide your jurisdiction with an official approval letter, there are some things that must be completed. First, your parish must formally adopt the current version of your mitigation plan by resolution and provide a copy of this resolution as documentation. Additionally, an electronic copy (CD) of your plan, including the signed resolution must be submitted to the LOHSEP; please send two CD's (one for FEMA and one for State) within the next 45 days.

We highly encourage you to complete this process in an expedited manner because in doing so, your jurisdiction will be eligible for a portion of the 7.5% of the total Federal monies spent on both Hurricane Katrina and Rita through the Hazard Mitigation Grant Program (HMGP). Please notify us as soon as possible about the potential completion date of this process for your jurisdiction.

We look forward to receiving your adoption resolution and electronic copies of your plan to allow for formal approval. If you have any questions, please contact me directly at 225-925-7557.

Sincerely,

Margaret Sang for
Shane Rauh
State Hazard Mitigation Officer

SER/mrs
CF: Jerry Tate

Section Nine
Coordination of Local Mitigation Planning

Contents of this Section

9.1 IFR Requirement for Coordination of Local Mitigation Planning

9.2 Local Funding and Technical Assistance

9.3 Local Plan Integration

9.4 Prioritizing Local Assistance

9.1 IFR Requirements for Coordination of Local Mitigation Planning

A key element of the DMA 2000 is the emphasis placed on strengthening the interactions between the states and local communities regarding hazard mitigation planning and implementation. Most significant mitigation occurs at the "local" level so it is beneficial to all concerned to make sure that local plans are as effective as possible in identifying hazards and developing action plans.

The IFR includes three specific requirements for the manner in which states coordinate with local communities for planning efforts:

- **Local Funding and Technical Assistance** per **Requirement §201.4(c)(4)(i)**: "[The section on the Coordination of Local Mitigation Planning must include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans..."
- **Local Plan Integration** per **Requirement §201.4(c)(4)(ii)**: "[The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan."
- **Prioritizing Local Assistance** per **Requirement §201.4(c)(4)(iii)**: "[The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures. Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs."

9.2 Local Funding and Technical Assistance

As described in Section Eight, the Plan emphasizes the need for the State to provide continuing funding and technical assistance to support mitigation planning at the parish and local community level. To gain perspective on what needs to be done in the future, it is important to also understand what has been accomplished to date.

The State of Louisiana, through OHSEP, has made a concerted effort to assist with the local plan development process by providing:

- Support to obtain Federal funding for local and parish level plan development;
- Technical assistance to plan preparers at the local and parish level;

- Plan reviews at draft and final stages of completion; and
- Coordination with FEMA Region VI on local plan development and review issues.

Current Status of Local Mitigation Planning in Louisiana

As of February 16, 2005, 63 parish level, 11 local community and 1 private non-profit organization plans have been undertaken in the State of Louisiana. One measure of the effectiveness of this planning effort is the percentage of the State's citizens who will be "covered" by a local hazard mitigation plan. Since the parish is the political unit of interest and can provide full coverage for all the communities within its boundaries, the SHMPC considered it appropriate to determine the percent coverage of the parishes represented by this number. There are a total of 64 parishes in the State; two of these parishes have undertaken a joint regional planning process so the number of parish plans required to cover the entire State is 63. With 63 parish plans completed or underway, the resulting level of compliance is 100 percent.

Current Funding

To date, a total of $3,638,375 has been dedicated to developing parish and local level plans. Table 9-1 includes a summary of the funding sources for these plans:

Table 9-1: Funding Sources for Local Hazard Mitigation Planning

Funding Sources	Amount
HMGP	$1,839,000
PDM	$ 461,300.
FMA	$ 610,400
Non-Federal (local)	$ 727,675.
Total	**$3,638,375.**

Source: OHSEP, 2005

Technical Assistance for Local Mitigation Planning

OHSEP, with funding provided by FEMA through HMTAP, conducted a series of local hazard mitigation planning workshops in 2002 to familiarize parish officials with the requirements of DMA 2000 and to offer training regarding hazard mitigation planning techniques per FEMA guidance. Five separate workshops were held and 56 of the 64 parishes participated in at least one workshop; a rate of 87%.

Continuing Technical Assistance

Per Section Eight, OHSEP intends to provide continued technical assistance to parishes and local communities in the State to develop and maintain comprehensive local mitigation plans and to pursue cost effective mitigation projects. For example, Plan of Action 'E' in Section Eight identifies specific steps OHSEP will take to support local hazard mitigation planning. Other action items include providing training and guidance for improving risk assessments and plan implementation that are important aspects of the overall process.

Plan Reviews

As of February 16, 2005, one local plan has been approved by FEMA.

OHSEP has reviewed a significant number of local and parish hazard mitigation plans and has made a commitment to provide the same level of service for all local planning efforts in Louisiana. Throughout the development and review process, OHSEP staff has, and will continue, to serve as liaisons between FEMA Region VI and the local jurisdictions. OHSEP staff was trained by FEMA to conduct plan reviews and the process OHSEP employs is as follows:

Step 1: The initial draft of a local parish plan is sent to OHSEP, reviewed and then forwarded with OHSEP comments to FEMA Region VI.

Step 2: FEMA Region VI reviews the plan and forwards their comments to OHSEP who then relays them back to the parish.

Step 3: The parish addresses both OHSEP and FEMA Region VI comments and revises the plan.

Step 4: A revised final draft is submitted to OHSEP, is checked and forwarded to FEMA Region VI.

Step 5: FEMA Region VI again reviews the plan, and if all comments were satisfactorily addressed, a letter stating that the plan is adoptable is mailed to OHSEP and the parish. In cases where comments have not been addressed satisfactorily, the parish again addresses the comments and repeats the process.

Step 6: The plan is then formally adopted by all participating jurisdictions.

Step 7: The plan is officially approved by the Regional Director of FEMA Region VI.

The timeframe for this review process is about six months, not including the time spent by communities and parishes to revise their plans in response to comments (in Steps 3 and 6), based on the following assumptions:

- Step 1 requires approximately 45 days for State review;
- Step 2 requires an additional 45 days for FEMA; and
- After resubmitting the plan for final review, the State is again given 45 days to review and FEMA is also given 45 days in Step 5.

Some local plans were being developed concurrently with the State Plan; they will be completed as outlined in their individual grant agreements between the OHSEP and local EMAs. Once finalized, the local plans will be sent to FEMA Region VI for official approval as required to satisfy DMA 2000 requirements.

9.3 Local Plan Integration

As described in Subsection 9.1, the IFR requirements pertaining to this Section, 201.4(c)(4)(ii) states that "[The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan." In developing the State Plan, OHSEP was aware of the importance of ongoing local planning efforts. Ideally, the process for developing the Plan would have used local risk assessments, goals, strategies and actions to help characterize the range of hazards, mitigation strategies and actions identified across the State. However, at the time most of this Plan was written, no local or parish plans had been approved by FEMA Region VI and thus the contents of plans that have been subsequently approved were not available to link with this Plan.

While all 64 parishes were contacted as part of the local capability assessment (as described in Section Seven), the information gathered as part of that effort was limited in scope. Therefore, most of the parish plan integration into this Plan must still be performed by OHSEP and the SHMPC as described below.

As part of integrating parish plans with this Plan OHSEP will undertake a review process to identify and compile key elements for further analysis (as outlined in Section Ten. The intent is to identify common characteristics in the local plans and analyses to incorporate into the State Plan. For example, data about local risk will be extracted and compared with the results of other local plans regarding:

- breadth of hazard coverage;
- level of detail in data and analyses; and
- file formats for digital information.

In addition, OHSEP will consider non-technical aspects for incorporation into the State Plan including goals, objectives and capability assessments for local communities and parishes.

Upon completion, the local plan information will be presented to the SHMPC with recommendations about how it may be included in subsequent updates to the State Plan. OHSEP anticipates that this will occur about the end of calendar year 2005, although the timing of this activity may change depending on the complexity and completeness of the local plans, and data compatibility among them.

Following analysis and consideration by the SHMPC, OHSEP anticipates that most of the usable local risk assessment and vulnerability data will be incorporated into the State Plan within two years of its initial approval, probably as part of the annual review and update process described in Section Ten.

It is clear that local conditions and priorities will change over time. To account for this, in addition to assembling and reviewing the approved local plans, the OHSEP will correspond with local EMA directors and other appropriate officials and organizations on an annual basis, requesting them to advise OHSEP of any significant changes in local vulnerability and risk, mitigation activities that have been completed or initiated, and changes in a community's mitigation goals, strategies or priorities. OHSEP will review the responses, prepare a report and recommendations, and present these to the SHMPC for its consideration.

9.4 Prioritizing Local Assistance

IFR subsection 201.4(c)(4)(iii) states that the State Hazard Mitigation Plan must include "[c]riteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with:

- highest risk,
- repetitive loss properties, and
- most intense development pressures.

Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs."

The sub-sections below discuss these four criteria. Following these subsections is additional discussion of how the State intends to prioritize applications for funding future planning efforts.

In all cases applicants must demonstrate that their risk is sufficient to merit grant funds, particularly when compared to the project cost, but there is often considerable uncertainty in risk determinations. For this and other reasons, the State considers a variety of factors in addition to risk and benefit-cost analysis in determining its priorities for mitigation grants.

Jurisdictions with highest risk

One of the primary purposes of this Plan is to identify the areas in Louisiana with the highest risk from natural and manmade hazards. As described in Section Five, the parishes in Louisiana have different levels of exposure and risk. Although the State does not have a formal system established to evaluate and prioritize potential mitigation projects on the basis of risk, this Plan is partly intended to begin the process of introducing such a structure to the process. In general, the State will direct mitigation grant funds to the areas with the highest risk. However, in many cases, more localized risk assessments (possibly produced in the local mitigation planning process), as well as risk assessments and benefit-cost analyses done in support of applications, may indicate areas with high risk outside the highest-risk parishes identified in this Plan.

It is also worth noting that the most worthwhile mitigation projects are a product of both the risk in a particular place and the effectiveness of a project. Although risk is clearly a good initial indicator of mitigation potential, the State will also carefully consider the effectiveness and cost of mitigation projects in determining funding priorities.

Jurisdictions with repetitive loss properties

There is currently no formal requirement that grants made through either the HMGP or PDM-C emphasize repetitive loss properties. However, in response to the Federal emphasis on reducing the burden that repetitive losses place on the NFIP, the State presently considers the repetitive loss status of properties in determining the grants it will support (i.e., forward to FEMA for consideration and funding), and will continue to do so as additional grant funds are available. As discussed elsewhere in the overall strategy for Louisiana, the State is in the process of developing a more rigorous process for evaluating grants. As part of that effort, the State is incorporating repetitive loss status into its grant evaluation criteria.

The FMA program mandates that grant funds are directed to NFIP repetitive loss properties, and the State will continue to comply with this requirement as it has since its inception. It is worth noting that the Flood Insurance Reform Act of 2004, which was signed into law by the President on June 30, 2004, reforms the NFIP to provide a disincentive to property owners to live in repetitively flooded areas. Rather than continue to rebuild, the program would provide repeatedly flooded homeowners assistance in either elevating or moving their homes away from floodwaters. Those who refuse mitigation assistance would pay premiums that will progressively approach the full actuarial costs for choosing to live in a risky area.

Jurisdictions with most intense development pressure

At the time this Plan was developed Louisiana had no formal process for evaluating potential mitigation grants. As it develops a more rigorous review and recommendation process, the State will include development pressure as a potential review criterion. It is assumed that parish plans will provide some indication of the implications of future development per DMA 2000 requirements for local plans. The degree to which this information is included in the local plans will determine to a large extent the ability of OHSEP and the SHMPC to make decisions based on this criteria.

Although development pressure is clearly a potential factor in any risk determination, development that is undertaken in accordance with adequate building codes, land planning and floodplain management principles should in many cases be less risky than development that pre-dates these codes and principles. However, the State is aware that increased development does cause related increases in population, infrastructure, etc., and may in some cases have adverse impacts on existing areas. These factors will be carefully considered in additional reviews.

Maximizing benefits according to benefit-cost review of local projects

The regulations that apply to all FEMA mitigation grant programs (HMGP, PDM-C, and FMA) state that proposed mitigation projects must be cost effective. Under some pre-established conditions, certain projects may be exempt from this regulation, but in most cases a benefit-cost analysis is undertaken for projects either prior to being submitted to OHSEP and FEMA for funding consideration, or during the grant evaluation process.

The PDM-C program, which was instituted in 2003/04, further emphasizes the role of cost-effectiveness by making the benefit-cost ratio the single most important criterion in project rating and evaluation. For the HMGP and FMA programs, the regulations require only that proposed mitigation projects are cost-effective, *not* that they are the *most* cost-effective of projects that the State or FEMA is considering. However, the State generally believes that projects with high benefit cost ratios should get preference, all other aspects being equal.

In most cases, grant applications are either accompanied by a benefit-cost analysis, or OHSEP or FEMA performs one in accordance with FEMA and the Office of Management and Budgets (OMB) regulations. Projects that do not achieve the required 1.0 benefit-cost ratio, and are not exempted from benefit-cost analysis, are rejected from funding consideration. This is the case for all three FEMA mitigation grant programs (HMGP, PDM-C, and FMA).

Prioritization of communities to receive planning grants

In determining priorities for which communities will receive mitigation planning grants, OHSEP will consider several criteria:

- Quality and completeness of the community's existing mitigation plan.
- The degree of risk in the community, as determined by the potential effects of natural hazards on population, infrastructure and operations per the results of this Plan.
- Existing capability, i.e., if the community already has the resources to create or update its plan and do they have the administrative infrastructure in place to implement actions.
- Potential for the plan to support or enhance community mitigation efforts.

These criteria are intended to blend objective and subjective considerations to determine the best way to spend limited funds to help communities improve their mitigation plans.

Although the preceding subsections discuss specific criteria required by the IFR, the State considers other factors in determining how to prioritize mitigation grant proposals. Among these other factors are:

- The extent to which the project identified by the community has been identified or developed through the local hazard mitigation process;
- Local needs, (i.e., which grants would help communities most);
- The hazard or hazards that the project is mitigating;
- The criticality of the facility/ies that the project is protecting;
- The status of a community with respect to the NFIP / CRS; and
- The community's adoption and enforcement of building codes.

This is not intended as a comprehensive list of factors, only as a general indication of the areas that the State will contemplate in reviewing project proposals.